What skills should we measure?

Kali Trzesniewski

University of California, Davis

Division of Agriculture and Natural Resources
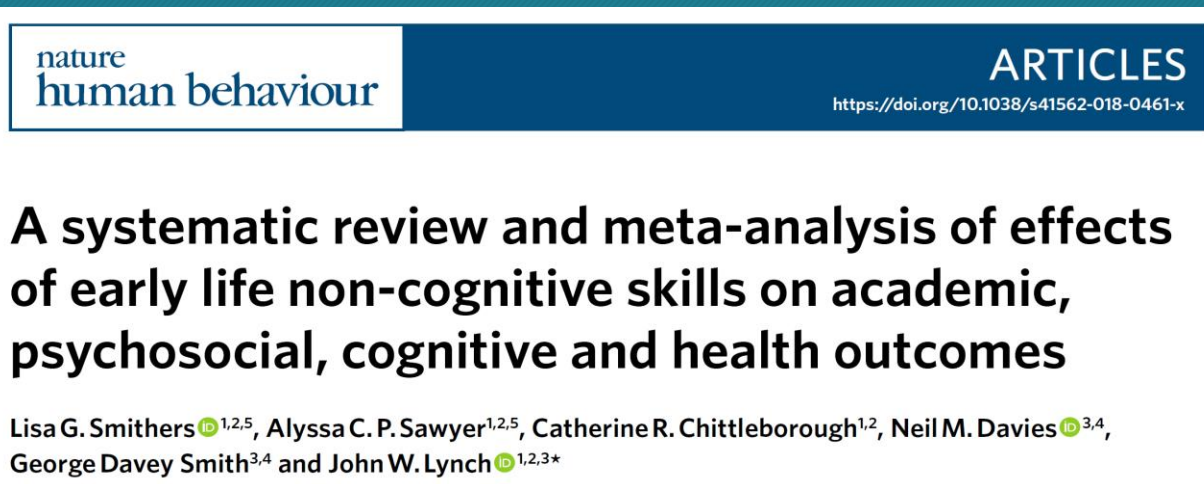
What do we know so far
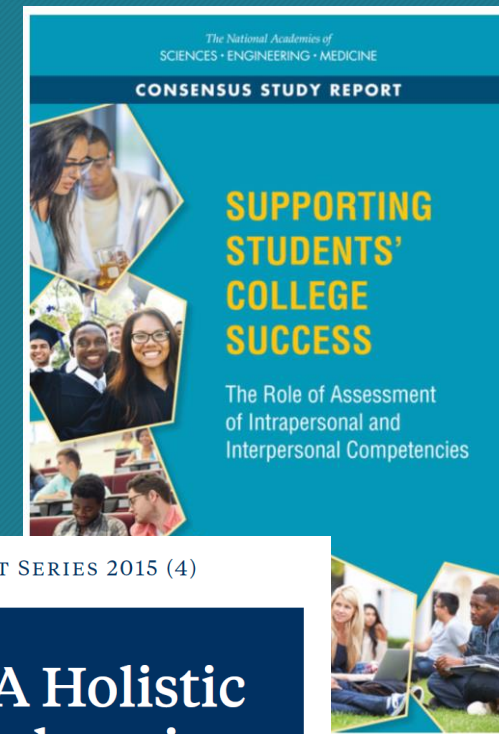
Several large scale investigations

Analysis of longitudinal data from 9 countries

OECD Skills Studies

Skills for Social Progress
THE POWER OF SOCIAL AND EMOTIONAL SKILLS

Comprehensive reviews

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

CONSENSUS STUDY REPORT

SUPPORTING STUDENTS' COLLEGE SUCCESS

The Role of Assessment of Intrapersonal and Interpersonal Competencies

Meta-analysis of interventions

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ARTICLES

https://doi.org/10.1038/s41562-018-0461-x

A systematic review and meta-analysis of effects of early life non-cognitive skills on academic, psychosocial, cognitive and health outcomes

Lisa G. Smithers [1,2,5], Alyssa C. P. Sawyer [1,2,5], Catherine R. Chittleborough [1,2], Neil M. Davies [3,4], George Davey Smith [3,4] and John W. Lynch [1,2,3*]

ACT RESEARCH REPORT SERIES 2015 (4)

Beyond Academics: A Holistic Framework for Enhancing Education and Workplace Success

Table 3.3. Returns on Skills (p. 72, OECD, 2015)

	Education	Labor Market	Social
Cognitive	High	High	Medium
Social-Emotional	Low-Medium	Medium	High

Analysis of longitudinal data from 9 countries

Conclusions

OECD Skills Studies

Skills for Social Progress

THE POWER OF SOCIAL AND EMOTIONAL SKILLS

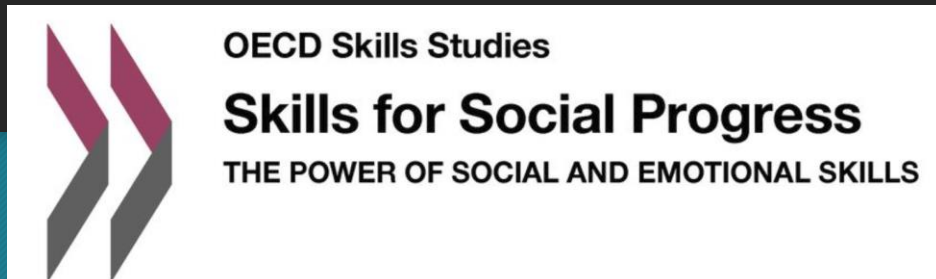Australia, Belgium, Canada, Germany, Korea, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States

Social-emotional skills

apprehensiveness, confidence, conscientiousness, cooperation, despondency, extraversion, grit, impulsiveness, locus of control, mastery, perseverance, persistence, responsibility, self-efficacy, self-esteem, social anxiety, social skills

Summary: Conscientiousness, Sociability, Emotional stability

Analysis of longitudinal data from 9 countries

OECD Skills Studies

Skills for Social Progress

THE POWER OF SOCIAL AND EMOTIONAL SKILLS

Conclusions

Australia, Belgium, Canada, Germany, Korea, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States

Cognitive Skills

numerical IQ, spatial IQ, verbal IQ, achievement test scores, grades, self-rated competence, math grades, spatial ability, verbal ability, mathematical knowledge, numerical operations, coding speed, PISA reading, maths, science, general cognitive ability, achievement tests, problem-solving tests

Summary: Cognitive skills
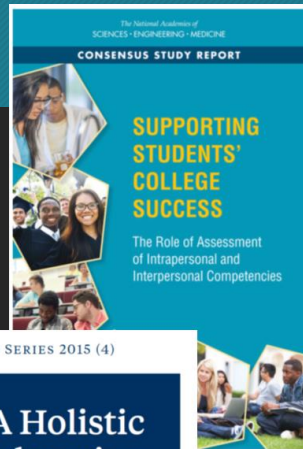
Analysis of longitudinal data from 9 countries

OECD Skills Studies

Skills for Social Progress
THE POWER OF SOCIAL AND EMOTIONAL SKILLS

Conclusions

Australia, Belgium, Canada, Germany, Korea, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States

➢ **dispositional conscientiousness**

➢ behaviors related to conscientiousness (self-control, hard work, persistence, and achievement orientation), sense of belonging, academic self-efficacy, growth mindset, utility, intrinsic, and prosocial goals and values, positive future self

Comprehensive reviews

Conclusions

academic motivation, responsibility, persistence, temperament, sociability and behavior problems, locus of control, self-esteem, attention, executive functions, cognitive control

.30 SD

Achievement

Meta-analysis of interventions

Conclusions

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Lisa G. Smithers [1,2,5], Alyssa C. P. Sawyer[1,2,5], Catherine R. Chittleborough[1,2], Neil M. Davies [3,4], George Davey Smith[3,4] and John W. Lynch [1,2,3]*
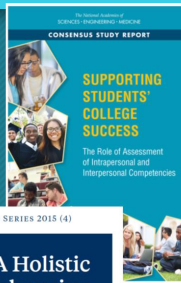
All together… (non-cognitive)

academic motivation, academic self-efficacy, agreeableness, attention, behaviors related to conscientiousness, cognitive control, collaborative problem solving, dispositional conscientiousness, emotion regulation, emotional stability, executive functions, extraversion, growth mindset, honesty-humility , intrinsic goals and values, locus of control, openness, persistence, positive future self, prosocial goals and values, responsibility, self-esteem, sense of belonging, sociability, studying and learning, technology and information literacy, temperament, thinking and metacognition, utility goals and values

Limitations & Possible Next Steps I

Issue

➤A lot of related constructs collected

➤Not clear whether all are needed/which are most important

Solution 1a

Convene group of subject matter experts for a facilitated consensus building meeting
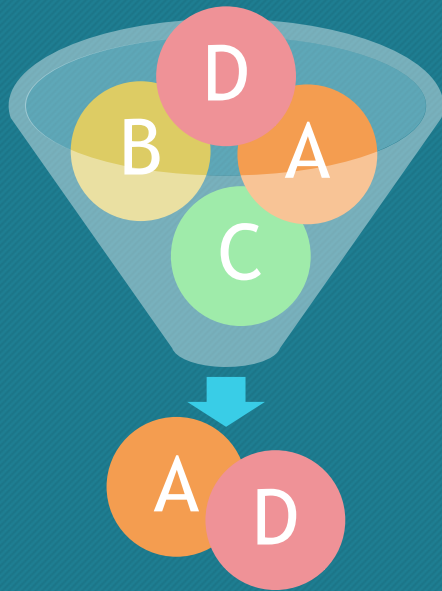
Solution 1b

Series of steps including mining existing data, experiments, primary data collection
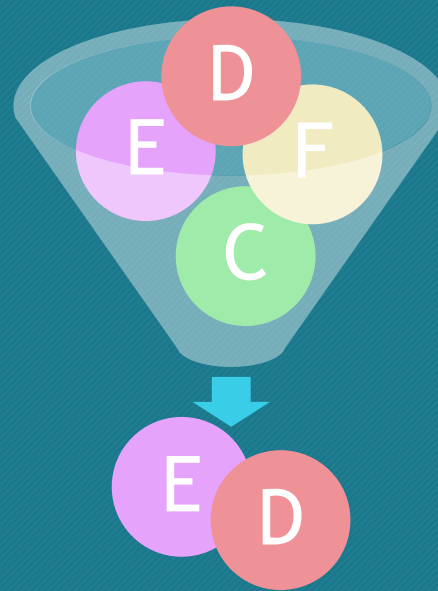
Step 1: Mine Existing Data

Mine existing longitudinal studies to identify the most robust, independent predictors

Use Big Data analyses to drill down to identify independent constructs/items

Step 2: Experiments

Strengthen the measurement of the most promising constructs

How easy or hard it is to do these things well

1	2	3	4	5

Very hard   Neutral, in between   Very easy

Pictorial Situational Judgement
"What would you do in this situation?"

Test different
- ☐ question types
- ☐ response scales
- ☐ Instructions
- ☐ etc.

Strongly Agree

Strongly Disagree

You cannot change how smart you are.

Not At All True	A Little Not True	Both	A Little True	Completely True

Really Sad	Sad	Neutral	Happy	Really Happy

How do you feel about yourself?

Step 3: Primary Data Collection

➤Test the most promising constructs

➤Using the most promising measurement techniques

➤Compete them together in a single study

➤Across diverse populations

End Result

A strong package of measures that can be used across studies across fields

Limitations & Possible Next Steps II

Issue

➤ Conclusions thus far are constrained to what historically has been studied

➤ Vast majority based on Western job markets and definitions of success

Possible Solution

➤ Skills mapping
  ➤ Identify skills needed for workforce in target countries
  ➤ Match to psychological skills and traits
➤ How
  ➤ O*Net: https://www.onetonline.org
  ➤ Manager surveys
  ➤ Correlational studies

An example of where skill matching might get us

Let's build the ideal employee

What are the core characteristics that cut across all levels of the job market?

The Ideal Employee

Likeable

Works well with others

Communicates well

Resilient to challenge & conflict

Diligent

Adaptable

Reliable

Honest

Confident

Drive to learn and improve

Takes pride in work

Inquisitive

Intellectually Humble

Learns quickly

Thinks independently

Problem solves well

Sets and manages goals well

Likeable

Works well with others

The Ideal Employee

Agreeable
Emotionally stable
Extraverted
Honest
Reliable
Good listener
Respectful
Prosocial
Executive functioning
(inhibitory control)
Sense of belonging

The Ideal Employee

Communicates well

Active listener
Verbal fluency
Self-control
Empathy
Perspective taking
Emotional stability
Executive Functioning
(working memory)

The Ideal Employee

Resilient to challenge & conflict

Diligent

Emotional stability
Conscientious
Grit
Growth mindset
Executive functioning
Locus of control
Future thinking
Meta-cognition
Utility goals

The Ideal Employee

Emotional stability
Conscientious
Executive functioning
Openness
Agreeable
Confidence
Locus of control

Adaptable

The Ideal Employee

Conscientious
Moral

Reliable

Honest

The Ideal Employee

Drive to learn and improve

Takes pride in work

Inquisitive

Intellectually Humble

Learning/mastery goals
Growth mindset
Conscientiousness
Openness
Intellectual humility

The Ideal Employee

IQ
Confidence
Executive functioning
Future thinking
Conscientiousness
Openness
Meta-cognition

Learns quickly

Thinks independently

Problem solves well

Sets and manages goals well

Skills & Abilities

Ideal Employee Traits

Skills & Abilities:
- Executive functioning
- Emotionally stable
- Conscientious
- Cognition
- Confidence
- Good Listener
- Openness
- Agreeable
- Growth mindset
- Prosocial
- Grit
- Future thinking
- Locus of control
- Meta-cognition
- Empathy
- Extraversion
- Honest
- Intellectual Humility
- Learning goal focused
- Perspective taking
- Reliable
- Respectful
- Sense of belonging
- Utility goals
- Moral

Ideal Employee Traits:
- Resilient to challenge & conflict
- Communicates well
- Works well with others
- Problem solves well
- Adaptable
- Diligent
- Learns quickly
- Likeable
- Thinks independently
- Reliable
- Takes pride in work
- Drive to learn and improve
- Inquisitive
- Honest
- Intellectually humble

A neglected component?

Executive Functioning

Executive Functioning

➢Inhibitory control

➢Working memory

➢Cognitive flexibility

Inhibitory Control

➢ Inhibit distraction & selectively attend, suppress attention to other stimuli

➢ Resist temptations, think before you act, inhibit acting impulsively

Working Memory

➢ Hold information in mind and mentally work with it

  ➢ holding in mind what happened earlier & relate that to what is happening now

  ➢ relating one idea to another

  ➢ relating what you read (or learned/heard) earlier to what you are reading (learning/hearing) now

  ➢ remembering multi-step instructions & executing them in the correct order

Cognitive Flexibility

➢ Being able to easily & quickly switch perspectives or the focus of attention

➢ Flexibly adjusting to changed demands or priorities

➢ Being able to think outside the box

Measurement of Executive Functioning

➢Usually lab based

➢Some limited field versions are available (e.g., NIH Toolbox)

➢More development is need

➢Question: how independent is it from what is currently being assessed?

What else might a full theory of change suggest?

Home environment (e.g., books in home)

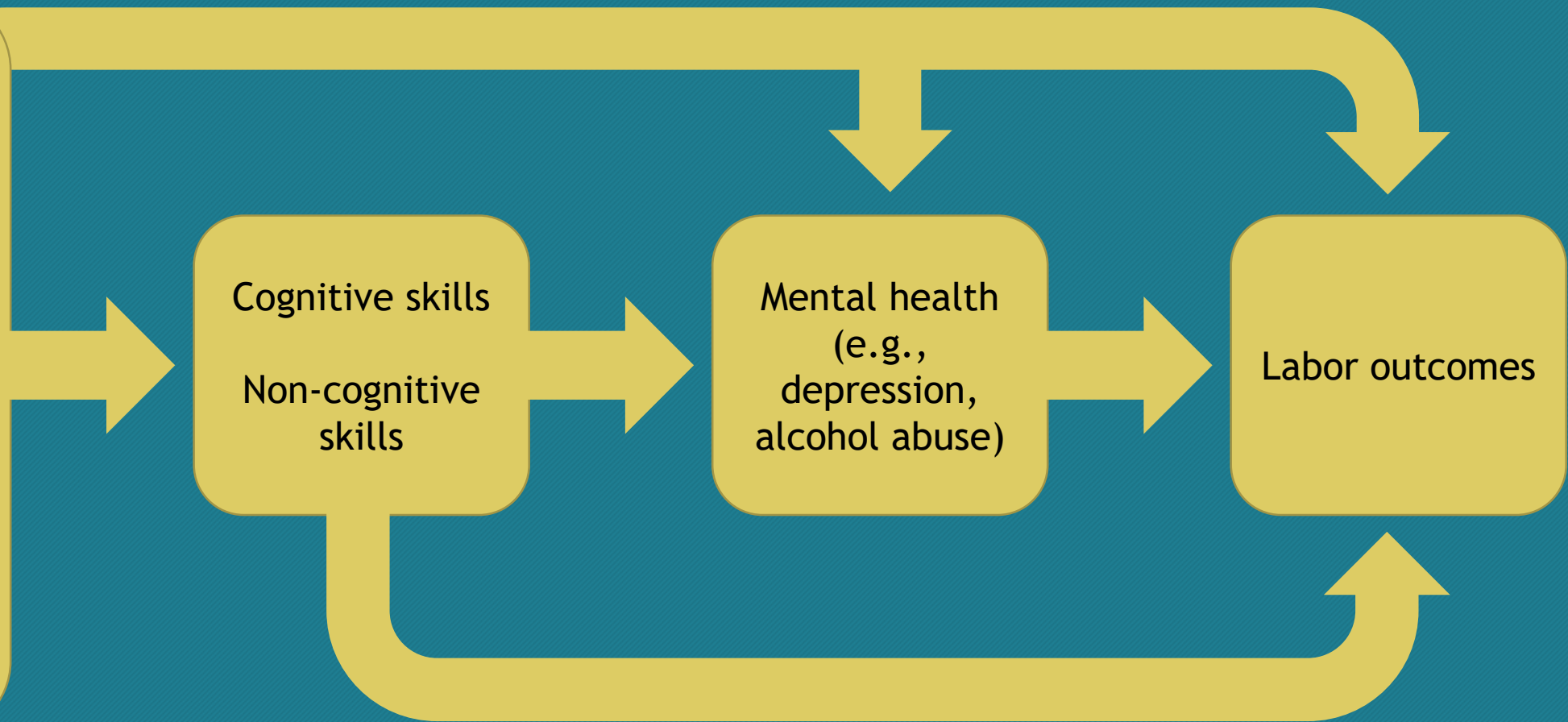Parent-child relationship

Parent involvement in school

Community safety

Community norms (e.g., children go to school)

Cognitive skills

Non-cognitive skills

Mental health (e.g., depression, alcohol abuse)
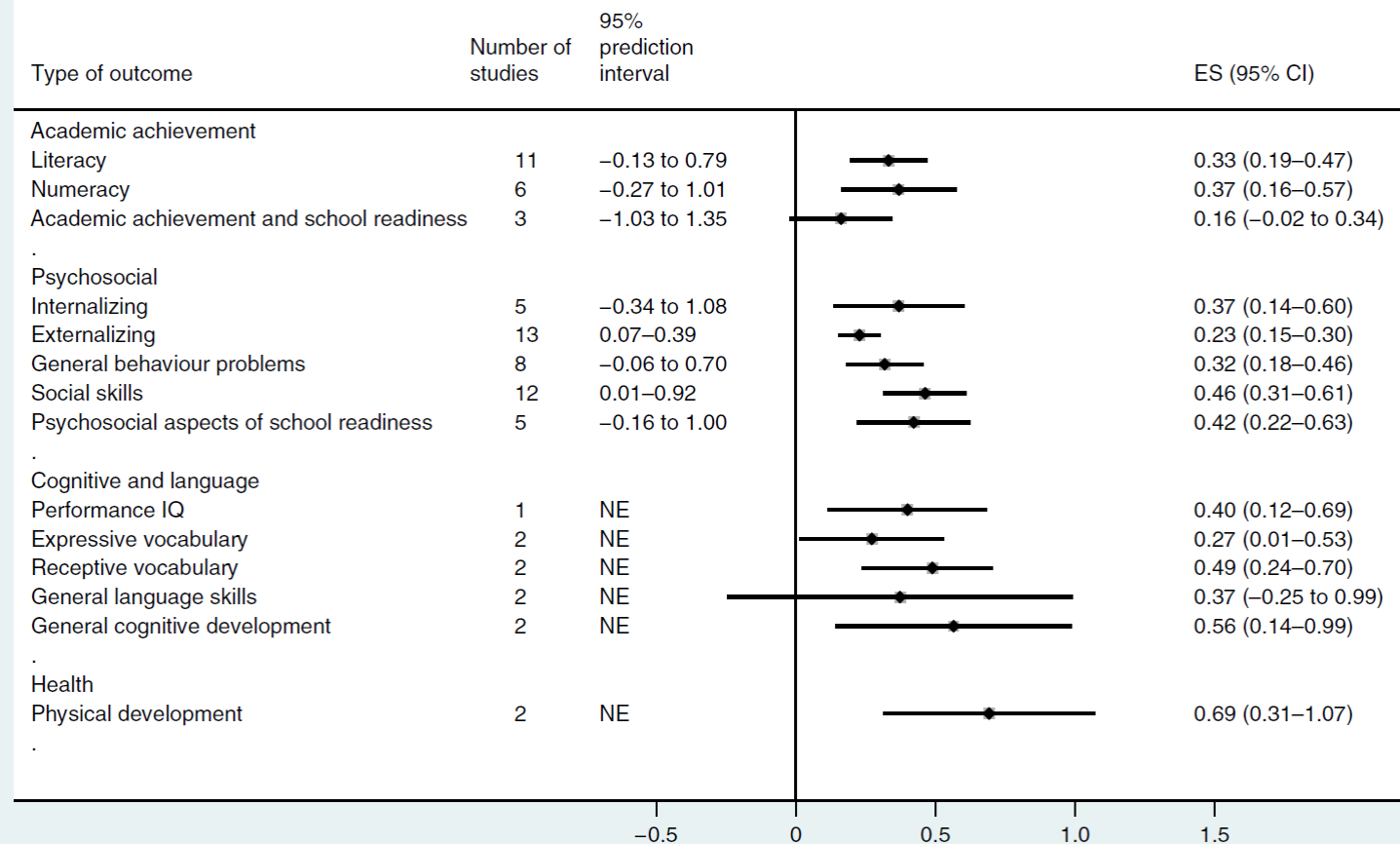
Labor outcomes

Concluding Thoughts

➢ This is not an exhaustive list

➢ e.g., aspirations, time management, higher level behaviors (leadership, entrepreneurship), financial literacy

➢ More work is needed to create the exhaustive list

➢ The potential future steps are what is needed for the full field, not just this project → would have wide-reaching value

Box 3.1. OECD's longitudinal analyses on the effects of skills and the causal process of skill formation

In 2012, the OECD's Education and Social Progress (ESP) project conducted longitudinal analyses for 11 OECD countries, including Australia, Belgium (Flanders), Canada, Germany, Korea, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States. The aim was to identify: 1) the effects of skills on a variety of socioeconomic outcomes; and 2) the causal process of skill formation with past skills interacting with new learning investments. Results from nine countries, including Belgium (Flemish Community), Canada, Korea, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States, are presented in this report.

The study was based on the following longitudinal data sets identified by the OECD, based on the availability of appropriate measures of skills, learning contexts and outcomes (education, labour market and social):

- Australia   Longitudinal Survey of Australian Children (LSAC), Australian Temperament Project (ATP)
- Belgium   Longitudinal Research in Secondary Education (LOSO)
- Canada   Youth in Transition Study (YITS)
- Germany   Mannheim Study of Youth (MARS)
- Korea   Korean Youth Panel Studies (KYPS)
- New Zealand   Competent Children (CC)
- Norway   Young in Norway (YiN)
- Sweden   Evaluation Through Follow-up (ETF)
- Switzerland   Transition from Education to Employment (TREE)
- United Kingdom   British Cohort Study (BCS)
- United States   Early Childhood Longitudinal Study – Kindergarten (ECLS-K), National Longitudinal Study of Youth (NLSY)

Type of outcome	Number of studies	95% prediction interval		ES (95% CI)
Academic achievement				
Literacy	11	−0.13 to 0.79		0.33 (0.19–0.47)
Numeracy	6	−0.27 to 1.01		0.37 (0.16–0.57)
Academic achievement and school readiness	3	−1.03 to 1.35		0.16 (−0.02 to 0.34)
.				
Psychosocial				
Internalizing	5	−0.34 to 1.08		0.37 (0.14–0.60)
Externalizing	13	0.07–0.39		0.23 (0.15–0.30)
General behaviour problems	8	−0.06 to 0.70		0.32 (0.18–0.46)
Social skills	12	0.01–0.92		0.46 (0.31–0.61)
Psychosocial aspects of school readiness	5	−0.16 to 1.00		0.42 (0.22–0.63)
.				
Cognitive and language				
Performance IQ	1	NE		0.40 (0.12–0.69)
Expressive vocabulary	2	NE		0.27 (0.01–0.53)
Receptive vocabulary	2	NE		0.49 (0.24–0.70)
General language skills	2	NE		0.37 (−0.25 to 0.99)
General cognitive development	2	NE		0.56 (0.14–0.99)
.				
Health				
Physical development	2	NE		0.69 (0.31–1.07)
.				

Meta-analysis of interventions

Conclusions

nature human behaviour

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Executive Function skills are more important for school readiness than are IQ or entry-level reading or math.

(e.g., Blair, 2002; 2003; Blair & Razza, 2007; Normandeau & Guay, 1998)

Executive Functions are also important for school success throughout the school years.

Improving EFs improves academic outcomes.

(e.g., Blair & Razza, 2007; Espy et al., 2004; Gathercole et al., 2004, 2005; McClelland et al., 2007; Passolunghi et al., 2007; Raver et al. 2011; Savage et al., 2006)

Slide borrowed from Diamond (2012)

Executive Functions are also critical for job success.

Poor EFs lead to poor productivity and difficulty finding and keeping a job (Prince et al. 2007).

Executive Functions are also important for marital harmony.

People with poor EFs are more difficult to get along with, less dependable, and more likely to act on impulse (Eakin et al. 2004).

Poor EFs can lead to social problems

such as **aggression, emotional outbursts, & crime** (Bailey 2007; Broidy et al. 2003; Moffitt et al. 2011; Prince et al. 2007; Saarni 1999).

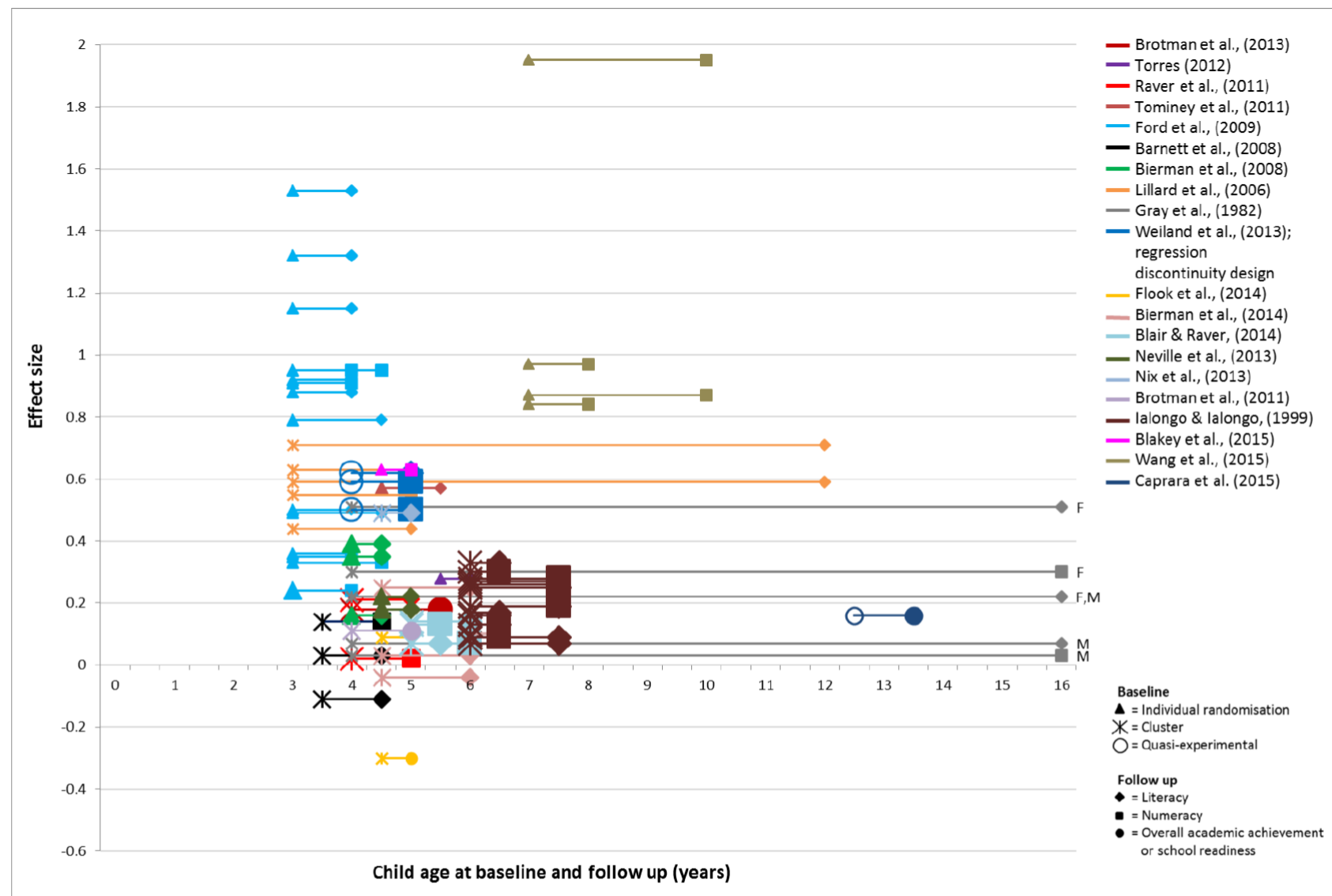**Early EF gains can reduce the later incidence of aggression & anti-social behavior** (Nagin & Tremblay 1999).

Country	Age of Assessments	Cognitive	Non-cognitive
Belgium	Grade 6	latent numerical, spatial, verbal IQ	latent extraversion, self-esteem conscientiousness
Korea	Age 14	latent achievement test scores and grades (conditioned on non-cognitive - are a function of cognitive and non-cognitive)	latent impulsiveness, despondency, apprehensiveness; latent locus of control (confidence in making own decisions, belief in one's capacity to deal with problems, belief in the capacity to take responsibility of one's own life)
Norway	Age 15-19	latent achievement tests, grades, self-rated competence	latent extraversion (shyness, social acceptance, friendliness); latent self-confidence (self-satisfaction, confidence in oneself)
Sweden	Grade 3	latent math grades, spatial ability, verbal ability	latent grit, social anxiety, social cooperation
United States	End high school	latent mathematical knowledge, numerical operations, coding speed	latent self-esteem, locus of control

Country	Age of Assessment	Cognitive	Non-cognitive
Canada	Age 15	latent PISA reading, maths, science	latent self-efficacy, sense of mastery, self-esteem
Switzerland	Age 16	latent PISA reading, maths, science	latent self-esteem (self-satisfaction, acknowledgement of own good qualities, confidence in doing things well)l latent self-efficacy (confidence in one's capacity to solve difficult problems when making efforts, confidence in handling whatever comes his/her way, confidence in dealing efficiently during unexpected events); latent persistence (orientation towards goal achievement, rigorousness and meticulousness)
United Kingdom	Age 10	latent general cognitive ability	latent self-esteem, locus of control, persistence
New Zealand	Age 8	latent achievement tests, problem-solving tests	latent perseverance, responsibility, social skills

Direct inputs, environmental factors and policy levers to enhance skills (examples)

	Family	School	Workplace	Community
Direct inputs	Parental attachment with children (e.g. reading books, sharing meals, playing); parenting styles (e.g. warm, authoritarian)	Curricular and extra-curricular activities designed to improve social and emotional skills; teacher's pedagogical skills and knowledge; teaching styles (e.g. mobilizing group discussions); classroom climate; apprenticeships, service learning, mentoring	Work-based training; management styles	Activities offered in the community (e.g. art classes in cultural centres, sports association, volunteering); media; social networks
Environmental factors	Family's socio-economic resources (availability of learning aids, technology in the household); family stressful and disturbing events (family violence, negligence, abuse, maltreatment, malnutrition)	School composition, resources, facilities, climate and safety	Workplace resources	Public services (transportation, parks, schools, childcare centres, out-of-school services); pollution; neighbourhod safety; unemployment rate and income levels
Policy levers	Parental leave provisions; flexible working arrangements; childcare services; family cash benefits	Teacher training, curriculum and recruitment	Work-study programmes; subsidized training programmes; income support programmes	Training programmes for social workers

Supplementary Figure 24. Effect sizes, study size and follow up for RCTs and quasi-experimental interventions with academic achievement outcomes
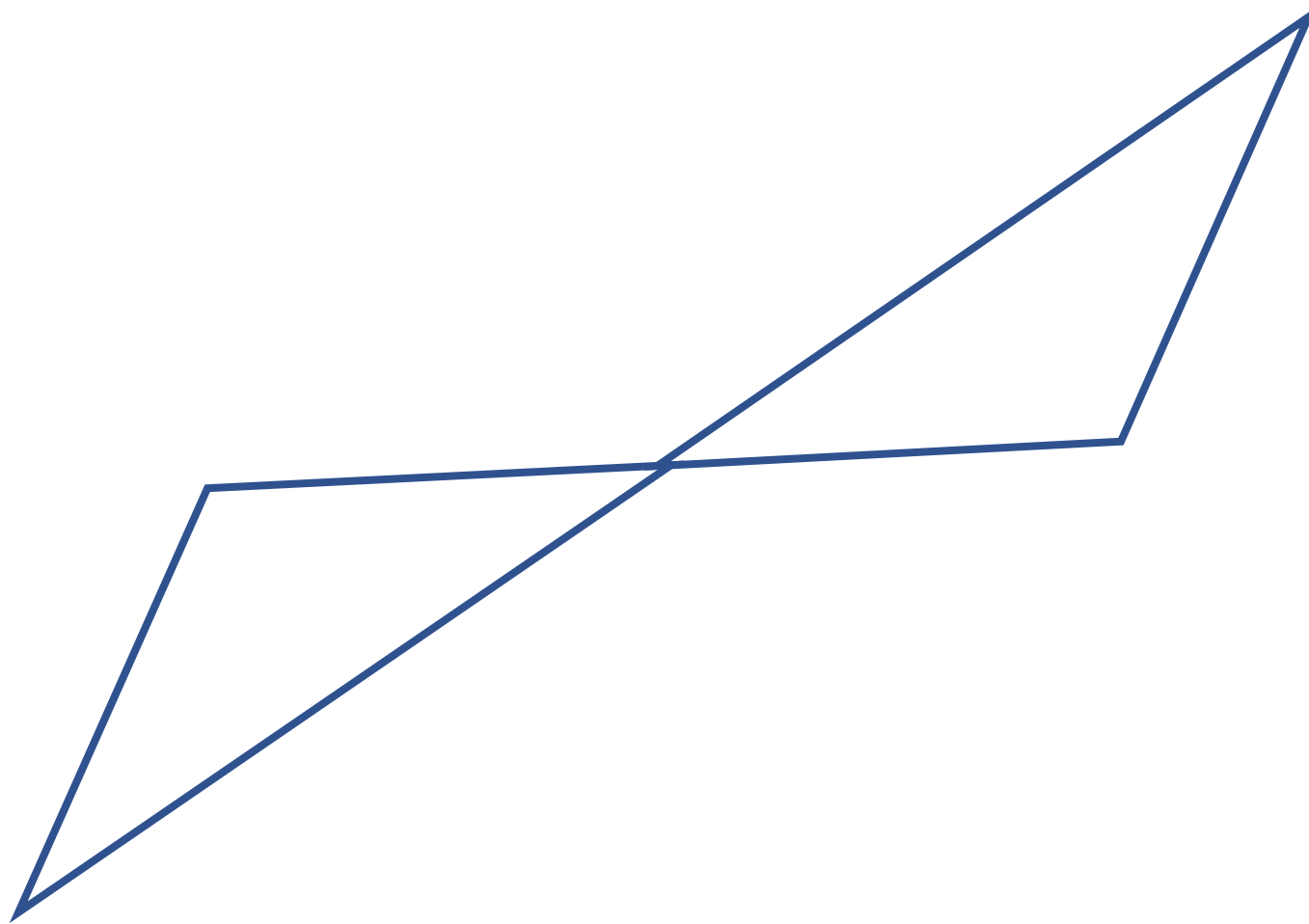
n = 20 publications. Six publications unable to be included because no effect size was reported or able to be calculated. Small, medium and large size markers correspond to studies of size <100, 100-500, >500, respectively. Where analyses stratify by sex, M = male and F = female.
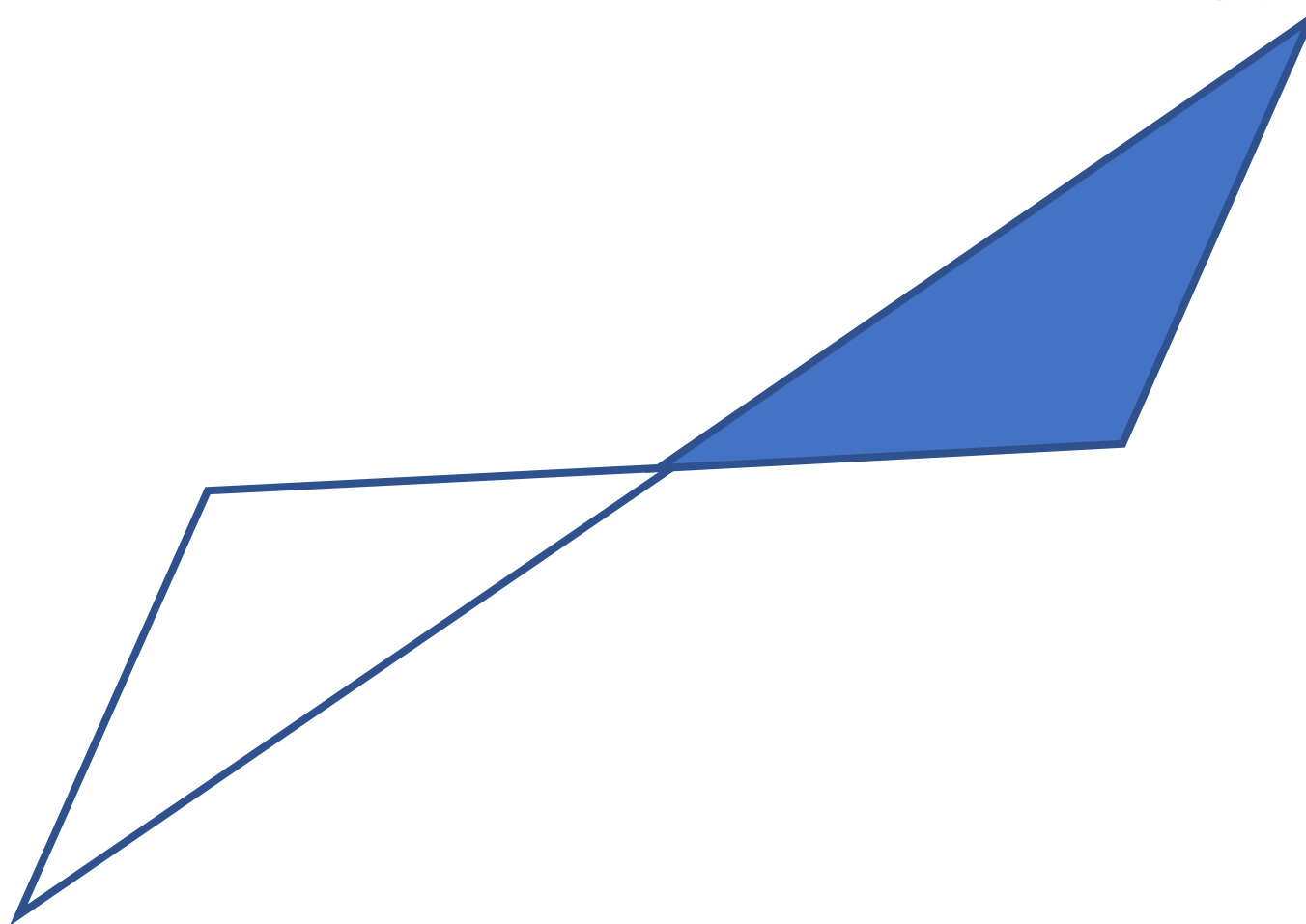
Alternative Measurement

I have high self-esteem

Strongly Agree

Strongly Disagree

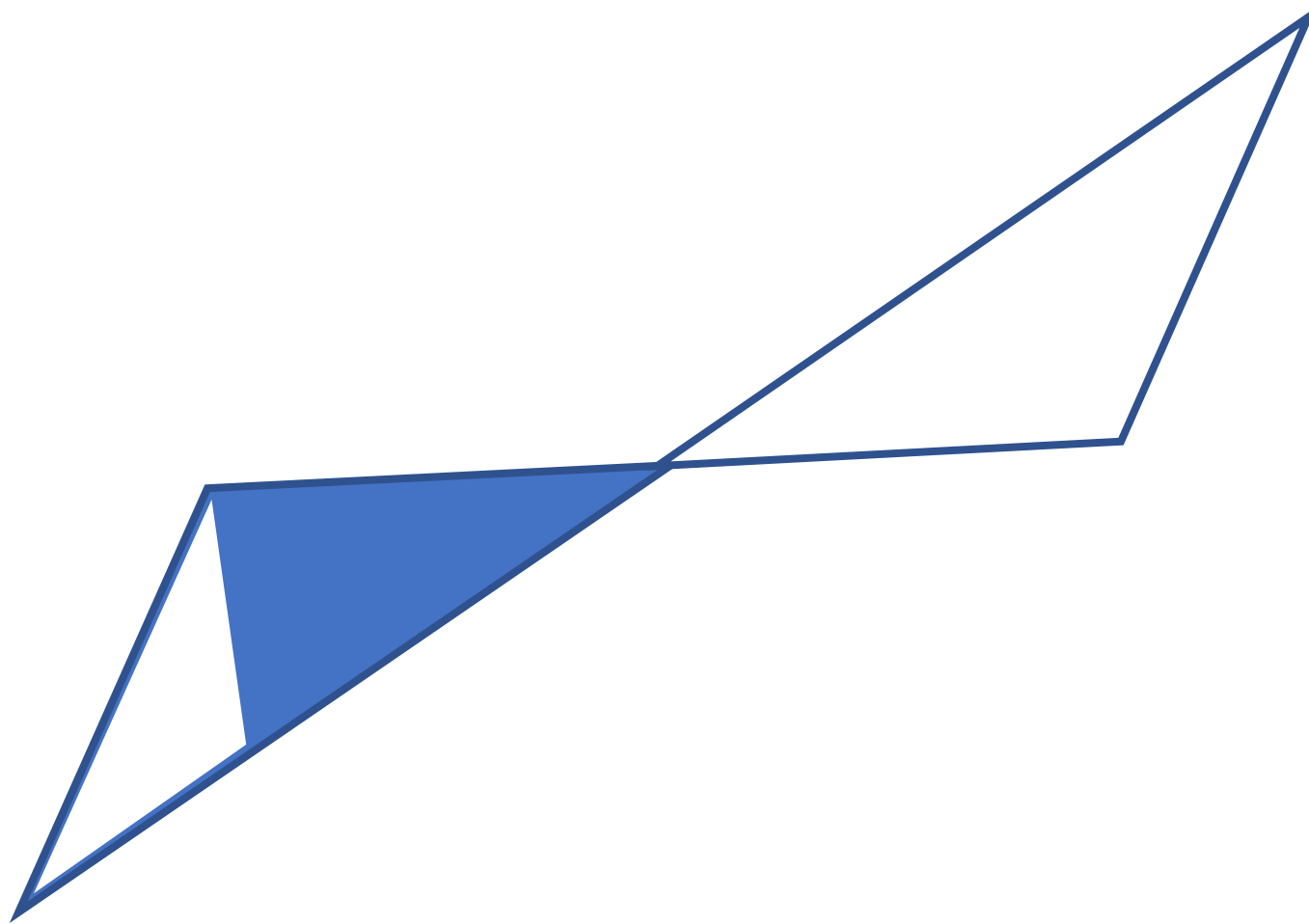# I have high self-esteem

Strongly Agree

Strongly Disagree

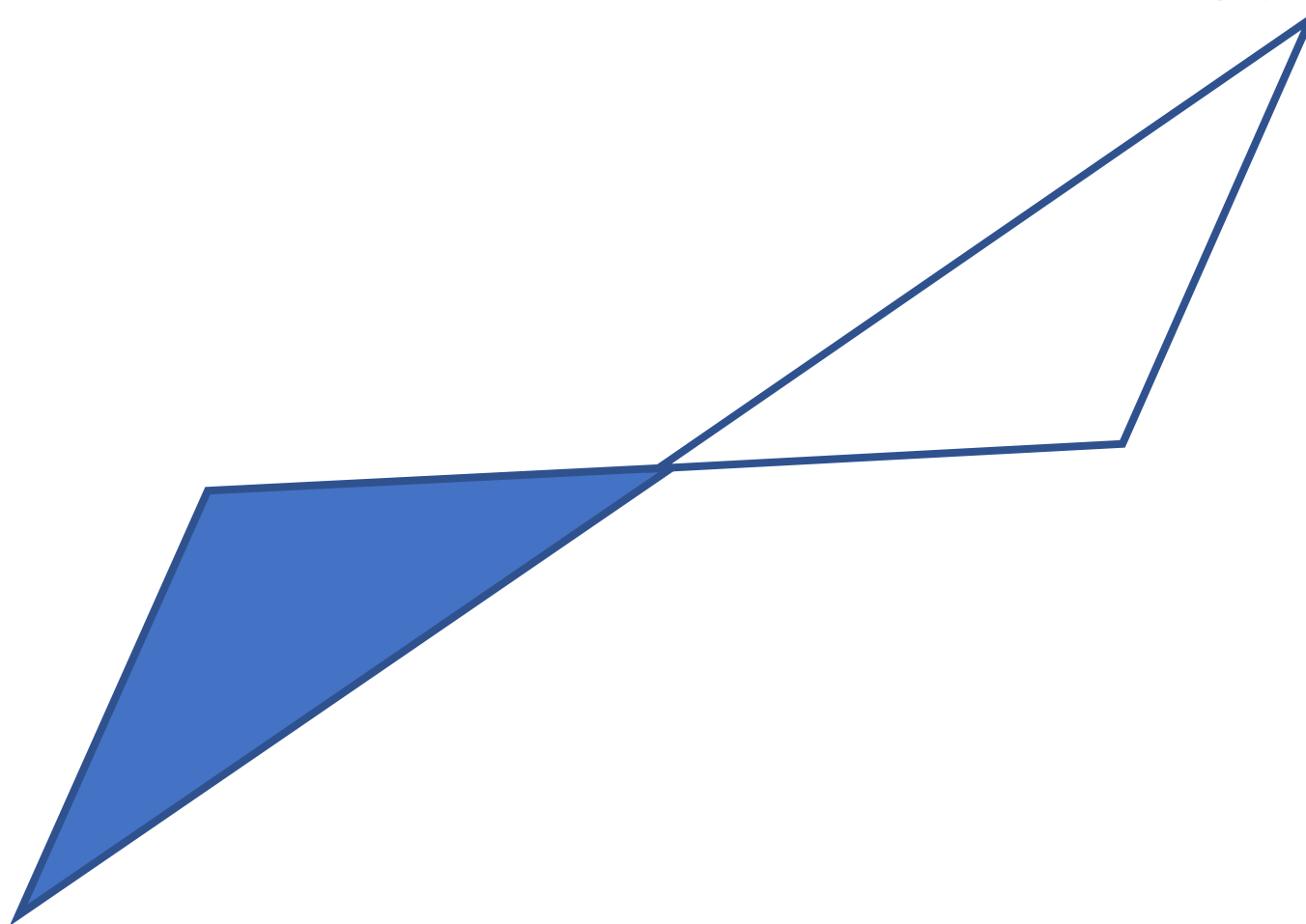I have high self-esteem

Strongly Agree

Strongly Disagree

I have high self-esteem

Strongly Agree

Strongly Disagree

Here are a number of activities or things you could do. For each activity, please select a response to indicate how easy or hard it is for you to do that thing well.

3→ Make conversation with a stranger.

1	2	3	4	5

Very hard   Neutral, in between   Very easy
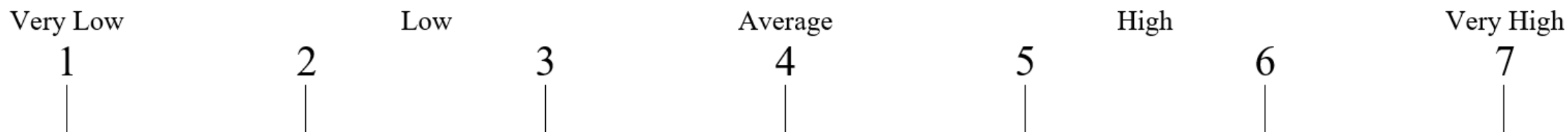
VS

I see myself as someone who is outgoing, sociable

strongly disagree to strongly agree

This study will ask you to rate yourself on several dimensions of college performance (e.g., knowledge, leadership). Rate yourself according to how well you have done in college *so far*.

On each of the following pages, please read the definition at the top of each page, and **before you make your rating**, read the two examples in the middle of the page. The two examples may not be exactly related to your behavior on that given dimension, but they give you ideas of low, average, and high levels of performance, and that should help you make an accurate rating.

Remember that everyone has both strengths and weaknesses. Because of that your ratings should reflect your best qualities, and they should also reflect the things that you can develop or improve on.

For **each dimension**, you will be asked to use the following scale to evaluate yourself:

Very Low		Low		Average		High		Very High
1		2		3		4		5		6		7

Continuous learning, intellectual interest and curiosity

> *Definition:* **Being intellectually curious and actively interested in learning for its own sake. Actively seeking new ideas and new skills, both in student's main area of study as well as in new areas.**

Before you make your rating, please read these two examples:

Example 1
You have a course project on an unfamiliar topic. Other students know more about the topic, and they also know where to find more information quickly online. You do not have the background knowledge to do as well as other students on this project, and you don't know where to find more information online. What do you do?

Very low	Average	Very High
Lose interest in the project and ask a friend for help in finishing it.	Ask the professor what resources you should use to complete the project.	Read more on the topic at the library to learn general information before taking on the course project.

Example 2
A professor offers students in your class many opportunities to take part in extra projects. These projects would help students learn the class material, but they don't directly affect students' grades. What would you do?
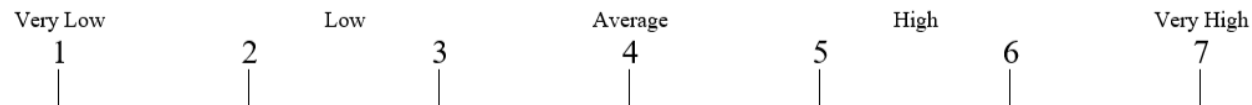
Very low	Average	Very High
Do not take on any of the projects. What matters is the graded course work.	Take on one of the projects so the professor sees you are trying.	Take on all projects to gain knowledge, regardless of the grades you receive.

---

2.   Please use the scale below to rate your level on this dimension.

Very Low		Low		Average		High		Very High
1		2		3		4		5		6		7

Leadership

An important class project you have been working on with a group of other students is not developing as it should because of petty differences and the need of some members to satisfy their own agenda. How would you proceed?

    a. Try to solve the group problems before starting on the work.

    b. Work hard by yourself to make sure the project is finished, taking on others' share of the work if necessary.

    c. Talk to the professor and get suggestions about solving the problem. If that doesn't work, try to switch groups or have an independent project.

    d. Schedule a number of meetings, forcing the group to interact.

    e. Take charge and delegate tasks to each person. Make them responsible for their part of the project.

    f. Talk to the group and demand that they start working together.

What are you most likely to do?
What are you least likely to do?

How do you feel about yourself?

Really Sad	Sad	Neutral	Happy	Really Happy

You cannot change how smart you are.

Not At All True	A Little Not True	Both	A Little True	Completely True

Suggestions

➢ Use example questions to train participants

➢ Ask open-ended questions (what were you thinking)