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Robots in education: opportunities and policy challenges

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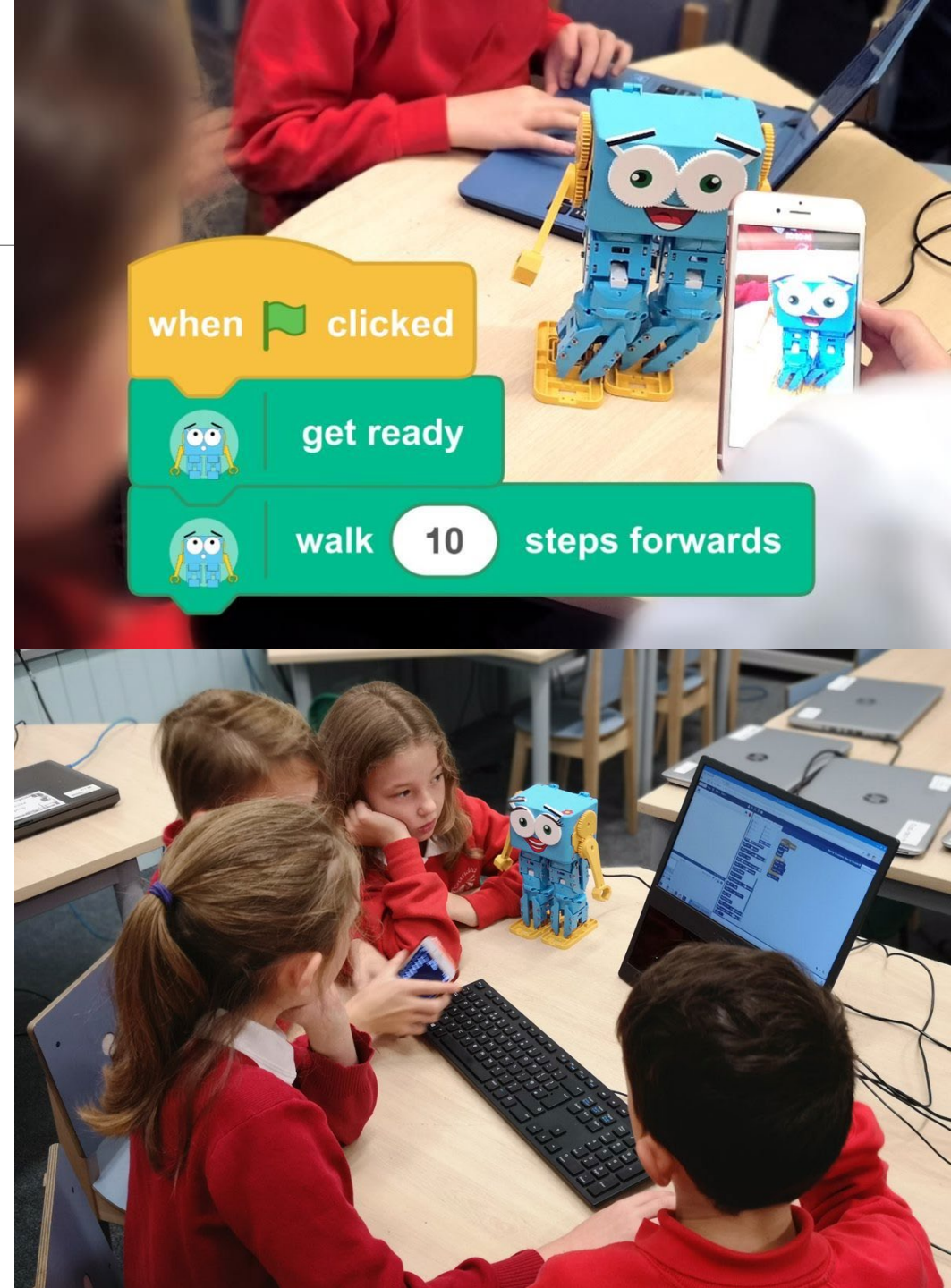


robots in (formal) education



Robots in the classroom

- Robots are currently mainly used in the teaching and learning of coding (or, more recently, « computational thinking »)
- Old idea that can be traced back to Papert (1970) and now applied to computational thinking (broader than coding)
- Few empirical studies show whether this is effective – and even less when it is effective (but at least 3 meta-analyses are available)





Social robots in the classroom

- Social robots are increasingly being experimented as taking on the roles of teaching aides (instructors, tutors, peer students, etc.)
- Some studies shows they are almost as effective as human beings (doing narrowly defined tasks)





Telepresence robots in the classroom

- Telepresence robots allow teachers or students to be and to move in a classroom while being at home
 - Potential to use older teachers
 - Potential to make students part of a class when they cannot be around
- Very useful in case of a pandemic inducing physical distancing – for a variety of situations

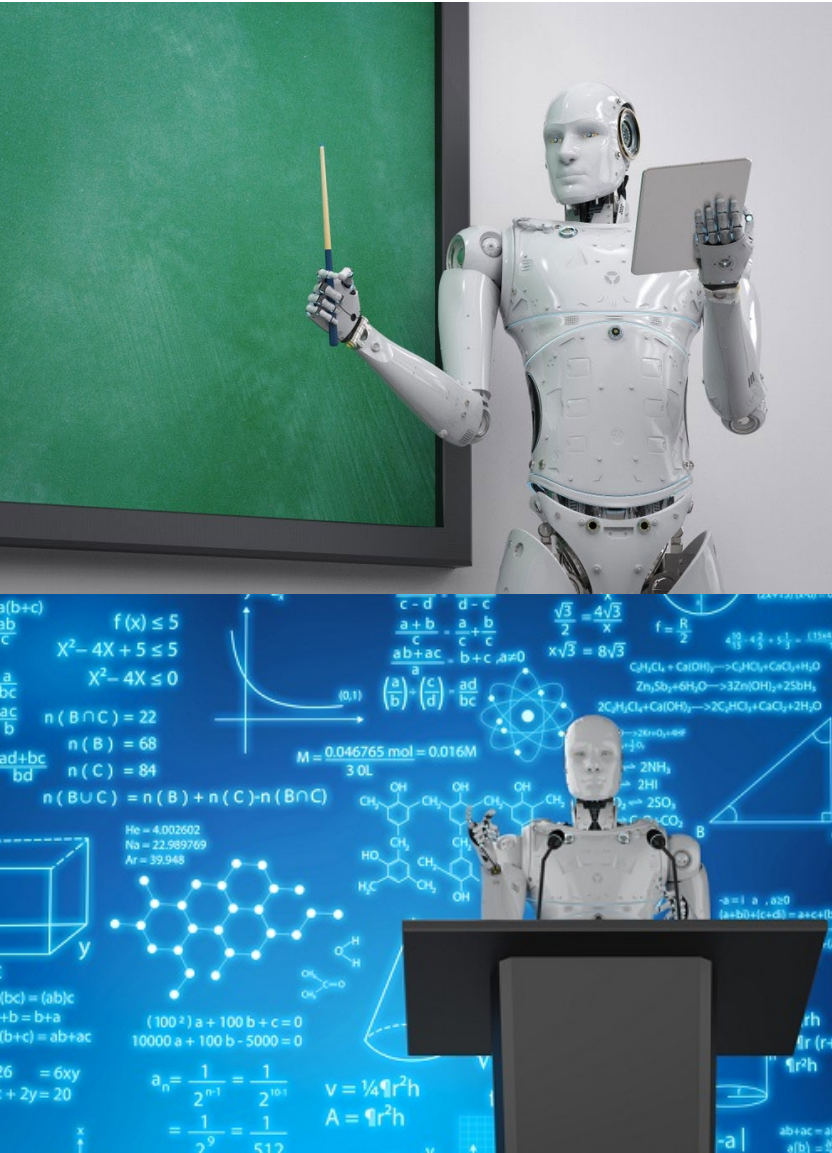




will teachers soon be out of job?



Are robots ready to replace teachers in the classroom? Not in the near future for sure



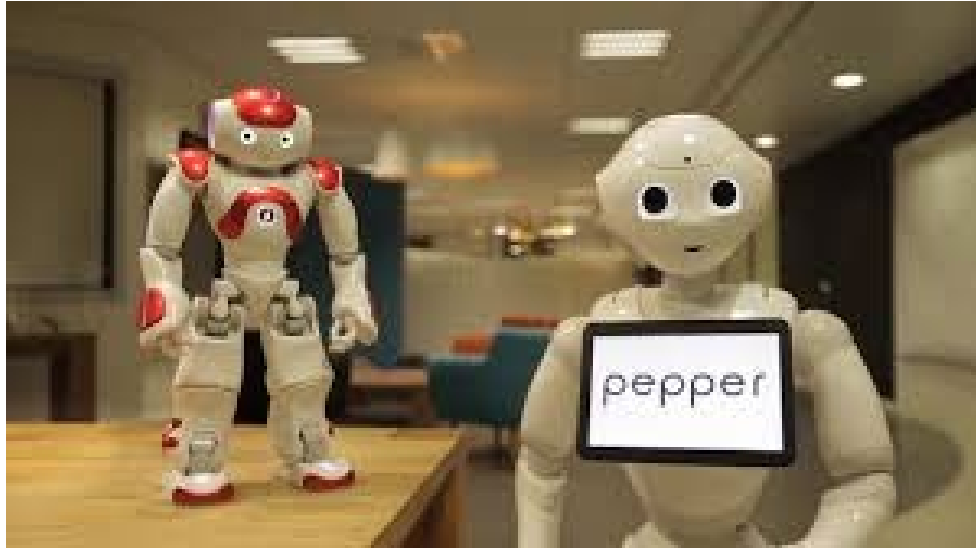
- This is NOT because robots will never perform certain teaching tasks better than humans
- This is NOT because human-robot interactions lack emotions (think of Dennett's intentionality stance – or how you felt about the robots of Star Wars) – the infinite patience of robots can do marvels in some contexts
- Teaching is a very diverse activity requiring many many skills that are not mastered yet by robots
 - Needs a lot of advances in robotics
 - Needs a lot of advances in AI for education (intelligent tutoring systems, etc.)



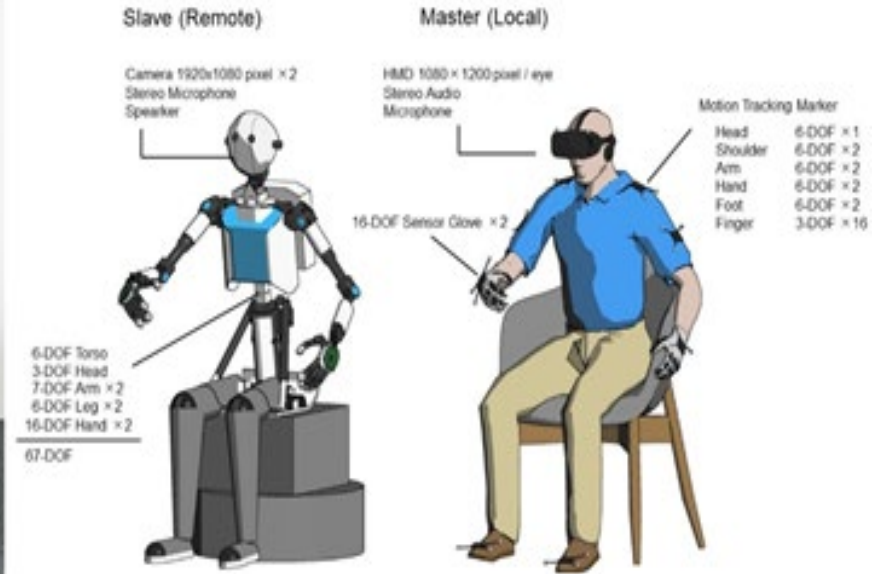
are robots affordable for schools?



Will social and telepresence robots ever be affordable for schools?



Nao (5600+ EUR) and Pepper (11.5+k EUR)



Telestar VI (experimental) – Telestar V (2011) was USD 15k

- Social and telepresence robots are still quite expensive by educational (public) budget standards – and require advanced functionalities
- More adoption will lower cost – but when will it happen?

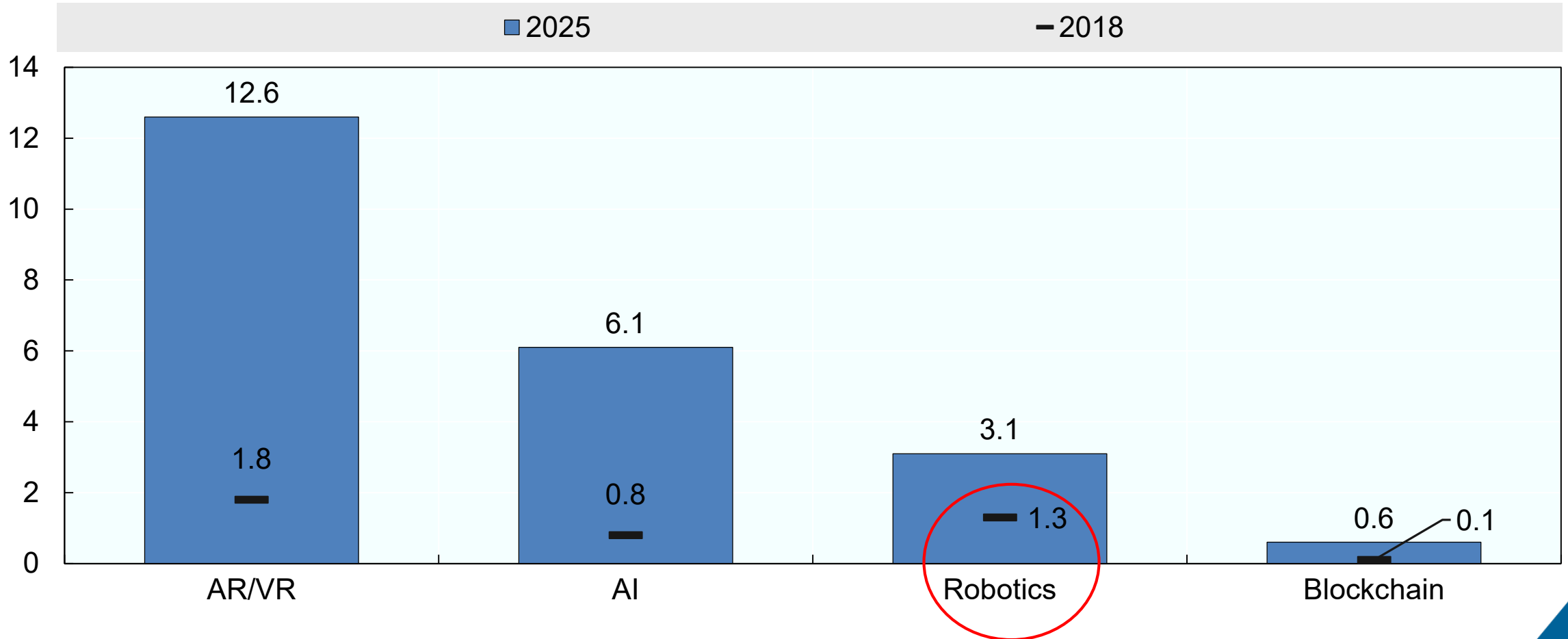


robots in the EdTech industry



Current and estimated expenditures in advanced education technology

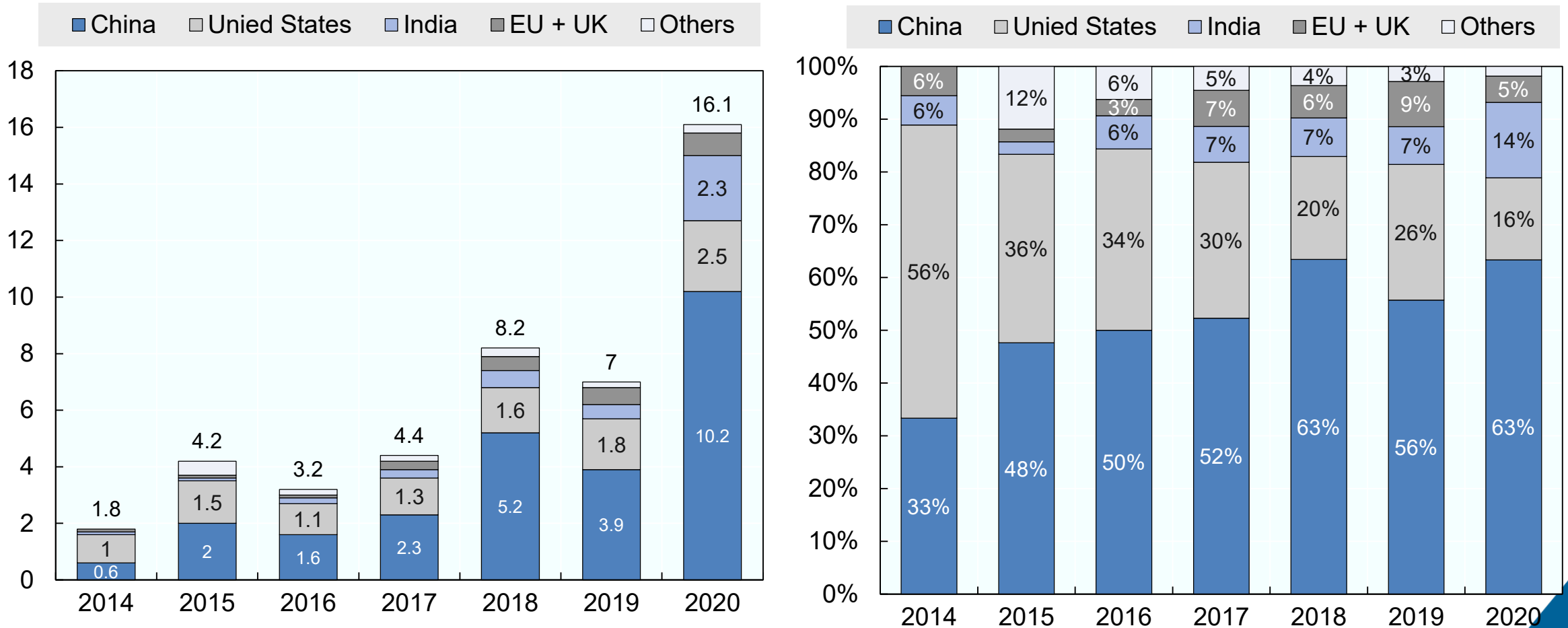
Advanced Education Technology Expenditure, 2018 and 2025 estimate, USD Billions





China represents over 50% of global education venture capital investment – and EU+UK: 5%

Venture capitalists have invested USD 16B in 2020, up from USD 2B in 2014 – mainly from China





some challenges ahead



What policy challenges for robots in education?

- **Usefulness**
 - Develop solutions with stakeholders (teachers, etc.) – not just EdTech
 - Work with schools on the benefits of the technological solution so it gets used
- **Effectiveness**
 - Verify that robots do what their vendors say (e.g. gives accurate diagnosis/predictions)
 - Ensure it improves outcomes (e.g. supports interventions to solve the problems)
- **Equity**
 - Privilege cheap solutions running on existing platforms (digital divide is bigger than we thought)
 - Establish standards and facilitate inter-operability and thus sustainability and affordability
 - Towards a generic robot that is just



What challenges for robots in education?

- **Fairness**
 - Ensure that robots are not replicating biases due to their historical data (e.g. machine learning) or due to the biases of the humans (or robots) who design them
 - Ensure that they do not create new biases (e.g. look at the results)
- **Transparency**
 - Open data/open algorithm: allow anyone (i.e. other experts) to see and verify/challenge/improve the algorithm
 - Explain how the algorithm works and which choices were made (to the extent possible)
 - Involve stakeholders to discuss the choices made when there is high stake
- **Data protection**
 - Data protection regulation in most countries: GDPR in Europe, FERPA in the US, etc.
 - Risk management policy: zero risk policy is not possible



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THANK YOU

<https://oe.cd/educationceriinnovationstrategy>

