PISA

2018

SKY'S THE LIMIT

Growth mindset, students, and schools in PISA

OECD

Preface

The OECD conducts the triennial Programme for International Student Assessment (PISA), a global yardstick for evaluating the quality, equity and efficiency of school systems. PISA regularly measures what 15-year-old students know and can do, and relates it to a wide range of aspects. For the first time in 2018, PISA included a "growth mindset" instrument to gauge students' beliefs about intelligence malleability. To date, this has been the most global attempt to study growth mindset, surveying more than 600 000 students in 79 countries and economies.

In September 2020, the OECD, in collaboration with the Yidan Prize Foundation, organised an international 3-day workshop (Annex C) that pursued a two-fold objective:

- Raise awareness and understanding of ongoing research and practices on growth mindset through the exchange of information among researchers and practitioners (Days 1 and 2).

- Explore and outline future research plans, including a collaborative international research infrastructure that would enhance growth mindset practices and policies (Day 3).

This workshop was an opportunity for PISA analysts to present the first preliminary cross-country analysis of growth mindset, and for researchers and practitioners to share the latest growth mindset developments and define the next steps of the research agenda. Capitalising on this event, the OECD has further analysed PISA data, linking growth mindset with learning outcomes, students' attitudes and well-being, teachers and school practices, and contextual features of educational systems.

Here, we present the PISA data and how it relates to the existing growth mindset literature. It is structured around 10 questions, progressively zooming out from the student level, to the teacher, school, and policy levels. Additional case studies summarise some of the workshop presentations or present relevant international practices pertaining to growth mindset development. This report provides insights to teachers and policy makers, and guides future actions towards better teaching practices and students' experience in schools.

OECD

Directorate for Education and Skills

Foreword

The Yidan Prize was founded on the belief that innovative, brilliant minds can come together to create a better world through education. We are pleased to work in partnership with the OECD and our laureates to help young people everywhere realize their full potential.

Our inaugural laureate of the Yidan Prize for Education Research, Professor Carol S. Dweck was recognized for her seminal work on growth mindset. Her research helps us understand how mindset relates to academic performance, aspirations, and well-being. It debunks the notion that ability and intelligence are fixed and shows instead that they can be developed over time.

However, the idea of a growth mindset is sometimes misunderstood, even among people familiar with the concept Having a growth mindset is not simply telling students they can achieve any goal, but highlighting the importance of effort and encouraging a willingness to explore new ways to learn.

Creating the right environment

Learning outcomes are better when mistakes are interpreted as opportunities to learn. Teachers can help learners grasp a deeper understanding of concepts when they try different ways to explain ideas and encourage questions and curiosity. In a growth mindset classroom, abilities and intellect are not judged based on ethnic or cultural backgrounds.

It is important to have an empowering environment which instills a growth mindset. So, we brought together education experts from around the world, including our laureates Ms Vicky Colbert and Professor Larry Hedges, to explore what that environment should look like, and how it can be encouraged. We tapped into a wealth of data and analysis on mindset across 79 economies through the 2018 PISA assessment, and learned more about the latest mindset research, as well as inspiring work of changemakers on the ground.

During our 3-day workshop held in September 2020, we explored how different cultures interpret growth mindset, how learners from diverse backgrounds might benefit from it and how much of that is influenced by teaching practices and school culture.

Working together

We are pleased to see closer collaboration among researchers and practitioners. Our hope is that by working together, further research and data collection will help us take on some of the key global challenges. Plans are well underway to include new items on mindset in the 2025 PISA assessment, and for new research by a talented, multidisciplinary team of experts.

The implication of this work is enormous. Imagine a world where every child, every teacher and every school believe ability and intelligence are malleable. Where effective, low-cost interventions that cultivate a growth mindset are available everywhere. Where every child learns to love learning, and love taking on new challenges. Where successive generations of young people build societies that face the most difficult challenges with open minds, intelligence, and passion. That is the future we want; it is the future we need.

This report offers many insights on mindset to policy makers and educators, and the promise of more to come.

Dr. Charles Chen Yidan
Founder of the Yidan Prize

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1. Why are we looking at growth mindset?

How do we improve students' learning experience and make educational systems more effective and efficient? Since its creation in 1961, the OECD has collected and published national statistics on education systems to support countries' evidence-based policy making. At the end of the 1980s, growing concern about the quality and comparability of available data led the OECD to develop the Indicators of Education Systems programme in 1988. In 1992, this programme initiated the now yearly Education at a Glance publication, which grouped indicators under the three following headings at the time:

- demographic, economic and social context,

- costs, resources and school processes, and

- outcomes of education.

To enrich the educational outcomes measures, the Programme for International Student Assessment (PISA) was established in 1997. Following an internationally agreed framework, PISA regularly measures what 15 year-old students know and can do, and relates it to a wide range of aspects (Box 1). PISA therefore offers insights on the sources of variation in education performance, whether within a specific educational system, or between countries (McGaw, 2008[1]).

Over the past two decades, PISA has become an international reference for comparing quality, equity and efficiency in learning outcomes across countries. It has supported teachers and schools in identifying areas for improvement and international best practices. And, it has provided policy makers with statistical evidence and a benchmark of international policies to support, or contribute to, national reform agendas (Schleicher, 2019[2]).

Yet, the last PISA assessment showed that most OECD countries saw virtually no improvement in the performance of their students since PISA was first conducted in 2000. For instance, Japan, Norway, and the United States displayed stable results in mathematics, reading, and sciences while Iceland, Korea, and New Zealand followed declining trends in all three fields assessed in PISA. In the meantime, some countries that spend relatively little on education (Estonia, Canada, Ireland) or students spend comparatively less time in school (Estonia, Finland, Switzerland) have reached high levels of performance (OECD, 2019[3]).

In the meantime, there is now an increasing expectation for students to become independent, lifelong and life-wide learners. PISA aims to critically assess students' competence and not only their content knowledge and routine cognitive skills. For instance, the latest PISA report highlighted that reading is no longer mainly about extracting information from carefully curated and government-approved textbooks but about constructing knowledge, thinking critically and making well-founded judgements from diverse forms of texts and sources (OECD, 2019[3]).

The stagnation of some countries' performances illustrates the difficulty of sustaining systemic improvement in education. It also asks the question of whether sufficient attention was paid to implementing corrective education policies (OECD, 2020[4]), or whether there are some critical determinants for educational success yet to unveil. In fact, many factors can influence educational outcomes, and PISA has progressively extended the scope of its analysis to adopt a more holistic approach to students' learning

experience. For instance, previous cycles included students' epistemological beliefs in science (2006), students' motivation in reading (2009), students' engagement at school (2012), and students' overall well-being (2015).

Against this backdrop, PISA included a "growth mindset" concept in its last 2018 assessment. Growth mindset has been discussed in the field of psychology over the last few decades. Possibly, it explains why certain students thrive when facing adversity while others languish. In a society with increasing uncertainties, it is inevitable that new challenges are faced which sometimes result in failure. For young people to strive, it is crucial for them to be able to confront difficulties and handle setbacks. During the global COVID crisis, the massive closing of schools heterogeneously impacted more than 1.6 billion students (UNESCO, 2020[5]). While the experience may have been enriching for students who are able to set their own learning goals, elaborate learning strategies, and master their progress, it was devastating for other students who are used to being led by others in their learning and who have little taste for steering their learning on their own (Reimers and Schleicher, 2020[6]; Gouëdard, Pont and Viennet, 2020[7]). The idea that psychology plays a role in students' learning processes sheds light on the limitations of traditional input-based indicators in predicting the performance of an education system. Focusing on learning processes themselves could provide insight on why some countries invest less time and money on education and yet still perform better than their counterparts.

The literature on growth mindset is still under development as researchers identify causal mechanisms using random control trials. The most recent research developments focus on heterogeneity of treatment effects to better understand how a growth mindset may influence various groups of students differently. By surveying some 600 000 students in 77 countries and economies, PISA offers a unique opportunity to contribute to this research as it analyses students, teachers, and schools in different contexts, and proposes to identify significant correlations to guide future research.

Box.1 What is PISA?

"What do young people know and are able to do?" In response to that question and to the need for internationally comparable evidence on student performance, the Organisation for Economic Co-operation and Development (OECD) launched the Programme for International Student Assessment (PISA) in 2000.

PISA is a triennial survey of 15-year-old students around the world that assesses the extent to which they have acquired key knowledge and skills essential for full participation in social and economic life. PISA assessments include the core school subjects of reading, mathematics and science, and also innovative areas, such as creative problem solving (2012), collaborative problem solving (2015), global competence (2018) and creative thinking (2021).

PISA is used as an assessment tool around the world. It was implemented in 43 countries and economies in the first assessment (32 in 2000 and 11 in 2002), 41 in the second assessment (2003), 57 in the third assessment (2006), 75 in the fourth assessment (65 in 2009 and 10 in 2010), 65 in the fifth assessment (2012) and 72 in the sixth assessment (2015). In 2018, 79 countries and economies participated in PISA. Some 600 000 students completed the assessment, representing about 32 million 15-year-olds in the schools of the 79 participating countries and economies.

What does the test measure?

In each round of PISA, one subject is tested in detail, taking up nearly half of the total testing time, and an innovative domain is assessed. The main subject in 2018 was reading, as it was in 2000 and 2009. Mathematics was the main subject in 2003 and 2012 and will be again in 2022, while science was the main subject in 2006 and 2015. With this alternating schedule, a thorough analysis of achievement in each of the three core subjects is presented every nine years; an analysis of trends is offered every three years.

The assessment

In PISA 2018, computer-based tests were used in most countries and economies with assessments lasting a total of two hours. In reading, a multi-stage adaptive approach was applied in computer-based tests whereby students were assigned a block of test items based on their performance in preceding blocks.

To gather contextual information, PISA 2018 asked students and the principal of their school to respond to questionnaires. The questionnaire sought information about the students themselves, their attitudes, dispositions and beliefs, their homes, and their school and learning experiences. School principals completed a questionnaire that covered school management and organisation, and the learning environment. The responses to the questionnaires provide both a broader and more nuanced picture of student, school and system performance.

To obtain additional information, some countries/economies decided to distribute a questionnaire to teachers to learn about their training and professional development, their teaching practices and their job satisfaction. In some countries and economies, an optional questionnaire was also distributed to parents, who were asked to provide information on their perceptions of and involvement in their child's school, their support for learning in the home, and their own engagement with reading and with other cultures.

The PISA 2018 Assessment and Analytical Framework (OECD, 2019[8]) presents definitions and more detailed descriptions of the subjects assessed in PISA 2018, and describes the genesis of the questionnaires in detail. The questionnaires from all assessments since PISA's inception are available on the PISA website: www.pisa.oecd.org.

Source: OECD (2019[8]), *PISA 2018 Assessment and Analytical Framework,* PISA, OECD Publishing, Paris,
https://dx.doi.org/10.1787/b25efab8-en

2. What is a growth mindset?

To help us understand why some people fulfil their potential and others do not, Carol Dweck developed a theory relying on a dual concept: a growth as opposed to a fixed mindset (Dweck, 2006[9]). A growth mindset is the belief that someone's ability and intelligence can be developed over time. Conversely, a fixed mindset is the belief that individuals are born with certain invariant characteristics, which cannot be altered by experience.

As shown in Figure 1, people who believe their talents are innate gifts (a fixed mindset) tend to attach more importance to validating their ability by narrowly pursuing performance goals, for instance, or avoiding challenges as high effort and setbacks are seen as signalling low ability. On the contrary, people who consider their ability to be malleable (a growth mindset) will strive to develop it by setting challenging learning goals. They consider effort an inherent part of the learning process and setbacks to be fruitful experiences to assimilate. People with a growth mindset are characterised by a greater passion for learning and a decreased anxiety about learning linked to their positive conception of failure. This leads them to stretch and expend efforts to reach their full potential whereas people with a fixed mindset are more likely to develop a hunger for approval that restricts them to their comfort zone (Dweck and Yeager, 2019[10]).

According to the theory, schools that instil a growth mindset in students may boost their achievement and improve their well-being. Students with a growth mindset are more likely to be resilient, develop learning strategies to achieve complex objectives, are willing to try new learning strategies, capitalise on learning experience, and respond positively to feedback (Yeager and Dweck, 2012[11]). Fostering a growth mindset has been sometimes simplified as merely praising effort or telling students they can achieve any goal they set (Box 2). But it also requires teachers and school leaders to develop specific pedagogies and practices, and create a conducive environment for students to develop and act on this belief (Dweck, 2016[12]).

> ### Box 2. Warning about false growth mindset
>
> The development of the growth mindset concept over the last 20 years has attracted significant attention among education professionals. However, the democratisation of the concept has been associated with simplification and misconceptions that can limit its scope. Three main misunderstandings are summarised below:
>
> - **A growth mindset is not a trait.** For some, a growth mindset amounts to a fixed personal characteristic such as "being open-minded" or "flexible", qualities individuals may consider they already have. However, mindsets can be dynamic and most individuals have both growth and fixed mindset components, evolving continuously. Recognising that a growth mindset is a continuous process, a perpetual questioning, is a necessary step to progress in its development.
>
> - **Growth mindset is not just about praising and rewarding effort.** Effort alone is unlikely to maximise personal growth, and praising effort unconditionally may have adverse effects such as creating satisfaction in the absence of progress. Rather, instilling a growth mindset is about rewarding progress and the processes that lead to greater learning such as trying different learning strategies and searching for meaningful feedback.

- **Growth mindset development is not the student's sole responsibility.** Some educators consider that telling students they can reach any goal they set is enough to foster a growth mindset. Encouraging students in their endeavours is indeed crucial for them to be able to fulfill their potential but mere encouragement can be superficial without an appropriate learning environment. Parents, guardians, and educators share a large responsibility in establishing a learning place where students are not continuously judged but one in which they dare to try, are not afraid of making mistakes, and receive constructive feedback from educators who believe in them.

Source: Dweck (2016[13]), *What having a "growth mindset" actually means*, Harvard Business Review.

Figure 1. A model of two mindsets by Carol S. Dweck
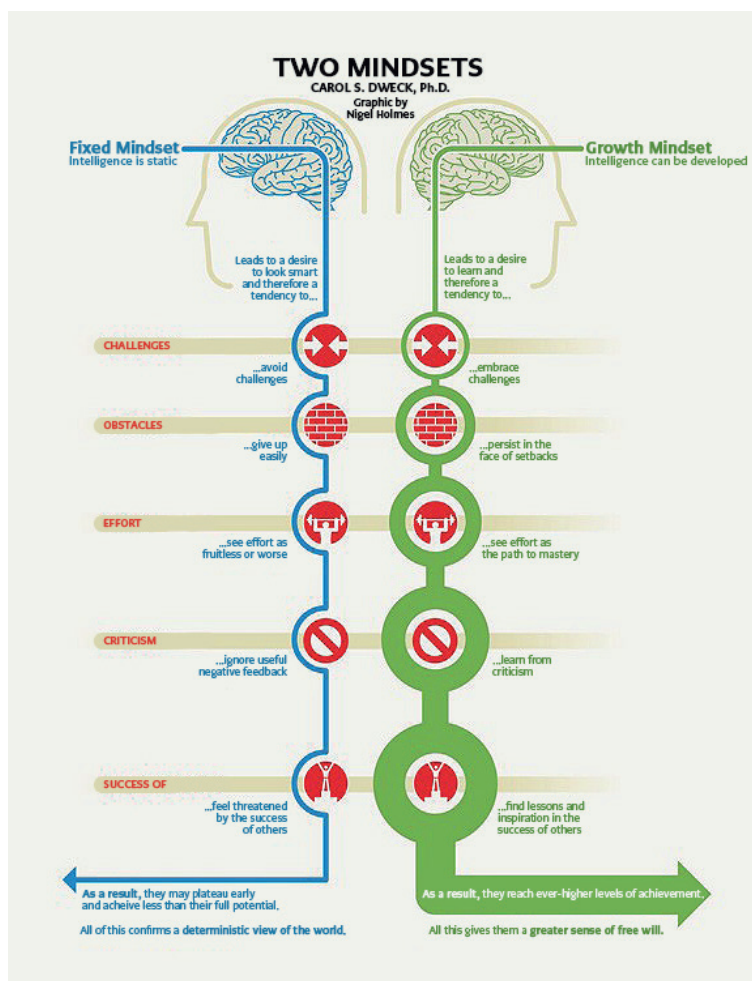
Source: Dweck, C. (2016), Mindset: The New Psychology of Success, Ballantine Books, New York, NY.

The bottom line: What is a growth mindset?

A growth mindset is the belief that one's skills and qualities can be cultivated through effort, good strategies, and support from others, as opposed to a fixed mindset that supposes them to be determined at birth.

According to the theory, a person with a growth mindset is more likely to embrace challenges and learn from setbacks to reach greater levels of achievement than a person with a fixed mindset who avoids challenges and mostly seeks approval.

Instilling a growth mindset is not just about praising effort, which can backfire and generate adverse effects. Rather, it implies rewarding progress and the processes that lead to greater learning. It is a process that requires continuous efforts from students and educators, parents, and guardians.

3. What does PISA show about growth mindset between different groups of students?

In PISA 2018, about 600 000 students from 77 countries and economies were surveyed to depict the landscape of growth mindset for 15 year-olds. PISA 2018 asked students whether they agreed ("strongly disagree", "disagree", "agree", or "strongly agree") with the following statement: "Your intelligence is something about you that you can't change very much". Disagreeing with the statement is considered a precursor of a growth mindset, as it is more likely that someone who thinks intelligence can change will challenge him/herself to improve it. As discussed in Box 2, a mindset is not a trait but the result of a continuous and perpetual process. Students who disagreed with the statement are considered to have a stronger growth mindset than students who agreed with it (Box 3) but for the sake of simplicity we refer to them as "presenting a growth/fixed mindset" in this report.

A majority of students presented a growth mindset in PISA but some countries lag behind. Almost two-thirds of students disagreed or strongly disagreed that intelligence is something that they cannot change very much on average across OECD countries (Figure 2). In three OECD countries (Estonia, Denmark, and Germany), three-quarters of students or more reported to have a growth mindset. However, in 26 countries and economies, including three OECD countries (Greece, Mexico, and Poland), a majority of students agreed with the fixed mindset statement "Your intelligence is something about you that you can't change very much". More than two-thirds of students in the Philippines, Panama, Indonesia, Kosovo, and the Republic of North Macedonia (hereafter North Macedonia) presented a fixed mindset.

Girls are slightly more likely to present a growth mindset. In 39 countries and economies, more girls present a growth mindset compared to boys (Figure 2). The most significant discrepancy takes place in Belarus with almost 13 percentage points, but on average across OECD countries, girls are only 3.5 percentage points more likely to have a growth mindset than boys. In only six countries and economies – North Macedonia, Korea, Hong Kong (China), Beijing, Shanghai, Jiangsu and Zhejiang (China) (hereafter "B-S-J-Z [China]"), Macao (China), and Chinese Taipei – boys demonstrated slightly more growth mindset. There is no significant difference between boys and girls in 32 countries and economies.

Students from a socio-economically advantaged background presented a growth mindset more often. In almost every education system, socio-economically disadvantaged students were more likely than advantaged students to agree that their intelligence cannot change very much over time (Figure 2). At the system-level, the socio-economic gap in growth mindset is related to the level of equity across all countries/economies. In education systems with greater equity (i.e. student socio-economic status is related to performance to a lesser extent), the socio-economic gap in growth mindset tends to be smaller (correlation coefficient=-0.41 across all countries/economies). The positive association between coming from a socio-economically advantaged background and developing a growth mindset may imply either that advantaged students are offered more opportunities to develop a growth mindset because of appropriate educational resources and a nurturing learning environment, or that advantaged students are more likely to perceive the social desirability of disagreeing with the fixed mindset statement (Box 3).

There is no clear pattern between students with or without an immigrant background in terms of growth mindset. In 41 countries and economies, there is no significant difference in terms of growth mindset between immigrant and non-immigrant students (Figure 2). The gap is in favour of immigrant students in 18 countries and economies, and especially in the Republic of Moldova, the Philippines, and the United Arab Emirates. However, in 11 countries and economies, the gap swings in favour of non-immigrant students, particularly in Colombia, Albania, and Iceland.

Figure 2. Growth mindset, by student characteristics
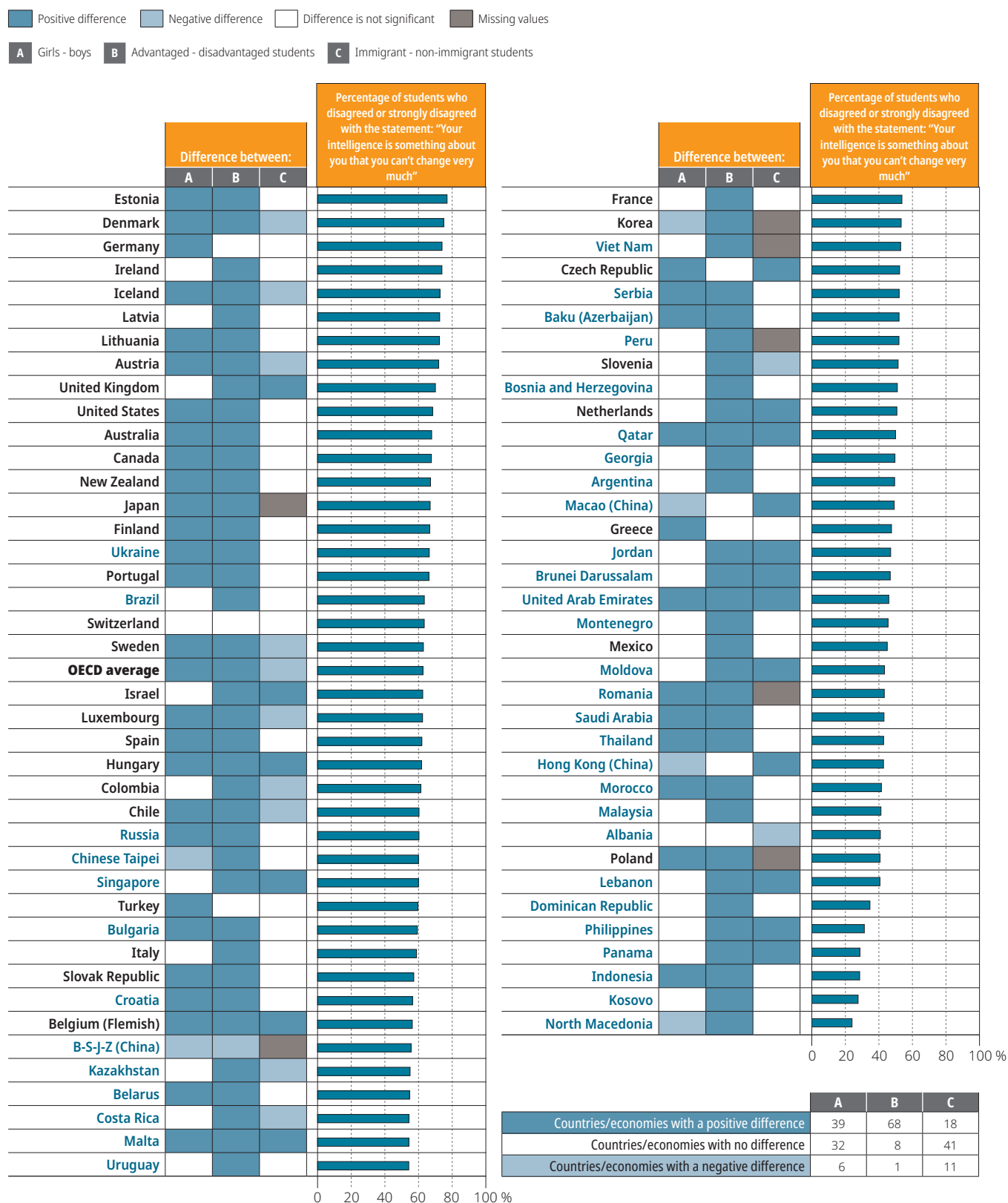
Legend:
- ■ Positive difference
- ■ Negative difference
- □ Difference is not significant
- ■ Missing values

A Girls - boys   **B** Advantaged - disadvantaged students   **C** Immigrant - non-immigrant students

	A	B	C
Countries/economies with a positive difference	39	68	18
Countries/economies with no difference	32	8	41
Countries/economies with a negative difference	6	1	11

Source: OECD, *PISA 2018 Results (Volume III): What School Life Means for Students' Lives*, Figure III.14.1, and Table B.2 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Box 3. Methodology for measuring growth mindset in PISA 2018

To measure growth mindset in PISA 2018, three items were initially developed as part of a global question: "How much do you agree or disagree with the following statements:

- No matter who you are, you can change your intelligence a lot.

- You can always change greatly your level of intelligence.

- No matter how much intelligence you have, you can always change your intelligence quite a bit."

Countries and economies that participated in PISA 2018 reviewed the three items and expressed concerns over data privacy and the ability of the items to effectively measure growth mindset. It was then suggested to phrase a question as the most "typical" way to inquire into growth mindset. In the end, it was decided that students should be asked whether they agreed ("strongly disagree", "disagree", "agree", or "strongly agree") with the following statement: "Your intelligence is something about you that you can't change very much." Students who disagreed with the statement are considered to have a stronger growth mindset than students who agreed with the statement.

Previous research has demonstrated the validity of single-item measures such as the single-item self-esteem scale (Robins et al., 2001[14]), the single-item ability ratings (Rammstedt and Rammsayer, 2002[15]), or the abbreviated 10-item measure of the Big Five (Rammstedt and John, 2007[16]). However, some concerns have emerged regarding the capacity of this single item in PISA 2018 to measure growth mindset accurately. In particular, two main issues have arisen:

- **The response format of the item** may influence student response. The selected item to measure growth mindset in PISA 2018 followed an "agreement question" rather than a "construct specific" format.

- **The item's cognitively demanding formulation** may reduce precision in the measurement as students had to disagree with a negative statement to report having a growth mindset.

This method of measuring growth mindset potentially suffers from i) acquiescent bias, or the tendency to agree with questions regardless of content, and ii) measurement error, as the cognitive load required by the question increases the likelihood of a random response. These elements can attenuate or magnify the correlations presented in this report. For instance, if more acquiescent people do better in school because they listen to teachers more, this would underestimate the correlation between growth mindset and performance since higher-achieving students are more likely to agree with the fixed-mindset statement. On the other hand, if lower-performing students are more likely to be confused by the question formulation and agree mistakenly to the fixed-mindset statement, this would lead to an overestimation of the relationship between growth mindset and performance.

As a consequence, results presented in this report reflect the initial stages of the measurement and analysis of growth mindset in PISA, and should be considered as such. Given the limited space for additional topics in the student questionnaire, this is, nonetheless, a significant step toward the elaboration of a more refined growth mindset instrument for PISA 2022/25.

The bottom line: What does PISA show in terms of growth mindset between different groups of students?

Overall, a majority of students present a growth mindset in PISA: in 53 countries and economies more than 50% of students disagreed with a fixed mindset statement. However some countries lag behind: in 25 countries and economies, more than 50% of students agreed with a fixed mindset statement.

The contrasting landscape of growth mindset in PISA makes the case that every student can develop a growth mindset. When a group of students (for instance, girls vs boys, disadvantaged vs advantaged, immigrant vs non-immigrant) is less likely to exhibit growth mindset, this should raise questions as to whether they benefitted from adequate resources and learning environment.

4. What is the relationship between growth mindset and academic performance in PISA?

The analysis of PISA results corroborates the literature on growth mindset that highlights a positive association between growth mindset and academic performance (Blackwell, Trzesniewski and Dweck, 2007[17]; Claro, Paunesku and Dweck, 2016[18]; McCutchen et al., 2016[19]; Outes, Sanchez and Vakis, 2017[20]; Paunesku et al., 2015[21]; Yeager et al., 2019[22]). More importantly, it confirms that a growth mindset has larger pay-offs for vulnerable students who are at the greatest risk of poor performance (Burnette et al., 2013[23]; Dweck and Yeager, 2019[10]; Yeager and Dweck, 2020[24]). This opens an avenue for designing policies and interventions promoting equity and bridging the performance gap between different groups of students.
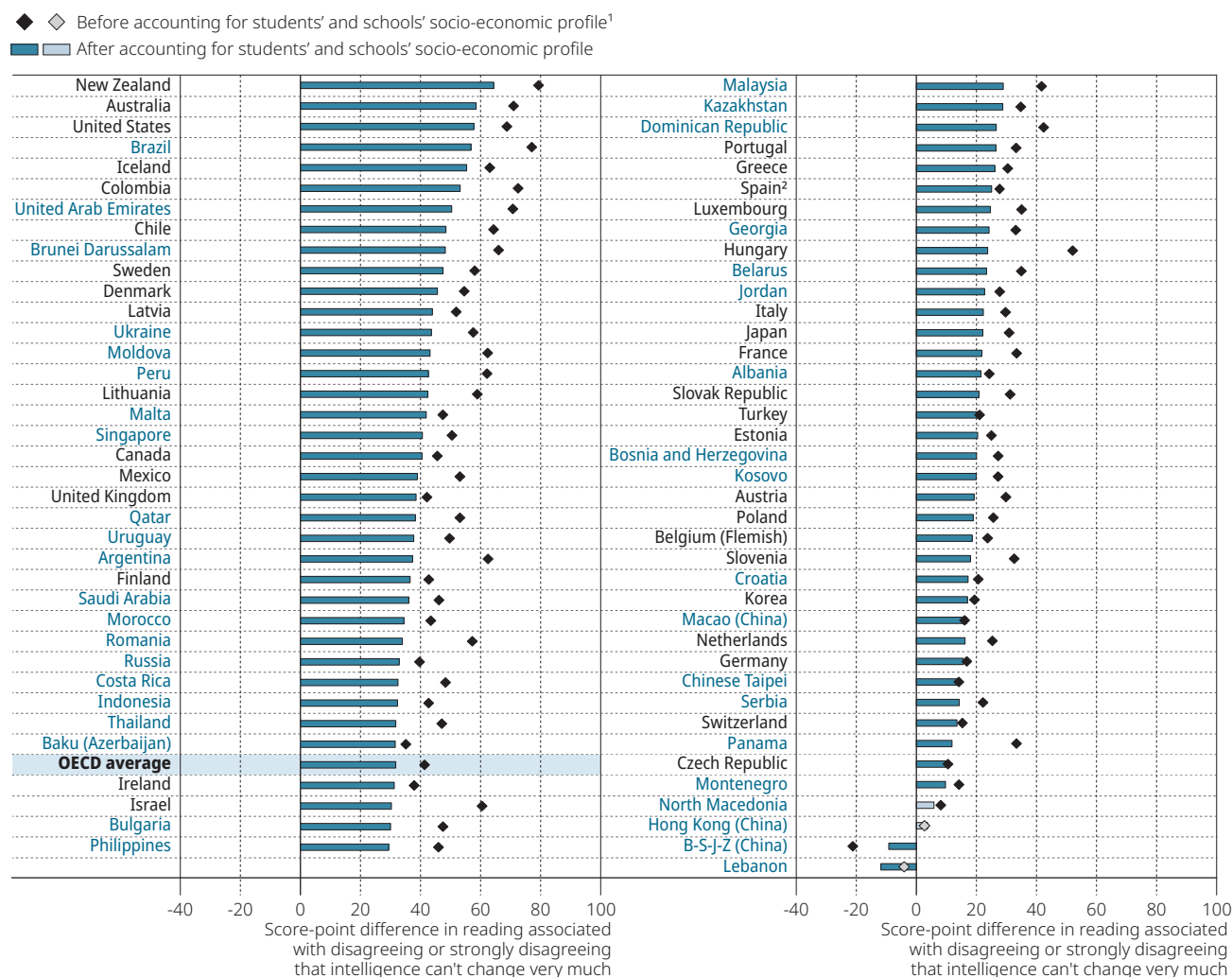
Students who reported having a growth mindset scored higher in PISA. On average across OECD countries, students who disagreed or strongly disagreed with the statement "Your intelligence is something about you that you can't change very much" scored 31.5 points higher in reading (Figure 3), 27 points higher in science, and 23 points higher in mathematics than students who agreed or strongly agreed with it after accounting for the socio-economic profile of students and schools (as measured by the PISA index of economic, social and cultural status) (Table B.3). The performance gap in reading was the widest in New Zealand, Australia, and the United States where students with a growth mindset scored around 60 points higher in reading than their counterparts after accounting for the socio-economic profile of students and schools. In only four countries and economies was this positive association not observed: North Macedonia, Hong-Kong [China], B-S-J-Z [China], and Lebanon.

In East Asian countries, growth mindset was not as strongly associated with academic performance as in most OECD countries. Compared to 32 points on average in reading across OECD countries, students with a growth mindset scored only 22 points higher in Japan, 17 points higher in Korea and Macao (China) and 15 points in Chinese Taipei after accounting for the socio-economic profile of students and schools (Table B.3). Growth mindset and reading performance were unrelated in Hong Kong (China), and even negatively associated in B-S-J-Z (China). According to some research conducted in Hong Kong (China) whose findings could be extrapolated to other Asian societies with a Confucian cultural heritage, growth mindset in such contexts can be assimilated into the dominant cultural ethos of working hard (vs. working smart, in other words, diligently as opposed to cleverly). This may lead to popular support for a "false growth mindset" centred on diligence (OECD - Yidan Prize Foundation, 2020[25]), and suggest that in such environments even fixed mindset students have internalised a value of working hard, which can attenuate the negative effects of a fixed mindset.

Growth mindset is associated with a slightly larger score gain among girls than boys. The performance gap in reading between students displaying or not a growth mindset was wider on average for girls (a 42 score-point difference) than for boys (a 39 score-point difference). This average gap of 3 points across OECD countries is statistically significant (Figure 4). The reading gap in favour of girls was the widest in North Macedonia, Denmark, and the Flemish Community of Belgium (above 24 points). It was the largest in favour of boys in Hong Kong (China), Turkey, and Colombia (above 12 points) (Table B.4). The research literature points, in particular, to the interaction between growth mindset and gender to explain outcome differences in science, technology, engineering, and mathematics (STEM) fields. It has been proposed that females are more vulnerable to the detrimental effects of a fixed mindset in mathematical ability (Dweck, 2007[26]; Good, Rattan and Dweck, 2012[27]). A short-term longitudinal study of high-school students in the United States indicated that while a growth mindset in mathematics appears to be beneficial for both genders, it is especially beneficial for adolescent females. Females

respond more to growth mindset as it corrects downward-biased expectancy beliefs – how much an individual expect to succeed and its confidence in the ability to succeed – and stereotypes that mostly amount to "males are better at math". Growth mindset may help curb self-defeating thoughts, and correct biased perceptions about math abilities that operate as a barrier to performance for many females (Degol et al., 2018[28]).

Figure 3. Growth mindset and reading performance

◆ ◇ Before accounting for students' and schools' socio-economic profile[1]
▬ ▭ After accounting for students' and schools' socio-economic profile

1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
2. See note in Annex A1 for Spain.
Note: Statistically significant values are shown in darker tones.
Source: OECD, *PISA 2018 Results (Volume III): What School Life Means for Students' Lives*, Figure III.14.2, and Table B.3 in this report.
`https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx`

Teaching growth mindset in schools can potentially diminish the negative effects of economic deprivation on students' academic achievement. On average across OECD countries, the performance gap in reading between students presenting a growth mindset and those not presenting it was wider among socio-economically disadvantaged students (a 39 score-point difference) than advantaged students (a 27 score-point difference), and this average gap of 12 points is statistically significant (Figure 4). This result is consistent with findings reported in previous research (Paunesku et al., 2015[21]; Claro, Paunesku and Dweck, 2016[18]). Using a nationwide sample of high-school students from Chile, Claro, Paunesku and Dweck show that those who hold more of a growth mindset consistently outperform those who do not at every socio-economic level – even after accounting for socio-economic and attitudinal factors. They also found that the lowest-income Chilean students were twice as likely as the highest-income students to report a fixed mindset. Mindset was identified as a stronger predictor of academic success than available resources for low-income students. In another study, Paunesku et al. (2015[21]) showed that a short growth mindset intervention in US high schools – consisting of a 45-minutes online session where students read an article describing the brain's ability to grow – was the most beneficial to students at risk of dropping out. These results suggest that a growth mindset may

help mitigate the negative effects of economic deprivation on academic achievement. Furthermore, the impact of aspirations on educational outcomes, and the possibility of aspiration-based poverty trap, where the failure to aspire may condition life outcomes (Appadurai, 2004[29]), pave the way for future mindset-related policies correcting socially-biased aspirations (Guyon and Huillery, 2020[30]).

Growth mindset is associated with a larger score gain among immigrant than non-immigrant students. The performance gap in reading between students presenting a growth mindset and those not presenting it was wider on average for students with an immigrant background (a 48 score-point difference) than students without an immigrant background (a 39 score-point difference), and this 9 points average gap across OECD countries is statistically significant (Figure 4). In Finland, Germany and Panama, the performance gap between students with and without a growth mindset was wider by more than 30 score points among immigrant students than non-immigrant students (Table B.4).

A mixed pattern emerged from PISA between growth mindset and educational expectations. PISA asked students if they expect to complete tertiary education, including obtaining a bachelor's, master's or doctoral degree (ISCED 5A and 6). In 37 countries and economies, and after accounting for student characteristics in socio-economic status, gender, immigrant background and reading performance, students with a growth mindset established more ambitious academic goals for themselves than students who presented a fixed mindset (Figure 5). For instance, in Iceland, Australia, and Ireland, students with a growth mindset are at least 47% more likely to expect completing a university degree. However, in 37 countries and economies, no statistically significant association was detected between growth mindset and educational expectations. In France, students with a fixed mindset are 14% more likely to expect completing a university degree (Table B.7). The literature has not yet explored the connection between growth mindset and transition to higher education. However, some work already hold promises for future research. Degol et al. (2018[28]) have analysed how a growth mindset in mathematics contributes to the shaping of beliefs and the likelihood of a STEM career. Yeager et al. (2019[22]) have documented how growth mindset leads to improved grades among lower-achieving students and increases overall enrolment in advanced mathematics courses, which may influence completion rates and access to higher education.

Box 4. Interpreting PISA data with caution

The purpose of most of the literature cited in this section (and more generally in this report) is to establish causality between growth mindset and various outcomes. To do so, researchers exploit the longitudinal nature of data or design random control experiments to establish whether instilling a growth mindset improves students' outcomes.

In contrast, PISA data are cross-sectional, and the survey has not been designed to identify causal mechanisms. Therefore, only relationships between variables are presented in this report. While these correlational results indicate how and whether the variables are associated, they do not inform on the direction of causality between the considered variables.

For instance, the positive correlation between growth mindset and academic performance in PISA can be explained in both ways:

- Instilling a growth mindset in students results in better academic performance as students with a growth mindset are more willing to face challenges, expend effort, learn from setbacks, and seek advice.

- Students with strong academic performance are more likely to develop a growth mindset as they have identified successful learning strategies and observed how their abilities have grown consequently. Students performing well may also associate their success to internal characteristics of effort and perseverance, while those performing poorly may attribute it to immutable characteristics to preserve their self-esteem.

PISA findings cannot prove cause and effect; rather, they present potential evidence to support existing theories and feed into the current research agenda by suggesting new avenues of research.

Box 5. Teaching growth mindset in an Asian society, the PASS model in Hong Kong (China)

Students in Hong Kong (China) are less likely on average than their OECD peers to present a growth mindset (Figure 2). In a Chinese cultural setting, teaching growth mindset is challenging because of the keen academic competition that does not leave much room for trialling and failing different learning strategies, and favours "working hard rather than working smart", or efforts that are diligent rather than clever.

The Positive Applied Social Science Program at the Chinese University of Hong Kong (PASS@CUHK) has researched how to foster growth mindset in such a challenging environment, and found two necessary conditions for developing growth mindset in schools in Hong Kong (China). First, there must be a strong growth mindset culture in the school. Second, students must have personal experience of meeting challenging and personally significant growth goals through deliberate practices of effective learning strategies.

The PASS model relies on helping teachers become education innovators through a whole-school intervention programme that helps them acquire and apply evidence-based skills in curriculum and pedagogical design, classroom management and assessment. PASS@CUHK has also enlisted award-winning architects to redesign and rebuild school campuses that support these teaching and learning innovations. Six strategies underlying these interventions at school-scale are:

- Create a physical environment that affords exploration and innovations in teaching strategies;

- Equip teachers with evidence-based knowledge and skills to become education innovators;

- Provide immediate online feedback to teachers on the effectiveness of their education innovations;

- Reform school administration to empower teachers in the pursuit of education innovation;

- Help teachers strengthen their growth mindset by reflecting on their innovation experiences; and

- Use icons and narratives to establish communicable and visible growth mindset norms in schools.

Research carried out by PASS@CUHK has showed that Hong Kong (China) schools that have implemented the PASS model significantly increased the number of their students presenting a growth mindset. In addition, the strengthening of the growth mindset in these schools has also been accompanied by a significant increase in students' learning motivation, perseverance, openness, academic engagement, academic achievement, subjective well-being, and purpose in life.

Source: OECD - Yidan Prize Foundation (2020[25]), *Growth Mindset Online Workshop: Mindsets and Well-Being, Chi-Yue Chiu*

Figure 4. Association between growth mindset and performance, by student characteristics

OECD average

Notes: All values are statistically significant.
All linear regression models account for students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Tables B.4, B.5 and B.6 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Figure 5. Growth mindset and educational expectations

◆ ◇ Before accounting for student characteristics[1]
▬ ▭ After accounting for student characteristics

Left panel header: Students who endorsed a **growth** mindset were more likely to expect completing university

Left panel inner label: Students who endorsed a **fixed** mindset were more likely to expect completing university

Left panel country list (top to bottom): Iceland, Australia, Ireland, Chile, Sweden, Indonesia, New Zealand, Lithuania, Italy, Denmark, Japan, Malta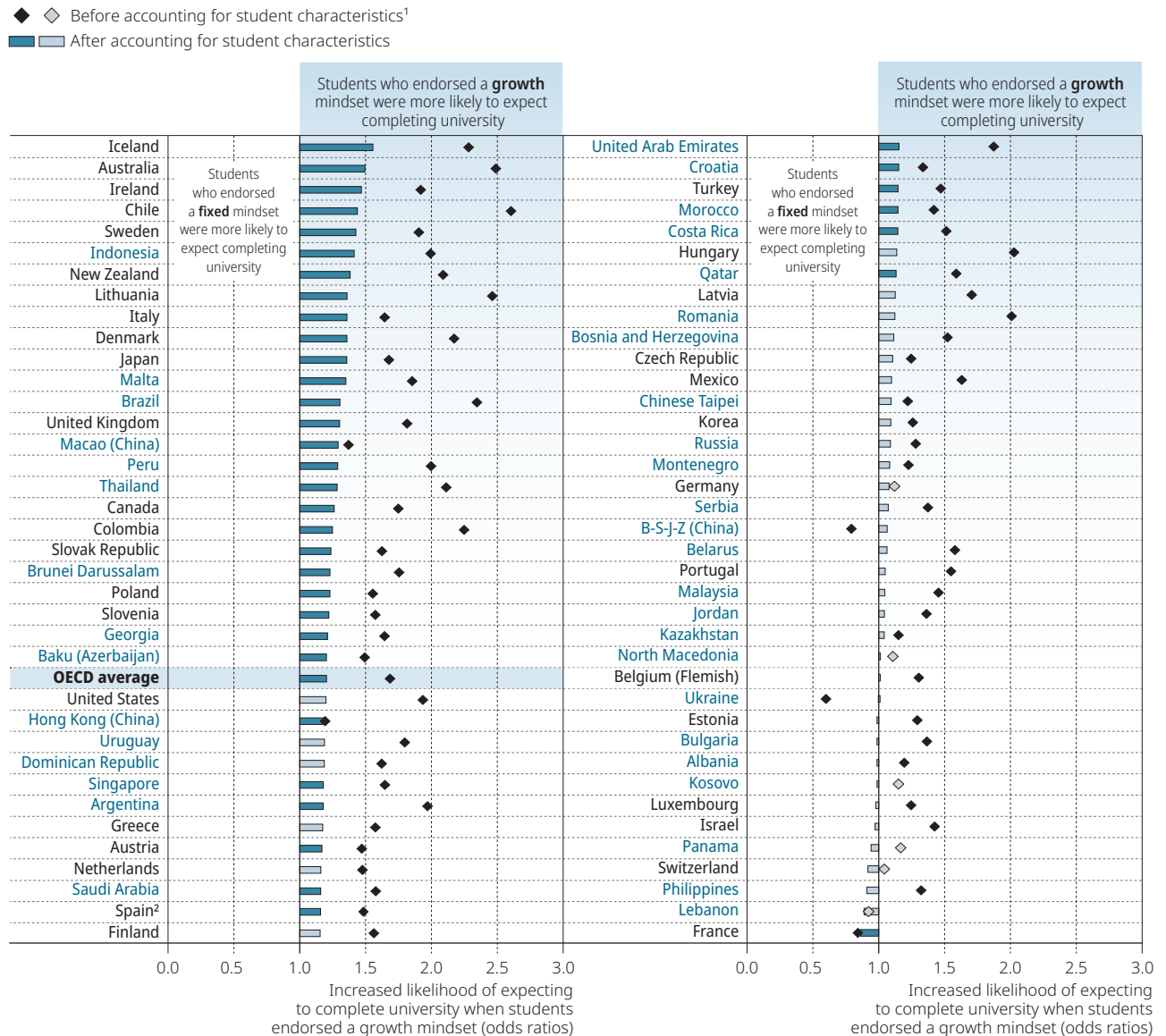, Brazil, United Kingdom, Macao (China), Peru, Thailand, Canada, Colombia, Slovak Republic, Brunei Darussalam, Poland, Slovenia, Georgia, Baku (Azerbaijan), **OECD average**, United States, Hong Kong (China), Uruguay, Dominican Republic, Singapore, Argentina, Greece, Austria, Netherlands, Saudi Arabia, Spain[2], Finland

Left panel x-axis: 0.0 0.5 1.0 1.5 2.0 2.5 3.0

Increased likelihood of expecting to complete university when students endorsed a growth mindset (odds ratios)

Right panel header: Students who endorsed a **growth** mindset were more likely to expect completing university

Right panel inner label: Students who endorsed a **fixed** mindset were more likely to expect completing university

Right panel country list (top to bottom): United Arab Emirates, Croatia, Turkey, Morocco, Costa Rica, Hungary, Qatar, Latvia, Romania, Bosnia and Herzegovina, Czech Republic, Mexico, Chinese Taipei, Korea, Russia, Montenegro, Germany, Serbia, B-S-J-Z (China), Belarus, Portugal, Malaysia, Jordan, Kazakhstan, North Macedonia, Belgium (Flemish), Ukraine, Estonia, Bulgaria, Albania, Kosovo, Luxembourg, Israel, Panama, Switzerland, Philippines, Lebanon, France

Right panel x-axis: 0.0 0.5 1.0 1.5 2.0 2.5 3.0

Increased likelihood of expecting to complete university when students endorsed a growth mindset (odds ratios)

1. Student characteristics include socio-economic status, gender, immigrant background and reading performance. The socio-economic status is measured by the PISA index of economic, social and cultural status (ESCS).

2. See note in Annex A1 for Spain.

Note: Statistically significant values are shown in darker tones.

Source: OECD, *PISA 2018 Results (Volume III): What School Life Means for Students' Lives*, Figure III.14.6, and Table B.7 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

The bottom line: What is the relationship between growth mindset and academic performance in PISA?

PISA findings cannot prove cause and effect; rather, they present potential evidence to support existing theories and feed into the current research agenda by suggesting new avenues of research.

On average across OECD countries, students who present a growth mindset scored higher in reading, mathematics, and science than their peers with a fixed mindset. In addition, growth mindset is associated with a larger score gain for girls, and disadvantaged and immigrant students when compared to boys, and advantaged and non-immigrant students.

These results, in line with the literature on growth mindset that highlights a positive association between growth mindset and academic performance, support further research focusing on the buffering effect of growth mindset on poverty, biased perceptions, and curbed aspirations. It opens an avenue for designing policies and interventions promoting equity and bridging the performance gap between different groups of students.
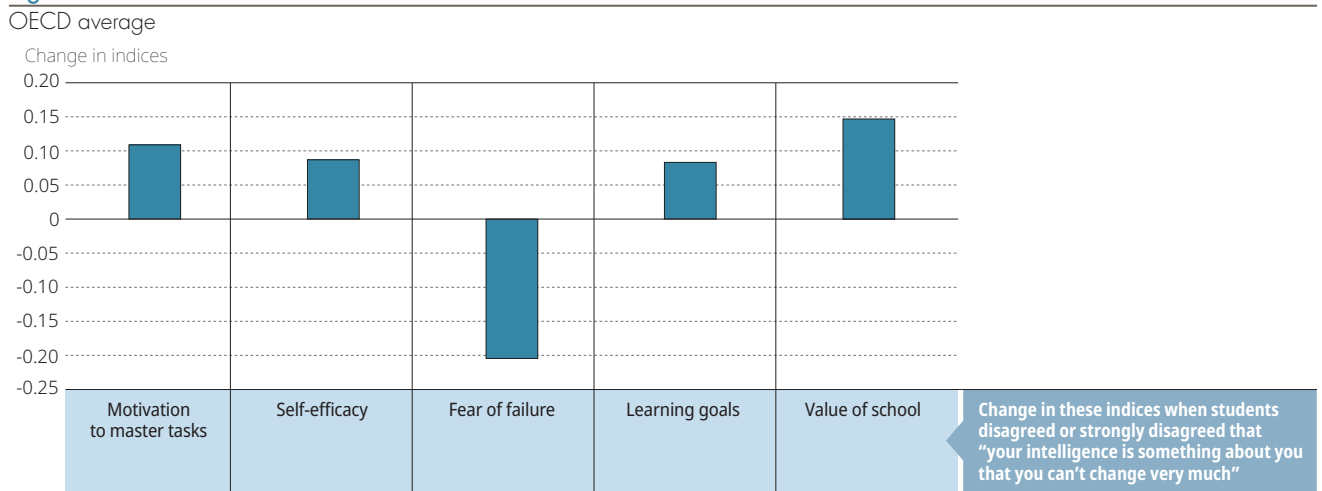
5. How can growth mindset lead to better results?

According to Dweck and Yeager (2012[11]; 2019[10]; 2020[24]), students with a growth mindset are more likely to be resilient and innovative in their learning strategies, and display higher levels of motivation – elements that could mediate the relationship between mindset and academic achievement. Several indices in PISA have been identified as potential mediators between growth mindset and academic performance: motivation to master tasks, general self-efficacy, fear of failure, value of school, and attitudes towards learning and schooling (Box 6).

PISA data show that students with a growth mindset valued school more, set more ambitious learning goals, reported higher levels of self-efficacy, and displayed higher levels of motivation and lower levels of fear of failure (Figure 6). Students in Ireland, Iceland, and the United Kingdom presented some of the highest positive correlations between growth mindset and motivation, learning goals, and value of schooling. Students in Korea, Hong Kong (China) and B-S-J-Z (China) displayed among the highest correlations between growth mindset and self-efficacy, and the lowest correlations between growth mindset and fear of failure (Table B.8). On average across OECD countries, growth mindset appears to induce a positive effect on students' behaviour, which, likely, facilitates academic success (Yeager and Walton, 2011[31]; Farrington et al., 2012[32]).

Figure 6. Growth mindset and student attitudes

OECD average

Change in these indices when students disagreed or strongly disagreed that "your intelligence is something about you that you can't change very much"

Notes: All values are statistically significant.

All linear regression models account for gender and students' and schools' socio-economic profiles. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Source: OECD, PISA 2018 Results (Volume III): What School Life Means for Students' Lives, Figure III.14.5, and Table B.8 in this report.

https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Blackwell, Trzesniewski and Dweck (2007[17]) have shown, for instance, that adolescents endorsing a growth mindset also developed more ambitious learning goals, held more positive beliefs about effort, and developed effort-based strategies in response to failure, which boosted mathematics achievement over the junior high-school transition. However, with an experimental design, Sriram (2014[33]) found that a growth mindset positively influenced effort behaviours but had no effect on the academic performance of at-risk college students.

Self-efficacy or beliefs about one's ability to exercise control over one's own activities is another promising mediator between growth mindset and academic performance as it can influence other attitudes. The way people perceive their coping abilities influences how well they motivate themselves, set goals, and persevere in the face of difficulties (Bandura, 2011[34]). Self-efficacy can drive higher achievement as it predicts performance better than previous achievements or ability, and is critical when individuals face adversity (Cassidy, 2015[35]).

PISA data showed that when students had higher motivation and self-efficacy, set more ambitious learning goals, and valued school more, they scored higher in reading, mathematics, and science. For instance, a one-unit increase in the index of motivation to master tasks is associated on average across OECD countries with an increase of 11 points in reading, 9 points in science, and 8.5 points in mathematics after accounting for the socio-economic profile of students and schools (Figure 7). Among OECD countries, this association is the highest in Norway where a one-unit increase in the index of setting ambitious learning goals is associated with an improved academic performance of 25 points in reading, 20.5 points in science, and 20 points in mathematics (Table B.9).

The relationship between fear of failure and performance is more ambiguous. A rational and moderate sense of fear may spur students to expend greater effort on academic tasks. Students with a higher fear of failure on average across OECD countries perform better in the three domains assessed after accounting for the socio-economic profile of students and schools (Figure 7). On the other hand, an exacerbated fear of failure may have detrimental effects as it causes stress and anxiety (Ashcraft and Kirk, 2001[36]), and may prevent students from engaging in challenging learning activities (Kaye, Conroy and Fifer, 2008[37]).

Growth mindset is negatively associated with fear of failure (Figure 6), but positively associated with performance (Figure 3). In effect, people with a growth mindset are characterised by a decreased anxiety about learning linked to their positive conception of failure (Dweck and Yeager, 2019[10]). These results suggest that if growth mindset positively influences performance through fear of failure, it does so by reducing the "unproductive" fear of failure that undermines performance. Additional research could further refine this mediating effect, by analysing for instance how it varies according to gender, socio-economic background, and migrant status.

Figure 7. Student attitudes and average PISA scores
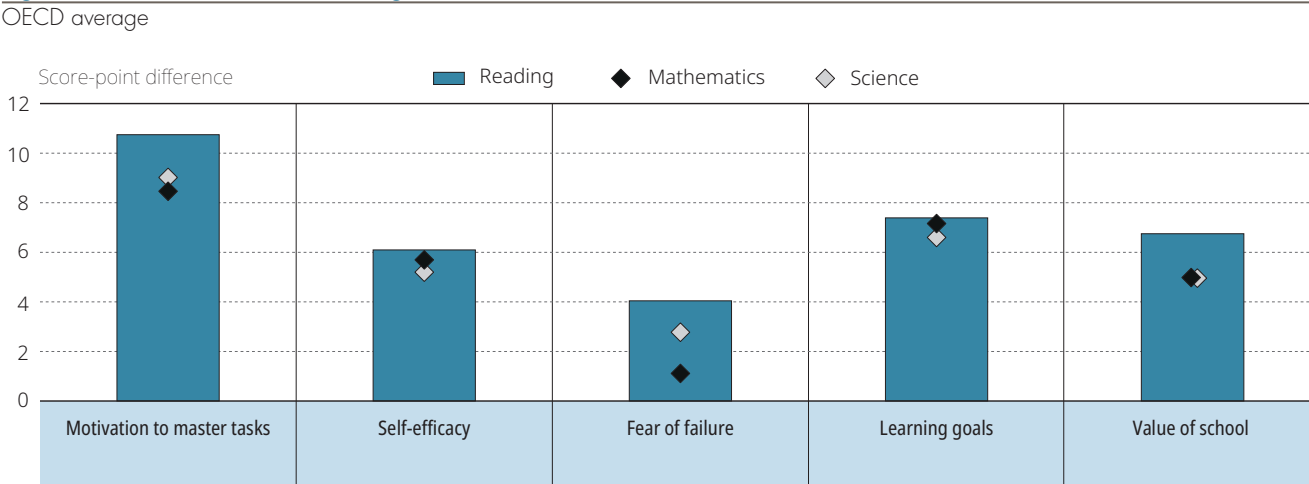
OECD average

Notes: All values are statistically significant.
All linear regression models account for gender and students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.9 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Box 6. Methodology for building student attitudes indices in PISA

A student-level scale index in PISA summarises responses from students to a series of related questions. It is constructed so that the mean for the OECD student population is zero and the standard deviation is one. For a given student, a positive value on the scale indicates a stronger characteristic than the average student across OECD countries.

Several PISA scale indices relate to student attitudes. They were built by asking students the extent to which they agree with specific statements:

- Motivation to master tasks: "I find satisfaction in working as hard as I can", "Once I start a task, I persist until it is finished", and "Part of the enjoyment I get from doing things is when I improve on my past performance".

- General self-efficacy: "I usually manage one way or another", "I feel that I can handle many things at a time", "I feel proud that I have accomplished things", "My belief in myself gets me through hard times", and "When I'm in a difficult situation, I can usually find my way out of it".

- Fear of failure: "When I am failing, I worry about what others think of me", "When I am failing, I am afraid that I might not have enough talent", and "When I am failing, this makes me doubt my plans for the future".

- Attitudes towards learning and schooling: "My goal is to learn as much as possible", or "My goal is to completely master the material presented in my classes", and "My goal is to understand the content of my classes as thoroughly as possible".

- Value of school: "Trying hard at school will help me get a good job", "Trying hard at school will help me get into a good <college>", and "Trying hard at school is important".

Source: OECD (2019[38]), *PISA 2018 Results (Volume III): What School Life Means for Students' Lives*, PISA, OECD Publishing, Paris

Box 7. The impact of a growth mindset intervention during the COVID-19 pandemic in Hamburg (Germany)

A recent experimental study analysed the effects of a growth mindset intervention on German 7th-graders' motivation and learning behaviour during the COVID-19 pandemic. More specifically, the aim of the study was to test if an online growth mindset intervention decreased 7th-graders' fixed mindset and work avoidance, and enhanced their growth mindset, mastery goals, and time spent learning at home autonomously during the temporary school closures due to the COVID-19 pandemic.

Participating students predominantly came from socio-economically disadvantaged catchment areas in the city state of Hamburg, Germany. The study comprised four online data collections that were distributed over the school year 2019/2020. Data were collected in regular lessons under teachers' supervision via a webpage on devices provided by schools. The first and second data collection gathered baseline information. In addition, during the second data collection in autumn 2019, 365 students were randomly assigned to either a growth mindset intervention or a control condition. Students from the treatment and control groups did not differ with regard to their prior achievement.

The third data collection gathered information following the intervention, including the measurement of various students' outcomes. However, in spring 2020, the unforeseeable COVID-19 pandemic occurred and schools were closed for several months. This led to the fourth data collection taking place at students' homes, where not all students had access to properly working devices. Only 213 students participated in this last stage, but control and treatment groups remained balanced in terms of prior achievement.

Materials for the experiment were comprised of condition-related reading and writing tasks. In order to also reach students who had difficulties with reading, scripted video clips with allegedly older students with heterogenous backgrounds enriched each experimental condition. For example, in the growth mindset intervention, one actor talked about how he developed his abilities with effort and adequate strategies – a message inherent to a growth mindset. In the control condition, the actors talked about future career plans.

The growth mindset intervention did not affect students' mindsets or learning goals in a statistically significant way even though change was observed in the expected direction: increase in growth mindset, less decrease in mastery goals, and decrease in fixed mindset and work avoidance for the students following the growth mindset intervention. However, the growth mindset intervention significantly affected students' learning behaviour during the COVID-19 pandemic. Whereas students in the control condition only spent 157.7 minutes learning per day, students in the growth mindset-intervention spent 209.0 minutes learning – a statistically significant difference of 51.3 minutes each day.

The results of this study highlight the significance of psychological factors for students' success. Probably due to the pandemic-related high dropout rate, the expected change in students' mindsets and learning goals was not statistically significant. It is striking, however, that a single 45-minutes growth mindset intervention early in the school year had such an impact in an autonomous learning situation during the COVID-19-related school closures. In comparison to the control condition, the growth mindset intervention led students to learn almost one hour more per day – in a completely novel and uncertain situation when they were mostly left to their own devices. Fostering students' growth mindsets not only appears to help autonomous learning behaviour in new, critical, and unsettling situations but provides some psychological protection from life's challenges.

Source: Dietrich, Ding and Spinath (2021[39]), "Effects of growth mindset- and sense-of-purpose-interventions on 7th-graders' motivation and learning behaviour during the COVID-19 pandemic", Manuscript submitted for publication.

The bottom line: How can growth mindset lead to better results?

In line with the growth mindset theory, PISA data reveal that having a growth mindset is associated with positive attitudes towards learning. These attitudes include motivation, self-efficacy, less fear of failure, ambitious learning goals, and appreciation of the value of school. Such positive attitudes towards learning may result in higher academic achievement.

On average across OECD countries, a positive relationship was estimated between motivation, self-efficacy, ambitious learning goals, appreciation of the value of school and the three academic domains tested in PISA. These results highlight the role of attitudes as potential mediators of the relationship between growth mindset and student achievement.

Fear of failure is negatively correlated with growth mindset and positively correlated with academic achievement. In effect, people with a growth mindset are characterised by a decreased anxiety about learning linked to their positive conception of failure. These results suggest that if growth mindset positively influences performance through fear of failure, it does so by reducing the "unproductive" fear of failure that undermines performance.

6. What is the relationship between growth mindset and students' well-being in PISA?

Children spend the majority of their time at school following lessons, socialising with classmates, and interacting with teachers and other staff members. Understanding what happens in schools is therefore key to ensuring that students enjoy good physical and mental health, feel happy and satisfied with different aspects of their life, and connect to others.

Research linking mindsets and mental health suggests that mindsets have an influence on overall well-being as they may buffer or exacerbate the adverse impact of negative life events. Attitudes such as self-efficacy affect the quality of emotional life and vulnerability to stress and depression (Bandura, 2011[34]). In a meta-analysis of 72 studies, Burnette et al. (2020[40]) have shown that growth mindset is negatively correlated with psychological distress. Yeager (2017[41]) found that the way young people respond to social difficulties depends on their mindset – having a fixed mindset being associated with more extreme affective, physiological, and behavioural responses such as depression and aggression. Similarly, Lee et al. (2018[42]) have showed that students with a fixed mindset present maladaptive stress responses during high-school transition, which confirms the hypothesis that beliefs can affect biological stress response.

Students with a growth mindset reported a stronger sense of belonging at school on average across OECD countries (Figure 8). The sense of belonging reflects how accepted students feel in their social context at school (Goodenow and Grady, 1993[43]), and has been associated with positive outcomes in the literature: higher academic motivation, self-esteem and achievement (Goodenow and Grady, 1993[43]; OECD, 2013[44]), reduced engagement in risky and antisocial behaviours (Catalano et al., 2004[45]), decreased likelihood of skipping classes and dropping out of school (Lee and Burkam, 2003[46]; Slaten et al., 2016[47]). The gap in students' sense of belonging at school between students with a growth mindset and those without is the widest in Ireland, Macao (China), Korea, and B-S-J-Z (China). It could stem from the fact that when confronted with adversity, students with a growth mindset are more likely to consider the challenge positively and sustain their involvement with the academic environment while students with a fixed mindset may consider the challenge as evidence of their misfit and withdraw from the academic environment.

Students with a growth mindset reported having positive feelings more often on average across OECD countries (Figure 8). The gap in positive feelings between students with a growth mindset and those without is the widest in East Asian countries, namely Korea, Chinese Taipei, Japan, Macao (China), and B-S-J-Z (China) (Table B.10). As discussed above, growth mindset is positively associated with sense of belonging but also with positive attitudes such as being motivated or setting ambitious learning goals. Students reporting these behaviours have also been more likely to report positive affect states such as enthusiasm, inspiration and happiness (Anderman, 1999[48]; Weber, Wagner and Ruch, 2014[49]).

Students with a growth mindset were more likely to be satisfied with their life but there is no statistical evidence that they had a stronger sense of the meaningfulness of life. The cognitive element of subjective well-being in PISA is composed of two elements (Box 8) and presents contrasted results. On one hand, life evaluation is positively correlated with growth mindset (Figure 9). On average across OECD countries, a student with a growth mindset is more likely to consider his/her life satisfactory by 27 percentage points. On the other hand, the sense of meaning and purpose in life is not significantly correlated with having a growth mindset (Figure 8). These results are consistent with Dweck's theory (Dweck, 2006[9]). Growth mindset – the belief that

someone's ability and intelligence can develop over time – may foster resilience and mitigate the impact of negative life events and increase life satisfaction but it does not convey a prescriptive value regarding meaning in life.

A group of countries including the Philippines, North Macedonia, Panama, and Lebanon presents the highest in absolute value, and statistically significant, negative relationship between growth mindset and the four measures of well-being presented in this section. In these countries, students with a growth mindset significantly report lower levels of well-being. For instance in Lebanon, a student with a growth mindset is less likely to consider his/her life "satisfactory" by 35 percentage points (Table B.11). This calls for further research to understand these relationships better.

Figure 8. Growth mindset and well-being indices

OECD average
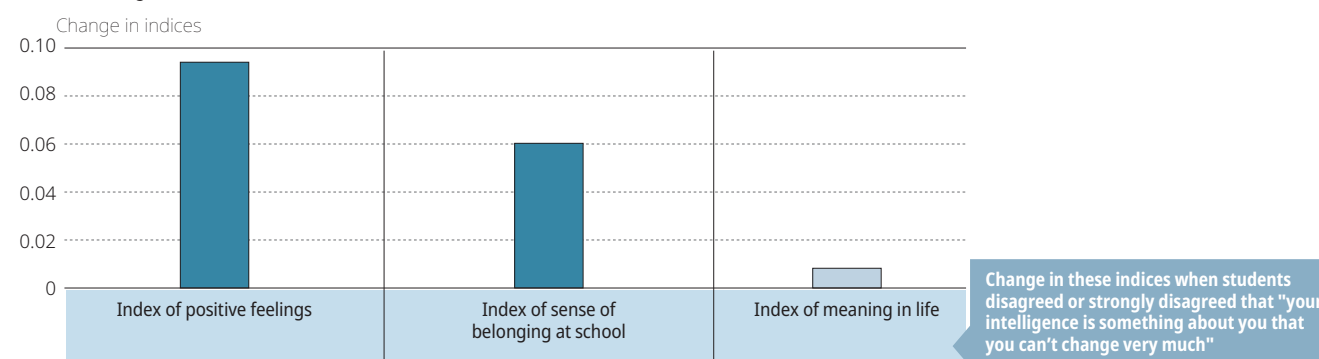
Notes: Statistically significant values are shown in darker tones
All linear regression models account for gender and students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.10 in this report.
`https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx`

### Box 8. Methodology for measuring students' well-being in PISA

PISA defines subjective well-being as a multidimensional construct that reflects the extent to which individuals believe (cognitive element) and feel (affective element) that their lives are desirable, fulfilling and rewarding. Subjective well-being is therefore measured according to these two dimensions:

- Life satisfaction: this corresponds to the cognitive element of subjective well-being in PISA. It refers to "life evaluation" – what a person thinks about his or her life satisfaction in global terms (life as a whole) – and "eudaemonia" – a sense of meaning and purpose in life.

  – Life evaluation: this is measured on a scale from 0 (not at all satisfied) to 10 (completely satisfied) where students were asked to rate their life satisfaction.

  – Meaning in life: PISA asked students whether they agree or disagree with the following statements: "My life has clear meaning or purpose"; "I have discovered a satisfactory meaning in life"; and "I have a clear sense of what gives meaning to my life".

- Feelings: this corresponds to the affective element of subjective well-being in PISA. Students were asked to report how frequently they feel "happy, lively, proud, joyful, cheerful, scared, miserable, afraid and sad".

In addition to subjective well-being, a sense of belonging at school may have a large impact on students' learning experience. PISA built a student-level scale index by asking students the extent to which they agree with the following statements about their school: "I feel like an outsider (or left out of things) at school"; "I make friends easily at school"; "I feel like I belong at school"; "I feel awkward and out of place in my school"; "Other students seem to like me"; and "I feel lonely at school".

Source: OECD (2019[38]), *PISA 2018 Results (Volume III): What School Life Means for Students' Lives*, PISA, OECD Publishing, Paris

Figure 9. Growth mindset and life satisfaction
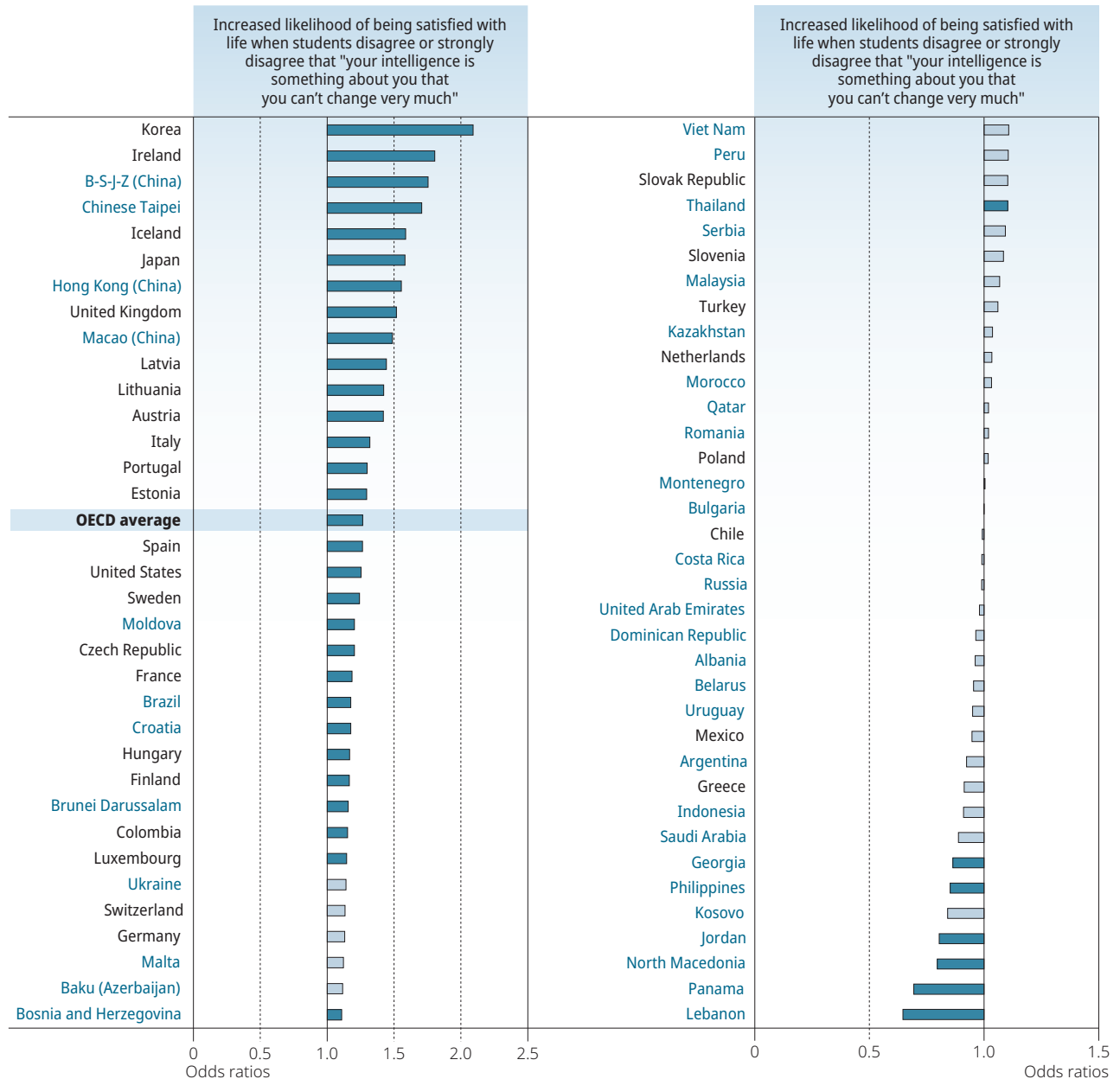
Notes: Statistically significant values are shown in darker tones.
All logistic regression models account for students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.11 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

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The bottom line: What is the relationship between growth mindset and students' well-being in PISA?

Research linking mindsets and mental health suggests that mindsets have an influence on overall well-being as they may buffer or exacerbate the adverse impact of negative life events.

Several PISA measures relate to well-being: life evaluation, meaning in life, occurrence of positive feelings, and sense of belonging at school.

On average across OECD countries, students with a growth mindset have a stronger sense of belonging at school, have positive feelings more often, and are more likely to be satisfied with their life. However, there is no statistical evidence that they have a stronger sense of the meaningfulness of life.

7. What teacher practices can support a growth mindset?

The role of teachers as providers of learning guidance and continuous feedback is critical to establishing a conducive environment to growth mindset development – a learning place where students dare to experiment and can receive constructive feedback (Dweck, 2016[13]). Do teachers emphasise and reward effortless ability or, on the other hand, progress or trying different learning strategies? Are students offered diverse learning opportunities and encouraged to take on challenges? Do teachers set less ambitious goals for struggling students and communicate that some students are not capable of performing well?

Research has shown that teaching is multidimensional. High-quality teachers not only raise students' achievement but also provide emotionally supportive environments that contribute to students' social and emotional development (Pianta and Hamre, 2009[50]; Jennings and DiPrete, 2010[51]; Jackson, 2012[52]; Blazar and Kraft, 2016[53]). Kraft (2017[54]) estimated how teachers affect students' self-reported socio-emotional measures, including consistency, perseverance, effort in class, and growth mindset. He found that among the four socio-emotional measures, teacher effects on growth mindset is the strongest and most consistently correlated measure with teacher effects on state tests and complex task performance. In other words, teacher's added values in academic and growth mindset development are intertwined. In an institution-wide study, Canning et al. (2019[55]) found that teachers' self-reported mindsets predicted the size of the racial achievement gaps in those teachers' classes. Indeed, the achievement gap between underrepresented racial-ethnic minority (URM) students and non-URM students was twice as large in classes taught by teachers who self-reported more fixed mindset beliefs. Teachers' mindset beliefs were the most robust predictors of students' academic performance in this study. That is, teachers' mindsets remained the consistent predictor of the racial achievement gap in their courses even when other faculty characteristics including faculty gender, race-ethnicity, age, and tenure status were taken into account. Moreover, students' perceptions of their teachers' mindsets matter for students' engagement and performance. In four studies (Muenks et al., 2020[56]), students' perceptions of their teachers' mindsets predicted their in-the-moment psychological experiences in class (including their sense of belonging, evaluative concerns, imposter feelings, and negative affect). These psychological experiences, in turn, predicted students' course engagement (including attendance and drop-out), their interest in the course (and the course field more broadly), as well as their end-of-term performance in that teachers' class.

A clearer understanding of how different teaching practices can affect mindset development would enable better leveraging of growth mindset to benefit students. Sun (2015[57]; 2018[58]) developed a framework of teaching practices in which identified teacher practices in mathematics are sorted according to a fluid gradient between fixed and growth mindsets. Canning et al. (2019[55]), discussed above, found that growth mindset faculty engaged more in specific practices that explained students' academic performance: growth mindset teachers were more likely to use pedagogical practices that emphasised students' learning and development during their teaching. Muenks et al. (2021[59]) identified four groups of teaching behaviours that signal teachers' growth mindsets to students: i) explicit messages that all students can make progress and succeed; ii) provision of opportunities for practice and feedback; iii) teachers' responses to struggles, confusion, or poor performance; and iv) the value teachers place on students' learning and development. Building on Muenks et al. (2021[59]), Kroeper, Fried and Murphy (2020[60]) asked students to organise 119 specific teacher behaviours and statements within those four groups of teaching behaviours. This study ranks all 119 behaviours as indicative of teachers' more fixed or growth mindset. Three teaching behaviours were identified as some of the strongest predictors of a growth mindset teacher: "the professor says to struggling

students: mistakes are opportunities to learn", "the professor tries different ways of explaining the course material to ensure that all students understand", and "the professor encourages students to email questions so they can improve their understanding of the material". LaCosse et al. (2020[61]) found that when teachers exhibited these types of behaviour in their first-day-of-class lectures, students perceived their teacher to have more of a growth mindset, anticipated more positive psychological experiences and greater performance, and expressed more interest and motivation for the course.

PISA asked students several questions about the teaching practices at their school during the language-of-instruction lessons, which led to the construction of 6 related indices. Three of these indices of teaching practices, namely the index of teacher support, the index of adaptive instruction, and the index of teacher feedback, are well-aligned with the three growth mindset teaching features highlighted in Kroeper, Fried and Murphy (2020[60]), and were analysed against the growth mindset measure in PISA.

The index of teacher support is the most highly associated with students' growth mindset among the three examined indices. On average across OECD countries, the four items composing the index are positively and significantly correlated with growth mindset (Figure 10). For instance, when students reported that their teachers help them with their learning, these students were on average 4 percentage points more likely to report having a growth mindset. The correlation between teacher support and growth mindset is the highest in the United Kingdom, Finland, Ireland, Macao (China), Hong Kong (China), Japan, and Korea (Table B.12). This association suggests that when educators not only teach, but also demonstrate an indefectible support to their students, it establishes a safe learning environment conducive to growth mindset development.

Figure 10. Growth mindset and teacher support
OECD average
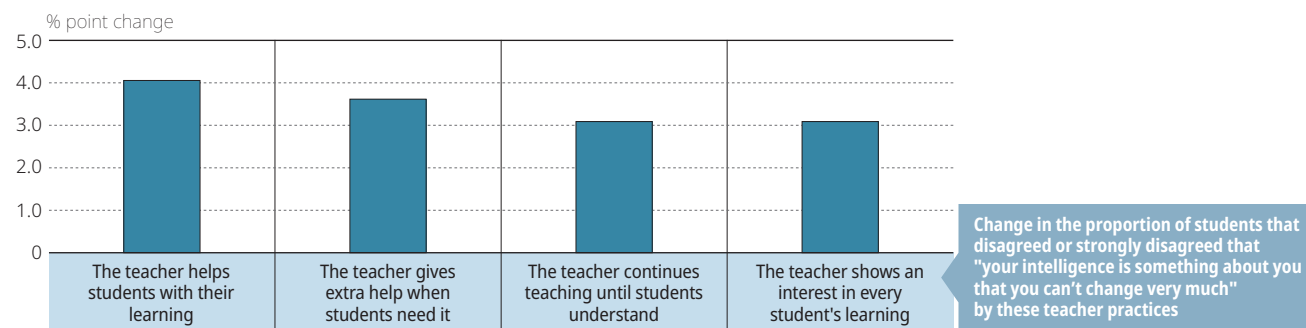
Notes: All values are statistically significant.
All linear regression models account for gender and students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.12 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

The index of adaptive instruction is positively associated with students' growth mindset. When students perceive that their teachers adapt the lesson to the class's needs and knowledge, these students are 3.5 percentage points more likely to disagree with the fixed mindset statement on average across OECD countries (Figure 11). This correlation is the highest in Korea, the United Kingdom, and Ireland (Table B.13). Adaptive instruction means tailoring teaching practice to students' needs so students can experience effective learning (Wang and Walberg, 1983[62]). Teachers using alternative instructional strategies appear more likely to help students overcome obstacles, integrate learning challenges as usual facets of the learning process, and contribute to instilling a growth mindset.

The relationship between teacher feedback and students' growth mindset differs according to students' proficiency in reading. When students have a medium level performance in reading, all three items composing the index of teacher feedback are positively and significantly correlated with growth mindset, although the magnitude of this association remains modest, around 2 PISA score points (Figure 12). However, the relationship is not significant for top-performing students, and even negative for lower-performing students. This may implies that teacher feedback may not matter to top-performing students perhaps because they already have developed a growth mindset or have resources outside of school to do so. For the negative association between teacher feedback and students' growth mindset among lower-performing students, some research has shown that certain teacher feedback can be detrimental to lower-achieving or minority students (Aronson, Fried and Good, 2002[63]; Rattan, Good and Dweck, 2012[64]). For example, Rattan, Good and Dweck (2012[64]) found that when teachers provided feedback in a way that tried to comfort and reassure lower-achieving students by telling them that "it's okay, not everyone can

be good at math," this feedback demotivated students. In other words, providing feedback without a clear growth mindset framework can still be delivered in a fixed mindset manner, which will not result in instilling a growth mindset in students. This corroborates one of the identified challenges of growth mindset development, namely providing relevant feedback, which is not solely about praising effort but about rewarding progress, providing effective learning strategies and the processes that lead to greater learning.

Figure 11. Growth mindset and adaptive instruction
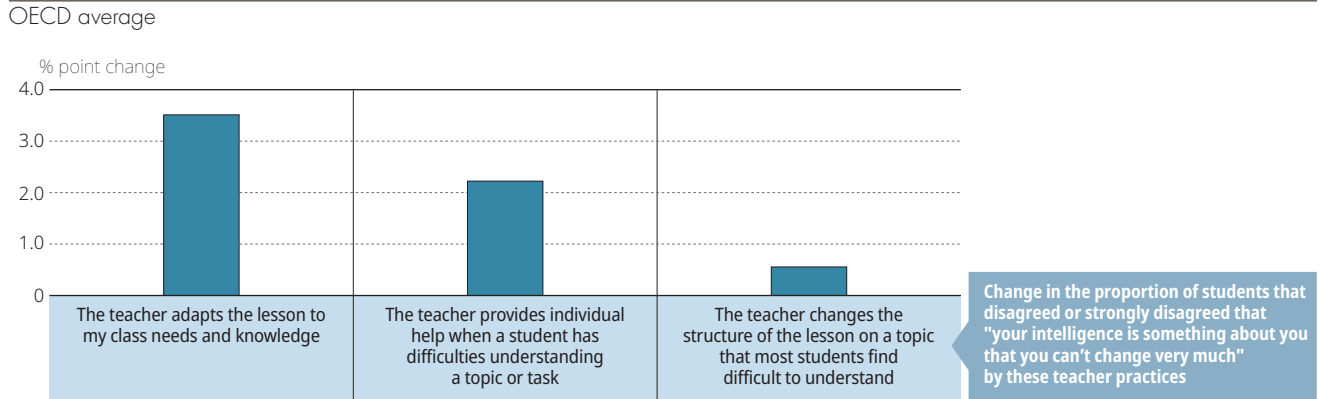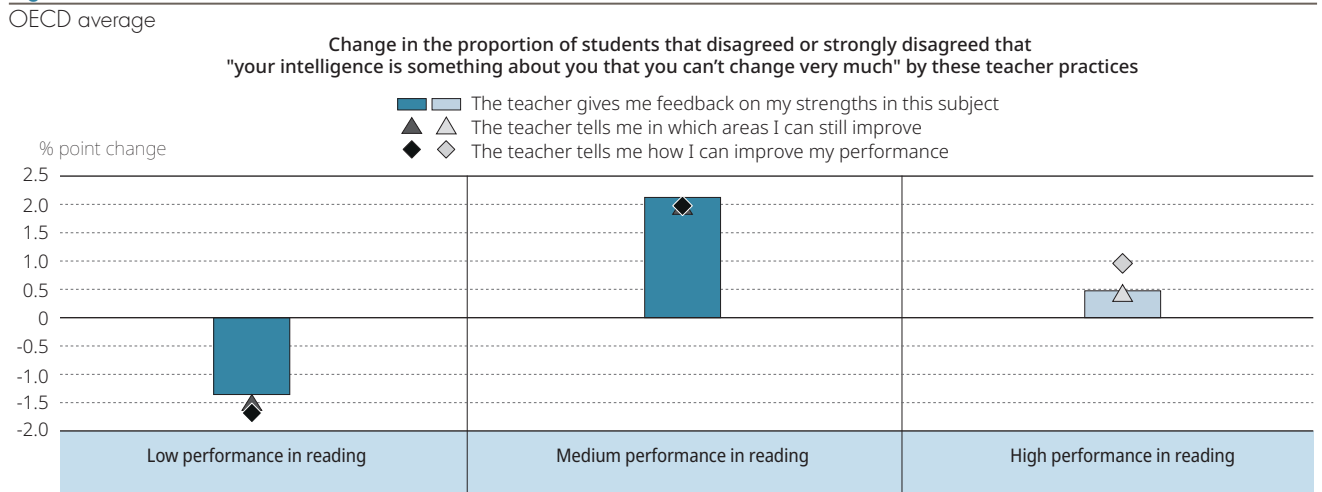
OECD average

Notes: All values are statistically significant.
All linear regression models account for gender and students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.13 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Figure 12. Growth mindset and teacher feedback

OECD average

Notes: Statistically significant values are shown in darker tones.
All linear regression models account for gender and students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.14 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Another explanation for this differentiated relationship according to students' performance levels would be that among lower performers, students who agreed with the fixed mindset statement are more likely to receive feedback. Conversely, among medium performers, students who disagreed with the fixed mindset statement are more likely to receive feedback. This could happen if some behavioural features of growth mindset resonate differently with the teacher depending on student performance. For instance, if the teacher perceives growth mindset as critical thinking and persistence for middle performers but as being confrontational and obstinate for lower performers, it could bolster teacher feedback among middle performers but deter it among lower performers. In any event, whether teacher feedback influences students' growth mindset development or the other way around, further research is required to investigate this relationship, and why it could differ according to students' proficiency in reading.

Teacher practices moderate the relationship between growth mindset and academic performance in PISA. On average across OECD countries, students who present a growth mindset score higher than their peers with a fixed mindset, and this difference increases when teachers present a higher level of support, adaptive instruction, or feedback (Figure 13). For instance in reading, this interaction between teacher support, growth mindset and PISA score is the most significant in the United States where students with a growth mindset scored 48 points higher than students with a fixed mindset when the index of teacher support was low, but scored 72 points higher than students with a fixed mindset when the index of teacher support was high – the 24-point difference being statistically significant (Table B.15). In other words, students in the United States benefit even more from having a growth mindset when there is a high level of interaction with the teacher compared with those in other countries and economies. These results require further investigation however, as the relationship was not significant in many countries and economies, despite the OECD average being significant.

Figure 13. Growth mindset and academic performance according to teacher practices

OECD average

Performance gain of having a growth mindset among students reporting
a high perception of the following teaching practices (reference: low perception of teaching practices)

Notes: All values are statistically significant.
All linear regression models account for gender and students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Tables B.15, B.16 and B.17 in this report.
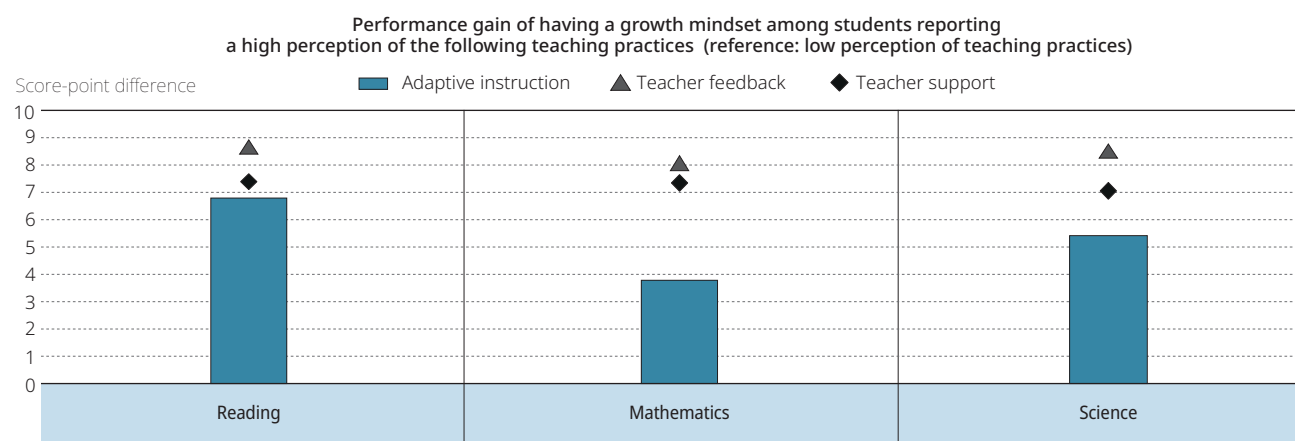https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

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Box 9. "Academic courage" to develop growth mindset: the EL Education Model (US)

EL Education is an American non-profit organisation that targets three areas of student achievement: mastery of knowledge and skills, character growth, and excellence in student work. It has partnered with schools and education districts to reach over half a million of pre-K12 students in the US, mostly in low-income urban and rural communities. EL Education promotes a model of engagement where students belong at the school and take actions leading to their success.

The EL Education model combines character and social-emotional skills development with building academic skills. These elements are integrated and discussed explicitly in classrooms. Academic courage, for instance, is highly prized. It enables students to raise their hand during lessons, admit being confused, ask questions, make mistakes in public, explain their thinking, critique others' thinking, and be excited about learning. In EL Education partner schools, students often say, "I am working on my mathematical courage right now, or my art courage, or public speaking courage."

This work on one's self inspires students to embrace challenge, foster their growth mindset, and support them in becoming leaders of their own learning. But it has to start with adults. EL Education works with teachers and school principals to address their own fixed mindset so they can model it and help their students.

Source: OECD - Yidan Prize Foundation (2020[65]), *Growth Mindset Online Worshop: Panel Discussion 3, Ron Berger*

Box 10. Getting rid of ability labelling or "fixed certainties" in a primary school in Hertfordshire (UK)

The school principal of a small primary school in Hertfordshire (UK) for 3 to 11 year-olds started an alternative improvement agenda when she first arrived in 2003. The school inspection had labelled the school as being in the "bottom set" and beset with "massive underachievement". By 2011, the inspection report called the school "outstanding in all areas".

This alternative route espoused the values of "learning without limits". This approach to leadership, teaching and community-building sought to avoid damaging labels. It also worked to move beyond the constraints of "fixed certainties" that lead to deficit thinking about so-called "ability" towards a collective belief in the art of the possible. When children and young people are inspired by teachers who refuse to set limits, they will exceed their own and others' expectations. This is expressed in the claim that "increasing the learning capacity of staff is the condition for increasing the learning capacity of children".

The school principal worked as an insider-researcher together with an external team from the University of Cambridge to document this reform journey. They identified seven key dispositions among staff mediating their professional development and learning capacity (Table 1). Although this was a small-scale qualitative study, its finding about developing a successful school model free from determinist beliefs about students' ability have made a transformative impact across England. A national conversation has begun about the importance of moving from differentiated lessons that may inadvertently reinforce stereotypes and limit aspiration towards a mastery approach that assumes high standards from every learner.

Table 1. Teachers' states of mind and their impact on learning

Seven key dispositions that increase the capacity for professional learning	States of mind that inhibit learning
Openness – to ideas, to possibilities, to surprise	belief that there is one right way, that outcomes are predictable
Questioning – restlessness, humility	reliance on certainties and ready-made solutions
Inventiveness – creative responses to challenges	compliance with imposed models and materials
Persistence – courage, humility	settling for easy answers, rejecting complexity
Emotional stability – taking risks and resistance	fear of failure, fear of trying new things
Generosity – welcoming difference	deficit thinking, desire for uniformity
Empathy – mutual supportiveness	fear, defensiveness, blame

Source: OECD - Yidan Prize Foundation (2020[66]), *Growth Mindset Online Workshop: Panel discussion 3, Alison Peacock*, Swann et al. (2012[67]), *Creating Learning without Limits*, UK: McGraw-Hill.

The bottom line: What teacher practices can support a growth mindset?

Good quality teachers not only contribute to raising students' achievement but provide supportive environments that foster students' social and emotional development.

The index of teacher support is the index of teaching practices the most highly associated with the development of students' growth mindset. This association suggests that when educators provide steady support to their students, it establishes a safe learning environment conducive to growth mindset development.

The index of adaptive instruction is likewise positively associated with students' growth mindset. Teachers using alternative instructional strategies that integrate learning challenges as usual facets of the learning process are more likely to help students overcome obstacles.

The relationship between teacher feedback and students' growth mindset differs according to students' proficiency in reading. While teacher feedback is positively correlated with growth mindset among medium performers, it is not correlated among top performers, and negatively correlated among low performers. Whether teacher feedback influences students' growth mindset development or the other way around, further research is required to investigate this relationship, and why it could differ according to students' proficiency in reading.

Teacher practices are not only correlated to growth mindset development among students, they also moderate the relationship between growth mindset and academic performance in PISA. On average across OECD countries, students who present a growth mindset score higher than their peers with a fixed mindset, and this difference increases when teachers present a higher level of support, adaptive instruction, or feedback.

These results highlight the critical role of teachers in establishing an environment conducive to growth mindset development, and providing guidance and continuous feedback to support the learning process of students.
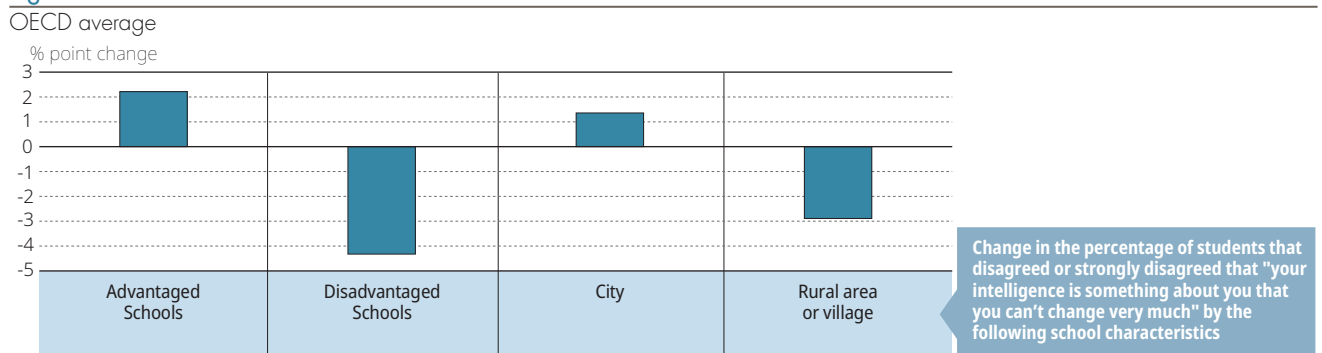
8. What school practices are associated with growth mindset?

The leadership style of the school principal and a school's assessment practices and accountability measures all help shape a student's specific learning environment and experiences. PISA asked school principals to complete a questionnaire that covered a wide array of topics, including school management and organisation, and the school learning environment.

Students in socio-economically advantaged schools are on average more likely to report a growth mindset. Compared to schools with a medium socio-economic profile[1], students are on average 2.2 percentage points more likely in advantaged schools and 4.3 percentage points less likely in disadvantaged schools to report a growth mindset (Figure 14). Since PISA does not allow causality to be identified, there are two possible explanations as to why students in socio-economically advantaged schools present more of a growth mindset. Such students may have already developed a growth mindset outside of schools, thanks to greater resources at home such as private tutoring (shadow education) or a personal environment less likely to curb their aspirations. Secondly, more advantaged schools may have more pedagogical resources and a teaching workforce to sustain the development of growth mindset among students. This raises the question of whether schools have the proper resources to ensure that every student, regardless of their socio-economic background, enjoys the same opportunities of developing a growth mindset. For instance in PISA 2018, 20% of students from disadvantaged schools believe that most of their teachers have lower academic expectations for students of some cultural groups. This only concerns 10% of students from advantaged schools, and the difference is statistically significant. Research has already highlighted that teacher expectations about student abilities are subject to bias related to socio-economic status (Rist, 1970[68]; Gollub and Sloan, 1978[69]; Auwarter and Aruguete, 2008[70]), which is likely to reduce the learning opportunities for the concerned students (Rubie-Davies, Hattie and Hamilton, 2006[71]).

Figure 14. Growth mindset and school characteristics

OECD average

Change in the percentage of students that disagreed or strongly disagreed that "your intelligence is something about you that you can't change very much" by the following school characteristics

Notes: All values are statistically significant.
The coefficients correspond to a linear regression including dummy variables coding for the schools' socio-economic profile and their location, and accounting for students' socio-economic profile as measured by the PISA index of economic, social and cultural status (ESCS). A first reference group gathers schools from a medium socio-economic background, and a second reference group gathers schools located in towns with 3 000 to 100 000 people.
Source: OECD, PISA 2018 Database, Table B.18 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Students in rural schools are on average less likely to report a growth mindset. PISA asked school principals to describe their community as rural when there are fewer than 3 000 people; part of a town when there are between 3 000 and 100 000 people; and part of a city when there are over 100 000 people. At a given socio-economic profile and compared to town schools, students are on average 1.4 percentage points more likely in city schools and 2.9 percentage points less likely in rural schools to report a growth mindset (Figure 14). These discrepancies culminated in Chile where students in rural schools were 14.4 percentage points less likely than their counterparts in town schools to report having a growth mindset. In Israel, students in city schools were 9 percentage points more likely than their counterparts in town schools to report having a growth mindset (Table B.18). Why rural schools are less conducive to growth mindset development could stem from many different reasons such as a lack of funding, a more difficult access to professional development for the teaching staff, and an ageing staff that is less aware of more recent pedagogical developments. In Chile, for instance, an OECD review established that schools in rural areas faced a recurring lack of resources and limited teaching capacity (Santiago et al., 2017[72]).

In schools, teachers' assessment practices and the way they define and report success shape students' and parents' beliefs about learning (Masters, 2013[73]). PISA asked principals to indicate how student assessment is used at the school, choosing from 11 options such as "to guide students' learning", "to inform parents about their child's progress", and "to compare the school with other schools". The analysis of PISA data did not reveal a clear pattern between the use of assessment and student growth mindset. However, one result indicated that students in disadvantaged schools are on average 1.9 percentage points more likely to report a growth mindset when assessment is used "to adapt teaching to [their] needs" (Figure 15).

PISA also asked principals to indicate which of 10 quality assurance processes were in place at the school, including "internal evaluation", "external evaluation", and "systematic recording of student test results and graduation rates". Similar to assessment use, the analysis of PISA data did not reveal a clear correlation pattern between quality assurance processes and student growth mindset. Nonetheless, in schools having a "written specification of the school's curricular profile and educational goals for quality assurance", or seeking "written feedback from students", students were on average across OECD countries more likely to report a growth mindset by 1.5 and 0.8 percentage points respectively (Figure 15).

These results call for a more specific review of the potential connection between growth mindset development and the different assessment and evaluation elements. Research has indeed shown the importance of aligning educational goals with evaluation and assessment to provide adequate incentives (OECD, 2013[74]; Gouëdard et al., 2020[75]). In the case of growth mindset development, this implies designing fit-for-purpose student assessments or self-reported measures that reflect a diversity of student outcomes and ensuring teachers and school principals develop ownership over holistic educational goals. Adjusting accountability systems to factor in growth mindset development with updated school evaluation and reporting processes, and providing the most relevant data for school improvement (Bae, 2018[76]) are also important.

Figure 15. Growth mindset and school practices
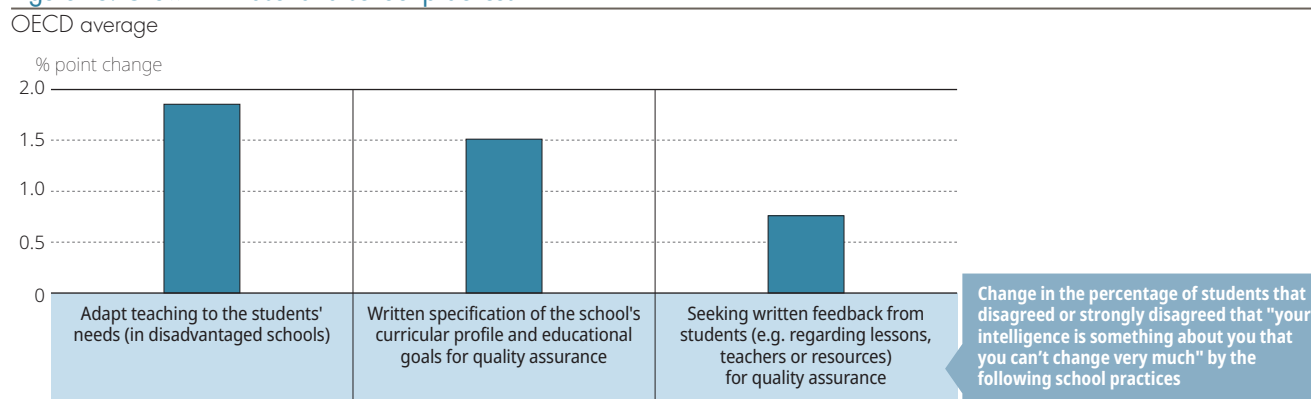
OECD average

Notes: All values are statistically significant.
All linear regression models account for students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.19 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Box 11. A pedagogical initiative that fosters growth mindset: the "Escuela Nueva" model

In the mid-1970s, a pedagogical innovation, called the Escuela Nueva or "new school", was developed for isolated rural multi-grade schools in Colombia. Initially implemented in a handful of rural schools, it was later adopted by the Colombian Ministry of Education and established as a national policy. By the early 1990s, it was expanded to 20 000 rural schools across the country to reach approximately 40% of Colombia's rural school children.

"Escuela Nueva" is a child-centred system in which the teacher acts as guide and mentor. Students advance from one grade to another and complete academic units at their own pace while participating in collaborative learning processes. The model promotes active learning with ''interactive and dialogue-based'' learning materials and develops cooperation and respect for other people's opinions as students participate in democratic institutions at schools.

An independent evaluation from the World Bank showed that students from Escuela Nueva schools performed better than their counterparts in language and mathematic (Psacharopulos, Rojas and Velez, 1993[77]). In a study of education in Latin America and the Caribbean, UNESCO attributed Escuela Nueva with the success of students in rural schools in Colombia (UNESCO, 1998[78]). Escuela Nueva has subsequently inspired educational reforms worldwide – in Latin America and the Caribbean, Africa, and Asia. The model's positive impact in Guatemala (Baessa, Chesterfield and Ramos, 2002[79]), Peru (USAID, 2010[80]), and Viet Nam (Parandekar et al., 2017[81]) has helped establish student-centred participatory pedagogy as a viable school alternative among historically deprived populations.

According to Vicky Colbert, co-author of the Escuela Nueva model and founder of the Fundación Escuela Nueva, adapting the model to urban areas and to displaced and migrant children is now more relevant than ever. Escuela Nueva strengthens socio-emotional skills and collaboration, and unlocks leadership skills. The model also shares core principles with growth mindset as students are expected to explore and learn actively rather than endure traditional teacher-centred knowledge transmission. Teachers guide and facilitate learning. They steer the learning process and reward progress. Teachers are also expected to challenge their habits and possible fixed mindsets through collaborative practices among educational staff and continuous professional development through action research.

In such an environment, students and teachers are expected to develop a growth mindset. However, the academic literature has not yet connected and analysed the Escuela Nueva model with a growth mindset perspective. Further research could determine whether Escuela Nueva fosters growth mindset, and if so, identify how the various features of the model – student-centred approach, teacher's benevolence, cooperation dynamics etc.– contribute to growth mindset development. The Fundación Escuela Nueva is currently on a pathway to analyse and research this connection.

Note: The Fundación Escuela Nueva is a non-profit organisation that advances, innovates, and further develops the Escuela Nueva model in Colombia and abroad.

Sources: Colbert and Arboleda (2016[82]), "Bringing a student-centered participatory pedagogy to scale in Colombia", *Journal of Educational Change*, Vol. 17/4, pp. 385-410.
OECD - Yidan Prize Foundation (2020[83]), Growth Mindset Online Workshop: Panel discussion 3, Vicky Colbert.

Box 12. Integrating social-emotional skills into school accountability, the CORE initiative in California (US)

CORE – California Office to Reform Education – is a partnership between eight California school districts that includes 1 500 schools and serves over 1 million students. CORE aims to improve student achievement by fostering collaboration and exchange of best practices between its members. In 2013, CORE received a waiver from the U.S. Department of Education allowing the districts to review key elements of their school accountability.

With the development and implementation of the School Quality Improvement System (SQIS), the CORE governing board embarked on promoting a more holistic vision of school quality. The SQIS refers to a full system of school accountability and continuous improvement, and relies on a quantitative assessment, which is the School Quality Improvement Index (the Index) that measures school performance. To reach a more rounded assessment of school quality, social-emotional and school culture-climate factors account for 40% of the Index, and academic factors account for 60%.

The choice of social-emotional competencies to include in the Index followed a voting process carried out among district representatives and field experts. Four specific competencies were selected: growth mindset, self-efficacy, self-management, and social awareness. The indicators and their weights for the Index computation were not set in stone, and can evolve with stakeholders' feedback and new research development.

The assessment of students' social-emotional skills in grades 5-12 was piloted in 2014-2015 in schools in CORE districts. The independent evaluation of this field test focused on 5 districts covering almost 400 000 students. It highlighted the strong internal reliability of the social-emotional measures, and their predictive validity based on various academic and behavioural outcomes. The evaluation concluded that the CORE SQIS provided promising evidence for education leaders and policy makers interested in broadening the definition of student success.

Sources: West et al. (2018[84]) "Development and implementation of student social-emotional surveys in the CORE Districts", *Journal of Applied Developmental Psychology*, Vol. 55, pp. 119-129.

The bottom line: What school practices are associated with growth mindset?

School environment contributes to students' socio-emotional development. And assessment practices and accountability measures can shape a student's specific learning environment and experiences.

Students in more advantaged and urban schools are on average more likely to report a growth mindset. This raises the question of whether schools have the proper resources to ensure that every student, regardless of their socio-economic background or location, enjoy the same opportunities of developing a growth mindset.

The statistical analysis of PISA data did not reveal a clear correlation pattern between the use of assessment and quality assurance processes with student growth mindset. However, research has shown the importance of aligning educational goals with evaluation and assessment to provide adequate incentives. Further research is required to identify which forms of assessments and quality assurance processes are more likely to support the development of a growth mindset.

9. What policies are associated with a growth mindset in education systems?

On average across OECD countries, students who present a growth mindset score higher in reading, mathematics, and science than their peers with a fixed mindset. Socio-economically disadvantaged students were also more likely than advantaged students to agree that their intelligence cannot change very much over time in almost every education system. In other words, growth mindset could be a factor in reinforcing achievement disparities between socio-economic backgrounds.

Research shows that vulnerable students could benefit more from developing a growth mindset than advantaged students since it could buffer the impact of poverty, biased perceptions, and curbed aspirations on education performance (Paunesku et al., 2015[21]; Claro, Paunesku and Dweck, 2016[18]; Degol et al., 2018[28]; OECD, 2019[38]). As a result, certain policies may foster equity as they support all students in the development of a growth mindset, which could contribute to reduce the achievement gap between different groups of students.

Grade repeaters are less likely on average to present a growth mindset. In PISA, after accounting for the socio-economic profile of students and schools, a student who has not repeated a grade is 50% more likely on average to disagree with a fixed mindset statement than a student who has repeated a grade (Figure 16). Two rationales could explain this relationship: either students without a growth mindset do not develop enough academically and tend to repeat more, or grade repeaters have fewer opportunities to develop a growth mindset. Repetition policies are designed for students who have not fulfilled the learning objectives that have been set for each grade. When there is not a clear national framework of competences, however, experts have argued that retention decisions are based on vague standards that leave too much room for teachers' evaluations, the same student being either passed or held back by different teachers (UNESCO and International Institute for Educational Planning, 1997[85]; Crahay, 2007[86]; UNESCO Institute for Statistics, 2012[87]). PISA data do not allow conclusions to be drawn about whether a lack of growth mindset induces grade repetition or whether grade repetition limits growth mindset development. In either case, special attention should be paid to students who repeat to make sure that if indeed they lack growth mindset, this will not hinder their future learning.

Students in general education are more likely on average to present a growth mindset in PISA. Compared to students enrolled in a vocational or pre-vocational programmes, students in general education are 12% more likely to disagree with the fixed mindset statement in PISA after accounting for the socio-economic profile of students and schools (Figure 16). Similar to the discussion on grade repeaters, PISA analysis cannot determine causality between growth mindset and enrolment in vocational programmes. Students enrolling in vocational programmes are more likely to have experienced problems during their school years, which may cause a fixed mindset (Aronson, Fried and Good, 2002[63]; Rattan, Good and Dweck, 2012[64]; Glerum, Loyens and Rikers, 2019[88]). But, it could also be true that tracking policies that sort students into different hierarchical streams of education may be to blame for hindering the development of a growth mindset. Students tracked into vocational programmes may perceive it as a strong negative signal about their academic ability. Tracking may also reinforce structural education inequalities as it selects students already studying in environments less conducive for learning and offers them a watered-down curriculum (Marks, 2006[89]; Reichelt, Collischon and Eberl, 2019[90]).

Proposed reforms to vocational education such as delaying tracking until later in life to limit misclassification (Brunello, 2004[91]), decreasing the degree of curriculum differentiation by allowing broader vocational curriculums (Ozer and Perc, 2020[92]), or developing a legal framework of "scaffolding" diplomas to access higher education from any track such as in the Netherlands (OECD, 2016[93]), are likely to support the development of a growth mindset among vocational education students. The deficit image that plagues vocational education (Abrassart and Wolter, 2019[94]) may also play a role as "being in a vocational track" is perceived among students, parents, and educators as a signal of ability limitation. Restoring the occupational prestige of vocational education may therefore contribute to growth mindset development. In Germany and Japan, two countries known for the excellence of their vocational tracks (German Federal Ministry of Education and Research, 2015[95]; OECD, 2009[96]), there is no significant difference in growth mindset between general and vocational education students.

Figure 16. Growth mindset and stratification policies

OECD average
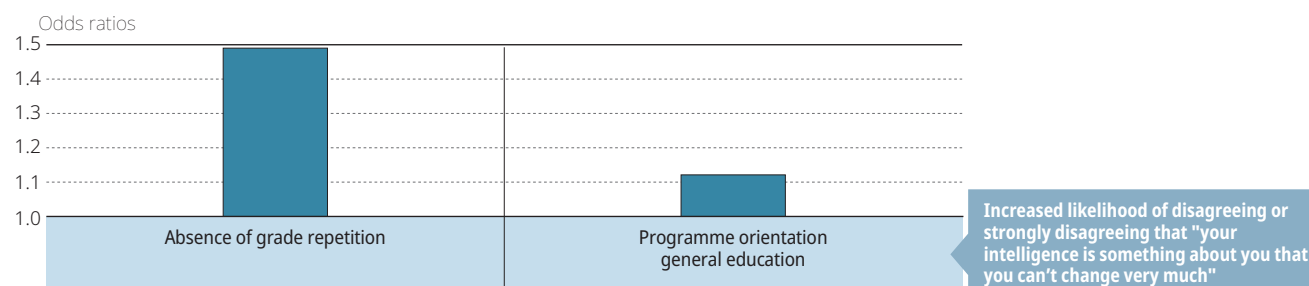
Notes: All values are statistically significant.

All logistic regression models account for students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Source: OECD, PISA 2018 Database, Table B.20 in this report.

https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

Figure 17. Growth mindset and academic inclusion
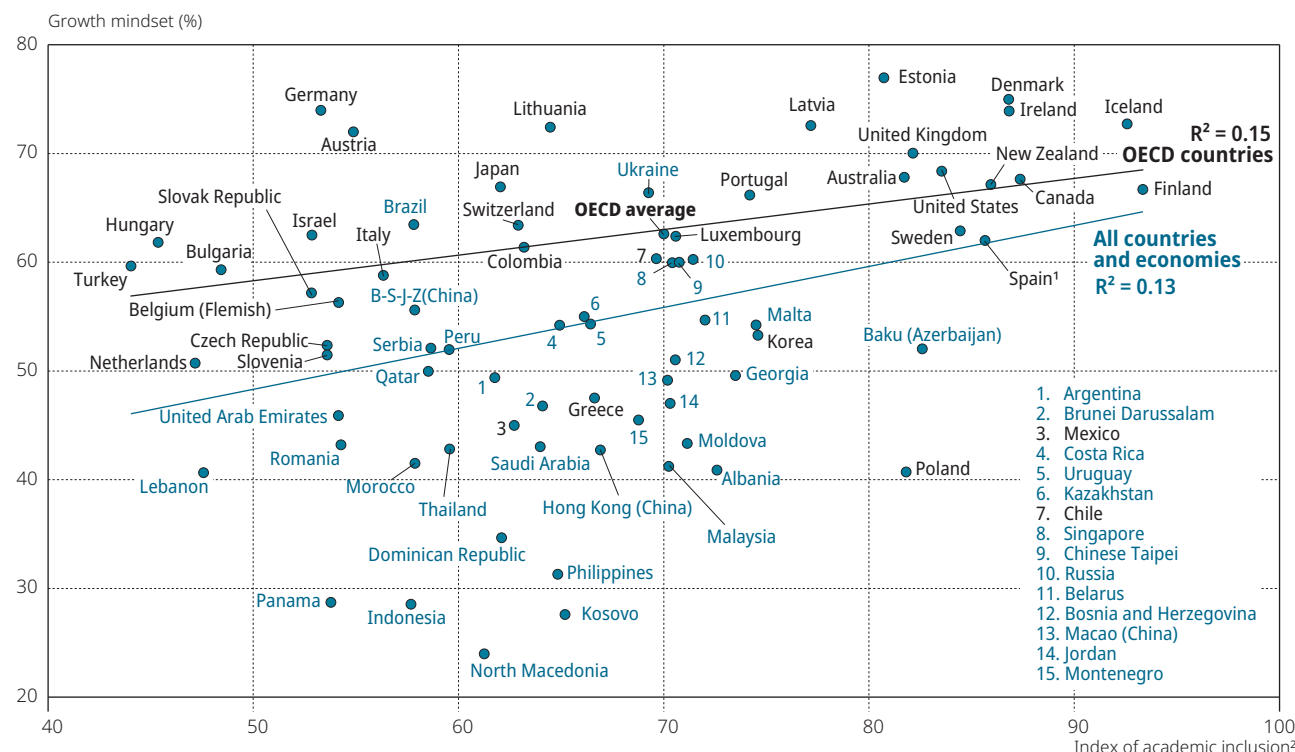
1. See note in Annex A1 for Spain

2. The index of academic inclusion is calculated as 100*(1-rho), where rho stands for the intra-class correlation of performance. The intra-class correlation, in turn, is the variation in student performance between schools, divided by the sum of the variation in student performance between schools and the variation in student performance within schools.

Source: OECD, PISA 2018 Database, Tables B.1 and B.21 in this report.

https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

The bottom line: What policies are associated with a growth mindset in education systems?

Vulnerable students benefit more from having a growth mindset than advantaged students since it is likely to buffer the impact of poverty, biased perceptions, and curbed aspirations on education performance. As a result, policies supporting the development of a growth mindset for all students may foster equity.

PISA analysis showed that grade repeaters and vocational education students are less likely to present a growth mindset. More generally, less inclusive education systems have a lower share of students with a growth mindset on average. This suggests that policies targeting these vulnerable students and providing necessary resources and support for developing a growth mindset may contribute to foster equity.

10. What can we expect from a growth mindset intervention?

Carol Dweck's (2006[9]) seminal book on growth mindset stated that changing people's beliefs may have profound effects. The expectations of large effects associated with simple growth mindset interventions may have contributed to the rapid dissemination of the growth mindset theory. More than 10 years later, expectations about the impact for growth mindset interventions have been refined with the transition to field experiments and replication science (Dweck and Yeager, 2019[10]).

PISA effect sizes associated with growth mindset are in line with the literature. Score gains related to having a growth mindset, presented in section 4, can be translated into standardised effect sizes (Box 13). On average across OECD countries, effect sizes associated with an increase by one standard deviation in growth mindset were 0.15 in reading, 0.12 in mathematics, and 0.14 in science after accounting for the socio-economic profile of students and schools (Figure 18). In a large study over a population-generalisable sample, Yeager et al. (2019[22]) estimated that an online growth mindset intervention lasting less than an hour would produce an effect size of 0.05 on the average GPA score of ninth-graders. However, this effect followed an intervention that shifted mindsets by 0.35 standard deviation. When scaled to correspond to an increase by one standard deviation in growth mindset, the standardised effect size equals 0.14, which is comparable to the effect sizes found in PISA.

Growth mindset interventions are not a silver bullet for improving student performance. Socio-psychological interventions in education complement, but do not replace, traditional reforms in education (Yeager and Walton, 2011[31]). Such interventions can help students take better advantage of learning opportunities but are likely to have limited impact on less vulnerable students. They are also highly context dependant and require careful consideration before being scaled up (Yeager and Walton, 2011[31]). For instance, the growth mindset intervention implemented in Yeager et al. (2019[22]) led to different results depending on whether peer norms at the school aligned with the message of the intervention or not.

Growth mindset interventions yield modest average treatment effects, but larger effects for specific subgroups. The importance of heterogeneity in treatment effects calls for a more careful consideration of average effects. In a meta-analysis of 43 growth-mindset interventions and their impact on academic achievement, Sisk et al. (2018[97]) concluded that growth mindset interventions only yielded modest average effects but presented significant effects for specific subgroups. The identification and targeting of such subgroups such as lower performers (Yeager et al., 2019[22]), socio-economically disadvantaged students (Paunesku et al., 2015[21]), and female students in STEM fields (Good, Rattan and Dweck, 2012[27]) is likely to boost the efficiency of the intervention. There is no clear evidence of the effect of such interventions on the academic performance of higher-achieving students but they may have boosted their willingness to take on challenges (Yeager et al., 2016[98]) and enrol in more advanced mathematics courses in the following year (Yeager et al., 2019[22]).

Policy decisions should not be solely determined by effect sizes: the scalability of an intervention and the cost of substitute interventions should also be taken into consideration. Harris (2009[99]) has developed a complete decision-making framework to compute cost-effectiveness ratios and benchmark investment options. Similarly, Kraft has enriched a heuristic on effect size (Box 13) with the cost per pupil and the scalability of the intervention (Kraft, 2019[100]).

Growth-mindset interventions fare well in both scalability and cost-effectiveness dimensions. Snipes, Fancsali and Stoker (2012[101]) reviewed 28 growth mindset-related interventions and while initial programmes may have required repeated in-person sessions with highly trained staff, shorter, online, and sometimes self-administered sessions have since been developed. They do not require large upfront fixed costs that need to be amortised over time, and can rely on new technology of information and communication that allow fast scaling up. For instance, Paunesku et al (2015[21]) implemented two online interventions, each lasting about 45 minutes. Broda et al (2018[102]) designed an online survey associated with a 25-minute activity and Yeager et al (2019[22]) relied on interventions that lasted less than an hour. These setups help maintain costs under control. A programme led by the World Bank in Peru in 2015, which consisted of a single 1.5 hour-long growth mindset session, was trialled in 400 secondary schools. The intervention induced effect sizes ranging from 0.11 to 0.24 on mathematics test scores at a unit cost of USD 0.2 per student. Highly cost-effective and scalable, the programme was implemented in 1 356 schools in 2016 (Outes, Sanchez and Vakis, 2017[20]).

Figure 18. Standardised effect size of growth mindset in academic performance
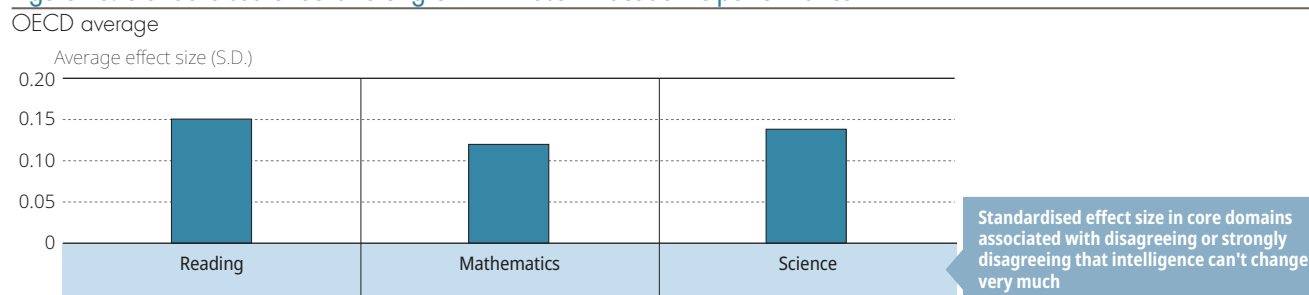
OECD average

Notes: All values are statistically significant.
All linear regression models account for students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Source: OECD, PISA 2018 Database, Table B.22 in this report.
https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Fig.xlsx

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Box 13. Understanding effect sizes in education

How are the impacts of different kinds of intervention compared when the outcomes are different? A standard measure in education, effect size quantifies "progress realised" between a treated and a control group. In layman's terms, this shows where the average treated student ranks among the control students. This measure provides a common metric (in units of standard deviation) with which to compare the effectiveness of different interventions.

An effect size is computed as the difference in means between two groups – such as treated and control groups in a random control trial – divided by the standard deviation of the measure of interest. Under usual statistical assumptions, the effect size indicates to what extent the distribution of the measure of interest overlaps between the two groups. For instance, in an education intervention with an effect size of 0.3 standard deviation, we expect the 50th percentile student of the treated group, similar to the 50th percentile student of the control group before the intervention, to be ranked at the 62nd percentile in the control group after the intervention.

In other words, the intervention has "moved" the average student from the 50th to the 62nd percentile. This progression can, in turn, be translated into months of learning using a table of typical standardised yearly growth coefficients (Bloom et al., 2008[103]). Therefore, an intervention with an effect size of 0.3 standard deviation targeting reading in Grade 1 is equivalent to 2.8 additional learning months.

To put these results in perspective, a recent meta-analysis explored 747 causal studies evaluating the impact of pre-K–12 education interventions on student achievement. It provides a general heuristic for interpreting effect sizes on achievement outcomes: less than 0.05 is small, 0.05 to less than 0.20 is medium, and 0.20 or greater is large. These values correspond to the 37th and 69th percentiles of the overall distribution of 1 942 estimated effects, and roughly split the distribution into three thirds. The median effect size represents 0.10 standard deviation (Kraft, 2019[100]).

The cohort analysis of 67 evaluation studies funded by the U.S. Institute of Education Sciences as a part of the i3 initiative (Boulay et al., 2018[104]), provides additional insights into the distribution of effect sizes obtained from recent randomised interventions in education. The unweighted average effect size of pre-registered interventions in existing schools was 0.03 standard deviation, which is "small" according to Kraft's heuristic. Only two programmes displayed a significant and "large" effect above Kraft's 0.2 threshold (Yeager et al., 2019[22]). These results have helped refine expectations about impact for field-based interventions.

Table 2. Examples of intervention effect sizes

Intervention	Outcome domain	Effect size	Additional learning months	Source
Extended school year intervention that provides 25 days of summer educational services to students in grades K-3 (StartSmart programme in the US).	English	0.11 – 0.15	0.96 – 1.31	Boulay et al. (2018[104])
	Mathematics	0.09	0.79	
A 12th grade English course developed by a task force of California State University faculty and high school educators to improve the academic literacy of high school seniors (ERWC programme in the US).	English	0.13	19.5	Boulay et al. (2018[104])
Meta-analysis of 6 interventions of one-to-one tutoring by teachers, paraprofessionals, or paid volunteers in grades 1 to 6 in the US.	Mathematics	0.20 – 0.37	2.37 – 4.39	Pellegrini et al. (2019[105])
Halving Grade 1 class size in underprivileged schools in France	French	0.08	0.47	Gurgand et al. (2019[106])
	Mathematics	0.13	1.03	

Note: The additional learning months are the author's computation, see Annex A2 for the detailed methodology.

The bottom line: What can we expect from a growth mindset intervention?

Growth mindset interventions are not a silver bullet for improving student performance. They are highly context-dependent; they can complement, but do not replace, traditional reforms in education. Such interventions are meant to help students take better advantage of learning opportunities but are expected to have limited impact on less vulnerable students. The identification and targeting of specific subgroups of more-at-risk students is likely to boost the efficiency of the intervention.

Policy decisions should not be solely determined by effect sizes: the scalability of an intervention and the cost of substitute interventions should also be taken into consideration. Growth mindset interventions fare well in both dimensions, which suggests they can be cost-effective ways to raise students' outcomes on a large scale.

Summary

A growth mindset is the belief that one's skills and qualities can be cultivated through effort, good strategies, and support from others as opposed to a fixed mindset that supposes them to be determined at birth. A person with a growth mindset is more likely to embrace challenges and learn from setbacks to reach greater levels of achievement than a person with a fixed mindset who avoids challenges and mostly seeks approval. Instilling a growth mindset is not just about praising effort, which can backfire and generate adverse effects. Rather, it implies rewarding progress and the processes that lead to greater learning. It is a process that requires continuous efforts from students, educators, parents, and guardians.

On average across OECD countries, students who present a growth mindset score higher than their peers with a fixed mindset. Growth mindset was also associated with a larger score gain for girls, disadvantaged, and immigrant students, when compared to boys, advantaged, and non-immigrant students. These results support further research focusing on the buffering effect of growth mindset on poverty, biased perceptions, and curbed aspirations. It opens an avenue for designing policies and interventions promoting equity and bridging the performance gap between different groups of students.

Research linking mindsets and mental health suggests that mindsets have an influence on overall well-being as they may buffer or exacerbate the adverse impact of negative life events. PISA data reveal that having a growth mindset is associated with positive attitudes towards learning – self-efficacy, less fear of failure, ambitious learning goals, and appreciation of the value of school. It is also positively associated with well-being as measured in life evaluation, the occurrence of positive feelings, and a sense of belonging at school.

Teachers play a critical role in establishing an environment conducive to growth mindset development, and providing guidance and continuous feedback to support the learning process. The level of teacher support for their students and their capacity to adapt instruction and include regular learning challenges in the learning process are positively associated with growth mindset development in PISA. These teacher practices moderate the relationship between growth mindset and academic performance. On average across OECD countries, students who present a growth mindset score higher than their peers with a fixed mindset and this difference increases when teachers are more supportive, adapt instruction, or provide feedback.

School environment contributes to students' socio-emotional development. Students in more privileged and urban schools are on average more likely to report a growth mindset. This raises the question of whether schools have the proper resources to ensure that every student, regardless of their socio-economic background or location, enjoys the same opportunities of developing a growth mindset. Research has shown the importance of aligning educational goals with evaluation and assessment to provide adequate incentives. However, the statistical analysis of PISA was inconclusive and calls for additional research to identify forms of assessments that would support the development of student growth mindset.

Growth mindset interventions are not a silver bullet for improving student performance. They are highly context-dependent; they can complement, but do not replace, traditional reforms in education. Such interventions are meant to help students take better advantage of learning opportunities but are expected to have limited impact on less vulnerable students. The identification and targeting of specific subgroups of more-at-risk students is likely to boost the efficiency of the intervention, and foster equity. Policy decisions concerning growth mindset interventions should not be solely determined by effect sizes, but also factor in scalability and the cost of substitute interventions. As growth mindset interventions fare well in both dimensions, this suggests they can be cost-effective ways to raise students' outcomes on a large scale.

Note

1. PISA calculates the school socio-economic profile as a weighted average of students' socio-economic status. A socio-economically disadvantaged (advantaged) school is a school in the bottom (top) quarter of the index of ESCS in the relevant country/economy.

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Annex A1
Notes on specific countries

Note on Belgium: Data related to growth mindset only include the Flemish Community of Belgium.

Note on Honk Kong (China), the Netherlands, Portugal and United States: Data did not meet the PISA technical standards but were accepted as largely comparable (see PISA 2018 Results Volumes I to V, Annexes A2 and A4).

Note on Spain: In 2018, some regions in Spain conducted their high-stakes exams for tenth-grade students earlier in the year than in the past, which resulted in the testing period for these exams coinciding with the end of the PISA testing window. Because of this overlap, a number of students were negatively disposed towards the PISA test and did not try their best to demonstrate their proficiency. Although the data of only a minority of students show clear signs of lack of engagement (see PISA 2018 Results Volume I, Annex A9), the comparability of PISA 2018 data for Spain with those from earlier PISA assessments cannot be fully ensured.

Annex A2
Methodology for translating effect sizes into additional months of learning

For comparability purpose, evaluators traditionally report effect sizes to gauge the impact of an intervention. These measures may however seem obscure to educators and policymakers. A more readily interpretable presentation of evaluation results consists in translating effect sizes into the corresponding additional months of learning.

The gap in students performance between the start and the end of the academic year corresponds to the effect size of an academic year. Bloom et al. (2008[103]) report empirical benchmarks for spring to spring growth by grade and subject, which amount to the annual learning gain of the average student in the United States (Table A.1). According to this Table, an average student would for example progress by 0.32 standard deviation during Grade 6.

The ratio of an intervention effect size over the average annual gain yields the additional years of learning associated with the intervention. Following the methodology described in Baird and Pane (2019[107]), namely setting aside differences in timespan (fall-to-spring vs. spring-to-spring), and assuming a 9-month academic year, effect sizes can be translated into additional learning months. For instance, the ERWC programme targeting 12th Graders in the United States (Table 2) presented a 0.13 effect size. This corresponds to an additional: 0.13 / 0.06 * 9 = 19.5 months of learning.

Table A.1. Average annual gains in effect size in reading and mathematics

Grade Transition	Reading Tests	Math Tests
Grade K - 1	1.52	1.14
Grade 1 - 2	0.97	1.03
Grade 2 - 3	0.6	0.89
Grade 3 - 4	0.36	0.52
Grade 4 - 5	0.4	0.56
Grade 5 - 6	0.32	0.41
Grade 6 - 7	0.23	0.3
Grade 7 - 8	0.26	0.32
Grade 8 - 9	0.24	0.22
Grade 9 - 10	0.19	0.25
Grade 10 - 11	0.19	0.14
Grade 11 - 12	0.06	0.01

Source: Bloom et al. (2008[103]) "Performance Trajectories and Performance Gaps as Achievement Effect-Size Benchmarks for Educational Interventions", *Journal of Research on Educational Effectiveness*, Vol. 1/4, pp. 289-328.

Annex B
List of tables available online

https://webfs.oecd.org/pisa2018/PISA2018IR_GrowthMindset_Tab.xlsx

WEB	Table B.1	Growth mindset
WEB	Table B.2	Growth mindset, by student characteristics
WEB	Table B.3	Growth mindset and performance in reading, mathematics and science
WEB	Table B.4	Association between growth mindset and reading performance, by student characteristics
WEB	Table B.5	Association between growth mindset and mathematics performance, by student characteristics
WEB	Table B.6	Association between growth mindset and science performance, by student characteristics
WEB	Table B.7	Growth mindset and educational expectations
WEB	Table B.8	Growth mindset and student attitudes
WEB	Table B.9	Student attitudes and average PISA scores
WEB	Table B.10	Growth mindset and well-being indices
WEB	Table B.11	Growth mindset and life satisfaction
WEB	Table B.12	Growth mindset and teacher support
WEB	Table B.13	Growth mindset and adaptive instruction
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WEB	Table B.20	Growth mindset and stratification policies
WEB	Table B.21	Total variation in reading performance, and variation between and within schools
WEB	Table B.22	Effect size of growth mindset in academic performance

Annex C
OECD – Yidan Prize Foundation: Growth Mindset Online Workshop

Table C.1. Agenda of the event

Dates: 3, 4 & 8 September 2020

	Paris time		
Day 1	15:30 – 15:45	Welcome Remarks	**Andreas Schleicher,** Director for Education and Skills, OECD **Edward Ma**, Secretary-General, Yidan Prize Foundation
	15:45 – 16:00	Growth Mindset: History and Current Knowledge	Presentation 1. **Carol Dweck**, Lewis and Virginia Eaton Professor of Psychology, Stanford University, Yidan Prize for Education Research Laureate 2017
	16:00 – 16:15	Growth Mindset and International Comparisons in PISA	Presentation 2. **Alfonso Echazarra**, Analyst, Programme for International Student Assessment (PISA), OECD
	16:15 – 16:25	Questions for Presentations 1 and 2	
	16:25 – 17:10	Growth Mindset Effects on Cognitive and Non-Cognitive Outcomes	Presentation 3. **Mari Rege**, Professor of Economics, University of Stavanger. Mindsets, Challenge-Seeking and Advanced Course-Taking, Presentation 4. **David Yeager**, Associate Professor of Psychology, University of Texas at Austin. Mindsets, Stress and Mental Health, Presentation 5. **Chi-yue Chiu**, Professor of Psychology and Dean of Social Sciences, Chinese University of Hong Kong Mindsets and Well-Being
	17:10 – 17:20	Questions for Presentations 3, 4, and 5.	
	17:20 – 18:30	Panel discussion 1. What Developmental Science Says about Student Mindsets (and Changing Mindsets)	Moderator: **David Yeager**, Associate Professor of Psychology, University of Texas at Austin Panellists: **Adriana Galvan**, Dean of Undergraduate Education and Professor of Psychology, UCLA **Mesmin Destin**, Associate Professor of Psychology, Northwestern University **Joe Allen**, Hugh Kelly Professor of Psychology, University of Virginia **Christopher Bryan**, Asst. Professor of Business, Government and Society, University of Texas at Austin

Day 2	15:30 – 16:30	Panel discussion 2. Impacts of Teachers' Mindsets and Practices on Student Engagement and Achievement	Moderator and Panellist: **Mary Murphy**, Professor of Psychological and Brain Sciences, Indiana University Panellists: **Andrei Cimpian**, Associate Professor of Psychology, New York University **Stephanie Fryberg,** Professor of Psychology, University of Michigan **Matthew A. Kraft**, Associate Professor of Education & Economics, Brown University
	16:30 – 17:30	Panel discussion 3. How Teachers and Schools Create Growth Mindset Cultures: Insights from Experts in Educational Practice	Moderator: **Stephanie Fryberg**, Professor of Psychology, University of Michigan Panellists: **Vicky Colbert,** Founder and Director, Fundación Escuela Nueva **Ron Berger**, Chief Academic Officer, EL Education **Ron Ferguson**, Lecturer in Public Policy and Director of the Achievement Gap Initiative Harvard Kennedy School, Harvard University **Alison Peacock**, Chief Executive of the Chartered College of Teaching
	17:30 – 18:30	Panel discussion 4. How Can We Learn from Variability in Growth Mindset Cultures Across and Within Nations?	Moderator: **David Yeager**, Associate Professor of Psychology, University of Texas at Austin Panellists: **Larry Hedges**, Professor of Statistics, Psychology, and Educational and Social Policy, Northwestern Uni. **Tony Bryk**, President, Carnegie Foundation for the Advancement of Teaching **Elizabeth Tipton**, Associate Professor of Statistics, Northwestern University **Sughra Choudry Khan**, Director of Education, Aga Khan Foundation, Pakistan
Day 3	15:30 – 15:35	Opening Remarks and Orientation	**Carol Dweck**, Lewis and Virginia Eaton Professor of Psychology, Stanford University, Yidan Prize for Education Research Laureate 2017
	15:35 – 16:30	Session 1. Creating Growth Mindset Cultures and the Challenges of Teacher Behaviour Change	Chair: **Mary Murphy**, Professor of Psychological and Brain Sciences, Indiana University Panellists: **Gregory Walton**, Associate Professor, Department of Psychology, Stanford University **Angela Duckworth**, Professor of Psychology, University of Pennsylvania.
	16:30 – 17:25	Session 2. Measurement of Teachers' Growth Mindset Beliefs, Practices and Classroom Climates: Individual Differences, Program Evaluation, and International Comparisons	Chair: **Kali Trzesniewski**, Associate Cooperative Extension Specialist and Director, UC Davis Panellists: **Sidney D'Mello**, Associate Professor, Insitute of Cognitive Science, University of Colorado Boulder **Dave Paunesku**, Executive Director and co-founder of the Stanford University Project for Education Research That Scales (PERTS) **Beatrice Rammstedt**, Professor of Psychological Diagnostics, Survey Design and Methodology, University of Mannheim, and head of the Survey Design and Methodology department at GESIS - Leibniz Institute for Social Sciences

| Day3 | 17:25 – 18:20 | Session 3.
Global Research Design and Infrastructure for Studying Teacher Mindset Practices, Beliefs and Climates | Chair: **Elizabeth Tipton**, Associate Professor of Statistics, Northwestern University
Panellists: **Jared Murray**, Assistant Professor of Statistics, University of Texas
Mari Rege, Professor of Economics, University of Stavanger.
Larry Hedges, Professor of Statistics, Psychology, and Educational and Social Policy, Northwestern Uni. |
| | 18:20 – 18:30 | Concluding Remarks | **Carol Dweck**, Lewis and Virginia Eaton Professor of Psychology, Stanford University, Yidan Prize for Education Research Laureate 2017
Edward Ma, Secretary-General, Yidan Prize Foundation
Miyako Ikeda, Senior Analyst, Programme for International Student Assessment (PISA), OECD |

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Note by all the European Union Member States of the OECD and the European Union

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PISA 2018

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