STEM skills and STEM education

Accelerating Europe‘s Tech Advantage

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BETTER POLICIES FOR BETTER LIVES

The future will always surprise us

Impact

Uncertainty

Climate change

Economic shocks

(cyber) war

Natural disasters

Pandemics

General Artificial Intelligence

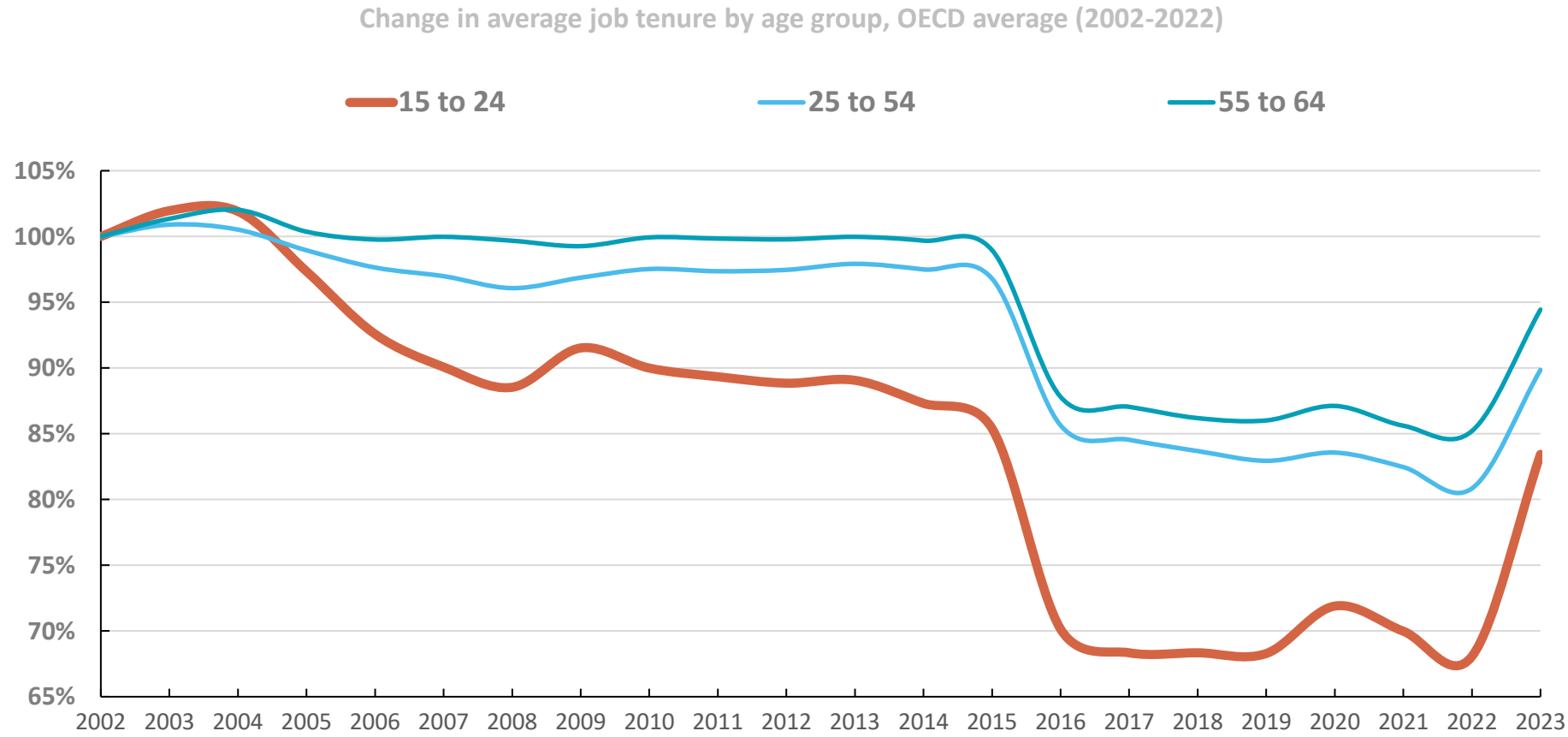
Ageing

Data breaches

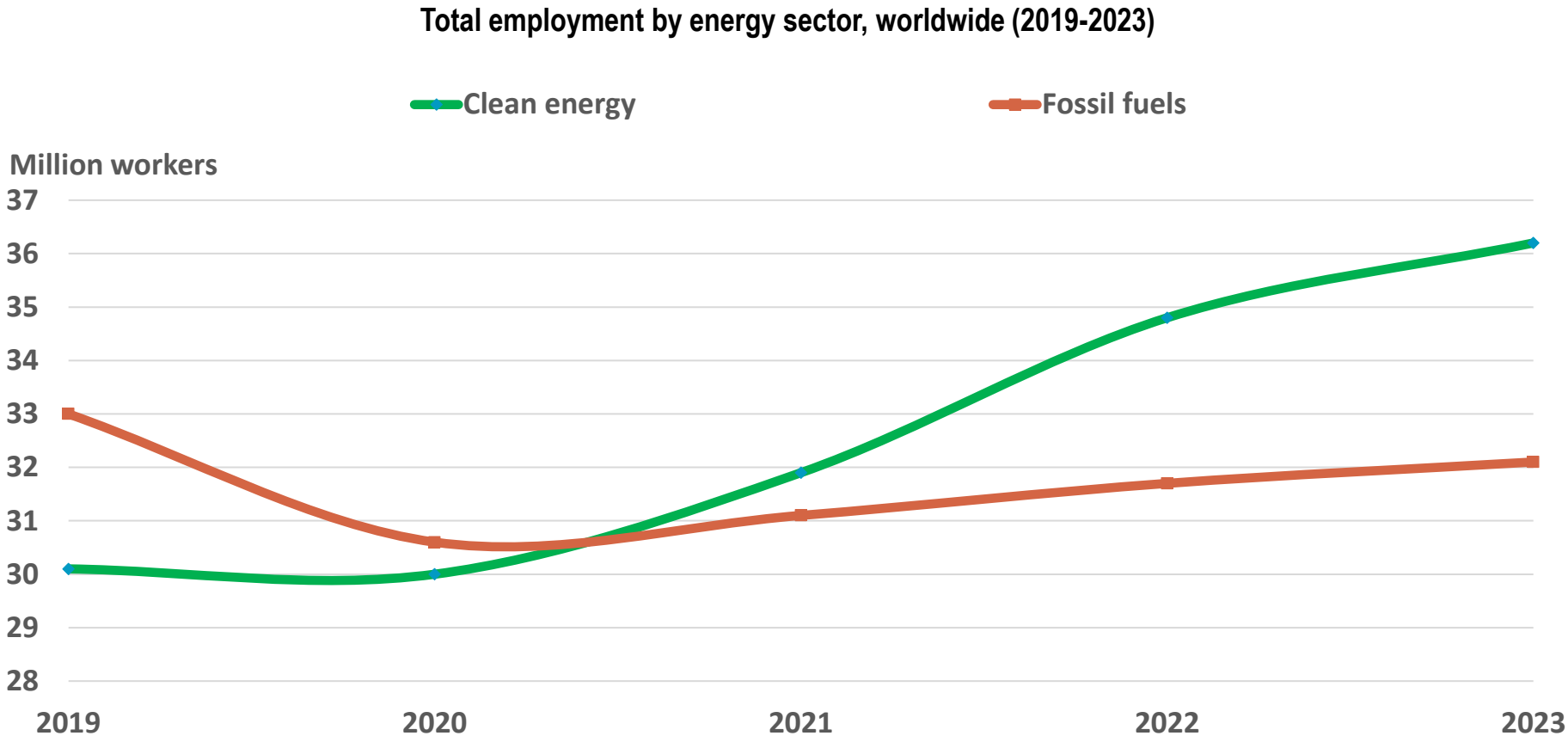
Energy cuts
Internet disrupted

Young people change jobs increasingly more often than older cohorts

Figure 2.4

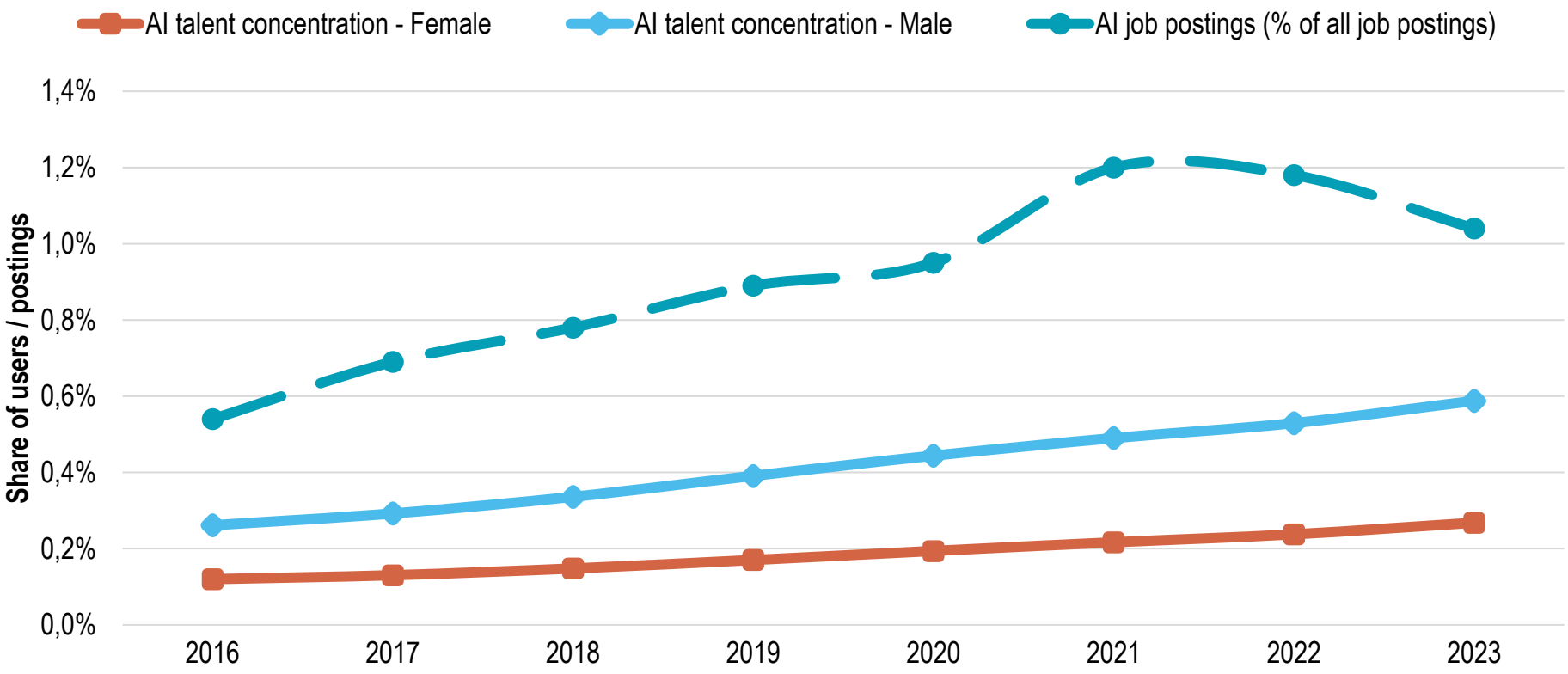


Employment in clean energy surpasses employment in fossil fuels



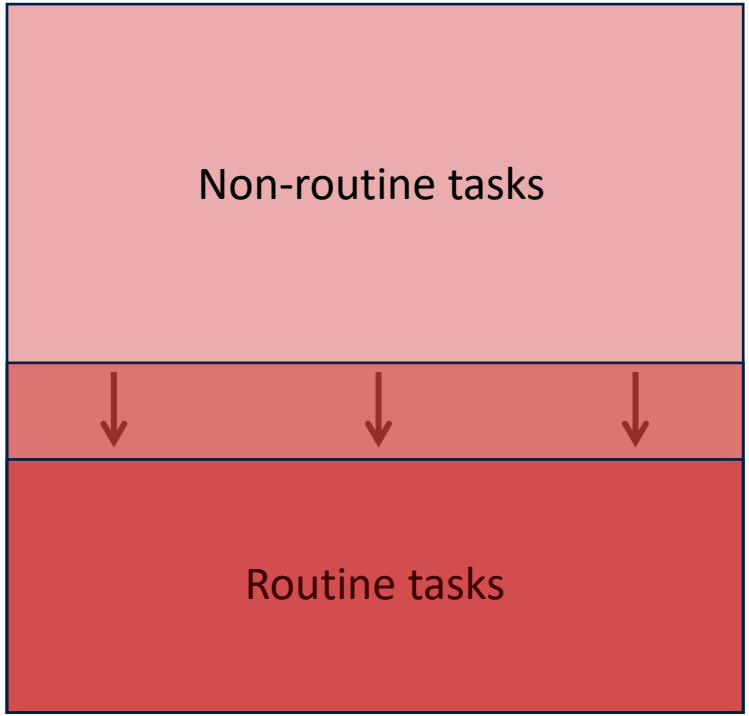
AI skills are more common and demand for AI labour is rising

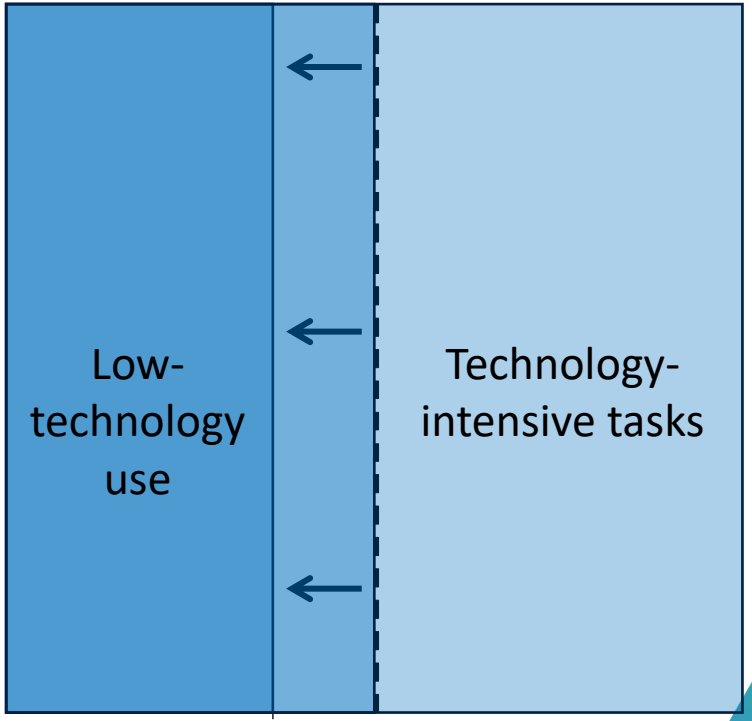
Share of LinkedIn users who are AI talents across 30 countries, by gender; Share of job postings demanding AI skills across 14 countries (2016-2023)



The kinds of things that are easy to teach…

… have now become easy to digitise and automate





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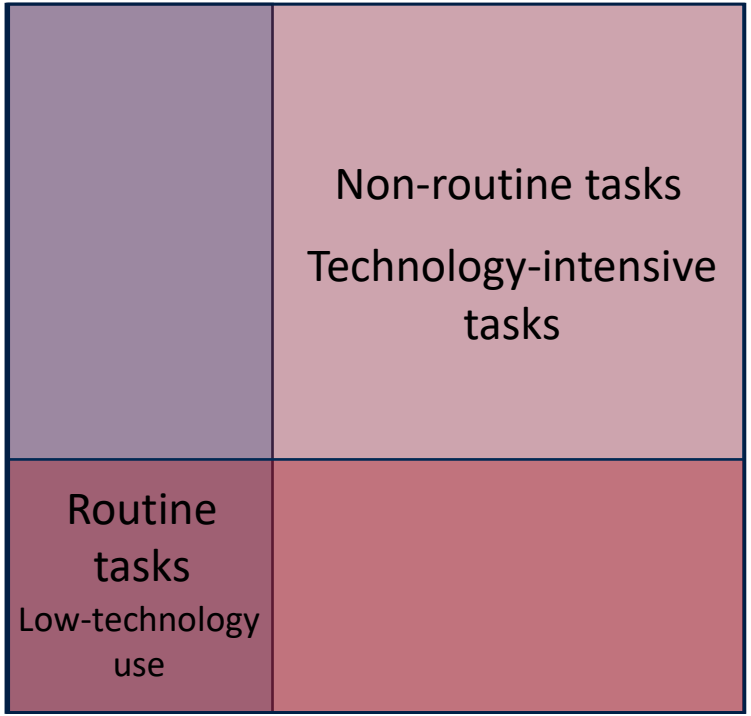


AI adoption changes the mix of skills demanded by firms

Figure 1.2

How skill demand evolved in establishments most likely to have adopted AI relative to other establishments

Skill group	Percentage point change
Administration and management; Management of financial, material, or personnel resources	-3.51
Clerical tasks; Customer and personnel service; Sales and marketing	-3.49
Office tools and collaboration software; Computer programming; Other digital skills*	-3.21
Learning; Originality; Quantitative abilities; Reasoning and problem solving	-3.16
Adaptability/resilience; Motivation/commitment; Self-management/rigour; Values	-1.51
Coordination; Judgment and decision making; Persuasion and negotiation; Social perceptiveness	-0.80
Active listening; Communications and media; Reading comprehension; Speaking; Writing	-0.79
Foreign languages	-0.46
Fine arts; History and archaeology; Philosophy and theology	-0.11
Training and Education	0.04
Industry Specific Knowledge	0.06
Law and government; Public safety and security	0.20
Medicine and dentistry; Psychology, therapy, counselling	0.24
Biology; Chemistry; Geography; Physics; Sociology and anthropology	0.25
Auditory and speech abilities; Physical abilities; Psychomotor abilities; Visual abilities	0.26
Engineering, production and technology**	0.57

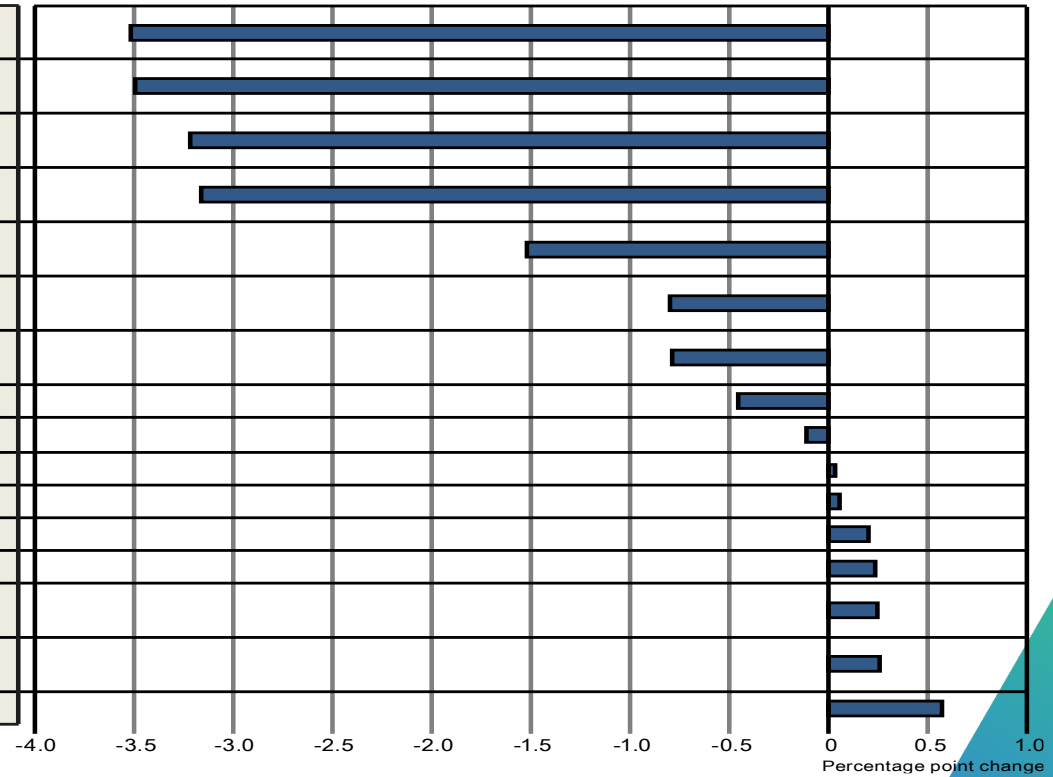
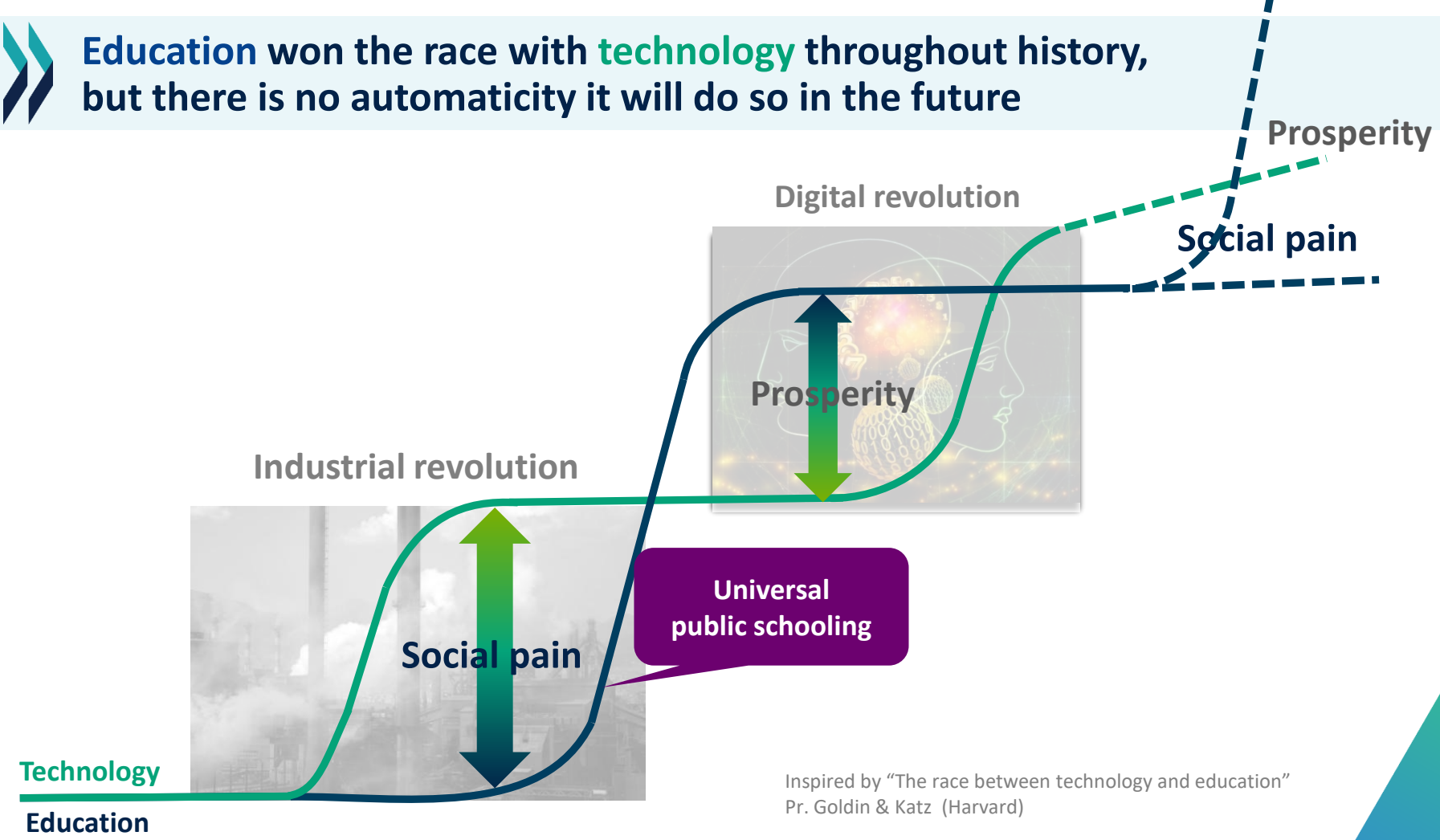


Figure 4.1 in Green (2024), “Artificial intelligence and the changing demand for skills in the labour market”

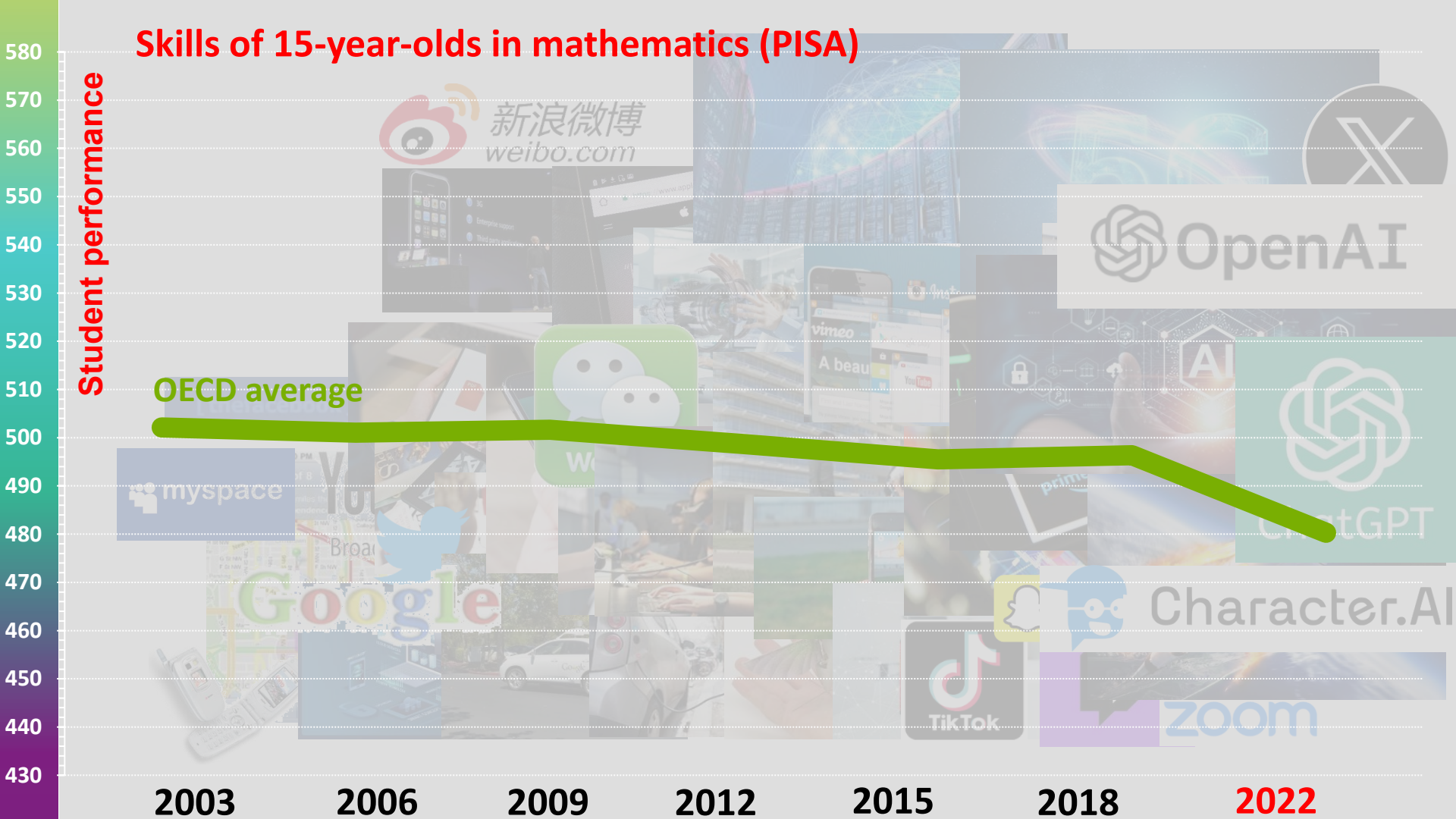
What’s gone wrong with education?

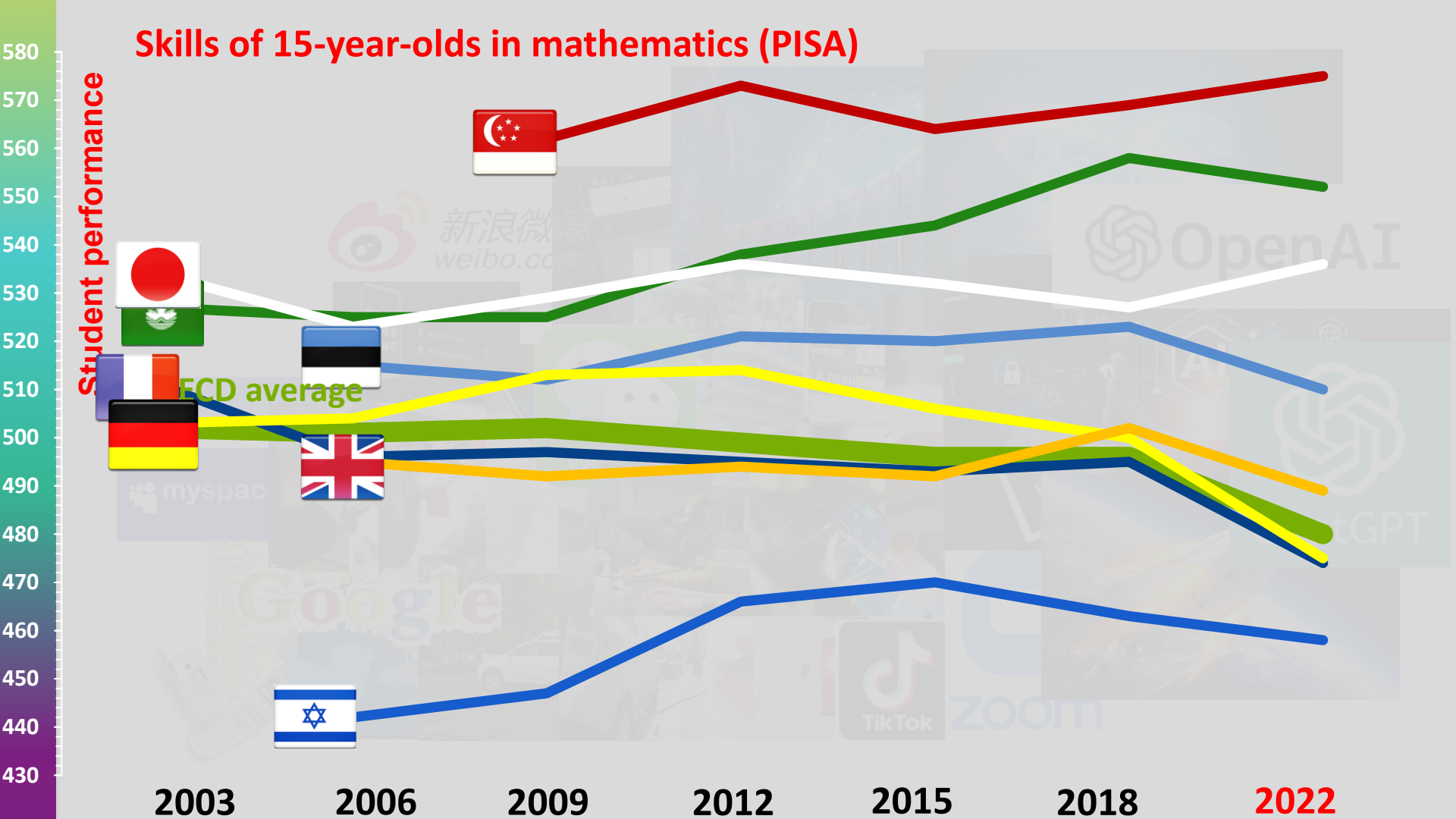
Graduates have difficulties finding good jobs while employers say they cannot find the people with the skills they need

Education won the race with technology throughout history, but there is no automaticity it will do so in the future



Inspired by "The race between technology and education"
Pr. Goldin & Katz (Harvard)


Skills of 15-year-olds in mathematics (PISA)
Student performance
580
570
560
550
540
530
520
510
500
490
480
470
460
450
440
430
OECD average
2003
2006
2009
2012
2015
2018
2022
新浪微博
weibo.com
OpenAI
myspace
Google
TikTok
Character.AI
zoom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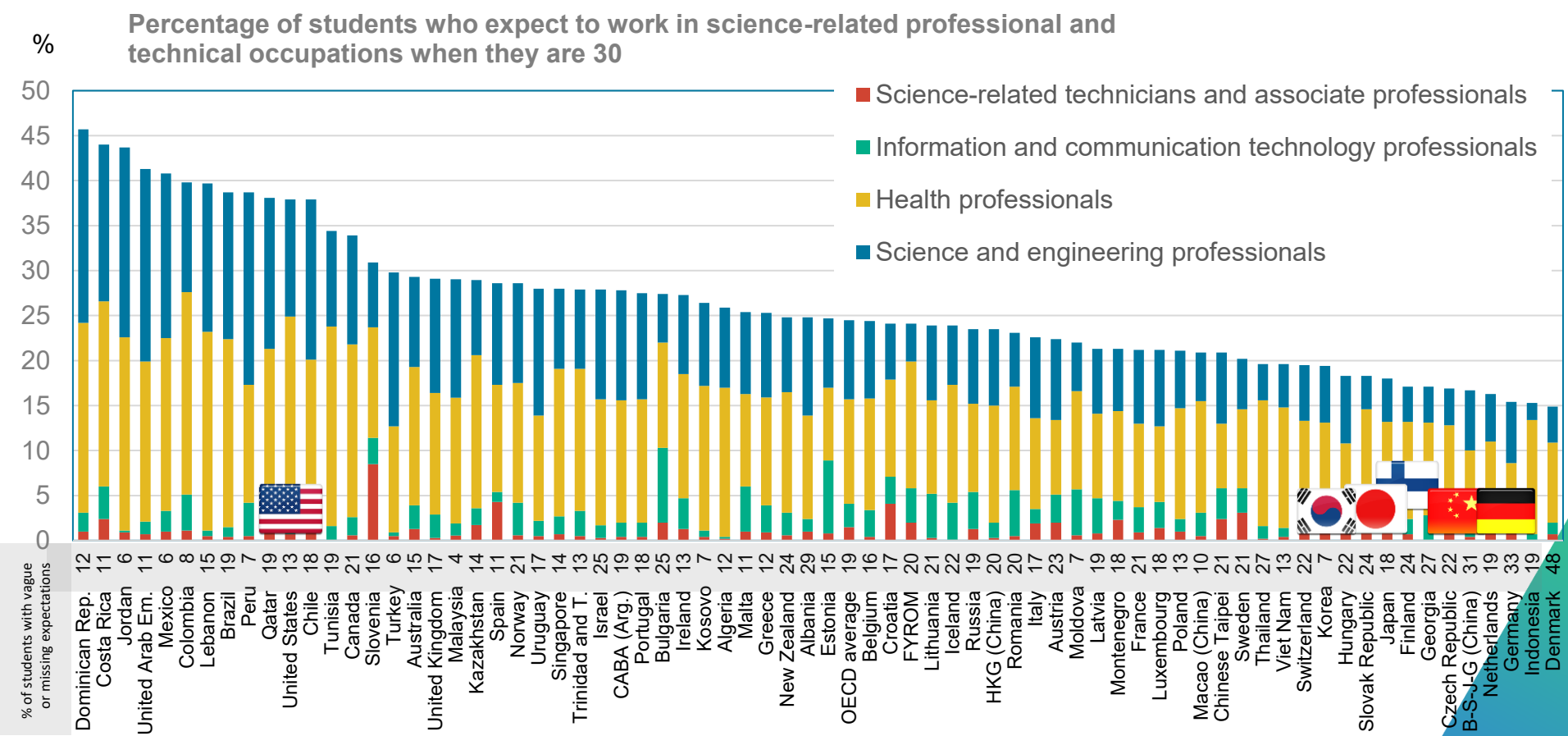
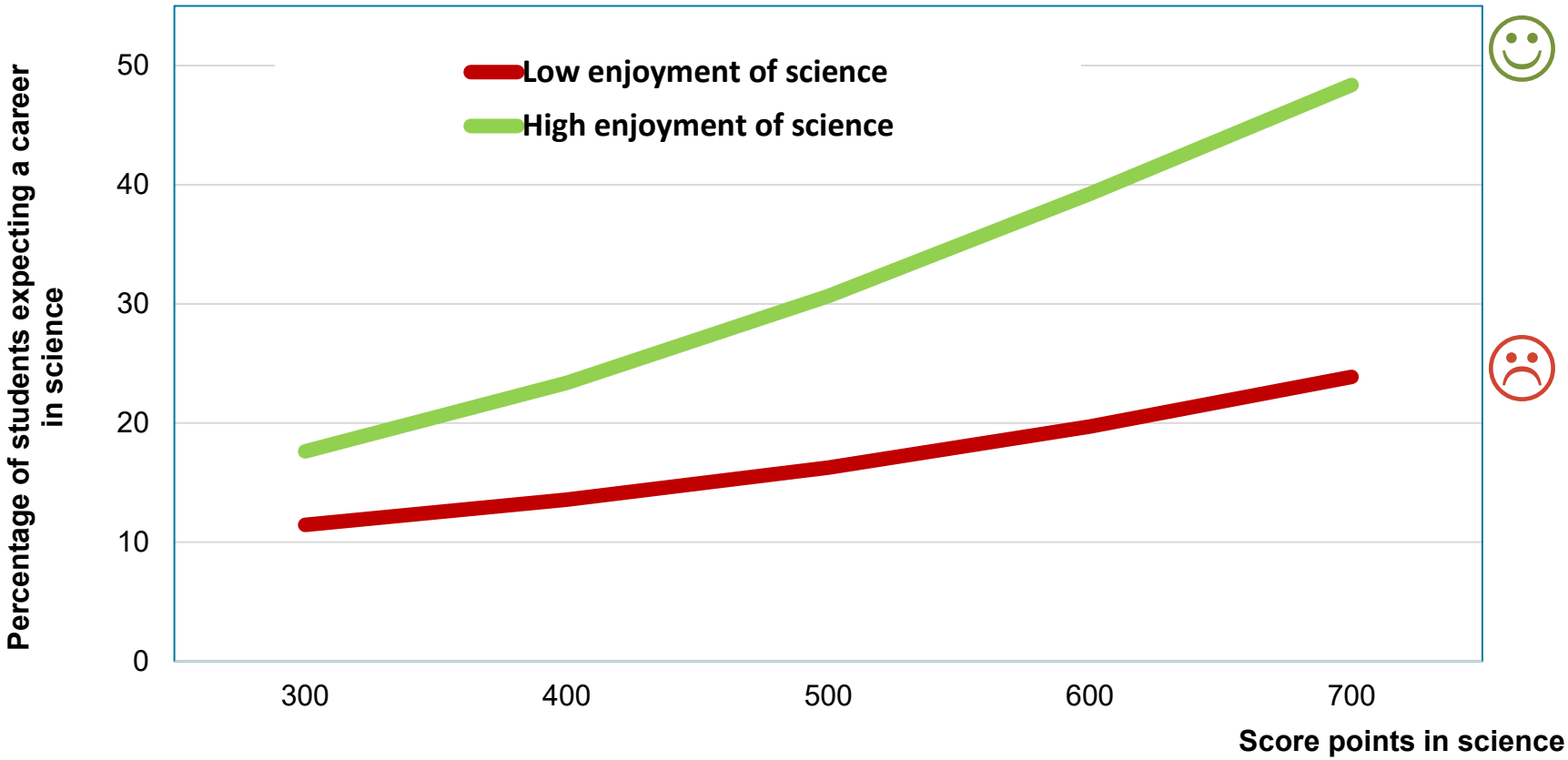
15-year-olds expecting a career in STEM

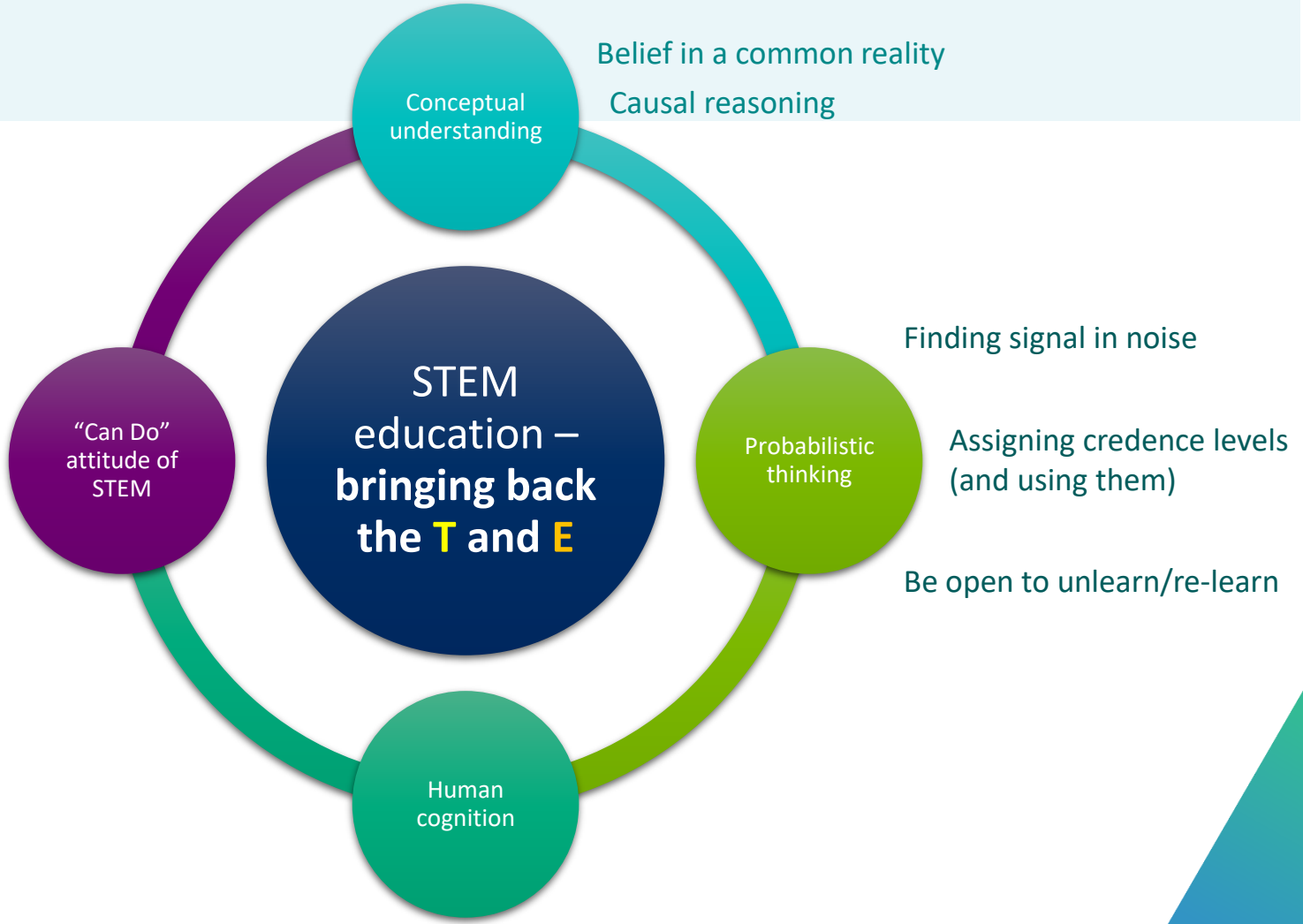


Students expecting a career in science

by performance and enjoyment of learning

Figure I.3.17

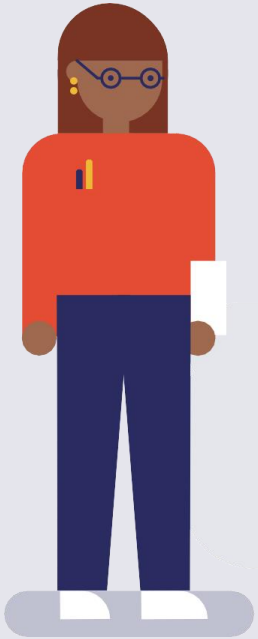



Belief in a common reality
Causal reasoning
Conceptual understanding
Finding signal in noise
Assigning credence levels (and using them)
Be open to unlearn/re-learn
Probabilistic thinking
Human cognition
Scientific optimism
Growth mindset
"Can Do" attitude of STEM
STEM education – bringing back the T and E

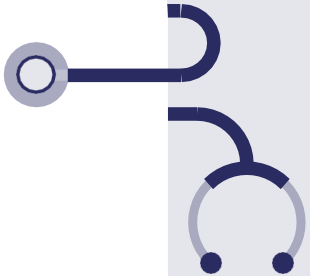
While the world of work has changed…

…young people's career aspirations are often narrow, unrealistic and distorted by gender and social background

Clear gender differences can be seen in five-year-olds' aspirations



GIRLS	RANK	BOYS
Teacher	1	Police officer
Veterinarian	2	Athlete/sportsperson
Doctor	3	Fire fighter
Hairdresser	4	Builder
Police officer	5	Teacher
Dancer	6	Parent
Parent	7	Fictional character
Fictional character	8	Doctor
Artist	9	Armed forces
Chef/cook	10	Bigger/older
Athlete/sportsperson	11	Pilot
Musician	12	Driver (type unspecified)
Shop sales assistant	13	Scientist/engineer
Royalty	14	Work with/be with father
Nurse	15	Car, van or taxi driver



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Clear gender differences can be seen in five-year-olds' aspirations

GIRLS	RANK	BOYS
Pet groomer/animal care worker	16	Chef/cook
Dentist	17	Someone who works (unspecified)
Fire-fighter	18	Someone who plays
[illegible]	19	Bulldozer driver
Scientist/engineer	20	Train, bus or tram driver
Beautician or related worker	21	Pet groomer/animal care workers
Sports coach	22	Musician
Ambulance worker	23	Astronaut
A sibling	24	Truck or lorry driver
Pilot	25	Farmer
Builder	26	Shop sales assistant
Creative/performing artists not classified elsewhere	27	Ninja
Natural creature (animal, fish, insect)	28	Inventor
Shop-keeper	29	Work with computers
Child-care worker	30	Car mechanic

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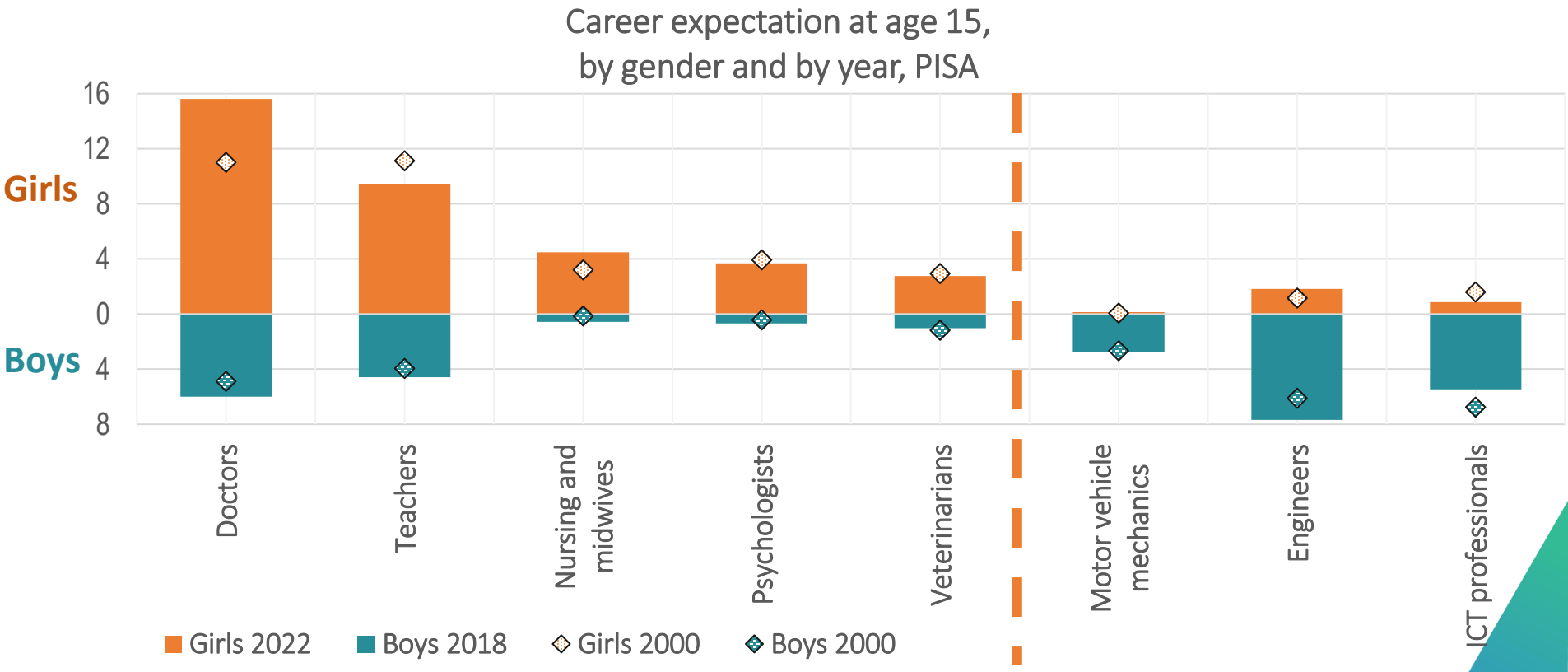
Labour market signals are failing to reach young people

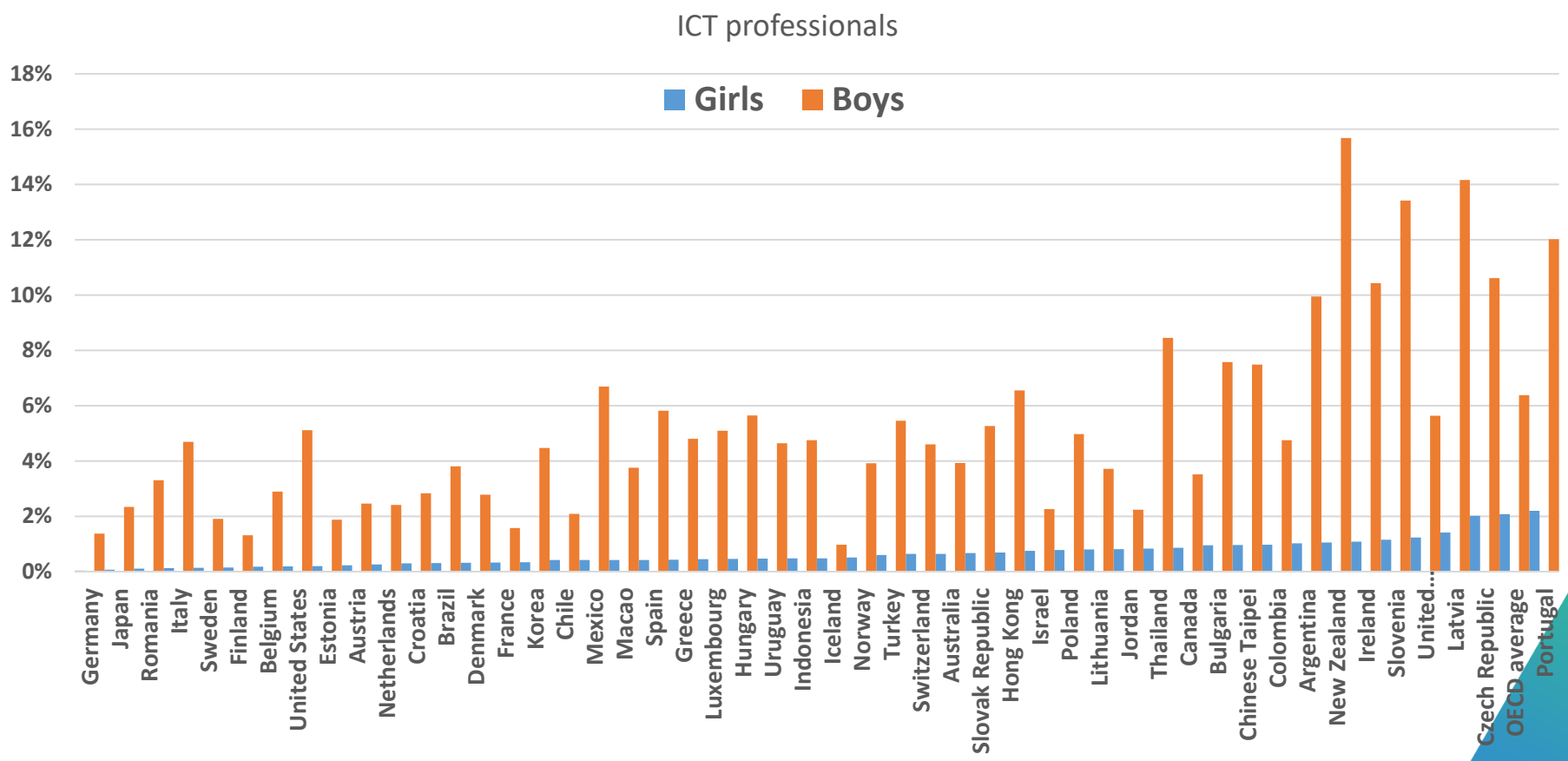
	Job title	Projected growth (%)	Student preference rank*	Median annual salary (2018)	Accessibility	Risk of automation
United States	Physical therapist assistants	33.10%	#29	$58,040	High – associate degree	Lower than average
	Occupational therapy assistants	27.10%	#71	$60,220	High – associate degree	Lower than average
	Computer user support specialist	10.60%	#229	$50,980	High – associate degree	Lower than average
Canada	Nurse aides and patient service associate	24.50%	#33	$ 40,715	High – associate degree	Lower than average
	Veterinary technician	21.50%	#32	$ 41,804	High – associate degree	Lower than average
	User support technician & Information systems testing technician	13.70%	#158	$ 55,290	High – associate degree	Lower than average

*Rank is based on ISCO occupation count of 543.

15-year-olds Girls and Boys have different career expectations

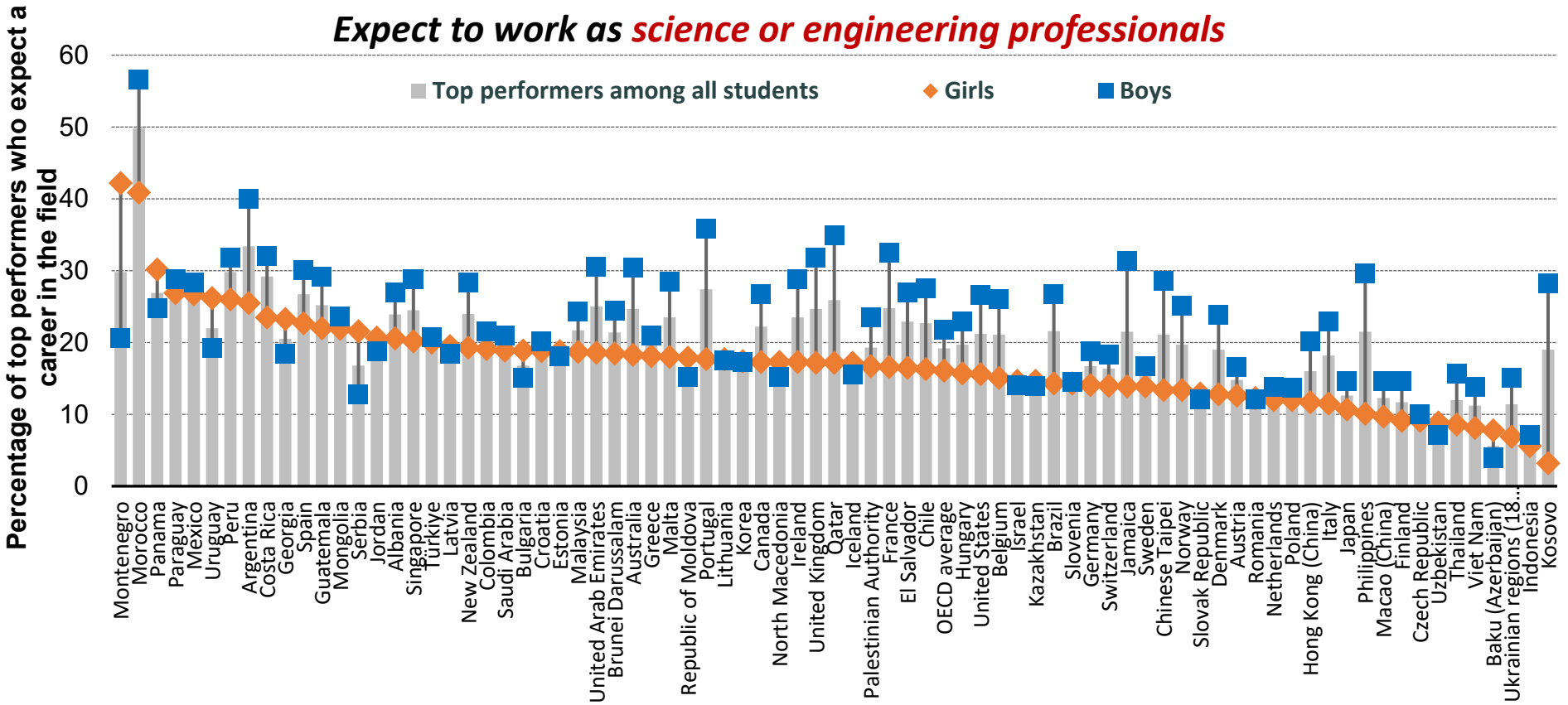


Percentage of 15-year-olds expecting to work as Information and Communications Technology professional (ISCO 25).



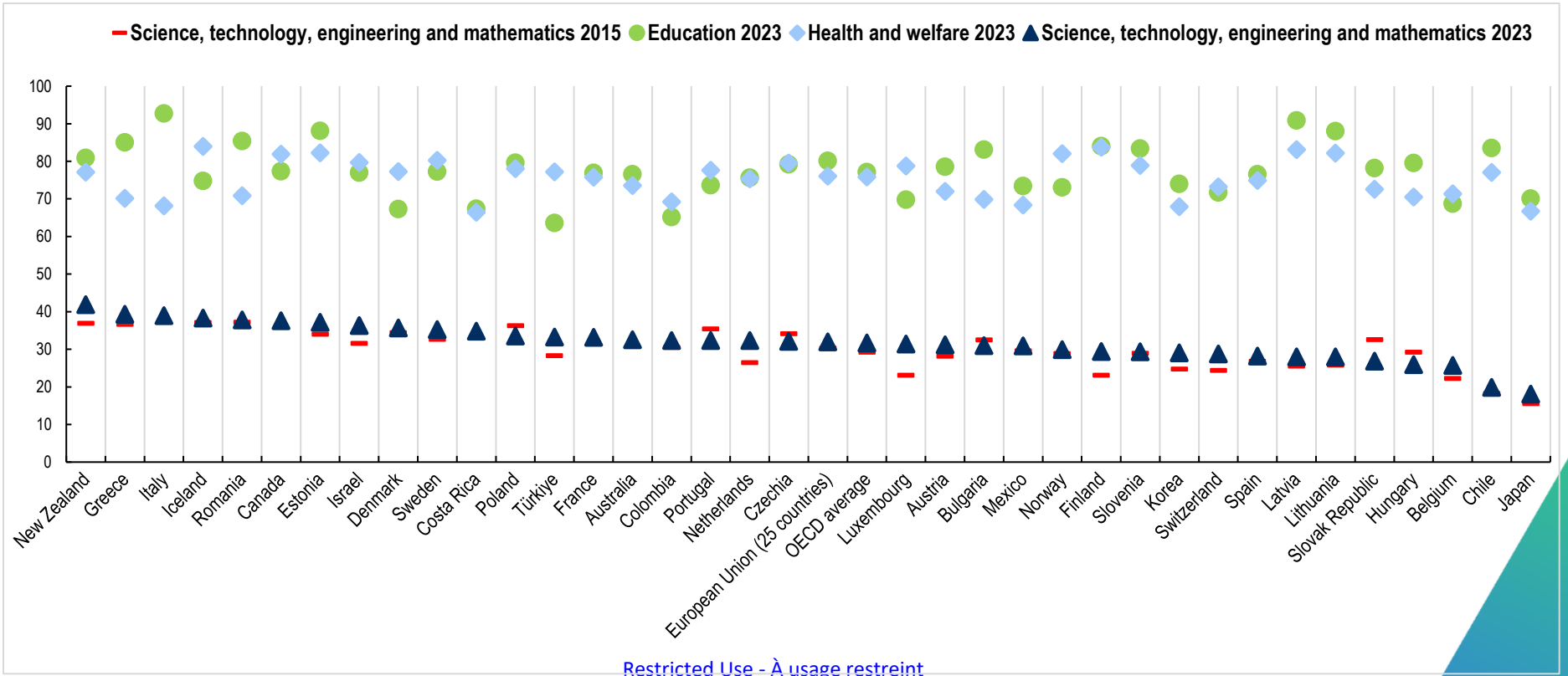
Gender gap in career expectations amongst top performers

High performers in mathematics and/or science who aspire to science and engineering professionals



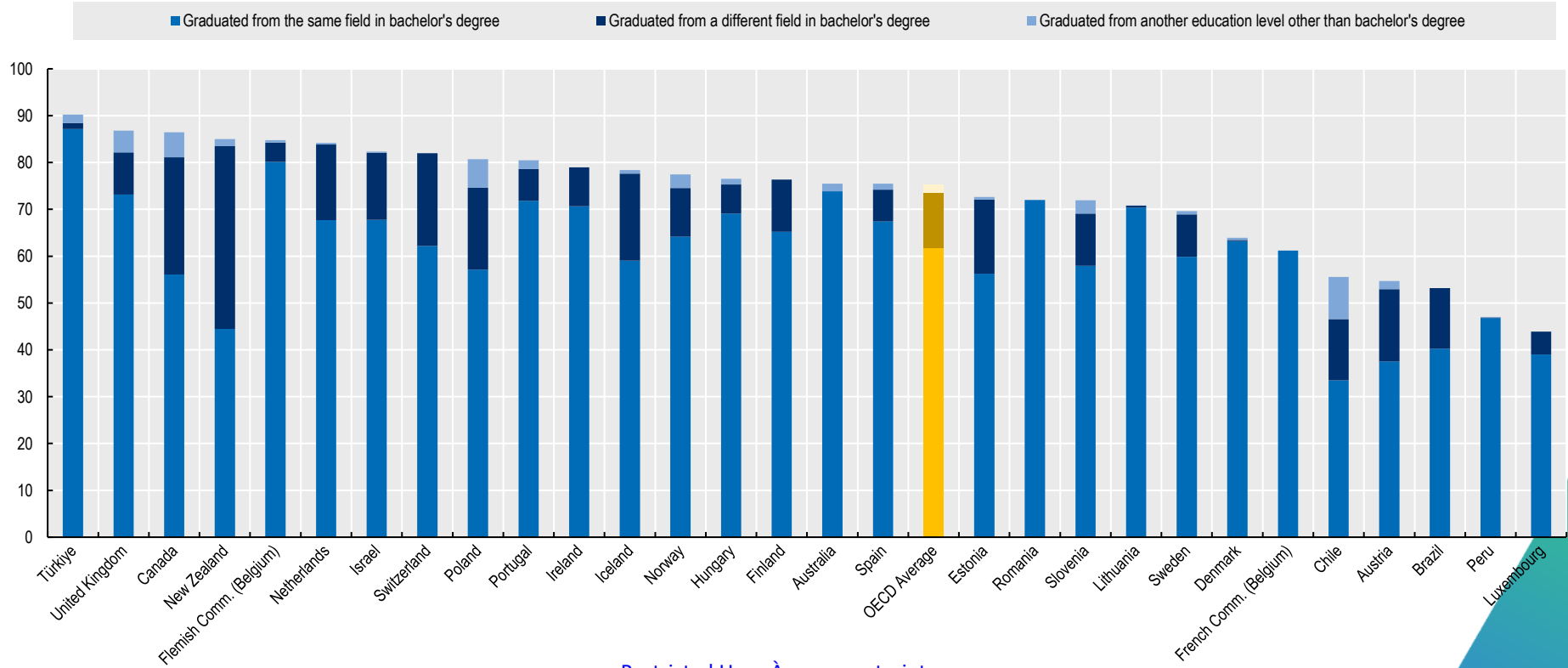
Women remain under-represented in STEM, with little change since 2015, while being over-represented in education and health

Women among new entrants in tertiary education, by selected field of study (2023)

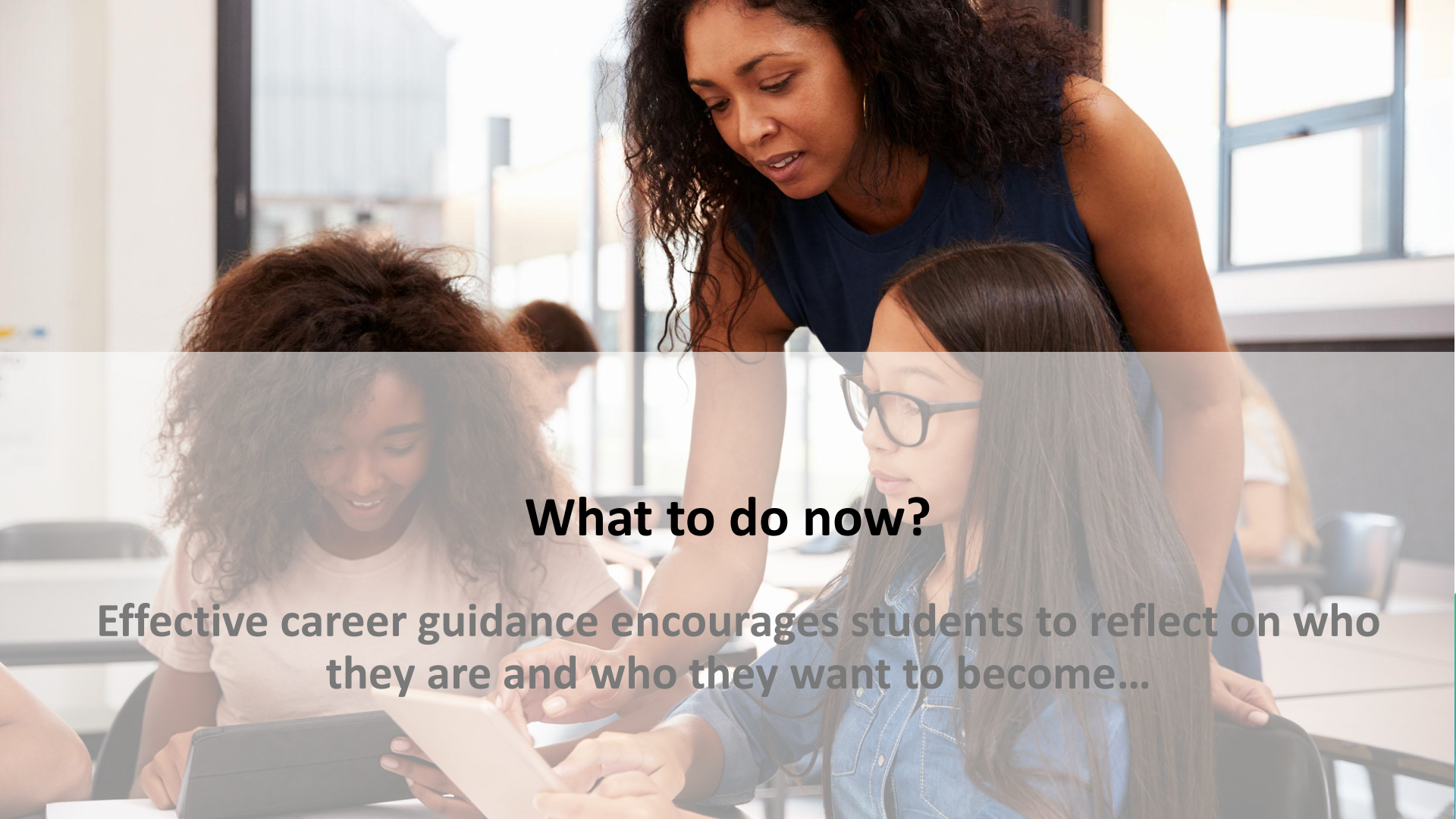


Women who start in STEM have a higher tendency to switch to another field

Completion rates of women in STEM bachelor's programmes, three years after theoretical end, by graduation status (2023)



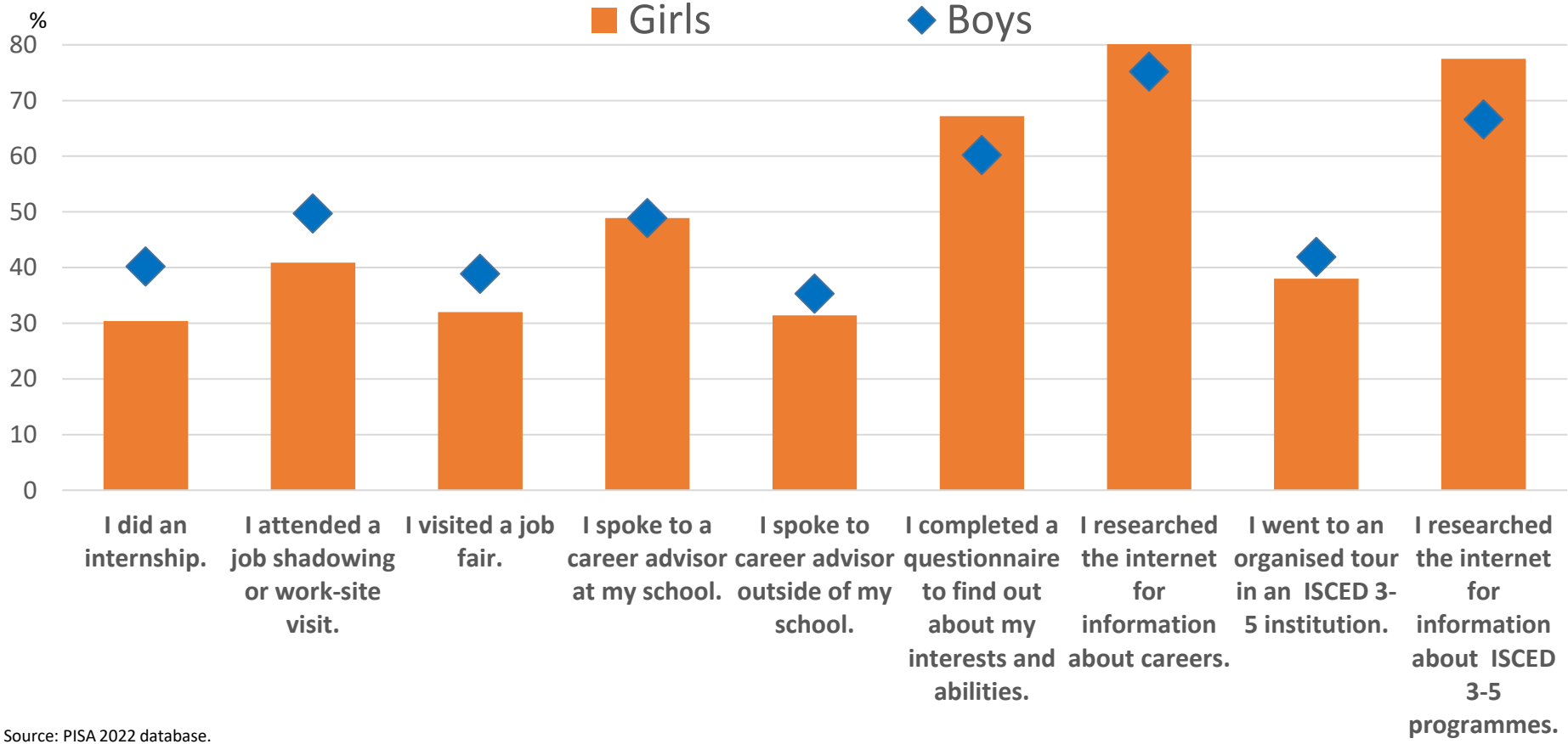
University educated men and women aged 25 to 65 chose to graduate in different fields of study



What to do now?

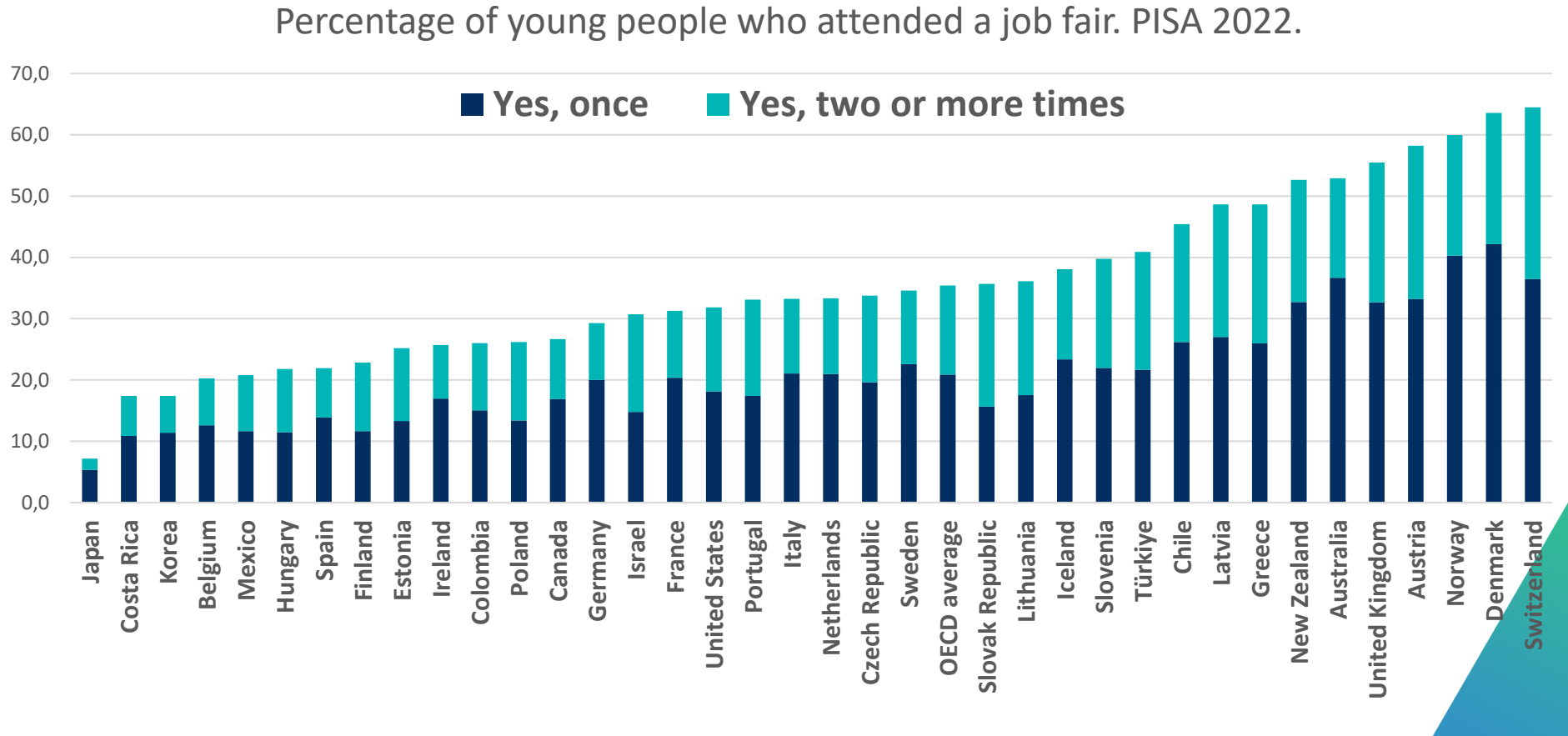
Effective career guidance encourages students to reflect on who they are and who they want to become…

Participation in career development activities by gender (OECD average)



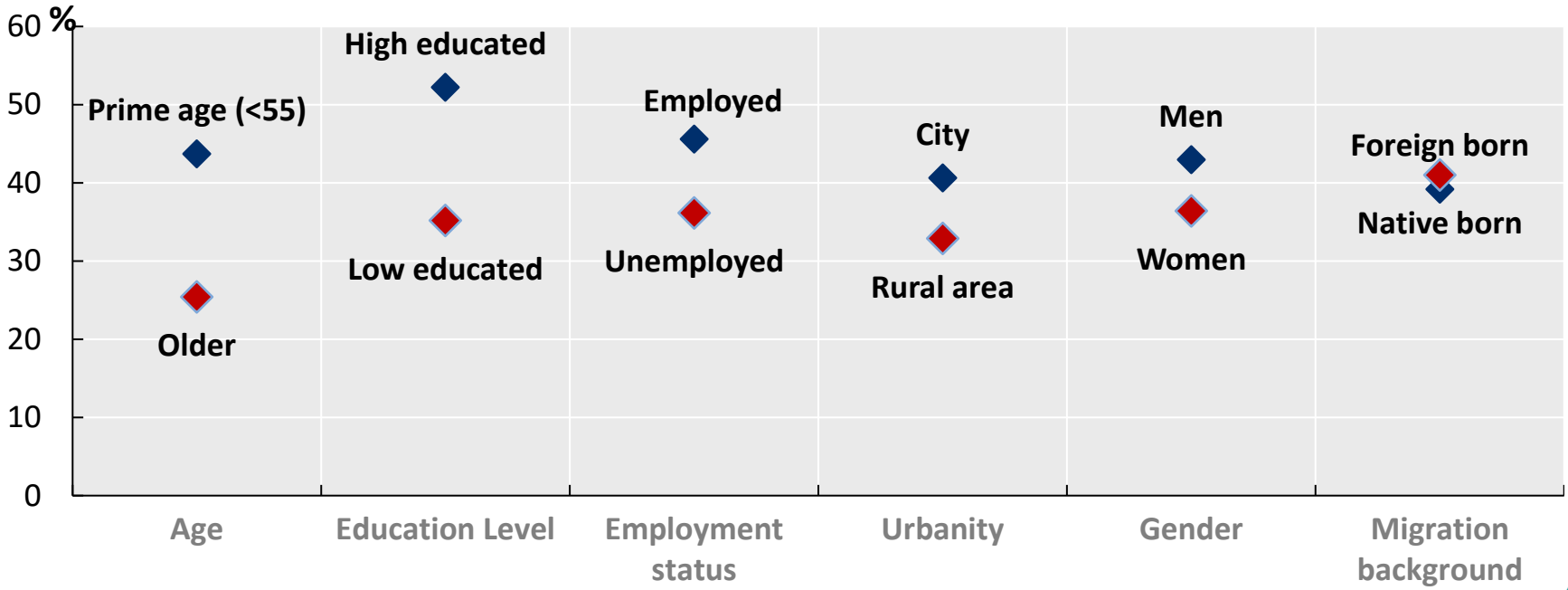
Source: PISA 2022 database.

Too few students are engaging with employers and people in work through their career guidance



Career guidance

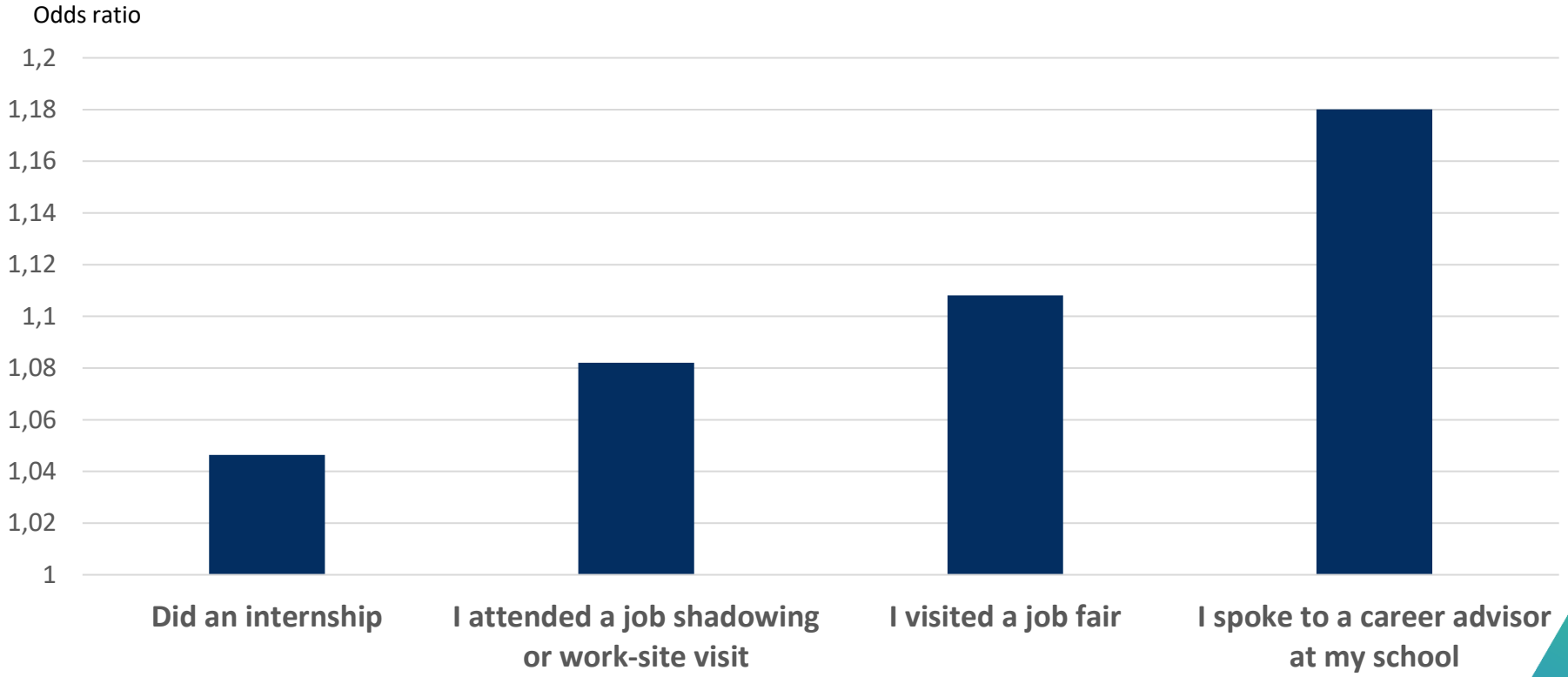
Percentage of adults who have spoken with a career guidance advisor over the past five years, by group



Note: Unweighted average for the eleven countries covered by the SCGA: Argentina, Australia, Brazil, Canada, Chile, France, Germany, Italy, Mexico, New Zealand and the United States. The sample size of foreign-born adults is smaller than 50 observations in Argentina, Brazil, France, Italy, Mexico and United States. The low educated group includes adults with a low or medium level of education (i.e. less than a bachelor's degree).
Source: OECD 2020 Survey of Career Guidance for Adults (SCGA)

Effect of participation in career development on positive attitudes towards school

Odds ratio of the likelihood of students agreeing with the statement "Trying hard at school will help me get a good job"

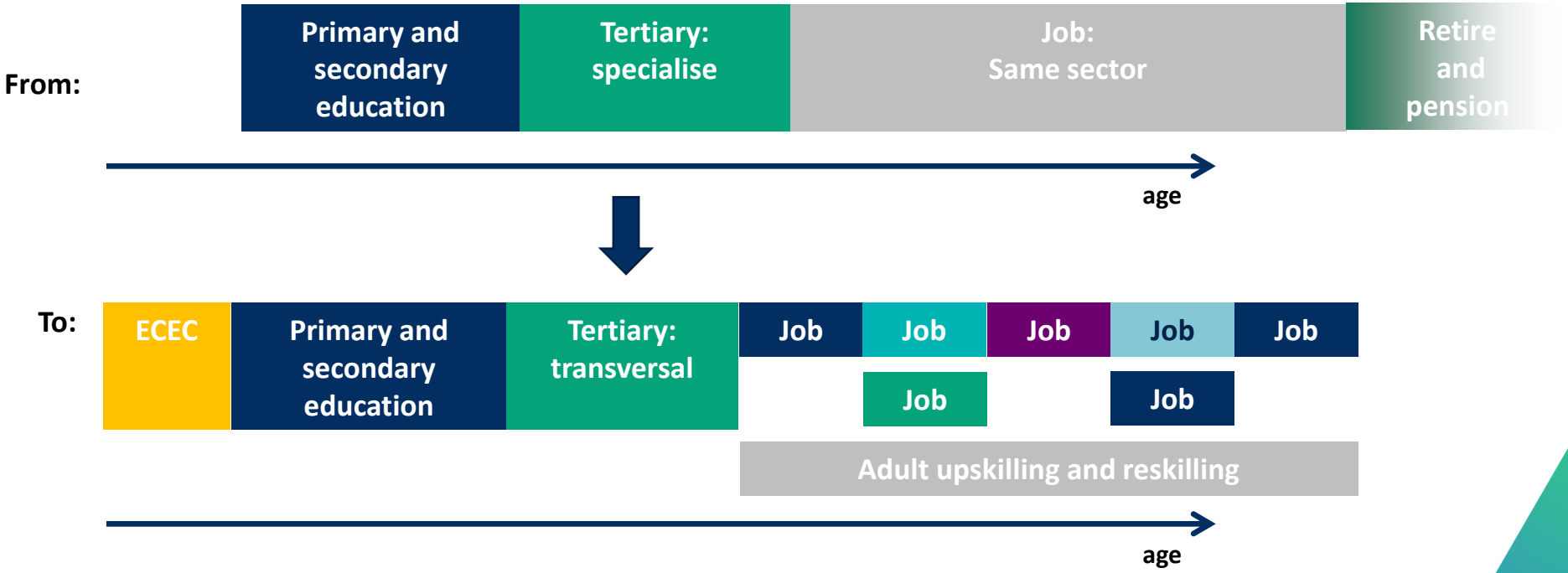


Note: Odds ratio are adjusted for gender, socio-economic status, school type (private/public,class size, urban/rural,staff/student ratio), immigrant background, motivational factors (whether students skipped classes or days) and cognitive potential (whether students repeated a year of study).

Source: PISA 2018 database


We used to learn to do the work
Now learning is the work

We used to learn to do the work, now learning is the work



Changing demands for education and training

Increased demand for skills means education systems have to respond

Education systems need to deliver:

- **Higher skills levels for more people in initial education and training**
- **Opportunities to upskill and reskill throughout life**

Front-loaded learning to lifelong learning

Multiple pathways

Combining work & study

Responding to priority skills needs

Motivating & incentivising individuals

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and remember:

Without data, you are just another person with an opinion