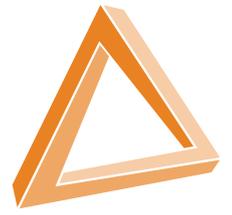


Byte-sized edtech research



AI for School Teachers

AI FOR SCHOOL TEACHERS

Introduction

*The following text has been adapted from **AI for School Teachers** (Luckin, George, Cukurova, 2022), available to buy from [routledge.com](https://www.routledge.com)*

With each passing day, the advances humans make in **AI** change the world. Perhaps most importantly, these advances are transforming the **world of work**. This transformation has significant implications for everyone, but as long-time educators, the authors of the book **AI for School Teachers**, on which this Byte-Sized EdTech Research is based, are particularly concerned about the implications for **teachers**. Teachers are responsible in large part for preparing students to act wisely and well – now, and in the future. Increasingly, this demands that teachers have a **working understanding of AI**, so that they can do two things:

1. Use AI **safely** and **effectively** to support their students' learning
2. Help students understand **how AI works** and how to use the power it brings **ethically**

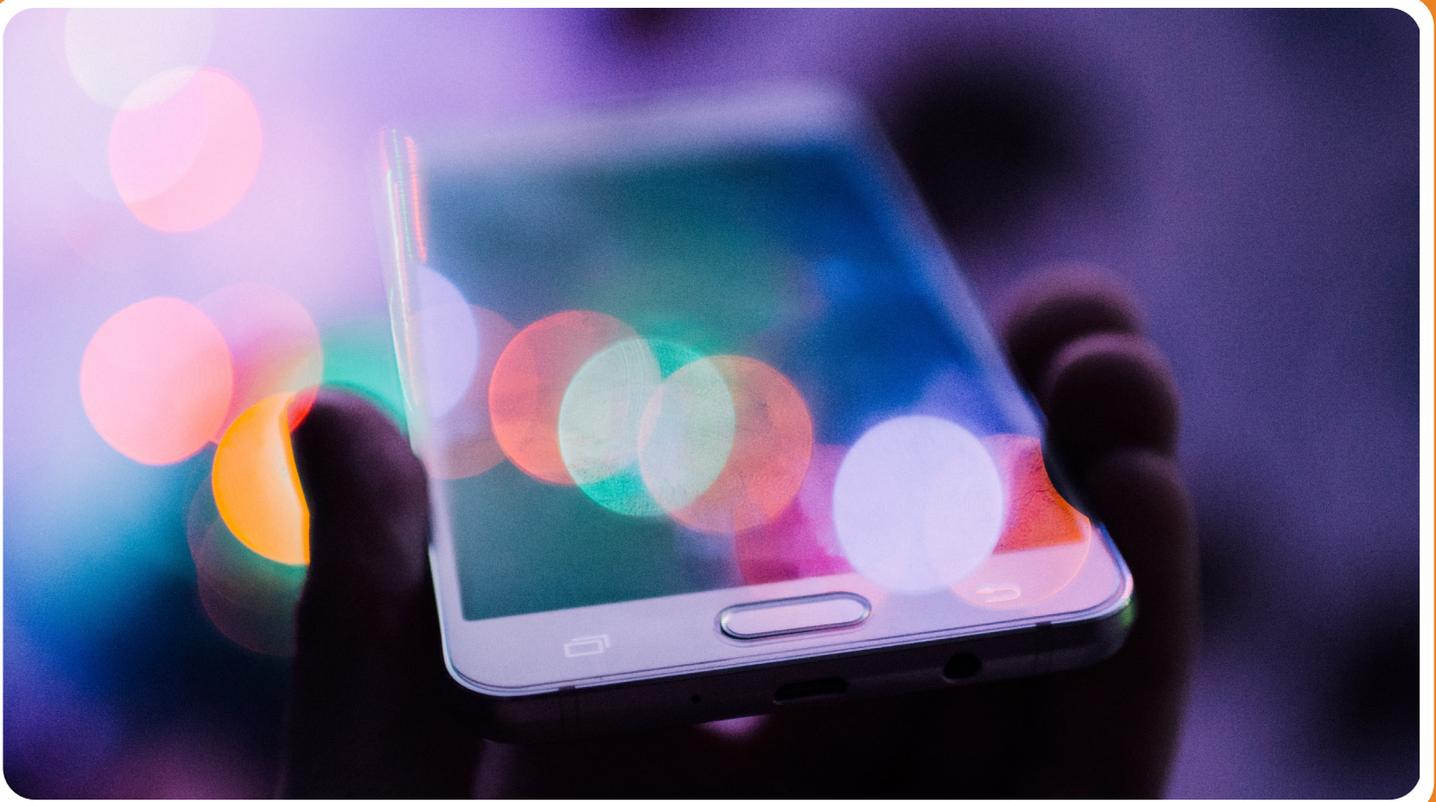
The authors joined forces because they want to convey the ways in which AI can help you, and they want you to understand **how to work alongside AI**, so that it **augments** what you are able to achieve as a teacher, school leader, parent, school governor, or trustee. Most of all, they want you to realise how amazing your own **human intelligence** and brain power is, so that you can keep AI firmly in its place as a **tool** to make you, and those around you, smarter. The aim is therefore to help teachers understand enough about AI to buy tools that will be **useful and appropriate to their context**, to **use AI effectively**, and to **help other people** to do the same. Educational examples are used throughout to illustrate the authors' points.

Meet the authors

AI for School Teachers was co-authored by 3 experts in education and Artificial Intelligence, providing teachers an all-access pass to one of the most important public conversations of our era

- **Rose Luckin** is Professor of Learner Centred Design at University College London and Founding Director of EDUCATE

- **Karine George** is an award-winning educationalist and an active research practitioner. She was a headteacher for more than 20 years in a school rated as 'Outstanding' by Ofsted
- **Mutlu Cukurova** is a Professor in Digital Technologies in Education at UCL Knowledge Lab, University College London



AI and you: what AI am I using already?

A good place to start in our discussion on the understanding of AI is to consider what AI you're using already in your daily life and workplace

- Many people use **speech-to-text** when they dictate a note on their mobile phone. The software that turns the **sound** made by their voice into the **words and spaces** that appear in the note is a **form of AI**
- Similarly, you might be using a **voice-activated personal assistant** in your home or on your phone. **Siri, Alexa, and Google Home** are all examples of this kind of device. AI analyses the **sounds** that come in through the microphone, **interprets the meaning** of these sounds, **constructs a response**, and **expresses the response** as spoken words
- There are many, many ways in which AI is being used by billions of people across the world. From **Google**

searches to online shopping and phone apps that help you **navigate**, AI is being used all the time, **and it is already being used in schools**

- There are **adaptive platforms** that help students on an individual basis through an AI that adjusts the **tasks** the student is asked to complete, and the amount of **help** they are given, for instance
- When anybody decides to spend **money** on AI they should understand **what the AI is doing** and **what the AI can do**
- This does not mean that they need to understand how to build an AI system or to write computer code, it just means that they need a **general understanding** of what is happening inside the **"black box"** of AI
- What are the **educational outcomes** we hope to achieve for our students and school with the help of AI?

Explanations, definitions and some history

Good Old-Fashioned AI

- In 1964, a system called **ELIZA**, a computer programme that played the role of a psychotherapist, was devised
- A potential patient was asked to type in their symptoms and ELIZA searched for **keywords**, and returned stock phrases to progress the conversation
- This approach was called **production rule-based pattern matching**, and although ELIZA's operation sounds primitive, several systems evolved from this approach became sophisticated enough to accomplish **advanced activities**, such as diagnosis and treatment recommendations from a set of symptoms
- The pinnacle of this pattern-matching approach was IBM's **Deep Blue**, a computer system that beat Grandmaster Gary Kasparov in several games of **chess** in 1997. It did this by analysing its gigantic **library** of possible moves that it could make, all of which had been **preprogrammed** by its development team
- This need to have an **exhaustive** amount of information preprogrammed is precisely the problem with what is known as **Good Old-Fashioned AI (GOFAI)**
- In chess, there are **thousands** of ways a game could look just **two moves** ahead. If you need to predict what the board looks like **twenty moves** ahead, the number of possible configurations stretches into the **quadrillions**
- There is a severe **limit** to the intelligence this style of AI can achieve. Once the knowledge is written into the computer program code, the system cannot be updated without going back and **changing the code**. No matter how many disease cases they diagnosed, or gas pipe fractures they identified, or games of chess they played, **GOFAI systems couldn't improve**



Machine learning and algorithms

- The approach that many **modern** AI systems use, however, is called **machine learning** and most of the AI that we use daily uses machine learning to produce its **'intelligent' behaviour**
- The **instructions** within a machine learning AI system, sometimes referred to as the **algorithm**, need to be trained
- In the same way that humans are 'trained' to recognise **similarities** and **differences** as we grow up and get more experienced, AI algorithms can be trained
- Preparing an algorithm to start to learn requires that the **data** fed into the machine learning system is correctly **labelled**
- When it comes to human learning, you probably learned concepts or the names of objects from people around you when you were young
- Without **humans** spending time correctly labelling things, many machine learning algorithms can't learn at all, so the **point to note** is that to **make a machine behave intelligently**, a lot of **human intelligence** is required
- Unlike Good Old-Fashioned AI, once a machine learning system has been trained to a level that its developers are confident is **accurate** enough to be used in the real world, **the system continues to learn** and crucially, **it improves**

Explanations, definitions and some history

Transparency and the Black Box

- Now you might think with regard to GOFAI, why call an AI that **cannot learn** artificially intelligent? The thing is, GOFAI comes with some significant **advantages**
- GOFAI creates a **trail of decision-making points** as its rules are fired. Therefore, any decision that a GOFAI system makes can be **explained**. This makes GOFAI systems highly **transparent** to outside viewing
- Machine learning AI, on the other hand, has **no rules**. It can therefore be extremely hard to know precisely **why** a machine learning system has made any particular decision
- Machine learning AI systems are what we call **'black box' systems**. There is no transparency available to show us what the algorithm in the machine learning AI system has done or why it has reached a particular **decision**
- Machine learning is fast, and it learns, and has many advantages over GOFAI. However, the disadvantage of not being able to provide an **explanation** for its decisions represents a significant problem, **particularly for education and training activities**, where it's really important to be able to **explain**, and often **justify**, why a particular decision has been made
- In an educational setting, it would be an absolute disaster if you couldn't justify or explain why certain actions were taken!



Data and AI

- One of the other **challenges** that most machine learning AI faces is the need for **enormous amounts of data** from which the AI can learn
- As an example, let's take an essay grading machine learning AI system. To grade essays **accurately** a machine learning AI would need to have processed **millions of essays** across the **full range** of possible grades. Do we have millions of examples of graded essays that cover the full range of possible marks? Are they in a **digital format** that can be **labelled** and made accessible to the machine learning AI? We may be able to collate sufficient examples, but it isn't easy! The hefty **data requirements** of machine learning AIs are a **key restriction** on their application
- So understanding the importance of data is key to engaging with AI. Think about what data you have in your **educational setting**
- This could be data about **individuals**, such as how they **perform** academically. Or perhaps it's data about how those individuals are **feeling**, whether they are anxious, or whether they are feeling confident
- There are many sorts of data available in any organisation, and quite often, some of the most **obvious** kinds of data are not really thought about when we ask the question: what data is **available**?
- For example, data about the **temperature** of a classroom, or about the **time** it takes people to get from one part of the building to another, or data about **light levels** in each classroom, or about which pupil regularly **sits next to** which other pupil
- We appreciate that teachers are **time-poor** and thinking about **data sources** may not seem like a good use of any time they do have, but the truth is that it is a good use of time
- In particular, if you are a **school leader** with many competing demands on your time, it is easy to overlook the value of data. We know that the very fabric of the building and all its **resources** are important assets in supporting the **delivery of learning**
- Schools have **inventories, logbooks, and financial data** that document the **purchase** of everything from **PE equipment** and **technology** to the replacement of **carpets** and even the number of **chairs** that are ordered. Schools are a treasure trove of underutilised data
- Dealing with issues as they arise can be **costly** and other budgets can suffer as money is pulled from one source to support another. Therefore, schools need to really examine **all the data** they have, as often the **solution** to many of the logistical nightmares schools have can be found in the data they hold

What AI can do in educational settings

The ETHICAL AI Readiness Framework has been developed to prepare an organisation to leverage the transformational power of AI

When it comes to engaging with AI in educational settings, the authors of the book this Byte-Sized EdTech Research is based on have developed the **ETHICAL AI Readiness framework**, a 7-step process for getting an organisation ready to leverage the transformational power of AI.

In the first part of this document there was a small history lesson and an exploration of AI - an education on the subject.

In the second part, the question is raised: **what can AI do for me and my school?**

To answer that, you must be introduced to the the ETHICAL AI Readiness framework, and must ask yourself what challenges you face in your educational setting, and if they are something AI can help you address.

The 7-Step ETHICAL AI Readiness Framework

STEP 1 - EDUCATE, ENTHUSE, EXCITE

STEP 2 - TAILOR & HONE

STEP 3 - IDENTIFY

STEP 4 - COLLECT

STEP 5 - APPLY

STEP 6 - LEARN

STEP 7 - ITERATE



Exploring the steps

STEP 1

E: Educate, Enthuse, Excite

The AI Readiness Framework

Each step must be carried out with rigorous ethics in mind

STEP 1:

The **first step** is to involve your organisation's whole team in **learning about AI**. What it is, what it **can** and **can't** do, and how it might help in your **educational setting**. Until now, teachers have been in a position similar to the majority of the general public. AI was a "**too busy to bother**" area that they might not have **understood** or particularly **trusted**, and given competing priorities, did not feel great pressure to understand. But with educational technology being thrust front and centre during the pandemic, there has been a **shift**. AI is now increasingly seen as a **valuable tool** for teaching and learning, and a critical component of the knowledge people will need to **flourish**

STEP 2

TH: Tailor & Hone

STEP 2:

The **second step** is to focus your thinking around a particular **challenge** your organisation faces, and consider whether it is even something AI can **address**. 10 key **prompts** exist in the framework to help you deep dive into your challenge, and will work to filter out **what can and can't be done** and how AI might help

STEP 3

I: Identify

STEP 3:

The **third step** comes into play once you've decided which challenge you're going to **tackle**. You and your colleagues must think about what **data** you have to hand, and what state it's in. It's likely your current data is spread **all over** your organisation, and you might not immediately see the **wealth** you're sitting on, so spending time **identifying** it, and making it **fit for purpose**, will reward you **tenfold** in the long run

STEP 4

C: Collect

STEP 4:

The **fourth step** is to begin to collect **new data** as it pertains to your challenge. This can involve **data capture methods** such as **surveys** and **interviews**, but it must be done **ethically**, with consideration for the people and sensitivities involved, as you must ensure **bias** does not creep into the dataset that will **skew your results** for the entire process

STEP 5

A: Apply

STEP 5:

The **fifth step** is to apply your **AI techniques** to the data and start to see what **results** emerge. Although it seems like this would be the climactic part of the process, only 20% of your time will be spent doing this, with the other 80% spent **identifying, cleaning, and collecting** all that data that powers the AI!

STEP 6

L: Learn

STEP 6:

The **sixth step** is about seeing the results of your AI applied to the data from the challenge, and **learning** from them. This is the most valuable step, as **findings** from the process will help not only shape how an **approach or solution** is created for the challenge, but will help you **understand your challenge** in a whole new way

STEP 7

Iterate

STEP 7:

The **seventh and final step** (which doesn't have a letter in the ETHICAL acronym) is about looking at the findings you've just received, and **going back to step 2 again** to check from the ground up that your **challenge** and your **AI** are as specific and informative as they can be. Remember that **AI alone will rarely yield a solution** – far more likely it will be that **AI combined with human intelligence** will have to work together to achieve a **solution**

The 7 steps in context

Step 1 - Educate, Enthuse, Excite

- A brief **history and exploration** of AI and some of its terms can be found in this document in the previous sections, but it is important to reiterate that the **first step** of the 7-step AI Readiness process is about **educating, enthusing, and exciting your team and colleagues** so that you can view yourselves through a 'data and AI lens'
- You will develop an '**AI mindset**' that allows you to view the challenges in your educational setting as those which may be solvable using AI. That allows you to see your **rich, complex data** as not just siloed, unconnected, impenetrable repositories of spotty information, but connective tissue

that unites the commonalities at school, such as issues around **attendance, attainment gaps, budgets, behavioural interventions, essay grading, homework, recruitment and more**

- An AI mindset allows you to be open to the possibility that actually, if your data was studied, it might reveal something unexpected that challenged your preconceptions about what otherwise seemed like an **obvious dilemma** at school that you just hadn't got around to **investigating**
- **Key Takeaway:**
 - Talk to your colleagues about **data**. AI is often a nebulous term with broad connotations that either **scares** or is **too vague** to be of meaning to people, but **collecting and connecting** all that disparate **data** in your school could help you and your colleagues immeasurably in the long run



- A key aspect of the AI Readiness approach is to help you focus your thinking on a thorny **challenge** you are currently facing as a teacher, headteacher, or possibly a school governor or trustee
- Maybe the challenges that you face are **systemic and process-based**. Or perhaps they are rooted in an attempt to shift your school from a traditional **pedagogic approach** to an **enquiry- or project-based pedagogy**
- Maybe you're:
 - Trying to **recruit, train or retain** the best staff
 - Analysing **attainment gaps**
 - Concerned about **bullying**
 - Trying to address the **gender gap** in maths
 - Understanding **learning analytics**
 - Worried about pupil **attendance**
 - Unsure as to whether your **marking and feedback** engages students or actually **helps them learn**

Step 2 - Tailor & Hone

- The AI Readiness Framework uses **ten key prompts** to help teachers and heads focus on one particular challenge that might be **addressed** and **better understood** by the application of AI. In the book this Byte-Sized is based on, you can find these prompts and the scoring metrics to help prioritise them, which will help you decide on **what to do next**
- List your **assumptions** during the exercise. Assumptions can be hard to make **explicit**, as they're often **unwritten best guesses** that have never been formalised, but they'll nevertheless shape the way in which a potential solution starts to **emerge**
- **Key Takeaway:**
 - Your head might be swimming with all the different issues you can see in your school, but performing an exercise to identify just what's **possible**, and how much of an **appetite** you and your colleagues have for the tackling of the challenge, will help ground your **expectations**, and direct your **approach**

The 7 steps in context

Step 3 - Identify

- In education and training, **data** is everywhere. You might have data about the **physical learning environment, the virtual learning environment, the curriculum, the pedagogy, the use of resources**, and much more besides
- In addition, the **connections** that exist **between** these things are also a form of data, as are the connections that exist between these things and **the people who are learning**
- Ask yourself:
 - Can I learn about the sort of data I should collect for my challenge from **existing research** on the topic?
 - What relevant data can I **currently access**?

- Data can be **unimodal** or **multimodal**, **quantitative** or **qualitative**, **structured** or **unstructured**
- It is also important to avoid the '**streetlight effect**' – searching for data under an illuminated spot because that's the only area in which you have **visibility**, rather than searching in the surrounding shade, which happens to be a much larger area
- **Key Takeaway:**
 - There is an understandable **reticence** about **data collection within education**: a worry that people who should not be able to access the data that's been collected will end up **seeing it**, or that it will be **misused**. It is therefore extremely important that **ethics** is at the forefront of our thinking when data collection and collation are being considered



- It is not always the best idea to select data sources that are **easiest** to access. Many times, it is worth going to a little more trouble to access data sources that are of the greatest **relevance** to our challenge
- Once we have identified works of relevance and we have identified **relevant data sources**, the next step is to **synthesise** all this data and information together. And don't forget, it is not just the data that you yourself might have collected or that from others in your organisation, there are sources out there that are **publicly available** and that can contribute to your understanding
- A few **initial questions** that need to be addressed for new data collection could be:
 - Who is going to have **responsibility** for collecting the data? Perhaps it will be a course or module leader, or a class teacher, a head of the department, or a teaching and learning policy lead
 - Timeframes: **when** will the data be collected? Today, next week, next month, next year?
 - Over what **period of time** will the data collection happen?
- And it is **important to consider** that this data collection could be occurring whilst teachers might be trying to keep up with their **schedules**

Step 4 - Collect

- Data can be collected by some common means, such as:
 - **Surveys**
 - **Interviews**
- But there is also **multimodal data**, such as video-enabled platforms, which can allow **analysis** and **reflection** of language used in classroom organisation or the addressing of **misconceptions**, or the style of **scaffolding** provided to individual students, or student-to-teacher **conversation**
- **Key Takeaway:**
 - Data collection needs to be designed carefully and must **complement** that data which is already available. **Thoroughly examining your challenge** in the earlier steps should allow you to frame exactly what data you **do and don't want**, so that you're not wasting your precious time or opening yourself up to **risk**, collecting something that will later turn out to be irrelevant

The 7 steps in context

Step 5 - Apply

- With a number of the examples featured so far in this piece, the kind of machine learning AI that has, as a default, been discussed, has been **supervised** machine learning
- This is the type of machine learning used when you want to train the AI to find something **specific** in the data, such as a child's face, or particular grade of exam script
- However, we **do not always know exactly** what we want the AI to find in data, so we need another type of machine learning that can find patterns in the data: **unsupervised** machine learning
- This is the tool we use in a situation where **we do not know what we are looking for** and so we cannot get the **algorithm** to learn what the target data we want to find looks like
- With **unsupervised** machine learning, the algorithm looks for **patterns**, searching for **similarities** that might surprise us
- Data that might be fed into an unsupervised machine learning algorithm could be:
 - **Log data** from interactions with an online learning platform such as mouse clicks
 - **Audio** from student conversations in breakout rooms in Zoom
 - **Performance data** from tests and exams

- Once machine learning has been applied to your data, and you've identified the **patterns** and **relationships** between data sources, you can use **human intelligence** to relate these patterns to the particulars of your **challenge**
- For a simplified example, in an educational setting, that might mean discovering several different patterns, such as **student profiles**, through your application of machine learning, and then **relating** those profiles to answers from a **student survey**. You might discover:
 - How **confident** each of the different student profiles are when in particular teaching sessions
 - Do some profiles **interact** or **learn more** in peer-to-peer sessions?
 - How do the different profiles respond to **feedback**; is there a correlation between **engagement with feedback** and **increased knowledge retention**?
 - Has any **additional technology** boosted student **confidence** based on those profiles?
- Imagine how useful it might be to have all that **siloe**d, **unconnected data** that you had at the beginning of the whole process now working in concert to show you patterns

- **Eye-tracking data** from live online teaching
- **Survey responses**
- Preparing this data is key and deciding what machine learning AI technique to apply to it will depend on the **context**
- You may not want to use **all** the data you have with just one AI technique anyway. You may end up applying some machine learning, and with the remaining data, using some more **traditional methods** not based in AI
- Human intelligence will need to be used to help clean – **label** – the data as well, in removing **errors**, and **feature engineering**
- Feature engineering is where humans help **describe** patterns so that the AI isn't scrambling about identifying commonalities with the data that make absolutely **no sense**
- **Key Takeaway:**
 - Unpacking what AI can do with the data that you've got will let you make greater sense of both the **data** you've collected, and **the challenge itself**. It may even reveal something in the data you had no idea was there. But it takes a lot of time to **prepare** the data, and if it isn't **clean**, you can get a lot of nonsense information out the other end. With an **increased understanding** of your challenge, you will be in a much better position to select the **AI tools and products** you need to make your life easier in your educational setting

Step 6 - Learn

- you hadn't even thought to look for in, for instance, **budgeting and spending**, or teacher or student **confidence**, **learning behaviours**, **recruitment**, **marking**, or **administration**
- Acting on those findings, and being confident at an **organisational level** that how you are tackling your challenge is **supported by the data**, is a great and rewarding feeling, and moreover, it can help you **organise** your institution in a tighter, more methodical manner, and understand the challenge better, so that you are not falling into **traps**, **constructing misconceptions**, or making mistakes with **similar challenges** in your school
 - **Key Takeaway:**
 - Including **human intelligence** at all stages of the process of leveraging AI, from **articulating your challenge**, to **cleaning** and **organising your data**, will mean that at the end of the AI Readiness exercise, you're able to materially address and improve the **conditions** in which your challenge appears, you're able to understand it in greater **depth**, and actually do something to **solve** it for people

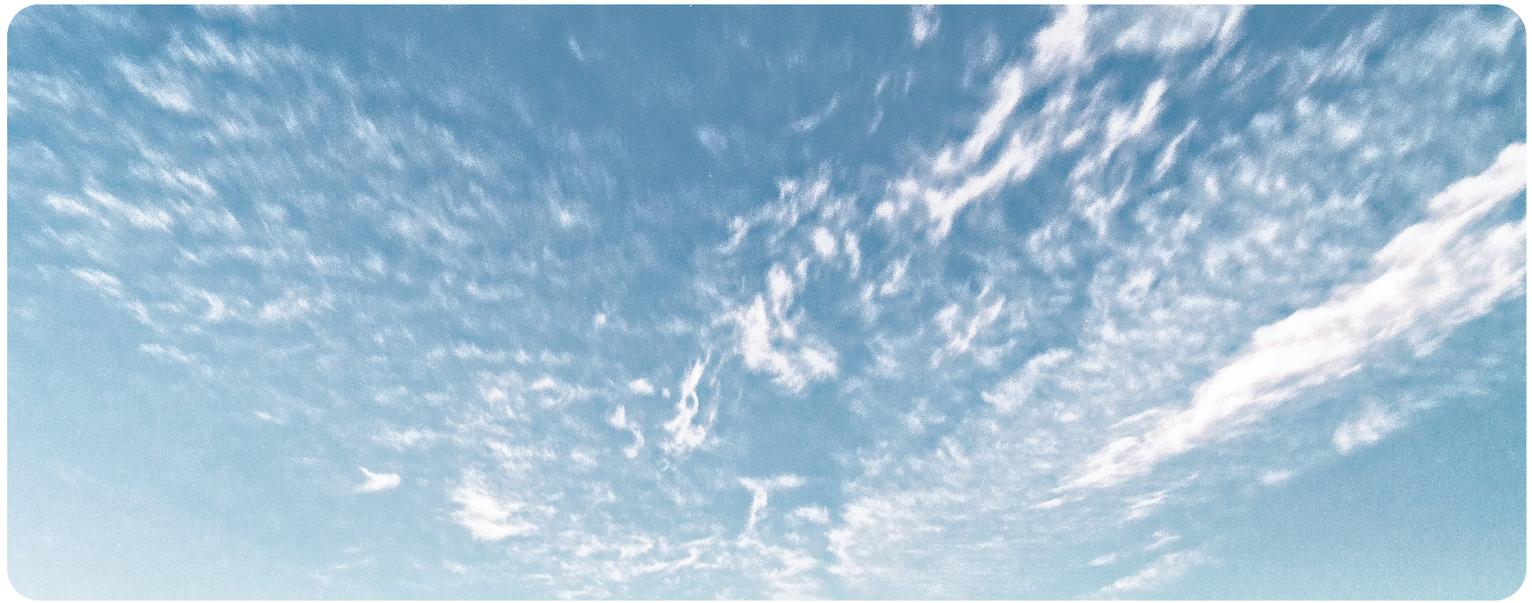
The 7 steps in context

Step 7 - Iterate

- The step of the ETHICAL AI Readiness framework without a letter in the acronym, step 7 is included to keep you and your colleagues **learning**
- You should repeat steps 2-6 as many times as you need to, to increase your confidence that the findings from the application of AI are **correct and effective**
- We can always **learn more** about the problems and challenges that we face as teachers by exploring the relevant data, applying AI thinking and AI tools and AI techniques
- Once you see the problems and challenges that you face in your educational setting through a data and AI lens, then you will be able to make better decisions about how these problems and challenges can be **addressed**

• Key Takeaway:

- Unless you do take your time to probe, prod, deconstruct, and scrutinise the **problem**, it will be **all too easy** for you to be persuaded that an AI product that automatically does the marking for teachers, for example, is the **solution**. AI is extremely accurate and fast. It uses absolutely the latest and most sophisticated deep learning to produce its marks
- However, in this example, if the real problem is about the **quality** of feedback that pupils require, then an AI marking product is not going to help you. Similarly, if the real problem concerns the **types** of activities and assessments that pupils are required to complete, then the AI marker is not going to crack your problem either. And if the real cause of the problem lies in the need for them to be able to **explain** and **justify** their **decisions**, then forget the AI marker, no matter how fast and accurate it is, as it will not be able to help you when it comes to **justifying and explaining** the marks it has **allocated**, let alone why they support a decision to revise **learning goals**



Conclusion

Much of the above text was adapted from AI for School Teachers (Luckin, George, Cukurova, 2022), available to buy from [routledge.com](https://www.routledge.com)

The above was a very brief **summary** of the **7-step ETHICAL AI Readiness Framework** and how it could help tackle some of the **challenges** in your school. Remember, however, that this Byte-Sized EdTech Research piece is based on a whole book, and in that book the authors use a **holistic and iterative organisational framework** that has been developed by the team at **EDUCATE Ventures Research** over several years.

To find out more about how you can benefit from examining your institution through a '**data and AI lens**', and leveraging the transformational power of AI to tackle your challenges, **order your copy** of **AI for School Teachers** at [routledge.com](https://www.routledge.com), and contact the **AI and Data Science Team** at EDUCATE Ventures Research at hello@educateventures.com

Thanks for reading!

- The EDUCATE Ventures Research Team, March 2022