AI and Education: An intelligence infrastructure to empower self-efficacy

Professor Rose Luckin
Technology capable of actions and behaviours “requiring intelligence when done by humans” (2018)
‘AI achieves its best ever mark on a set of English exam questions’
New Scientist April, 2019
Deep Blue vs Gary Kasparov

AI that CANNOT Learn


Game 6

The final of the 1997 match of Kasparov vs. Deep Blue shocked Kasparov and the world. Deep Blue played a very aggressive sacrificing a knight on move eight! Kasparov never recovered from this stunning move and went down in flames in just 19 moves.

Deep Blue (Computer) vs. Garry Kasparov

IBM Man-Machine | New York, NY USA | Round 6 | ECO: B17 | 1-0

match. Kasparov simply collapses after this sacrifice. 8... Qe7 9. O-O fxe6

(9... Qxe6?? 10. Re1)

10. Bg6+ Kd8 11. Bf4 Black has a very difficult time developing and finding a plan. 11... b5 12. a4 Bb7 13. Re1 Nd5 14. Bg3 Kc8 15. axb5 The computer open lines to the enemy king. White has a decisive advantage. 15... cxb5 16. Qd3 Bc6 17. Bf5 All of the tactics are flowing for Deep Blue. All pieces are participating in the hunt for the king. 17... exf5 18. Rxe7 Bxe7 19. c4 Kasparov resigns! What a game and sacrifice by Deep Blue. 1-0
2016

Alphago vs Lee Sedol

AI that learns
But, Machine Learning AI is still just…

Pattern Matching
A Perfect Storm

Data, plus **very sophisticated** AI, plus computing Power and Memory
Like oil, data is crude and must be refined in order to derive its value.

It must be ‘cleaned’ before it can be used by AI.
Artificial Intelligence (AI) is intelligent in a particular sort of way, Humans are intelligent in many ways. AI and HI are not the same and the differences are extremely important.

We want humans to complement the AI automation not repeat it!
3 routes to Impact on Education

1. Using AI in Education to tackle some of the big educational challenges

2. Educating People about AI so that they can use it safely and effectively

3. Changing Education so that we focus on human intelligence and prepare people for an AI world
Implications for Education

ACTION 1 Using AI in Education to tackle some of the big educational challenges

ACTION 2 Changing Education so that we focus on human intelligence and prepare people for an AI world

ACTION 3 Educating People about AI so that they can use it safely and effectively

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Implications for Education

1. Using AI in Education to tackle some of the big educational challenges
“It's an educational revolution”: how AI is transforming university life.

https://www.theguardian.com/education/2019/apr/17/its-an-educational-revolution-how-ai-is-transforming-university-life

Introducing AI in primary school prepares kids for future

AI and big data powers personalised learning pathways and personalised messages based on learning behaviours - Learn how every brain learns.
EMPOWER YOUR WORKFORCE.
INNOVATE WITH YOUR CSR STRATEGY.

Chatterbox is an online language learning platform for professionals powered by refugees who are experts in their fields.
Features

1. **Cutting-edge methodology** endorsed by high-ranking universities combining AI-assisted self-study and regular practice with native speakers.

2. **Innovative matching algorithm** pairing learners with refugee language coaches who share their professional backgrounds and interests.

3. **Highly tailored solution** with group and individual study options adaptable to any schedule and budget.

4. **Award-winning social impact** helping talented yet underemployed refugees reclaim their professional identities.
Shaping language learners as confident speakers

- Language acquisition practice assistant
- Real-time analytics of speech clarity and physical presence
- Self-paced, micro-learning modules to improve
- Popular with second language learners of English
- Leverages ASR, NLP and Vision Computing layers

**THE SUNDAY TIMES**
“Apps to change your life”, November 2018
Science-based A.I. platform that monitors child’s language and cognitive development and guides parents through a personalised and home-based curriculum

Working with:

Goldsmiths
University of London

The Hong Kong University of Science and Technology

The University of Sydney

Contact:
Sandra Sobanska, sandra@oyalabs.com
Evidence-based A.I. platform that monitors child’s language and cognitive development and guides parents through a personalised and home-based curriculum.

**AI/NLP MONITOR:**
We monitor the quantity and quality of early parent-child talk.

**01 MONITOR**

**02 ANALYSE**

**03 IMPROVE**

Shaping positive parenting habits

**PERSONALISED:**
Activity ideas
Book & Toy Bundles
Expert consultations

Contact:
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Algorithms automatically increase the number of training loops for the domains where you have the greatest need...

If attention is your greatest need you will receive more Attention loops → building resilience in Attention. As you progress the loops become more challenging.
The Potential

Implications for Education

1. Using AI in Education to tackle some of the big educational challenges
Data is the ‘new oil’, and is the power behind AI.

It can also be the power behind HI.
"Why did Apple make you"
tap to edit

For one reason only: to make your life easier, and more fun (I guess that’s two reasons, huh?)
Data is the new oil

We need to clean data to extract value

We need to apply what we know about human learning to the design of the algorithms that we use to process the data we collect about educational interactions
Implications for Education

2. Educating People about AI so that they can use it safely and effectively
EDUCATE people about AI to help them reap its benefits

- **AI understanding**: Teach people the skills they will need for their AI-enhanced work and life
- **Ethics: what is responsible AI?**: AI augmented HI: teach people to work effectively with AI
- **Technical AI understanding**: Teach people to build AI systems
What is the worst that can happen?

Input

Processing: Machine Learning algorithms and training data

Output

Who? Knowledge and Consent
Purpose and justification. We can say no.

PLUS: Bias and Bias Explanation and Validation Regulation

PLUS: Audience Honesty and truth
Transparency Appropriateness
Implications for Education

Educating People about AI so that they can use it safely and effectively

http://instituteforethicalaiineducation.org
Education is crucial – regulation will never be enough
3. Changing Education so that we focus on human intelligence and prepare people for an AI world
We are now in the early stages of the Fourth Industrial Revolution,
Media coverage and predictions about BIG changes

PwC ‘Will Robots Really Steal our Jobs’ report 2018
PwC ‘Will Robots Really Steal our Jobs’ report 2018
Machine Learning and Human Intelligence
The future of education for the 21st century
Rosemary Luckin
1. Interdisciplinary Academic intelligence
2. Meta-knowing intelligence
3. Social intelligence
4. Meta-cognitive intelligence
5. Meta-subjective intelligence
6. Meta-contextual intelligence
7. Perceived self-efficacy
What is Human Intelligence in an AI world?

Interwoven Intelligence

- 7 elements to human level intelligence: all elements are essential;
- 5 elements can be considered under the heading meta intelligence;
AI can help
Data Cleaning

Applying what we know about human learning
"Why did Apple make you" tap to edit

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### PELARS CPS Framework

#### Collaborative problem solving dimensions

<table>
<thead>
<tr>
<th>Identifying Facts</th>
<th>Establishing and Maintaining Shared Understanding</th>
<th>Taking Appropriate Actions to Solve the Problem</th>
<th>Establishing and Maintaining Team Organization</th>
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<td>Representing and Formulating Knowledge</td>
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<td>Generating Hypotheses</td>
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<td>Planning and Executing</td>
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<td>Knowledge and Skill Deficiencies</td>
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<tr>
<td>Monitoring, Reflecting, and Applying</td>
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Non-verbal signifiers of CPS?

**Synchrony** – Students’ visual synchrony, measured with eye-trackers, positively correlated with students’ learning (Schneider and Pea, 2013);

**Individual Accountability** - Group goals and individual accountability, 2 key features of successful groups (Slavin, 1991).

**Equality** - two-way dialogue taking direction from one another (Damon and Phelps, 1989; Dillenbourg, et al., 2016)

**Intra-individual variability** – The creation of a common ground among group members based on students’ ability to understand (Marlowe, 1986).
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Adaptive learning for Meta Cognitive and Meta Subjective Intelligence

Khan-Galaria, Luckin and Cukurova
"Great vocabulary Jamie, well done!"
What are the indicators of learner self-regulation in a virtual classroom environment?

Visualisation of framework of SRL indicators

- **Learner attempts to solve a maths problem and it is incorrect**
- **Evaluation: learner monitoring e.g. ‘why did I get that wrong?’**

**Conditions:**
- **Tutor (e.g. engagement prompts, motivational practices, style of feedback)**
- **Online resources which learner can engage with (e.g. ability to highlight, underline, etc)**
- **Learner (beliefs, domain knowledge, knowledge of study tactics)**

**Operations:**
- **Cognitive, critical thinking e.g. challenging questions**
- **Cognitive, Organising e.g. paraphrasing, summarising, scanning**
- **Cognitive, Rehearsing e.g. passive re-reading**
- **Cognitive, Elaboration e.g. constructive dialog**
- **Metacognitive e.g. positive self talk**

**Evaluation:**
- **Learner monitoring e.g. ‘let me check if that’s right’**
- **Learner adaptations e.g. switch to new study tactic or metacognitive strategy**
- **Learner monitoring e.g. ‘let me check if that’s right’**

**Products:**
- **Task planning and goal setting e.g. learner sets goals for next activity (can be prompted/unprompted)**

**Process start**
- **Learner asks tutor for answer**
- **Tutor gives answer**
- **Learner gets solution correct**
- **Learner gets solution incorrect**
- **Learner starts new question/activity**

**Process end**

| Monitoring self efficacy | Self-awareness of progress | I can't do this'  'I'm starting to understand' Mapped to levels of progress | Linguistic Inquiry and Word Count (LIWC) Log likelihood function |
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What does this mean for teaching?

**Numeracy and literacy**, including **data literacy**, will of course remain fundamental to all education, as will the **basics of AI**;

Emphasis for the remaining subject areas needs to be on **what** these subjects are, **how** they have arisen, **why** they exist and **how to learn** them;

Debate and Collaborative Problem Solving provide powerful ways to help students understand their relationships to knowledge and to hone their ability to challenge and question;

To ensure that teachers and trainers have the **time** to work with their students and trainees to develop these complex skills, **we can use AI to help.**
AI can help

**AI** – **AI tutoring systems for numeracy, literacy (including data literacy) and basic subject knowledge;**

**HI** – **Refine this understanding** through activities such as debate and collaborative problem solving;

**HI** – **Develop learners’ social and meta intelligence** (meta-cognitive, meta subjective, meta contextual and accurate perceived self-efficacy);

**AI** – **analyse learner and learning data** so that teachers know when to provide optimal support and learners get to know themselves more effectively.
“The risk is that the education system will be churning out humans who are no more than second-rate computers, so if the focus of education continues to be on transferring explicit knowledge across the generations, we will be in trouble.” (Financial Times 2017)
But how do we make this happen?
Partnership between educational stakeholders is essential to build capacity
UCL EDUCATE
Understanding and improving the London EdTech ecosystem
The Golden Triangle

EdTech Developers

Teachers & Learners

Academic researchers
Busuu combines AI-powered courses with instant feedback from native speakers

1. **AI-powered language courses**
   - High quality courses in **12 languages***, created by experts
   - Intelligent learning with AI (predictive vocabulary and grammar trainer, speech recognition)

2. **Practice with native speakers**
   - Community of 90 million+ users from 190 countries
   - Instant feedback on voice and text exercises

* English, Spanish, German, French, Italian, Portuguese, Mandarin, Russian, Japanese, Arabic, Polish, Turkish
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The Golden Triangle

ENABLER 1
Train educators and trainers

ENABLER 2
Train AI developers

ENABLER 3
Engage educators, trainers, researchers and AI developers in co-development

Data, evidence and research

Teachers & Learners

Academic researchers

EdTech Developers
ACTION 1
Tackle Education challenges using AI

ACTION 2
Prioritize human intelligence

ACTION 3
Educating People about AI

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Data, evidence and research
AI and Education: the Reality and the Potential

- AI is smart, but humans are and can be way smarter

- 3 ways AI can enhance Learning and Teaching
  - Tackle Educational Challenges using AI
  - Prioritize Human Intelligence
  - Educate people about AI: Attention to Ethical AI for Education is essential

- Partnerships are the only way we can achieve this
Thank you