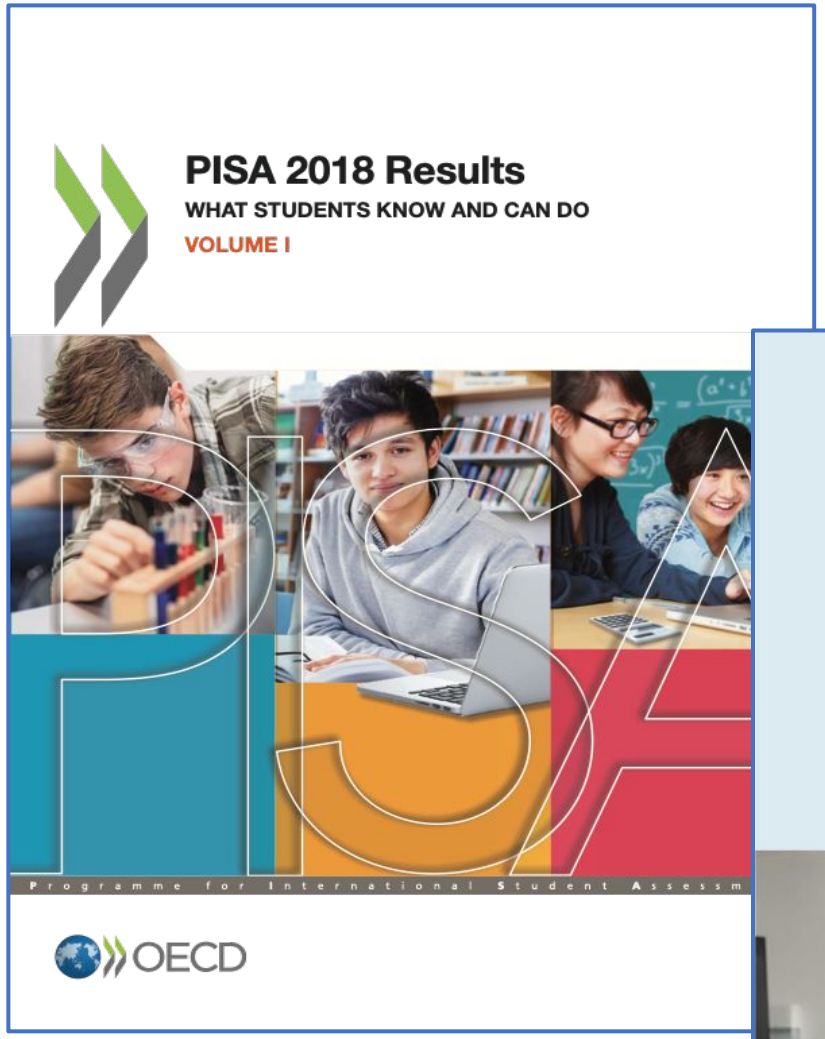
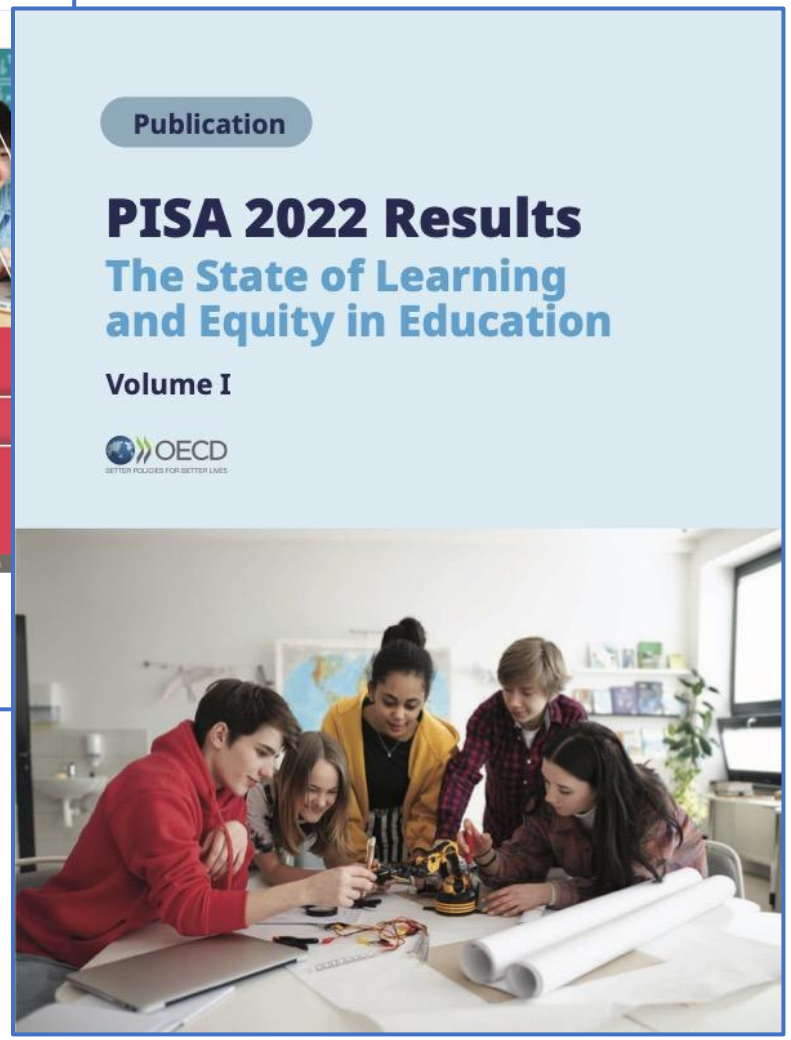
De La Salle University's Multidisciplinary Research on PISA





Allan B. I. Bernardo

De La Salle University

Multidisciplinary teams

College of Education
- Rochelle E. Lucas
- Minie C. Lapinid
- Ma. Joahna M. Estacio

Data Sciences Institute
- Macario Cordel
- Thomas Tiam-Lee
- Unisse Chua

Center for Inclusion, Diversity, & Wellbeing
- Katrina F. Resurreccion

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- Marissa O. Calleja
- Rene M. Nob
- Ma. Caridad H. Tarroja
- Reinier Dave Zapanta
- Gesselle Manguiat

Office of Counseling Services
- Elaine Aranda
- Joel Navarez
- Patricia Taba
- Rosette Morga

Caveat about presentation

What it IS NOT about:

- does not refer to educational assessment practices
- does not provide guidance to improve educational assessment practices in the Philippines

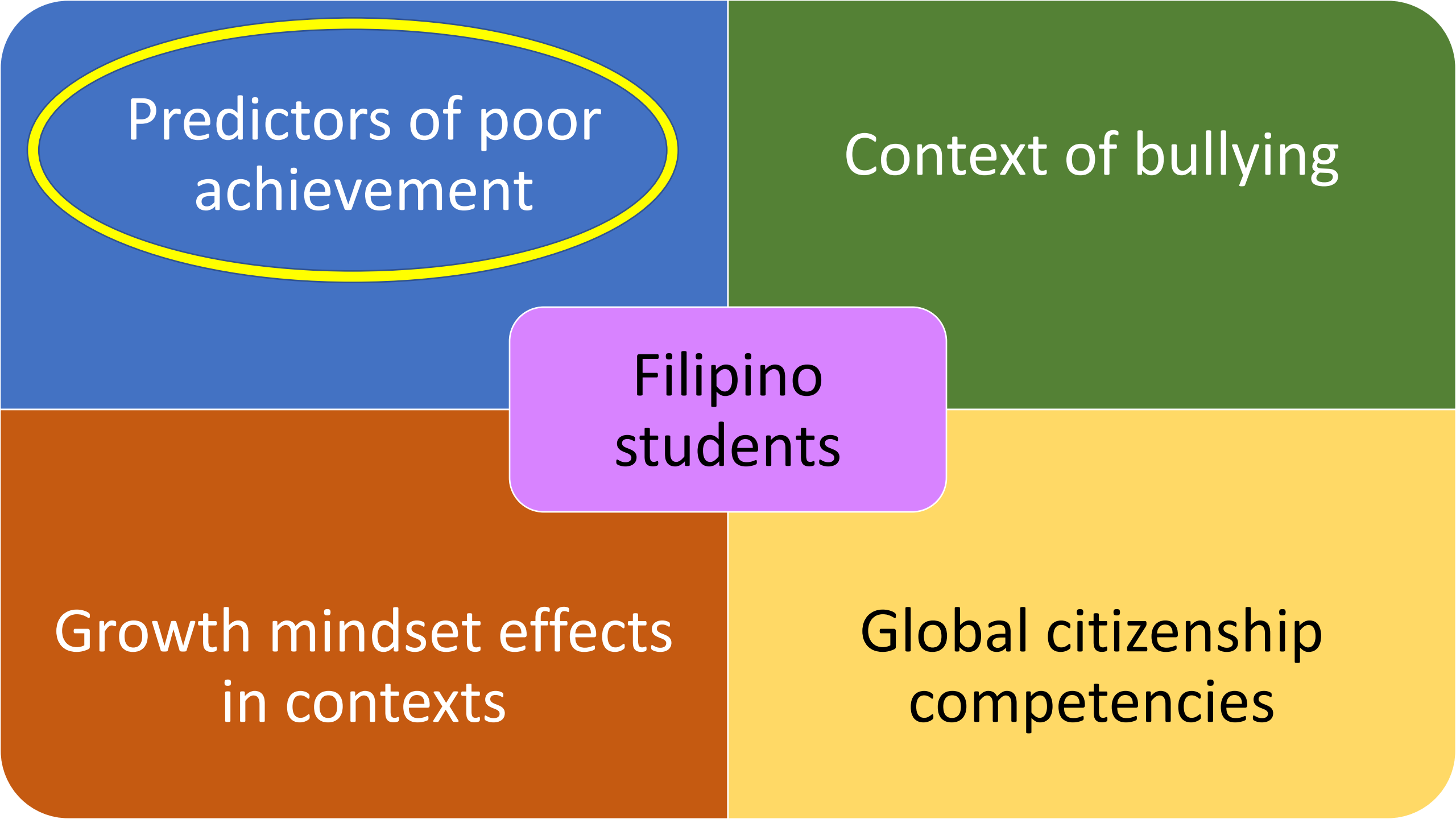
What it **IS** about:

- research to better understand learning and achievement in Philippine context
- guides for interventions and reforms

Philippine Development Plan 2017-2022

"Participate in international large-scale assessments (ILSAs). The country's participation in ILSAs such as the Trends in International Mathematics and Science Study, Programme for International Student Assessment, and South-East Asia Primary Learning Metrics will be prioritized to measure learning outcomes vis-à-vis other countries and provide information to evaluate the country's progress in improving math, science, and literacy and build evidence for policy development and decision-making."

NEDA (2020, p. 173), *Updated Philippine Development Plan (2017-2022)*


Predictors of poor achievement
Context of bullying
Filipino students
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Classication algorithms

- Develop models that will identify one group vs. another
  - Poor-achievers vs. Better-achievers
- What combination of variables best identifies membership in one group vs. the other?

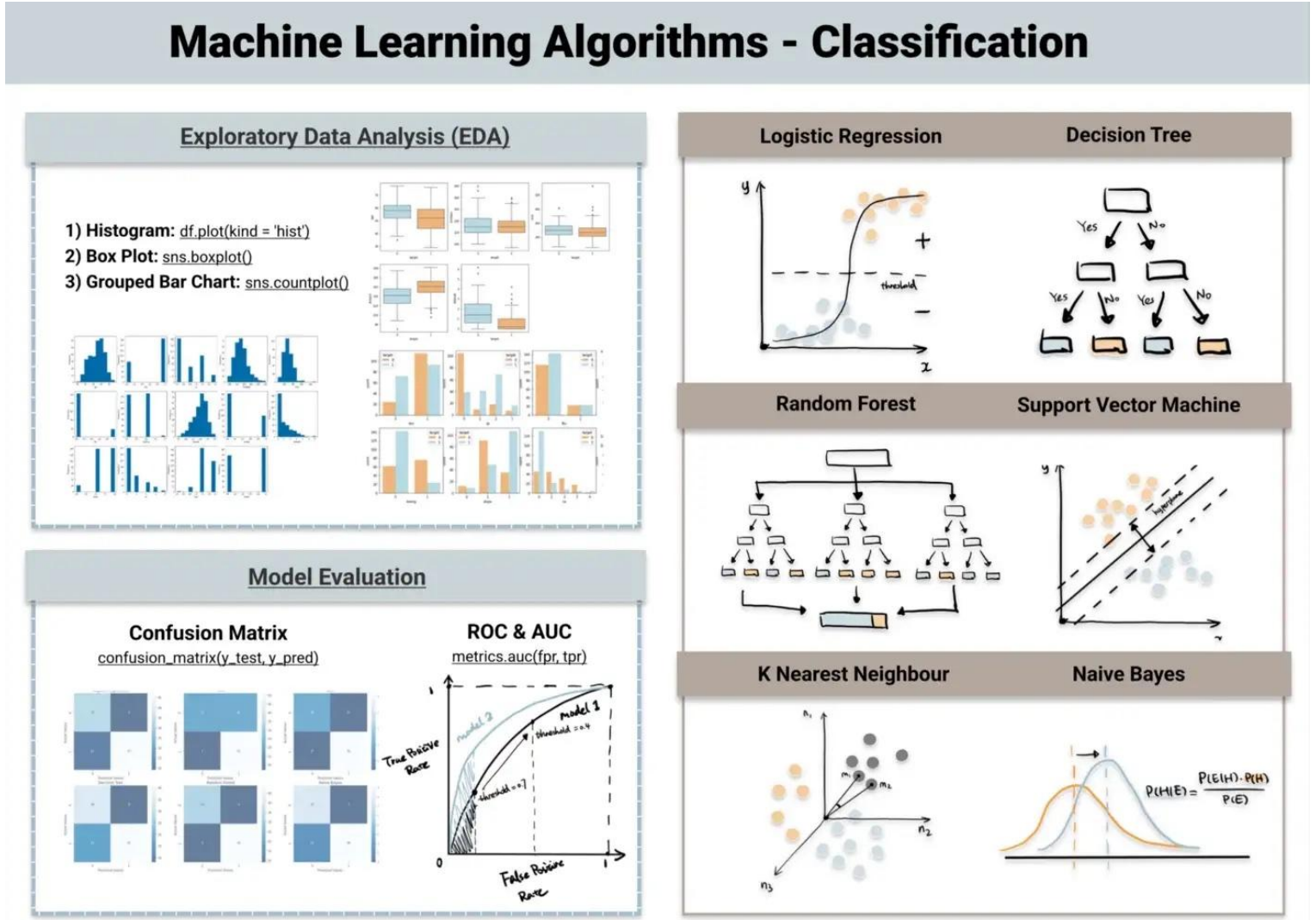
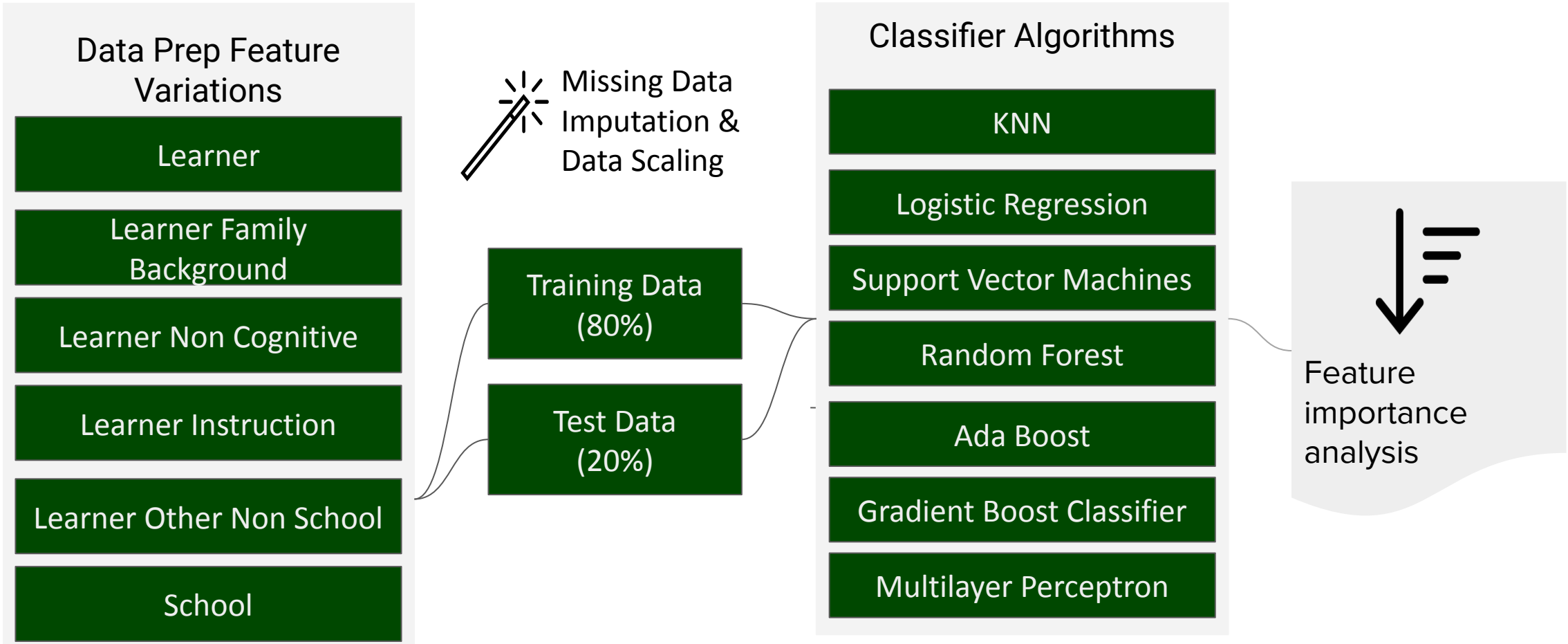


Image from https://towardsdatascience.com/top-machine-learning-algorithms-for-classification-2197870ff501



Mining the PH PISA Data

READING VARIABLES

- Negative reading self-concept
- Low metacognitive awareness of reading strategies
- Low enjoyment of reading
- Low reading of fiction for enjoyment

TEACHING VARIABLES

- Frequent teacher feedback
- Asking students their thoughts on the reading material
- Low teacher enthusiasm

ICT VARIABLES

- Low ICT resources at home
- Infrequent use of ICT to learn about a topic
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MOTIVATIONAL VARIABLES

- Low persistence in mastering tasks
- Low mastery learning goals
- Low valueing for schooling
- Low expected occupational status after high school
- Low growth mindset beliefs

SCHOOL ENVIRONMENT VARIABLES

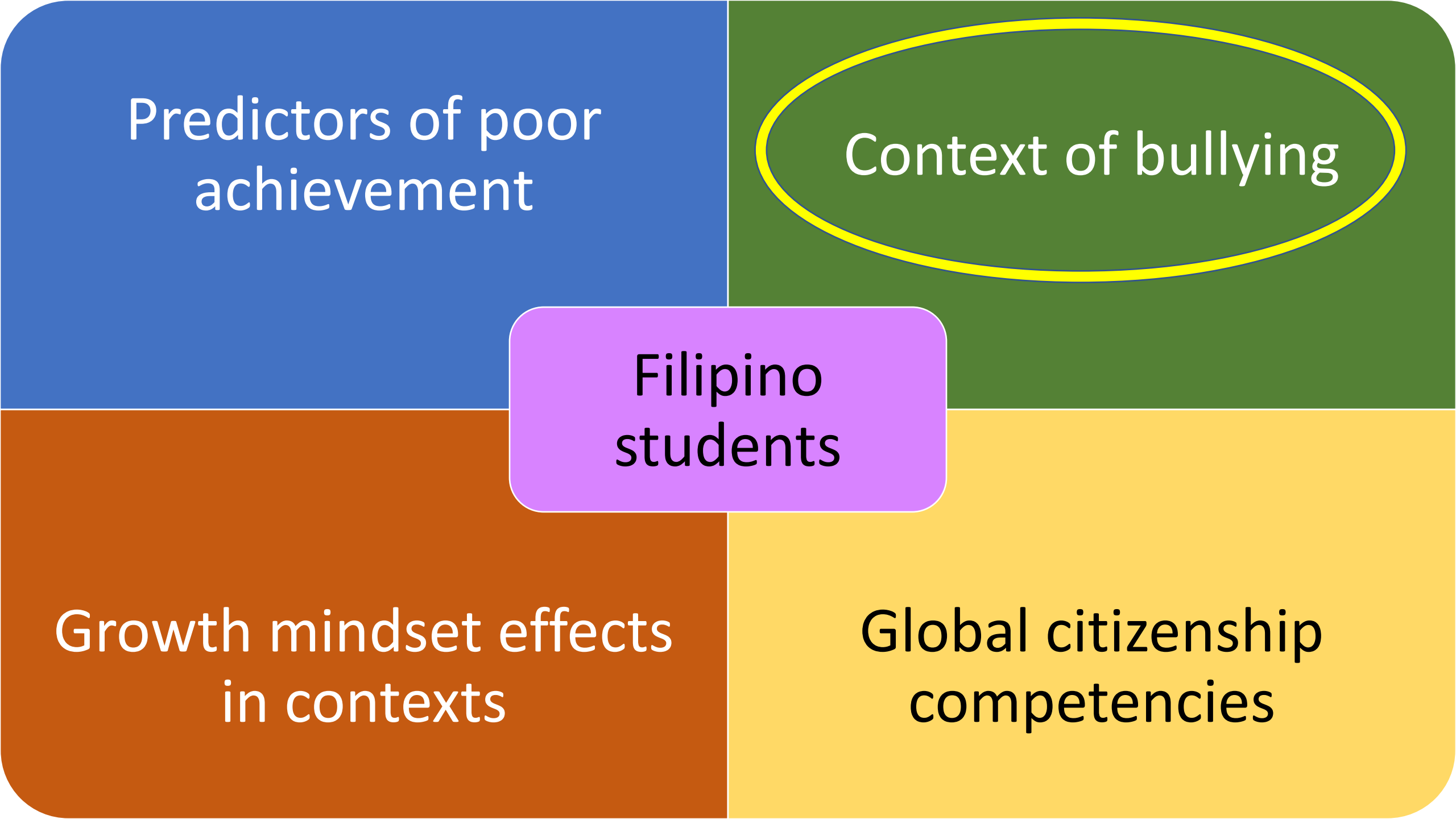
- High exposure to bullying
- Low sense of belonging
- Low perceived cooperation among students

Low Economic, Social, and Cultural (ESC) Status of family

Best model: Support Vector Machines

Social psychological environments of low-achieving Filipino students

Psychological responses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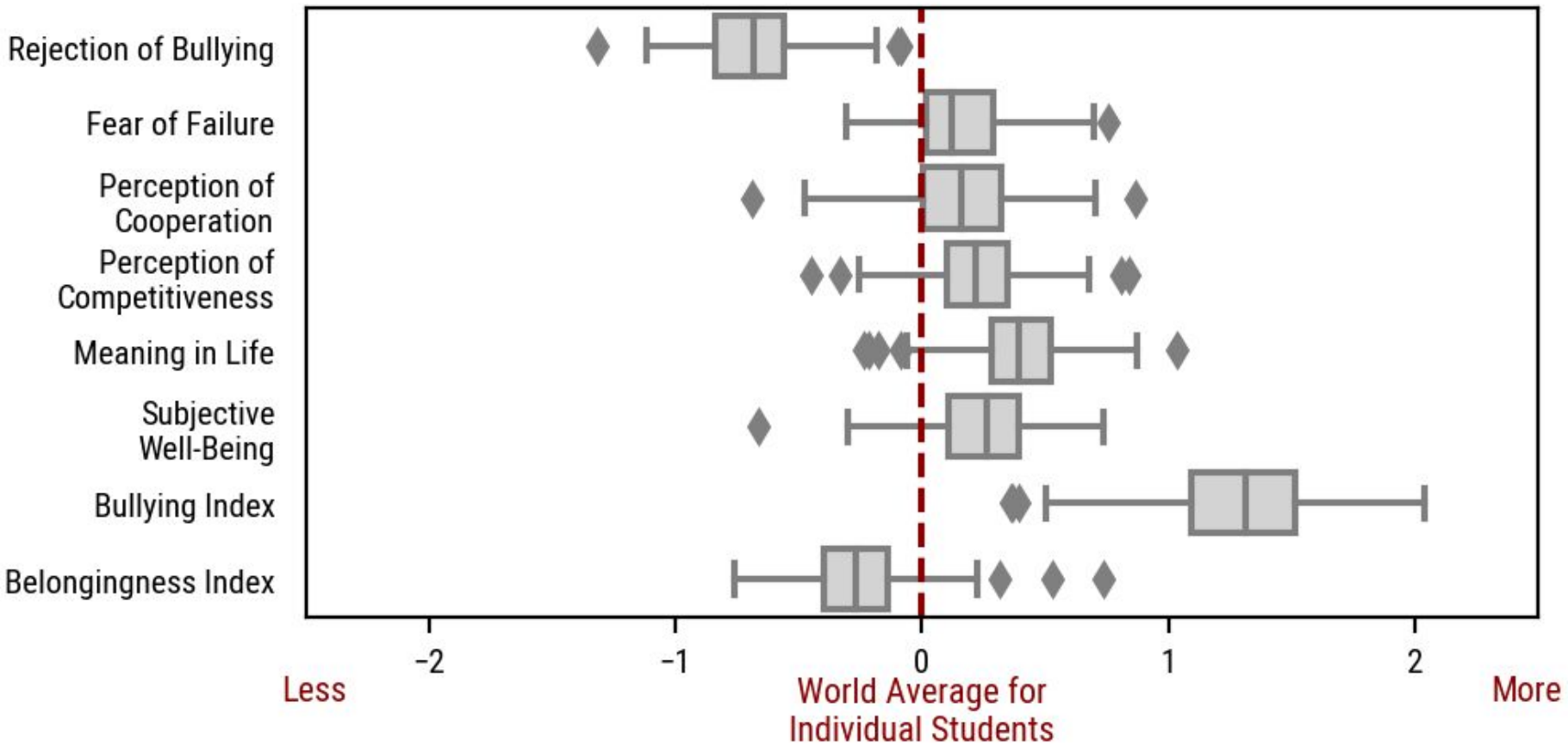
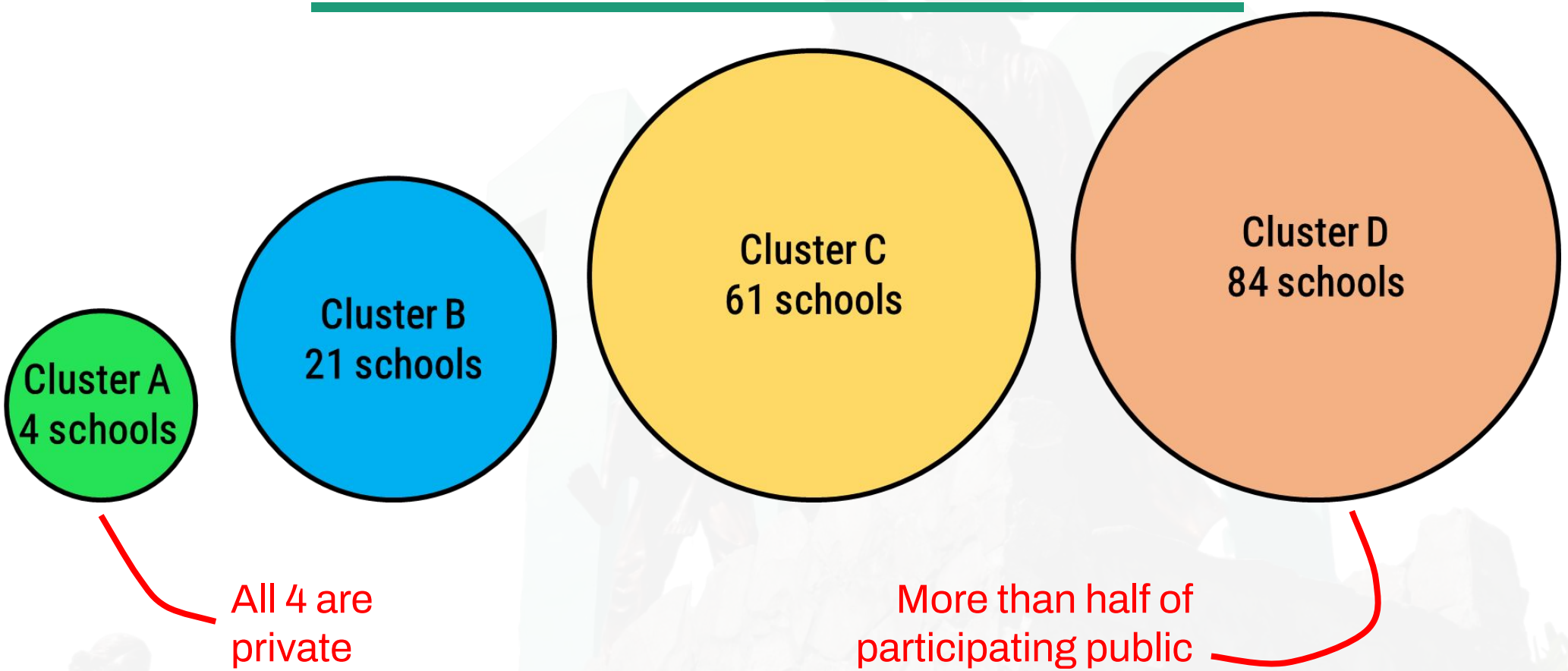
School Environments



Clustering Results



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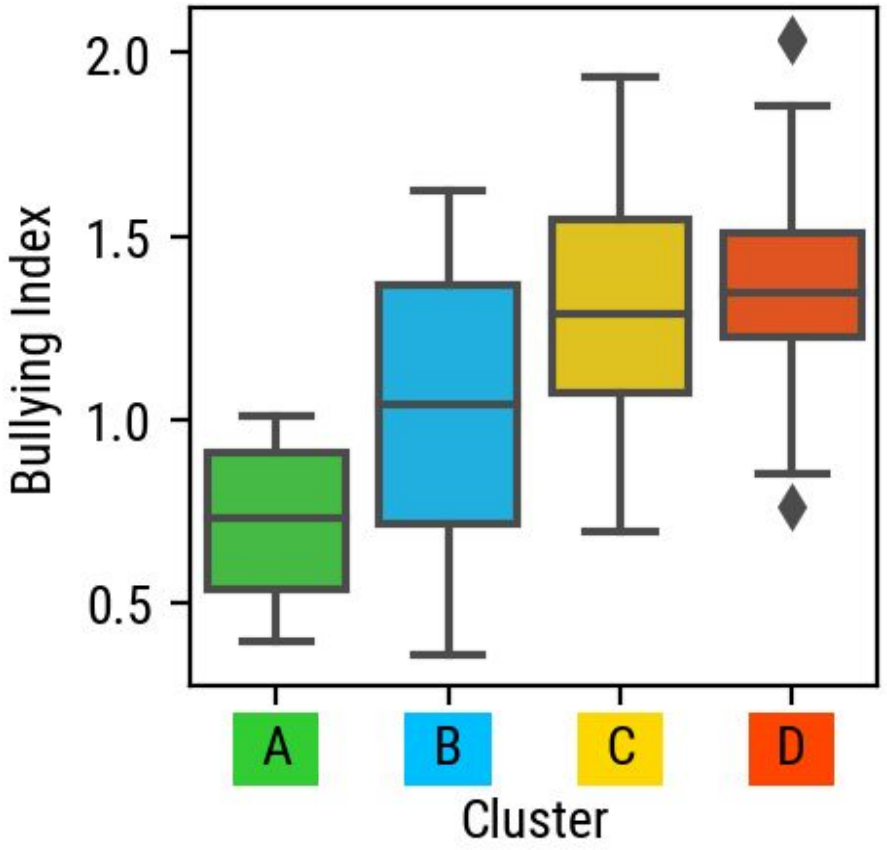

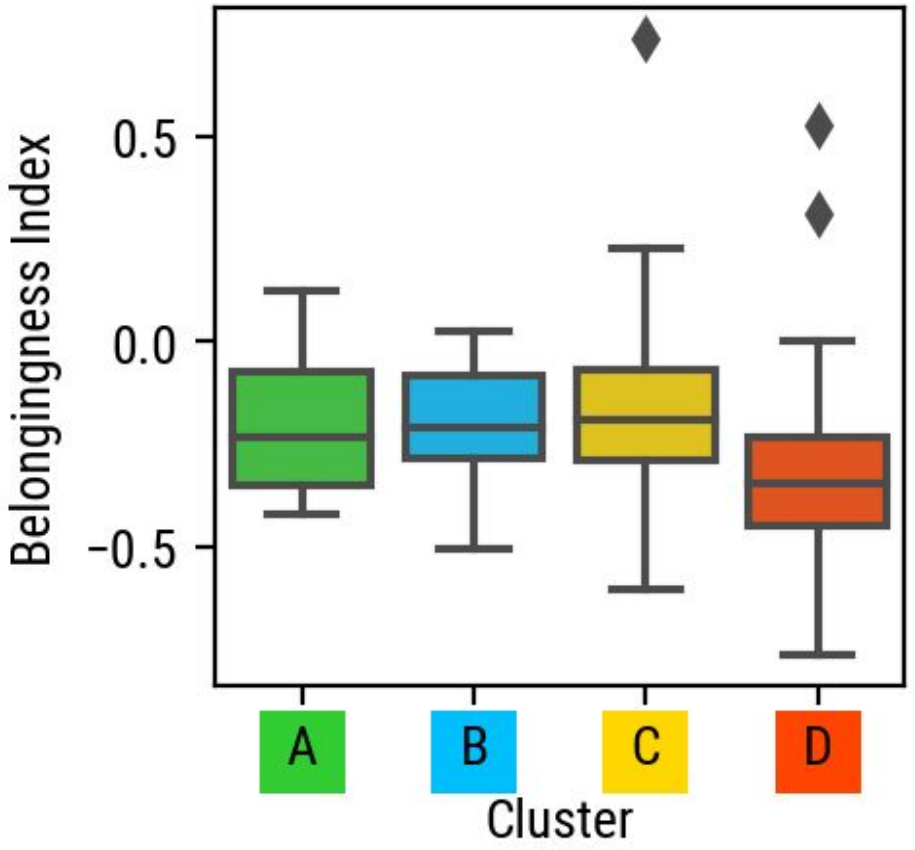

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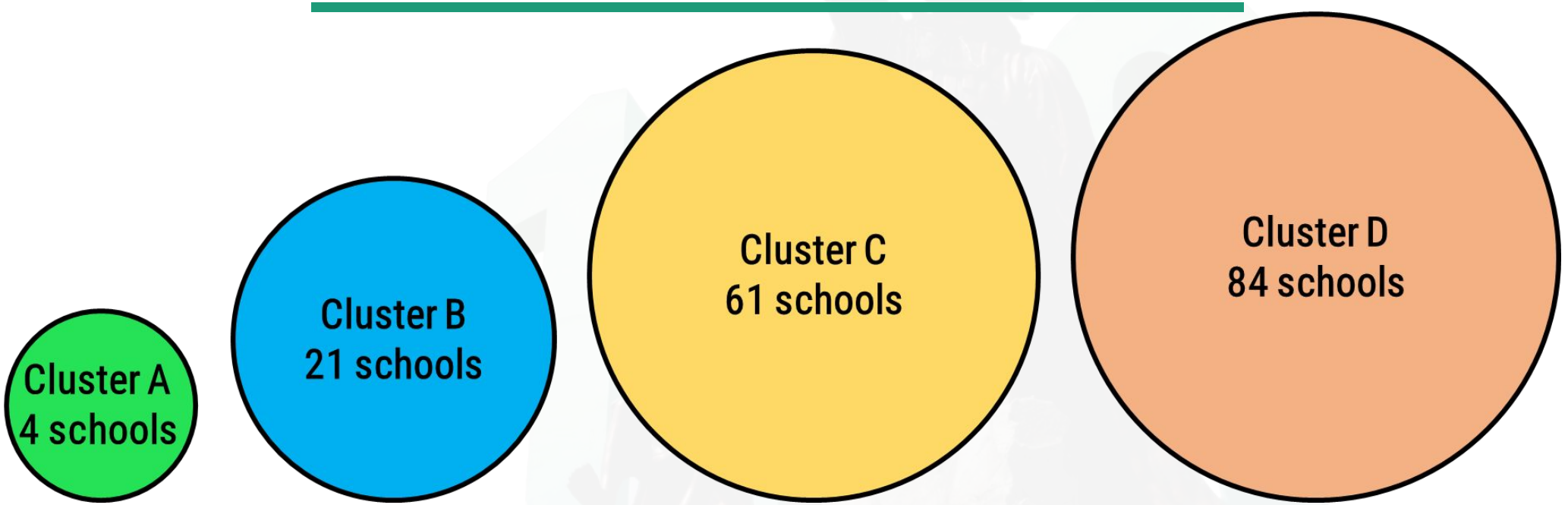


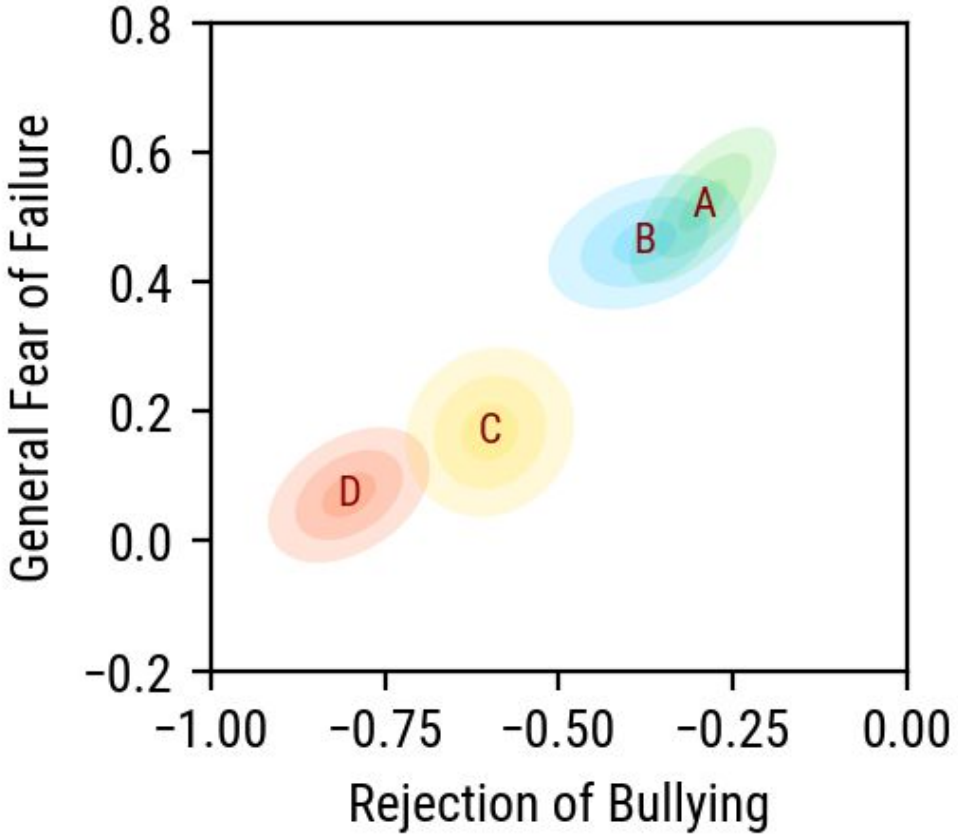
Lowest level of bullying among cluster

Relatively low bullying, but more variable

Relatively high bullying

Relatively high bullying + lowest level of belongingness

Environment Profiles of Each Cluster



Clusters A and B:

high rejection of bullying

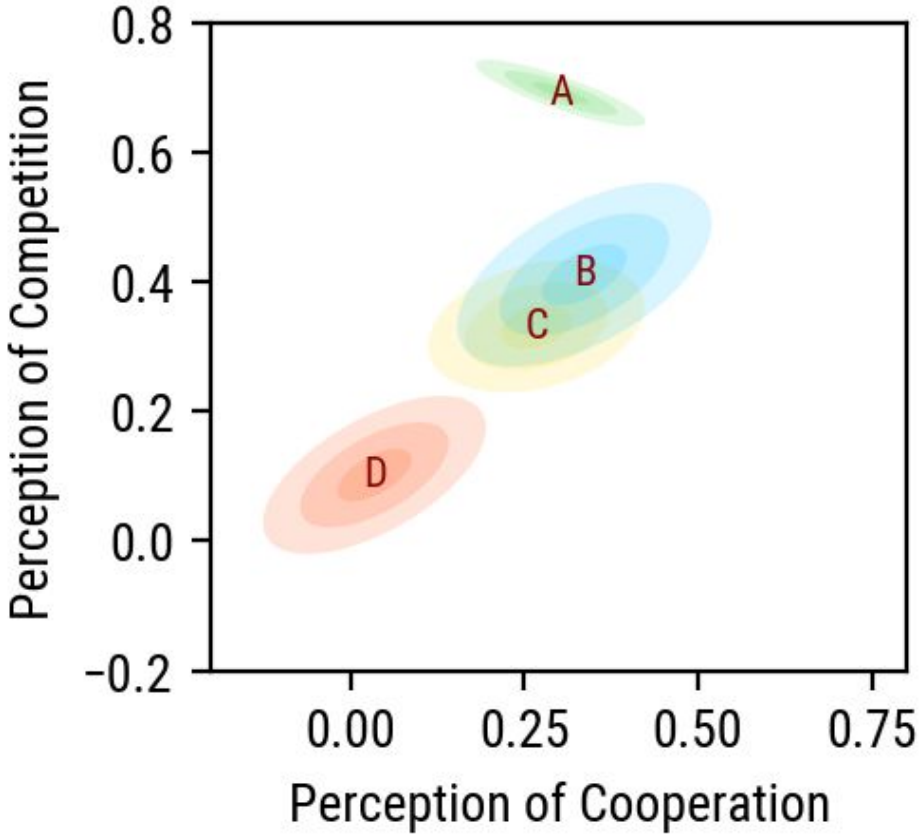
high fear of failure

Clusters C and D:

low rejection of bullying

low fear of failure

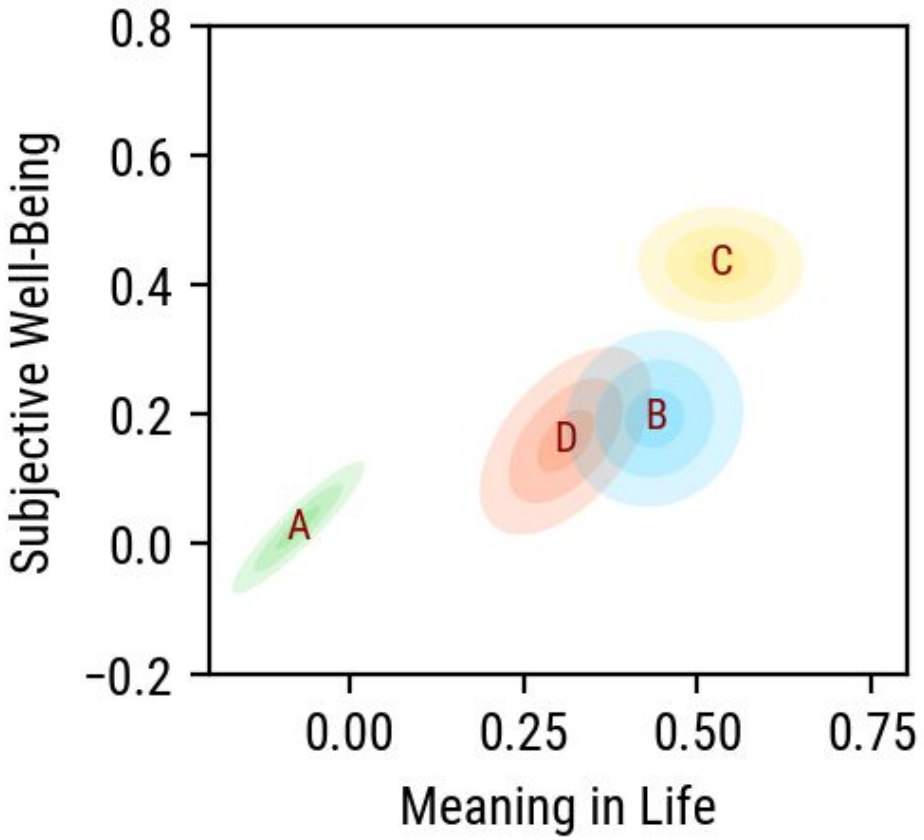
Environment Profiles of Each Cluster



Clusters A, B, and C have similar perception of cooperation, but **Cluster A** has a **significantly higher perception of competition**.

Cluster D has a **significantly lower perception of cooperation** and **significantly lower perception of competition**.

Environment Profiles of Each Cluster



Clusters C:

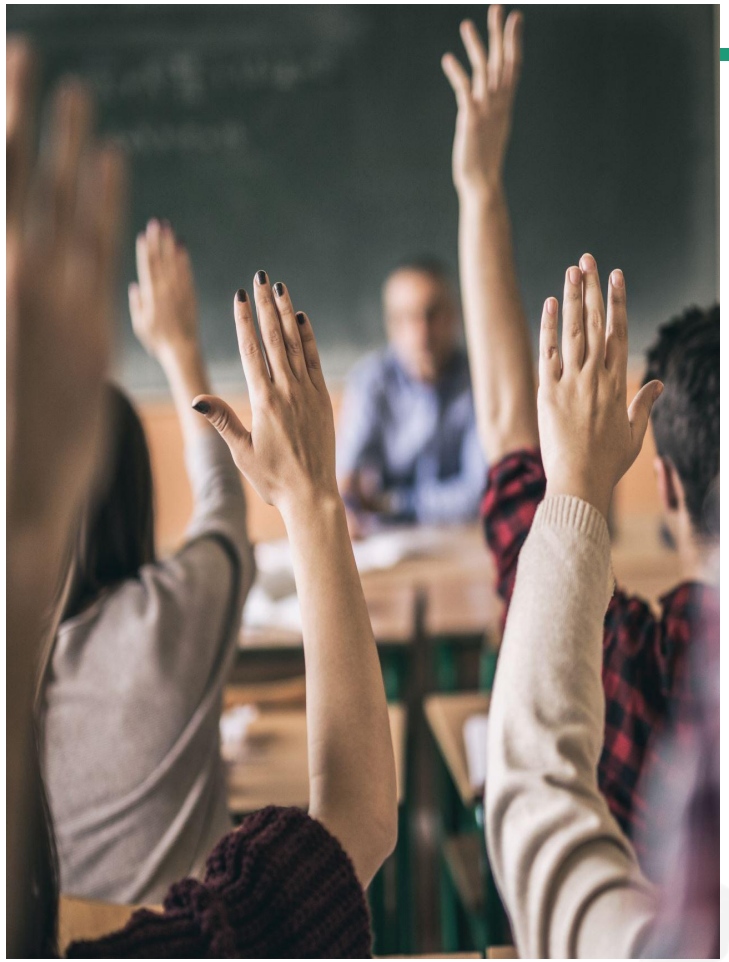
High subjective well-being

High meaning in life

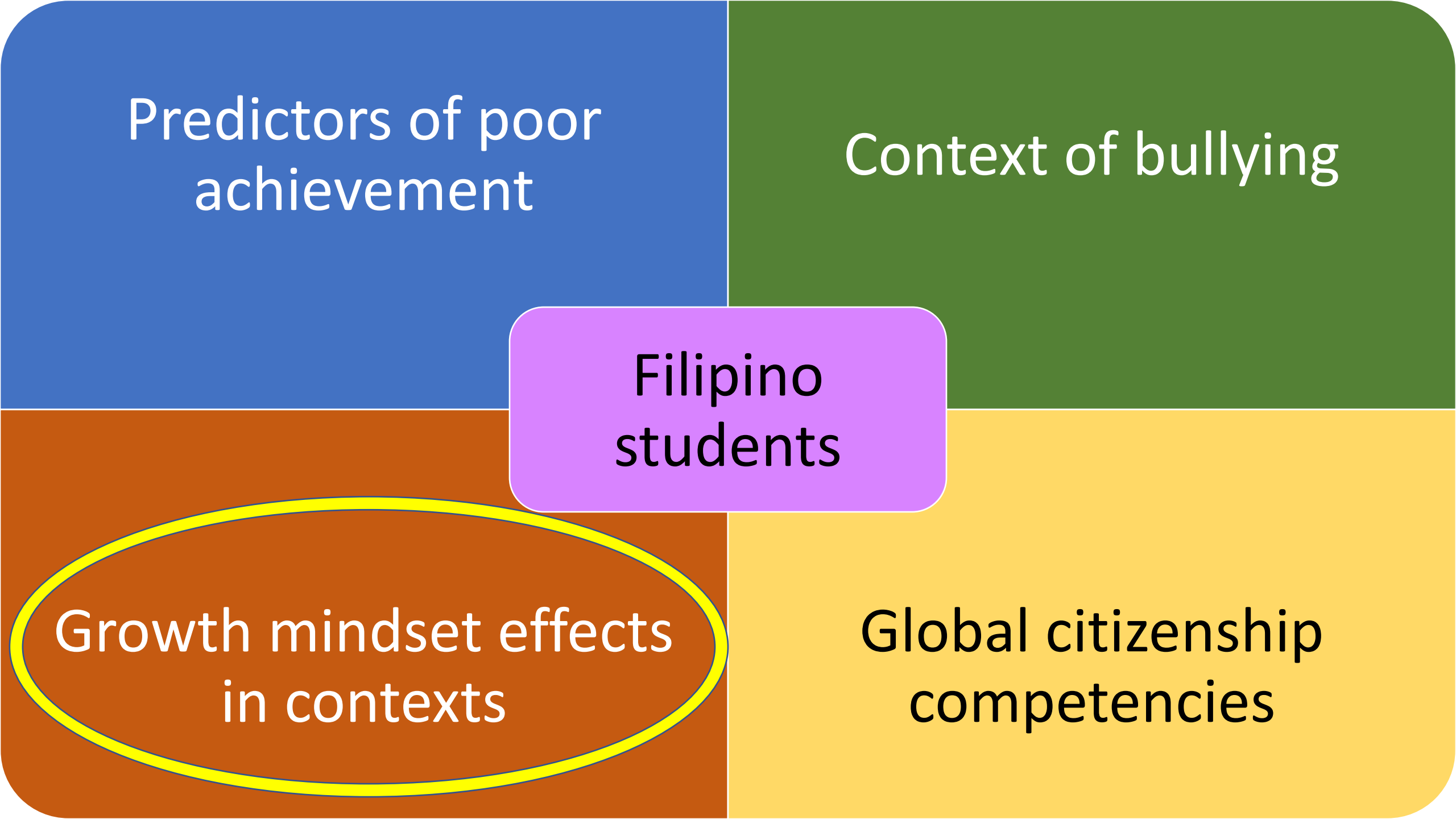
Cluster A:

Surprisingly low meaning in life

Summary



- Less-bullied clusters A and B are similar.
  - High rejection of bullying, high fear of failure
  - Main difference: A has significantly less meaning in life, high sense of competition
- More bullied clusters C and D are similar:
  - Low rejection of bullying, low fear of failure
  - Main difference: C has high subjective well-being, while D has low sense of competition, low sense of cooperation, and low sense of belonging.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Low Economic, Social, and Cultural (ESC) Status of family

Filipino students' reading achievement in PISA (Bernardo, 2023)

- economic, social, and cultural status (ESCS)
- regressions on moderating effect of SES indicators on the relationship between growth mindset and achievement (controlling for sex, several teacher and student motivational factors)

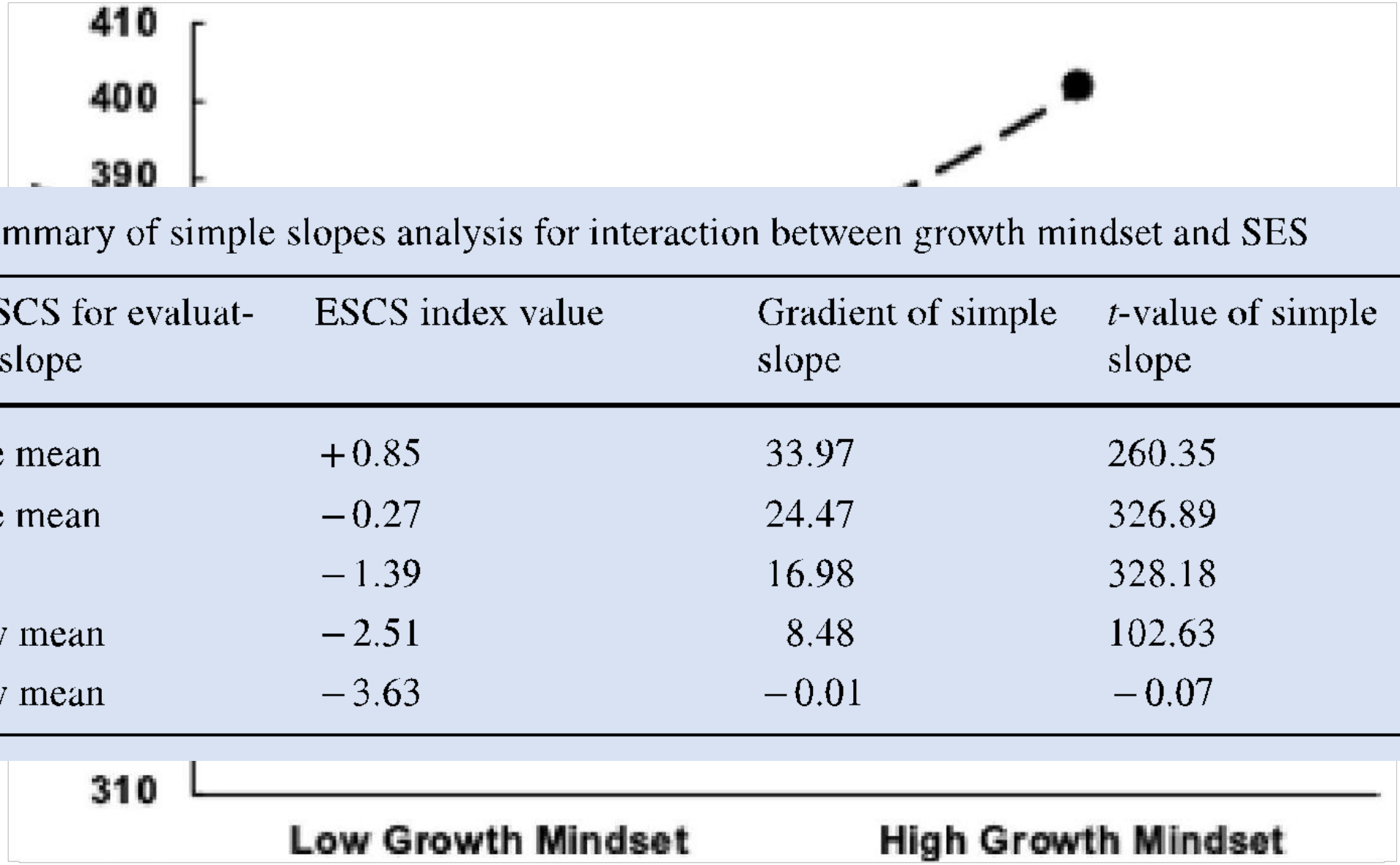


Table 3 Summary of simple slopes analysis for interaction between growth mindset and SES

Value of ESCS for evaluating simple slope	ESCS index value	Gradient of simple slope	*t*-value of simple slope	*p*
2 SD above mean	+0.85	33.97	260.35	< .001
1 SD above mean	−0.27	24.47	326.89	< .001
Mean	−1.39	16.98	328.18	< .001
1 SD below mean	−2.51	8.48	102.63	< .001
2 SD below mean	−3.63	−0.01	−0.07	.945

Fig.1 Graphic representation of moderating effect of socioeconomic status on the relationship between growth mindset and reading proficiency of Filipino students in PISA 2018.

Growth mindset does not positively predict achievement of students from lower SES families

Believing that they can change their level of intelligence does not help students in contexts where the resources are inadequate to support the students' efforts to improve their abilities

Social axioms and growth mindset (Bernardo, et al., 2021)

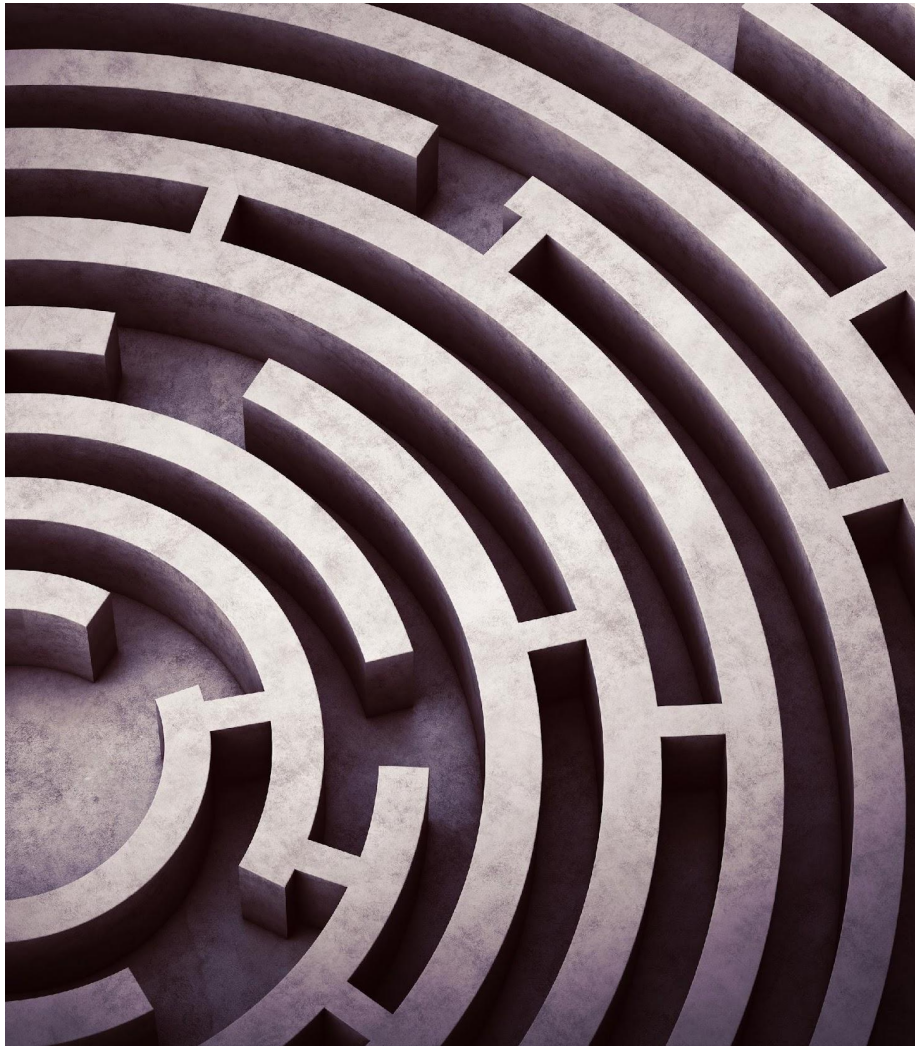
- Nationally representative samples of 39 countries/territories (n=273,074)
- Country-level social axiom scores (39 countries)
- Multilevel modeling with random slopes (MLM-RS)
  - Individual level: sex and SES as covariates, growth mindset predicting achievement
  - Country-level social axioms moderate country-level slope of growth mindset relationship with achievement

Social axioms
(LEUNG & BOND, 2004)

- Generalized beliefs about the social world
  - Reward for application
  - Fate control
  - Religiosity
  - Social cynicism
  - **Social complexity**

Social complexity

- beliefs that behaviors and outcomes may vary across different situations; that there are usually multiple solutions to problems
- Hypothesis: weaker growth mindset effect on achievement in societies where this belief is widely endorsed
  - desired educational outcomes could be attained through a variety of approaches – not just one's effort
  - focus students' attention on a wider range of options beyond personal effort and ability to attain educational outcomes.
  - student might not even view success in school as the most important pathway to attain their goals in life



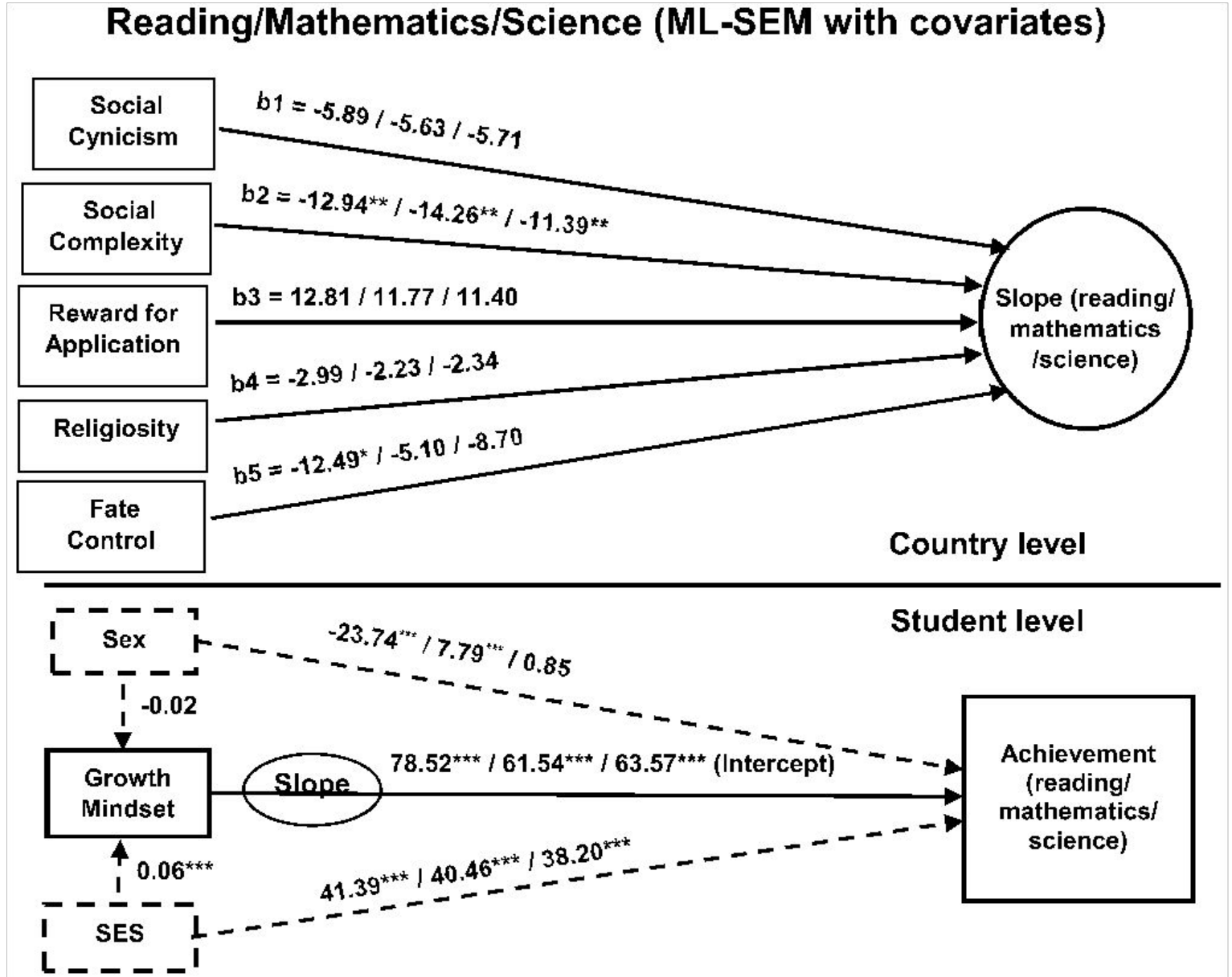


Figure 1. Multilevel-level structural equation modeling with random slopes (estimate unstandardized). Notes: $^{**}p < .01$; $^{***}p < .001$, $^{*}p = .063$; Intercept = recalibrated starting value of mindset effect on achievement.

Summary

- The studies show that growth mindset effects have positive associations with achievement in specific social contexts.
- The positive association of growth mindset with achievement is **weaker** in students from lower SES families in the Philippines
- The positive association of growth mindset with achievement is **weaker** in countries with high normative social complexity beliefs

Some further complexities

Varieties of mindsets in second/foreign language learning

- General growth mindset
- Language growth mindset
- Second language / foreign mindset
- Second language reading / foreign language reading mindest

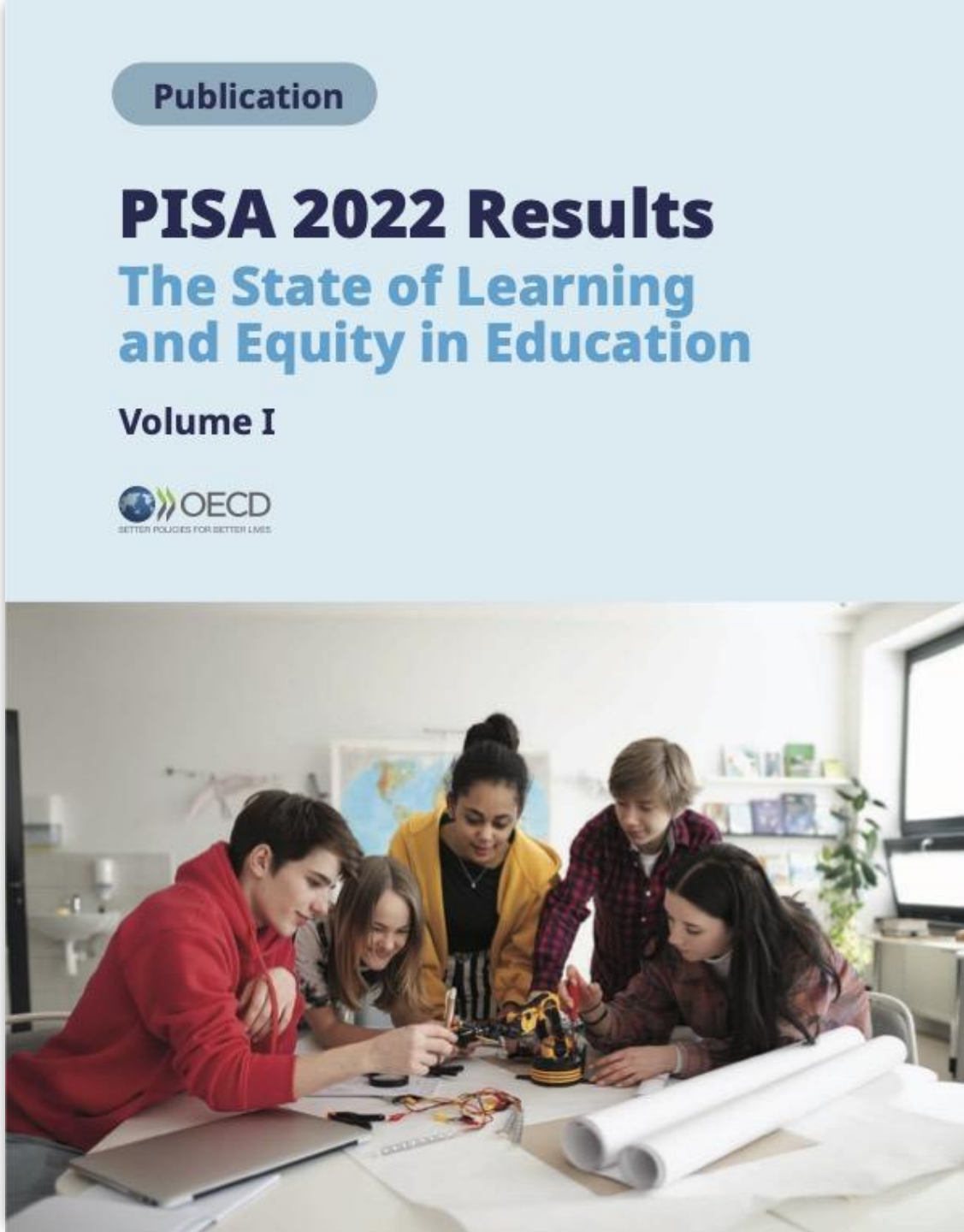
Growth mindset in PISA 2022 data

Distinct measures for growth mindset for

- intelligence
- Mathematics
- reading language
- Creativity

Philippine data:

- 35.2% had a growth mindset for intelligences
- 42.6% had a growth mindset for learning English



Philippine PISA 2022 data

Reading proficiency :

- negatively correlated (--.04**) with growth mindset for intelligence
- **positively** correlated (.11***) with growth mindset for **English** language

Side note:

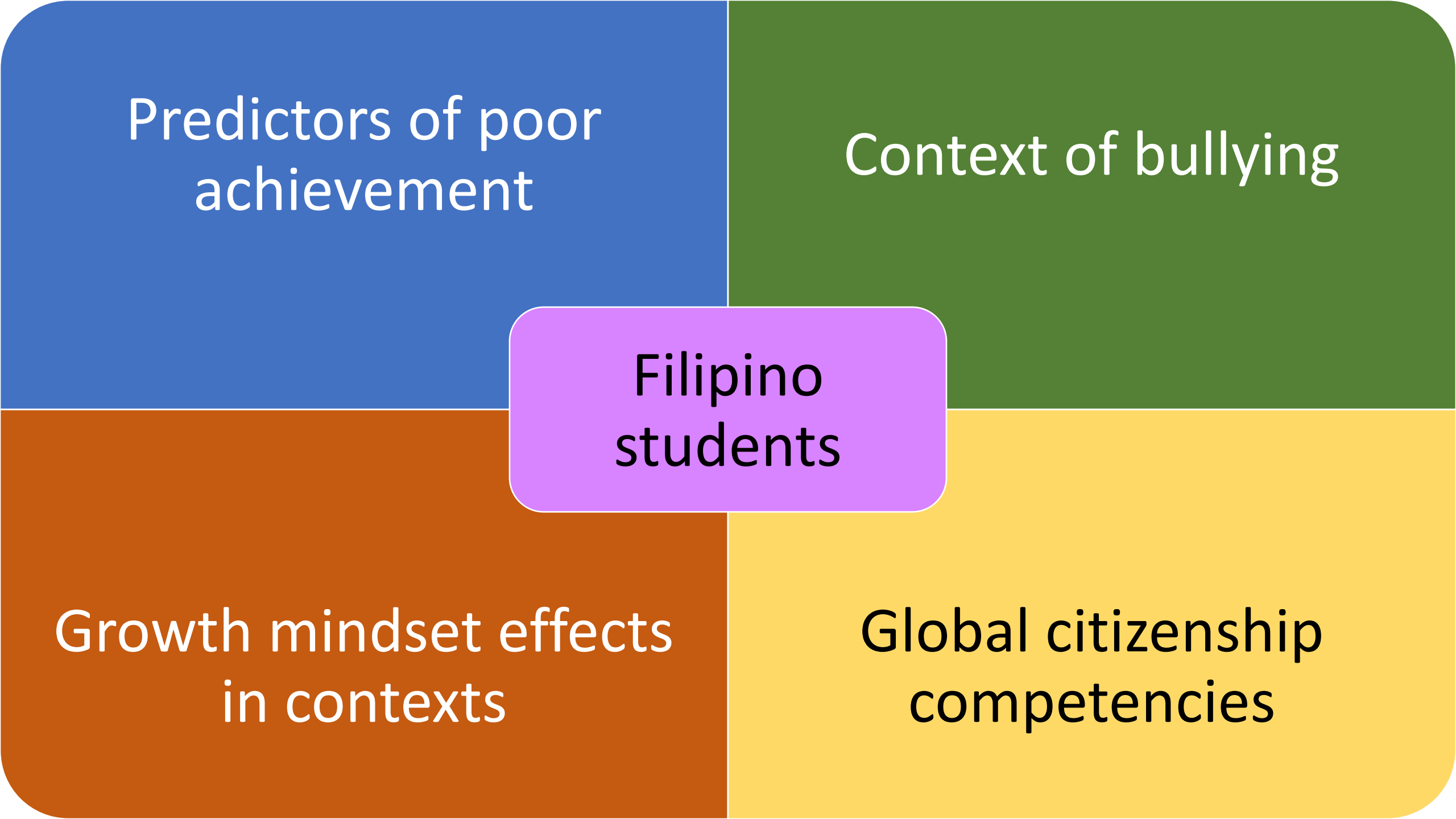
- Growth mindset for English was positively correlated with various SES measures (ESCS, parents' education and occupation, ICT resources at home)

Philippine PISA 2022 data

Two-step cluster analysis of growth mindset data

CLUSTER #	1	2	3	4
N	2,945	958	1,466	1,433
GM Intelligence	1.88[c]	3.18[b]	1.88[c]	3.30[a]
GM English Language	1.84[d]	1.88[c]	3.16[b]	3.29[a]
PISA Reading Proficiency	337.75[b]	334.51[b]	369.24[a]	362.42[a]

Note: Different superscripts indicate statistically significant means using Scheffe's post hoc comparisons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Methodological diversity

- Machine learning / data-analytics
- Standard statistical
- Hierarchical linear regression models
- Multilevel analysis / multilevel structural equation modeling

Concluding points

- Large scale assessment data can enrich knowledge about student learning
- But it does not have to be “international”
- Good quality, in depth, well-sampled data can guide educational theory, practice and reform

Some publications

- Bernardo, A. B. I. (2023). Growth mindset and reading proficiency of ESL learners: Examining the role of students' socioeconomic status using PISA 2018 Philippine data. *European Journal of Psychology of Education, 38*, 675-693. https://doi.org/10.1007/s10212-022-00629-6
- Bernardo, A. B. I., Cordel, M. O, Calleja, M. O., Teves, J. M. M., Yap, S. A., Chua, U. C. (2023). Profiling the low-proficiency science students in the Philippines using machine learning. *Humanities and Social Science Communications, 10*, 192. https://doi.org/10.1057/s41599-023-01705-y
- Bernardo, A. B. I., & Mante-Estacio, M. J. (2023). Metacognitive awareness of reading strategies and its relationship with Filipino high school students' reading proficiency: Insights from the PISA 2018 data. *Humanities and Social Science Communications, 10*, 400. https://doi.org/10.1057/s41599-023-01886-6
- Bernardo, A. B. I., Cordel, M. O, Lapinid, M. R., Teves, J. M. M., Yap, S. A., Chua, U. C. (2022). Contrasting profiles of low-performing mathematics students in public and private schools in the Philippines: Insights from machine learning. *Journal of Intelligence, 10*(3), 61. https://doi.org/10.3390/jintelligence10030061
- Bernardo, A. B. I., Cordel, M. O., Ricardo, J. G. E., Galanza, M. A. M, & Almonte-Acosta, S.A. (2022). Global citizenship competencies of Filipino students: Using machine learning to explore the structure of cognitive, affective, and behavioral competencies in the 2019 Southeast Asia Primary Learning Metrics. *Education Sciences, 12*(8), 547. https://doi.org/10.3390/educsci12080547
- Bernardo, A. B. I. (2021). Socioeconomic status moderates the relationship between growth mindset and learning in mathematics and science: Evidence from PISA 2018 Philippine data. *International Journal of School and Educational Psychology, 9,* 208-222. https://doi.org/10.1080/21683603.2020.1832635 [IF=1.8; CS=4.0; CSP=74%; Scopus Q2]
- Bernardo, A. B. I., Cai, Y., & King, R. B. (2021). Society-level social axiom moderates the association between growth mindset and achievement across cultures. *British Journal of Educational Psychology, 91,* 1166-1184. https://doi.org/10.1111/bjep.12411
- Bernardo, A. B. I., Cordel, M. O, Lucas, R. I., Teves, J. M. M., Yap, S. A., Chua, U. C. (2021). Using machine learning approaches to explore non-cognitive variables influencing reading proficiency in English among Filipino learners. *Education Sciences, 11*(10), 628. https://doi.org/10.3390/educsci11100628 [IF=2.5; CS=4.8; CSP=81%; Scopus Q1]
- Bernardo, A. B. I., Cordel, M. O., & Chua, U. C. (2024). *Global competencies of Southeast Asian students: Exploring the PISA 2018 and SEA-PLM 2019 Global competence surveys using data mining approaches*. SEAMEO-INNOTECH. Link to monograph

THANK YOU VERY MUCH FOR LISTENING!!!

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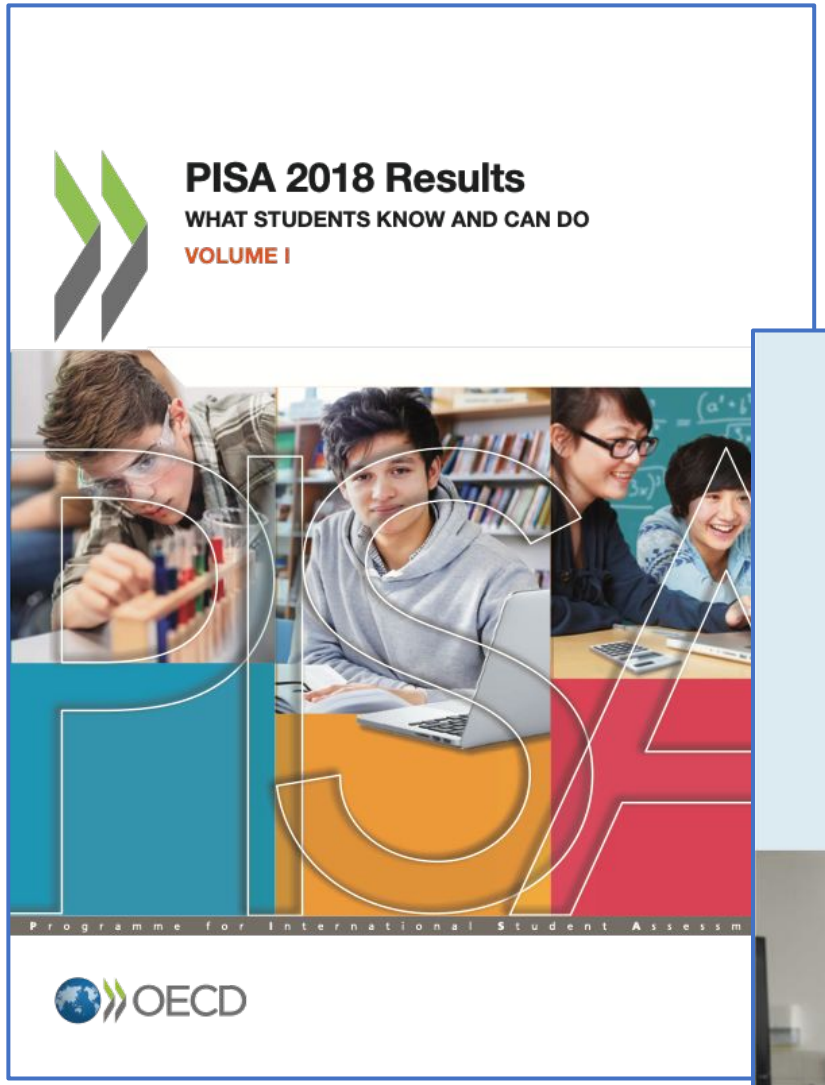

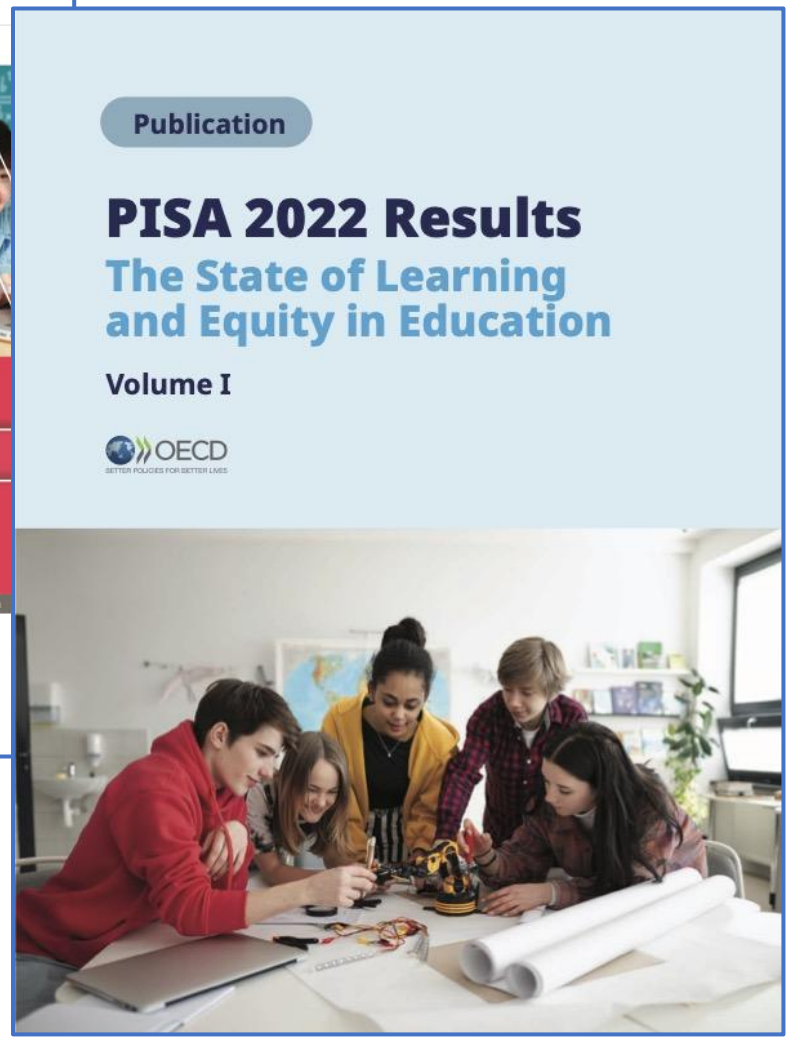

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