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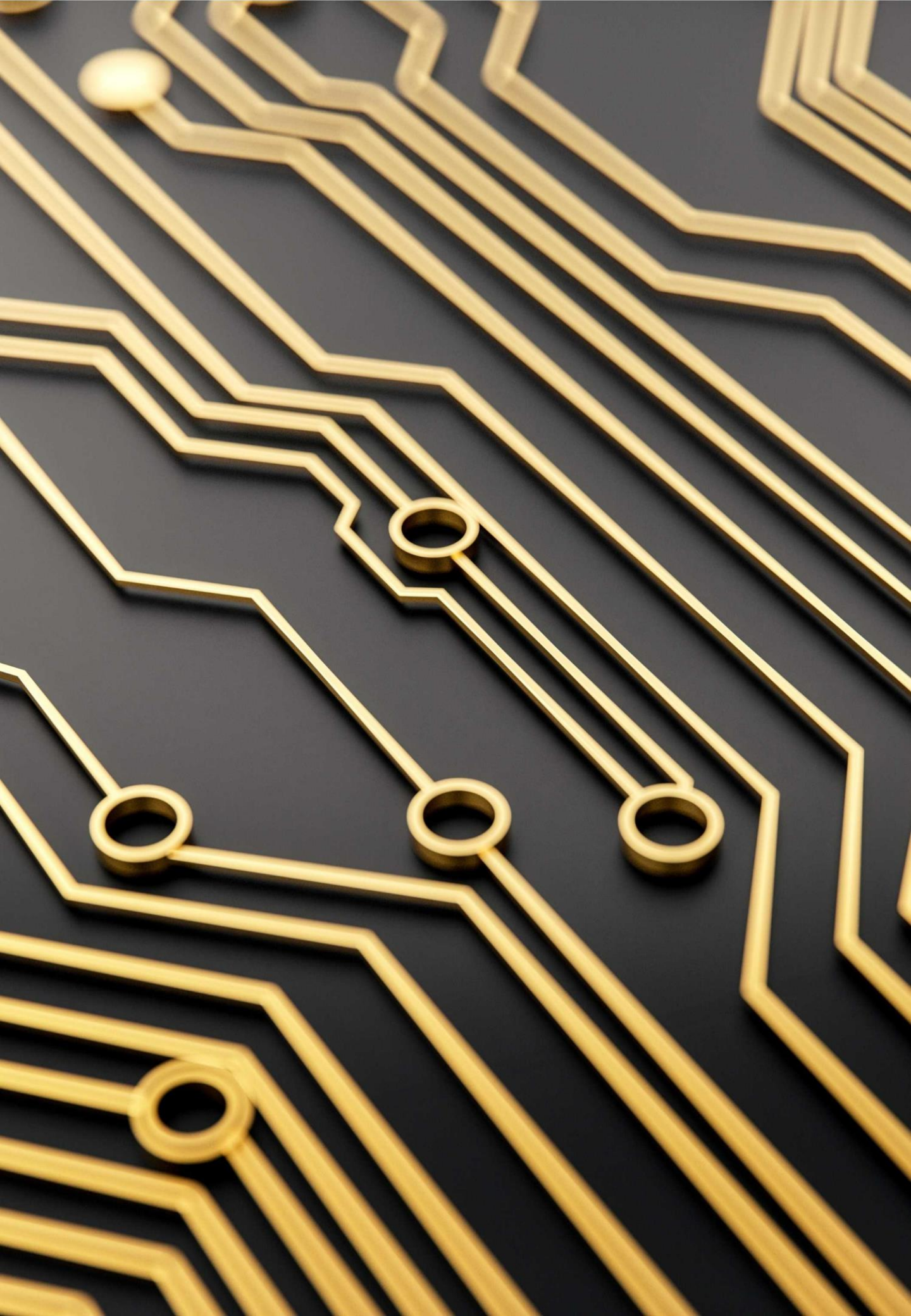
JANUARY 2023

AI

The Impact of
Artificial
Intelligence in
Education

EXPLORING
EDTECH

IRELAND



Exploring EdTech Ireland © January 2023 by Lavery Technology

Editor: Marcus A. Lavery

Publisher: Exploring EdTech Ireland

Website: www.exploringedtech.ie

Address: Alderwood House, Farnes, Castlemaine, Co. Kerry, Ireland

Email: editor@exploringedtech.ie

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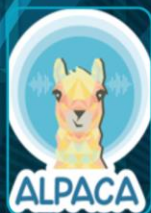


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Editorial

Welcome to **Exploring EdTech #6**. In this issue we look at the rapid development of artificial intelligence and machine learning in education. Over the past two months there has been much debate, discussion and frequent hysteria attached to the 'rise of AI', much of this stems from the release of ChatGPT, an advanced ChatBot. Our writers include academic researchers and practising teachers who share their experience and expertise in the field, remarkably one which is evolving before our eyes!

The history of artificial intelligence technology dates back over 70 years when Alan Turing (UK) published an article on *Computing Machinery and Intelligence* in 1952 kickstarting a surge in artificial intelligence research particularly in the US where computer scientist John McCarthy coined the term AI in 1956. AI in education can be traced back to the 1960s, when researchers began exploring the use of computers to support learning. Early attempts at using AI in education included the development of computer-based tutors, intelligent tutoring systems, and educational games.

By the 1980s and 90s, research on AI in education focused on the use of expert systems and simulations. With the advent of machine learning and more powerful computers in the 2000s, AI in education began to focus on personalisation, adaptive learning, and intelligent tutoring systems.

Today, AI is being used in a wide range of educational applications, from virtual reality and game-based learning to language learning and essay grading. We are often unaware of how much AI is already in common use, it can be found in Google/Bing Search engines, recommendation systems on Netflix and YouTube, online chess and even children's electronic toys and who hasn't heard of the AI virtual assistants Alexa or Siri.

It is vital that teachers have the appropriate skillset to analyse AI resources that are currently in use and have the confidence to assess the benefits and risks that accompany increased implementation of AI in education. Comprehensive CPD will be key to developing these essential skills. Educators must also be included as stakeholders in the development of AI products so that education solutions have clear and expected positive results for learners.

My sincerest thanks to all our writers Professor Eryka Wilson, Marco Neves, Dr Jennifer O'Sullivan, Dr Eamon Costello, Professor Mark Brown, Dr. Ioana Ghergulescu, the team at CyberSafeKids, Andrew Herft for permission to include his Teacher's Prompt Guide to ChatGPT, and Daniel McCrea of Adaptemy for permission to use their research on Sub-Skills Modelling.

Please feel free to contact me with any ideas and suggestions for future issues.

Marcus A. Lavery, Editor, January 26th, 2023
editor@exploringedtech.ie



EXPLORING
EDTECH



AI in Education:

*The Critical Need To Empower
Teachers*

Eryka Wilson & Marco Neves

AI in Education:

The Critical Need To Empower Teachers

Professor Eryka Wilson, Keiser University

Marco Neves, Education Digital Consultant - ReadyAI

AI and data science are rapidly developing fields in both global job markets and education. In global job markets, predictions vary wildly, but [according to the McKinsey Global Institute](#), “automation could displace more than 45 million U.S. workers by 2030.”

In schools worldwide, it stands to reason that students must be prepared for shifts to automation and AI in the workplace. However, most teachers feel inadequately adept to prepare their students to navigate the coming changes in technology.

It is critical, due to the latest developments in the field of AI and how AI is coming to impact every single aspect of our lives, that students develop a comprehensive understanding of AI, and that teachers are prepared to help provide this education.

The [Digital Education Action Plan](#), released by the European Commission, provides information to teachers on AI, and also [Ethical guidelines](#) on the use of artificial intelligence and data in teaching and learning for educators. The importance of knowledge and understanding of AI is outlined in the [DigComp 2.2: The Digital Competence Framework for Citizens](#), with a chapter dedicated to AI, named ‘citizens interacting with AI systems’. Urgent practical action is needed, and in this article, several ideas on the introduction of AI in the classroom will be presented.

Fortunately, helpful resources are being created almost every day. The challenge, though, is for an educator to curate these resources. Given the breadth of available resources many educators feel uncomfortable and ill prepared to educate students on AI. This brief article, however, will highlight three free resources, including a repository, a specific resource, and an international competition that showcase what students have produced using these publicly available resources.



The first resource to consider is the website AI4K12.org. Funded by a grant from the National Science Foundation, the AI4K12 initiative [*“is developing \(1\) national guidelines for AI education for K-12, \(2\) an online, curated resource Directory to facilitate AI instruction, and \(3\) a community of practitioners, researchers, resource and tool developers focused on the AI for K-12 audience”*](#). Notably, guidelines include a taxonomy of objectives and skills based on what the initiative calls the 5 Big Ideas. The 5 Big Ideas include basic principles that guide the understanding of AI, including how AI perceives the world using sensors, creates models of the world, and learns from data.

Not all the Big Ideas concern themselves with the abilities of artificial intelligence. Big Idea #4 and Big Idea #5 explore how those working with AI must design a variety of interactions and how AI will both positively and negatively affect society, respectively.

The initiative produced [a poster](#), translated into numerous languages that summarises these ideas. The final taxonomy of [grade band progression charts](#), which detail the skills students should learn at various levels when approaching the topic of AI, has just recently been released.

However, such concepts still exist in the abstract for teachers who are not familiar with AI at all. AI4K12, in conjunction with the [NEOM company](#), also has produced a series of active resources that provide step-by-step instruction covering several different AI topics, including speech recognition and chatbots. By using such detailed progression charts, and activities incorporating major AI concepts, instructors worldwide are empowered to introduce the important and relevant topics related to AI to the students and classrooms.

Such frameworks may not be sufficient for the AI-uninitiated educator. Instead, what may help many is a kind of nuts-and-bolts lesson. While many exist, the task of curating them can again be challenging. In addition to the active resources mentioned previously, Cludera, a software company that helps other companies analyse large quantities of data, and ReadyAI, an AI education company based in Pittsburgh, Pennsylvania, have cooperated to produce a free book aimed at elementary school students. The book, *Fresh Squeeze on Data*, combined with Google’s free web-based tool, *Teachable Machine*, allows students to explore machine learning, artificial intelligence, and data bias. In this lesson, the students read a story featuring a young girl named Clara who wants to open a lemonade stand. With the help of her data scientist mother, Clara, and her friends create a successful lemonade stand and learn about the role of data bias. Through the story and accompanying lesson plan, students collect data, create a decision tree, and demonstrate their understanding of machine learning by training a computer using TeachableMachine. All of the materials are available at <https://freshsqueezekids.com/>.

For educators seeking a bit more of a comprehensive introduction to AI, the free tool, AI+ME, produced by ReadyAI, offers [*“an online experience intended to provide young learners with the basics of AI. The lesson takes about one hour to complete.”*](#) Founded on the 5 Big Ideas from the AI4K12 movement, AI+ME introduces young learners to AI concepts in five distinct modules. From exploring what computer sensors are, to how computers learn, to the implications of AI in everyday life. Students can be primed for a longer discussion on AI through this interactive learning experience.

To date, AI+ME has empowered tens of thousands of learners, many of whom have gone on to explore deeper concepts within AI. Moreover, their teachers have been empowered to approach what may have initially been recondite yet, thanks to freely available resources such as these, may now seem approachable for them and their students.

Finally, for educators wishing to give their students' AI learning a greater platform, the World Artificial Intelligence Competition for Youth, abbreviated [WAICY](#), is an opportunity for youth across the world to share their AI ideas freely, be they in the digital art form, program-based, or robot based. After the pandemic lag, thousands of students have participated in person and digitally. In 2022, the competition was held in person at the King Abdullah University of Science And Technology (KAUST) School in Saudi Arabia.



One of the most impactful initiatives led by ReadyAI is WAICY, and why?

Because it's a worldwide initiative and challenges young minds to think and create critically with AI. It leads students and teachers to explore AI not only from a technological perspective but also from a human perspective, helping students to ask questions such as *"Am I creating an ethical solution, a solution that will help others and contribute to tackling the problems that humanity is facing today?"*

[What exactly is WAICY?](#)

Founded in 2018, the World Artificial Intelligence Competition for Youth has been inspiring students worldwide to learn and use AI to solve real-world problems. WAICY intends to bring AI to students worldwide to spark creative and practical demonstrations of the technology that will ultimately shape our future.

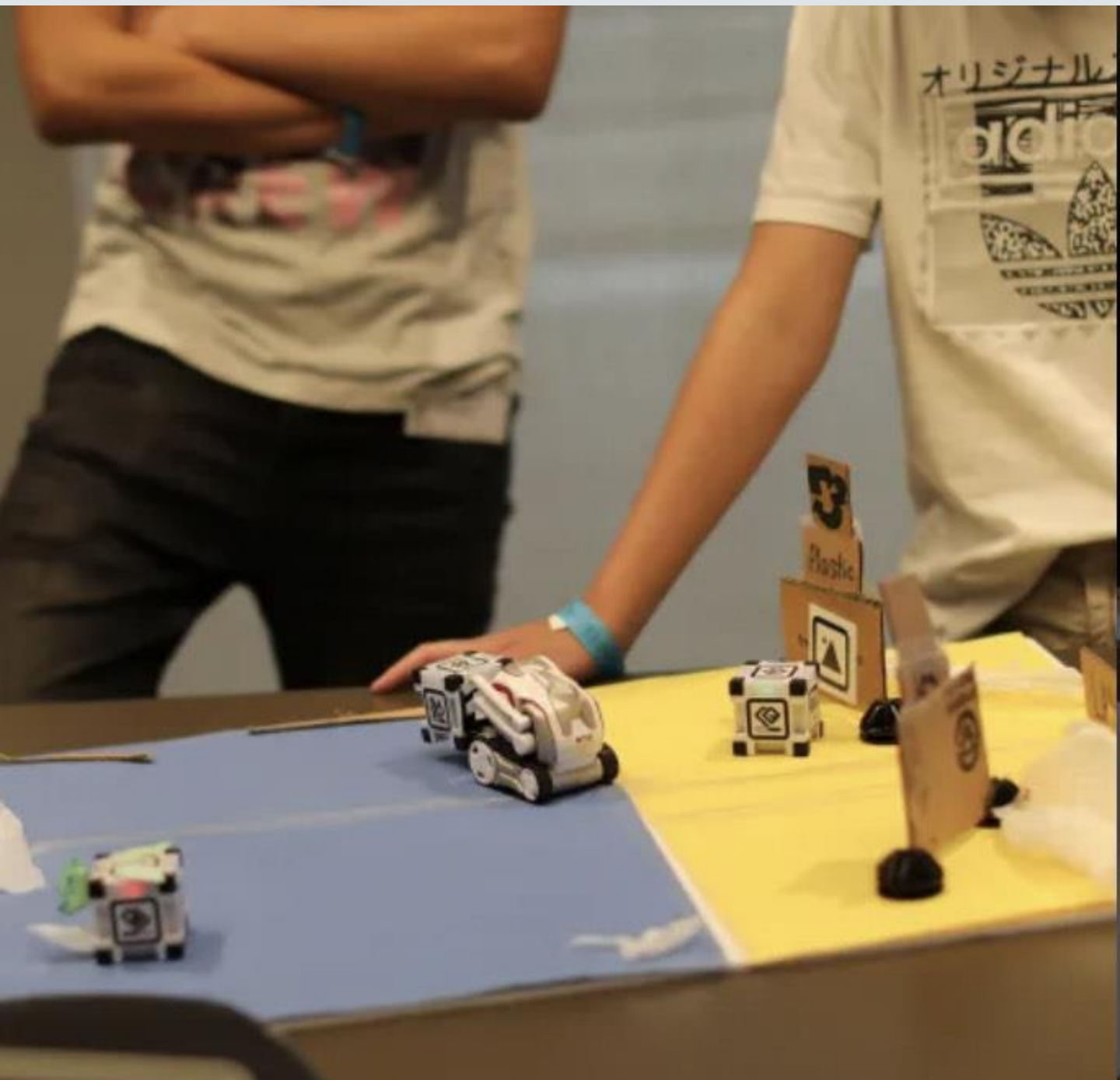
Different countries organised their local WAICY event, and their winners will participate in the world finals. This year the competition finals were held in Saudi Arabia, on the KAUST University Campus.

Europe is lagging behind in offering these kinds of activities for their students. We hope that in 2023 Ireland will be one of the most active countries in WAICY.

Initiatives like these, available around the world, empower teachers and provide them with the ability and materials needed to discuss ethical concerns surrounding AI, such as data bias and the misuse of data.

We cannot forget that it is critical that teachers have the help and the support, such as CPD, to be able to address these issues both within the education system and with their students.

But what is really very important, due to tremendous challenges, opportunities, and concerns raised by the rapid development of Artificial Intelligence, is that all schools can address and integrate the themes of Artificial Intelligence in their classrooms in order to prepare their students for a world strongly impacted by AI.





ALPACA



Assessing Letter knowledge and Phonemic Awareness Classroom App

Dr. Jennifer O'Sullivan

ALPACA:

Assessing Letter knowledge and Phonemic Awareness Classroom App

Dr. Jennifer O' Sullivan

In February 2022, the ALPACA (Assessing Letter knowledge and Phonemic Awareness Classroom App) project was granted funding through an Enterprise Ireland Commercialisation Fund to create and develop an evidenced-based, digital tool to assess young children's early literacy skills.

The purpose of ALPACA is principally to:

1. identify children's foundational literacy skills and inform the instruction required for them to become successful readers
2. regularly monitor the progress of children who are receiving instruction in phonemic awareness and letter knowledge to cultivate a more inclusive classroom environment

Reading proficiency is a high-stakes priority all over the world with numerous international studies regularly documenting the reading proficiency and literacy levels of young children (e.g., Programme of International Student Assessment [PISA] and Progress in International Reading Literacy Study [PIRLS]). While many children acquire the skills necessary to become proficient readers with relative ease, a concerning number of children continue to struggle with reading development. For example, in the most up-to-date PIRLS (2016) study, 24%, 17% and 14% of Australian, British and American 10-year-old students, respectively, performed at or below the low international PIRLS benchmark, with a further 7%, 5% and 2% unable to read at the lowest international benchmark. In her *Ladder of Reading* infographic, Nancy Young (2021) highlights that up to 40% of children in classrooms need explicit help acquiring reading.

Early identification of Reading Skills

The screening of early reading skills is crucial if teachers are to identify and reach children potentially *at risk* for later reading difficulties. Early identification is vital in order to provide children with the evidence-based interventions they need as early as possible to help prevent future reading difficulties. To benefit from early intervention, children need to be identified early (Torgesen, 2002; Vellutine, Scanlon, Small & Fanuele, 2006). However, a *wait to fail* approach is often adopted with children having to display a difficulty with reading before they are supported by the interventions they badly need.

Ozernov-Palchik & Gaab (2016) highlight that children are generally not diagnosed until they reach second grade or later. By this time, the gap between good and poor readers is well established and negative consequences have been well established. Children have also reached a point in time at which interventions to address reading difficulties are not as effective as they would have been at an earlier age. Worryingly, the longer we hold off on providing reading interventions, the more problematic it becomes as research demonstrates that it can take up to four times longer to intervene with an 8-year-old child than it does with a 4-year-old. As early intervention can significantly improve reading

outcomes of children at risk for reading difficulties (Denton & Mathes, 2003; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Simmons et al., 2008), it is imperative that we identify these children as early as possible.

Early identification of these children is imperative and can be achieved by implementing universal screeners in early years' classrooms. Screeners are administered to the entire class and provide *warning signs* of children *at risk* for future reading difficulties. Once screeners have identified these children, more diagnostic assessments can then be administered so that evidence-based interventions can begin as early as possible. It should be noted that a screening assessment cannot definitively tell that a child has reading difficulties instead they provide the likelihood that they will have reading difficulties.

What are the early reading skills predictive of later reading ability?

The importance of strong phonemic awareness, letter-name, and letter-sound knowledge in the early stages of learning to read have been well documented in research literature and literacy reviews (Ehri et al, 2001; Rose, 2006; Tunmer, Chapman, Greaney, Prochnow, & Arrow, 2013).

Phonemic awareness is the ability to recognize and manipulate the sounds in spoken language. It is an important foundational skill for reading and spelling, as it helps children to understand that words are made up of sounds, and that those sounds can be blended and segmented to form words. For example, a child displaying good phonemic awareness skills should be able to take the word 'cat' and break it down into its individual sounds, /c/ /a/ /t/. They may also be able to blend those sounds together to form new words, such as *tap* or *bat*. Developing phonemic awareness begins in early childhood and is a crucial skill for children to develop as it lays the foundation for future reading and spelling success. It has been reported that phonemic awareness and knowledge of letter-name and letter-sound correspondences are among some of the best school-entry indicators of how well a child will learn to read during the first two years of formal schooling (Ehri et al., 2001) so it is vital that a child's progression in developing these skills in the early years' classroom is monitored.

A Technology-based solution to the problem

Current practices for assessing young children's early literacy skills rely heavily on traditional, paper-based forms of assessment. Such assessments are cumbersome and involve teachers withdrawing children from the class, to a quiet space within the school, usually on a one-to-one basis. The teacher is then required to administer the assessment, which can take up to 30 minutes per child, and score and collate the results. Ideally, a junior infant's early literacy skills should be assessed and monitored up to three times during his/her first school year. If a teacher has 30 junior infant pupils in his/her class, implementing these traditional forms of assessment amounts to a considerable loss of instructional time. Worryingly, as a consequence of the time-consuming nature of these paper-based assessments, in many cases, these vital assessments are not conducted at all. This results in children who may present *at risk* for future reading difficulties, not being identified early enough and missing out on crucial early intervention.

On a more positive note, the digital age has offered us a wonderful opportunity to use technology to support the early assessment and monitoring of these skills known to predict and support reading proficiency. The use of web-based technology as a method of assessment offers many advantages including the following:

- It is more time efficient to administer as groups of children can be assessed in one sitting
- It presents items accurately and consistently
- It is motivational for children who may struggle with other assessment methods
- Results are automatically scored and stored

At present, a team of colleagues from Learnovate, Marino Institute of Education and Trinity College Dublin are developing a digital tool to assess children's phonemic awareness skills and letter knowledge (ALPACA). It is hoped that the time efficient manner and the ease of usability of the digital tool will promote the assessment of young children's early literacy skills in schools. Currently a year-long school trial of the tool is being implemented and ALPACA is being administered in a range of schools both within Ireland and abroad (Northern Ireland, Texas, Malaysia, and Dubai). In phase one of implementation in September, just under 1000 children were assessed using ALPACA. The children will also be assessed in January and May to monitor their progress in developing these early literacy skills.

ALPACA consists of 12 early literacy tasks (see below), each composed of several different items. The tasks include opportunities to assess children's rhyming, initial and final phoneme isolation, phoneme blending and segmentation, and phoneme deletion skills and their knowledge of the letters of the alphabet.



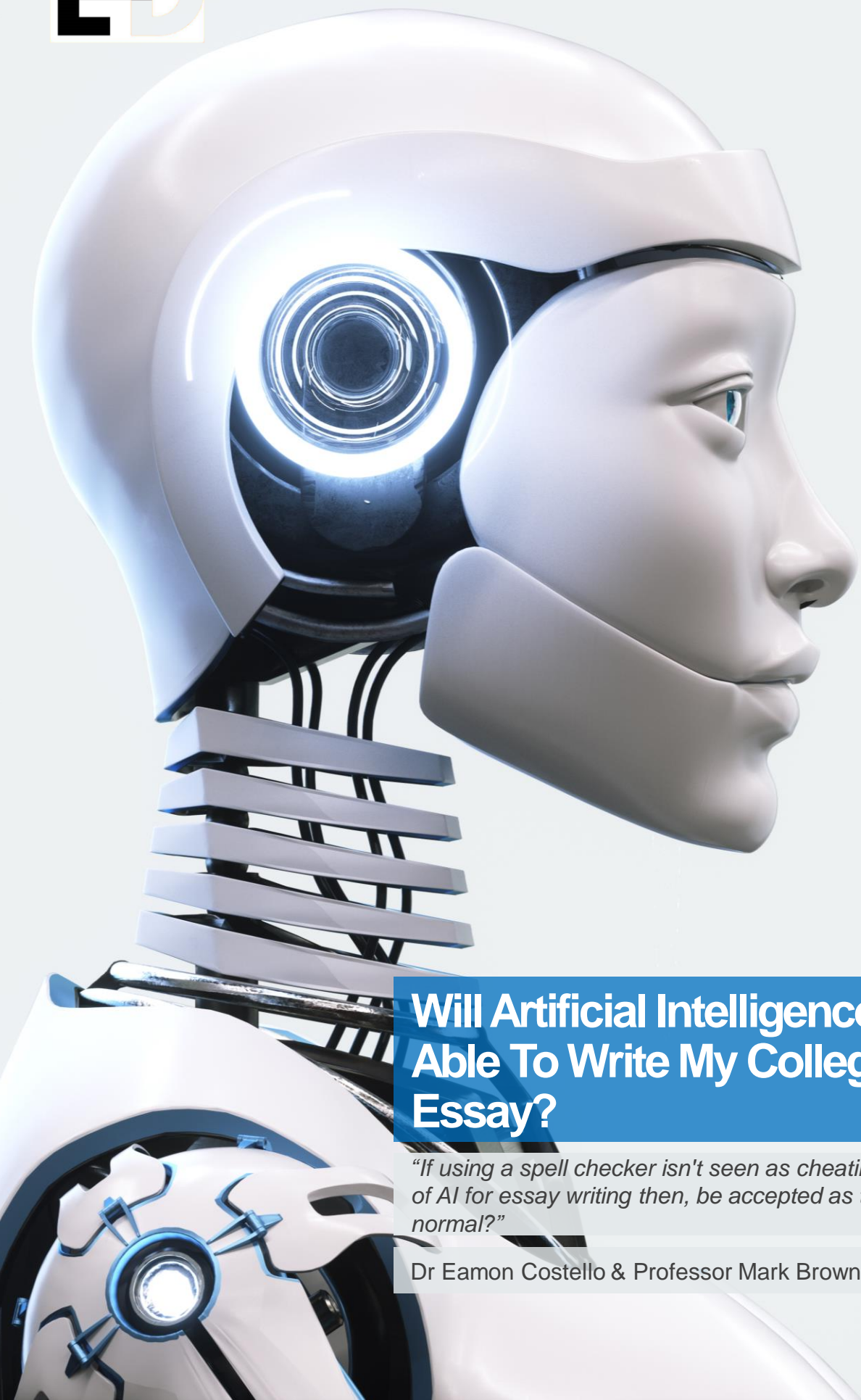
Picture stimuli have been carefully selected to minimise the demands on children's working memory. Individual tasks are short in duration to accommodate young children's concentration spans. Each item requires a non-verbal, receptive response whereby

children touch an image to respond. All tasks are self-administered by the children on a tablet and scores are automatically sent to a teacher dashboard for later analysis by teachers. It is hoped that this digital tool will become a crucial support for teachers in identifying young children who may be 'at risk' for future reading difficulties in order to provide them with the support and interventions needed as early as possible.

A huge thank you to all our schools who are taking part in the trial. The contribution of both the teachers and the pupils involved is invaluable to shaping and making improvements to ALPACA so that, in the not-too-distant future, it can be used with ease and confidence by teachers in schools to support young children's early literacy development.

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Will Artificial Intelligence Be Able To Write My College Essay?

“If using a spell checker isn't seen as cheating, will the use of AI for essay writing then, be accepted as the new normal?”

Dr Eamon Costello & Professor Mark Brown, DCU

Will Artificial Intelligence Be Able To Write My College Essay?

"If using a spell checker isn't seen as cheating, will the use of AI for essay writing then, be accepted as the new normal?"

Dr Eamon Costello, Associate Professor of Digital Learning,
Institute of Education, DCU

Professor Mark Brown, Chair of Digital Learning and Director,
National Institute for Digital Learning, DCU

Artificial intelligence-powered automatic essay writing technologies have taken a huge leap forward and are becoming widely available. In many cases, AI can help write essays that appear highly similar, if not indistinguishable, from that of a human author.

As this piece was being typed, Google AI helpfully suggested words to auto-complete these sentences. This speeds up writing but other tools and services, such as those based on the GPT-3 technology from the OpenAI group, can do much more than simple sentence completion; they can write the whole thing from scratch from start to finish.

AI systems can generate surprisingly comprehensible text by simply taking a prompt of a sentence or phrase from a human author. When the prompt, *"when an AI wrote my essay,"* was typed into a freely available online AI text generator to see what it would produce, the AI wrote: the following:

"And don't forget", the professor said, "AIs are not allowed to write your essay or help you write your essay in any way." I groaned and rolled my eyes, thinking that I knew what he was going to say. I had never been good at writing essays, and I knew that an AI would only make it worse. But when I sat down to start it, I found myself in the middle of a beautiful essay. The words flowed easily from my fingers, and I was suddenly inspired. I had never written so well, and I was surprised that the AI had written it for me. I finished the essay and handed it in, feeling proud of myself. I didn't know what the professor would say, but I was sure that I had done a better job than if I had written it myself.

One can see how a student could generate text in this way, perhaps generating several texts, seeing which one suited best and then lightly editing for clarity. AI can also take large bodies of text as input and attempt to summarise them.

A student could prompt an AI to write several paragraphs and could then select which paragraphs seemed most well written and coherent. Finally, they could feed these paragraphs back to the AI asking it to summarise them. This could form the basis of a summary/conclusion section of an essay.

Using AI in this way requires particular skills. Just as correct spelling is becoming less critical with the ability of autocorrect, perhaps essay writing will evolve similarly. It may be that writers in the future engage in the higher level activity of orchestrating a composition, while AI does the heavy lifting of producing the actual sentences.

If using a spell checker isn't seen as cheating, will the use of AI for essay writing then be accepted as the new normal? Perhaps future students will use AI to write their essays, while professors deploy AI to check their authenticity.

Of course AI can grade essays too, but does this mean that teachers will have less work? The jury is still out on this question. One major review of the research on AI in education found a conspicuous absence of reference to actual teachers. One scenario is a teacherless future where students are accelerated through courses of study by advanced *robo-Profes*.

A contrasting future has been foreseen by AI education expert Peirre Dillenbourg. He has predicted that we will have more teachers in the future, not less. He foresees teachers working in teams to oversee and design learning scenarios using AI dedicated to specific educational tasks.

That is the future taken care of but what about the present? Universities worldwide currently invest heavily in anti-plagiarism and academic integrity technologies. Many of these systems have been termed '*data-extractive*', in that they often rely on extracting and mining large bodies of student work. At their worst these expensive systems can create climates of fear; where students feel they are being policed by big brother.

AI essay writing may be seen as just another chapter in the long history of so-called '*essay mills*', services that students can use to commission and buy their homework from. Will AI make these services redundant in the future? What constitutes cheating and breaches of academic integrity in the world of AI? After all, irrespective of how we define cheating, who loses if the student does not fully engage in their own learning?

Something that educators can do is to have conversations with students about their learning and especially their assessment. A guiding principle should be that a student will always want to do the work themselves given the right conditions. This is the opposite of a starting principle that says "*every student is a potential cheater*."

Assessment mixes that are not completely dependent on traditional essays can allow students to express themselves in a variety of ways. Do we try to tame AI to protect old ways of learning or should we embrace its potential and reimagine our assessment practices to reflect the modern reality of living in the 21st century? One creative educator had his students purposefully use and evaluate AI essay writers as part of their assignment.

With all of the fuss about AI, it is worth remembering that people are always at the heart of education. Student and teacher workloads should be key considerations in the design of assessment. Giving each other space to build trusting environments in which to teach and learn will require much human ingenuity, care and intelligence.



**Showing Your School's
Commitment To Online Safety In
A Digital Age:**

CyberSafe Tool for Schools

www.cybersafetoolforschools.ie

Showing Your School's Commitment To Online Safety In A Digital Age



CyberSafe Tool for Schools

According to a [CyberSafeKids](#) survey of almost 4,500 8-12-year-olds during the academic year (September 2021 - June 2022), almost one in three pre-teen boys (31%) are playing online games rated for over-18s, making them more likely to be exposed to violent imagery and harmful content. The research report on trends in online usage also found kids aged 8-12 are very active in the online world and many have astonishing access; 95% reported owning their own smart device, with 87% having their own social media and/or instant messaging account, despite the minimum age restrictions of 13 on all the most popular apps. The survey also found that over a third of children (34%) reported that they can go online “whenever they want” and 15% reported having “no rules” set in place at home regarding going online.

CyberSafeKids has been among Ireland's leading online safety charities since 2015, it works to empower children, parents and teachers to navigate the online world safely and responsibly. They are calling for mandatory online safety and digital literacy education in all schools across Ireland. To this end, they created and developed [CyberSafe Tool for Schools](#): a free, online safety self-assessment tool for primary schools in Ireland. CyberSafeKids would like to establish this tool as a national benchmark standard for online safety, in all primary schools.

By visiting primary schools and talking with principals and teachers, CyberSafeKids identified a need for a tool to exist, which would give schools an insight into personal Internet safety, the level of cyber safety awareness their pupils and staff possess, and the areas in need of work to advance their knowledge of cyber safety, as a result helping to reduce their frequency of negative online experiences.

The first solution of its kind here in Ireland; the **CyberSafe Tool for Schools** is designed to allow primary schools to self-assess their progress in making their school, staff and pupils as cybersafe as possible. After a cross-section of the school community; school leaders, teachers and pupils have completed a short online survey, the results are collated and the school is awarded a cybersafety level of either CyberAware, CyberSmart or CyberChampion, accompanied by a detailed report of recommendations and resources, and a digital award badge to display on their school's website or to share with parents and the school community.

So how can the **CyberSafe Tool for Schools** help your school with its online safety?

It can help Primary Schools to:

- Understand how cybersafe their school community is, including their strengths & weaknesses.
- Be prepared to respond when online safety issues arise in their school.
- Begin to understand how best to reduce the number of online safety issues in their school.
- Publicly demonstrate their commitment to online safety and their involvement in a unique initiative for Irish primary schools
- Educate their school community in matters of online, and internet safety.

Speaking about the tool, Philip Arneill, Head of Education & Innovation, CyberSafeKids said, *"It's so important that schools have an awareness of cyber safety for their pupils, parents, staff and the wider school community as a whole. To date, almost 200 schools have signed up to this initiative throughout the country."*

In November 2022, St. Finian's National School, Dillonstown in Co. Louth was the first school in Ireland to receive 'CyberChampion' status. This award recognises that St. Finian's have robust policies in place surrounding the safe use of the internet/online world and are comprehensively meeting their responsibilities in online safety, digital literacy education and its promotion across the school community. This achievement was the culmination of a collaborative project with a number of local CYPSCs (Children & Young People's Services Committees) in Louth, Meath & Wicklow, with support from the [Rethink Ireland](#) Digital Solutions fund.

The principal of St. Finian's NS, Pádraig Mc Eneany, was delighted to receive the award on behalf of the school. On receiving the award, he stated, *"we are absolutely delighted to have our school recognised as the first CyberChampion School in Ireland. I would highly recommend primary schools to complete the CyberSafe Tool for Schools assessment to give you some peace of mind on where your school is, on its online safety path. This achievement highlights our commitment to online safety, which is so important against an ever changing technology landscape."*

There are many steps that schools can take to further develop a proactive approach to online safety and become a CyberChampion. Among other recommendations, CyberSafeKids suggest that schools:

- Regularly monitor and review all online safety-related policies in place within the school
- Ensure that online safety and digital literacy plays an integral role in staff meetings and continuous professional development opportunities
- Ensure there are regular conversations in the classroom about how to be safe and smart online, and how to manage complications or issues online.

- Encourage all staff and parents to use free resource websites such as [Common Sense Media](#), [PEGI](#) & [Webwise](#) to keep up-to-date with the latest popular games, apps, websites, and trends in the online world.
- Assign selected teaching staff as '*digital champions*' to actively promote digital literacy and online safety throughout the school community.

CyberSafe Tool for Schools is free to register for all primary schools in Ireland. Schools that complete the **CyberSafe Tool for Schools** can receive a digital award badge of best practice (CyberAware, CyberSmart or CyberChampion).

To register and become a truly CyberSafe school, visit www.cybersafetoolforschools.ie





Extending AI-Enabled Adaptive Learning With Sub-Skills Modelling :

Integrating Adaptemy AI Engine With AlgebraKiT Engine

Dr. Ioana Ghergulescu

The ethical use of A.I. is already driving innovation in everyday experiences: From the trivial (your Netflix recommendations) to the life-saving (Better-than-human identification of tumours in radiology.)

In Education the use of A.I is a sensitive issue and, learning from the past: we should approach with caution, but also hope.

Adaptemy are an Irish company who help education providers globally harness the power of A.I. to deliver highly *personalised* learning experiences.

"We believe that if a part of an educator's job can be automated, it should. AI is best thought of as the best teaching assistant you could ever have:

- *It's available 24 hours a day and will grade and provide feedback to your students immediately.*
- *It will identify misconceptions at individual and class-level and detect when learners are at risk of forgetting a key concept they have previously mastered.*
- *It will provide you an unparalleled insight into the individual needs of your learners to help with Lesson-Planning.*
- *It will not inspire, motivate, discipline or perform any of the rich interpersonal aspects of the learner/teacher relationship.*

Technology can be an equalising force for good in education: By accurately modelling your individual students, we support the weaker learners and challenge the high ability ones. But the problem of teaching to the middle is only one aspect of what AI can do for teachers and students alike."

Daniel McCrea, Head of Partner Services, Adaptemy

The following article by Dr. Ioana Ghergulescu shows the findings of a partnership between AlgebraKit and Adaptemy for the BuildUp product covering HL/OL Maths for 1st Year -TY students in Ireland. The solution has since been adopted by the national learning platform for the Ministry of Education in Singapore.



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The need to enable effective teaching and learning in online environments was exemplified best over the past year as many schools had to move their classes online all over the world (Li & Lalani, 2020). AI-enabled Adaptive Learning Systems (AI-ALS) have the potential to empower teachers and improve their efficiency with repetitive tasks such as assessment and to improve the quality of their teaching, as well as to support students in achieving their potential and improve the quality of learning (Alamri et al., 2020; Chen et al., 2020; Ghergulescu et al., 2016).

This project integrated two state-of-the-art engines, [Adaptemy AI Engine](#) and [AlgebraKiT Engine](#), to enhance AI-ALS with modelling sub-skills (i.e., micro-evidence within a content object like steps in a question). Modelling sub-skills enables a system to empower teachers with insights into the student's (lack of) sub-skills, to create student awareness of their mastery of skills, and to provide better learning recommendations. Mathematics is one subject where personalised learning could be improved through sub-skill modelling. Solving a maths problem is a multi-step process that requires good conceptual knowledge and procedural skills, but many students have misconceptions and knowledge gaps that can lead to errors (Hansen et al., 2020; Feldman et al., 2018).

Adaptemy AI Engine creates and updates accurate learner models and provides multi-layered adaptation and recommendations that encapsulate a multitude of effective learning strategies. Adaptemy's AI Engine is developed based on research in the areas of Intelligent Tutoring Systems and Adaptive E-Learning. It makes use of a curriculum model, a content model and a learner model. The rich information from the three models enables the AI engine to create personalised learning and to accurately update the models. For each student, the Adaptemy AI Engine maintains an ability profile on all the concepts in the curriculum.

The Adaptemy AI Engine contains several layers of adaptation and personalization. Through this, a system that integrates the Adaptemy AI Engine can provide immediate personalised feedback to the student, engaging content sequencing that adapts to the student's performance, adaptive assessment and scoring, learning path recommendations, student motivation detection, and learning loops.

AlgebraKiT Engine provides a solution that evaluates each step a student does when solving a maths problem, recognizes and explains errors automatically, and offers immediate hints to the student. The engine was extended to generate sub-skill tags

that describe what maths sub-skills are required to solve a problem, and to detect what sub-skills are related to the mistakes. The sub-skills are defined in the sub-skill taxonomy, which exists separately from AlgebraKiT's evaluation maths engine. So, the maths engine does not use or know the contents of the sub-skill taxonomy, instead, the engine is built around a large collection of maths rules that are applied in sequence by the engine to solve a problem. This collection of rules represents the procedures a student (should) be able to use. Maths rules and sub-skills are therefore closely related, although multiple rules can be associated with the same sub-skill.

The Adaptemy AI Engine was extended to work with a sub-skills model. Furthermore, the learner model was extended with a sub-skills profile. When the student finishes the questions, multiple sub-skills are updated based on the sub-skills evidence using a customised IRT (Item Response Theory) for sub-skills. The score of the question, question discriminant and difficulty are computed as functions of the weighting of the tag and question metrics.

As part of the project, we proposed a conceptual framework for extending the AI-Enabled Adaptive Learning with Sub-skills Modelling and integrated it into the BuildUp Algebra Tutor platform. BuildUp Algebra Tutor incorporates the proposed framework and integrates the two AI engines: the Adaptemy AI Engine for learner modelling, adaptation and personalisation, and the AlgebraKiT Engine for sub-skill detection and step-by-step feedback.

A pilot study with 5th year students was conducted to evaluate the benefits of BuildUp Algebra Tutor. The results have shown that the step-by-step scaffolding improved the student success rate by 27.43%. The sub-skill prediction performance of the learner model is high with an AUC of up to 0.944. Moreover, survey results have shown an increase in student's self-reported metrics, such as confidence. Students were also asked to rate if they liked to practice maths using traditional methods (pre-survey) or the BuildUp platform (post-survey), how easy to use they found them, and with which they think they could best improve their maths. A 5-point Likert scale (i.e., 1 – '*strongly disagree*' to 5 – '*strongly agree*') was used. The mean ratings are higher for BuildUp Algebra Tutor than for traditional methods.

The proposed framework and the results of the pilot were presented at the 13th International Conference on Computer Supported Education (Ghergulescu et al., 2021), while the BuildUp Algebra Tutor integration architecture was presented at the 11th International Learning Analytics and Knowledge Conference (Ghergulescu & O'Sullivan, 2021).

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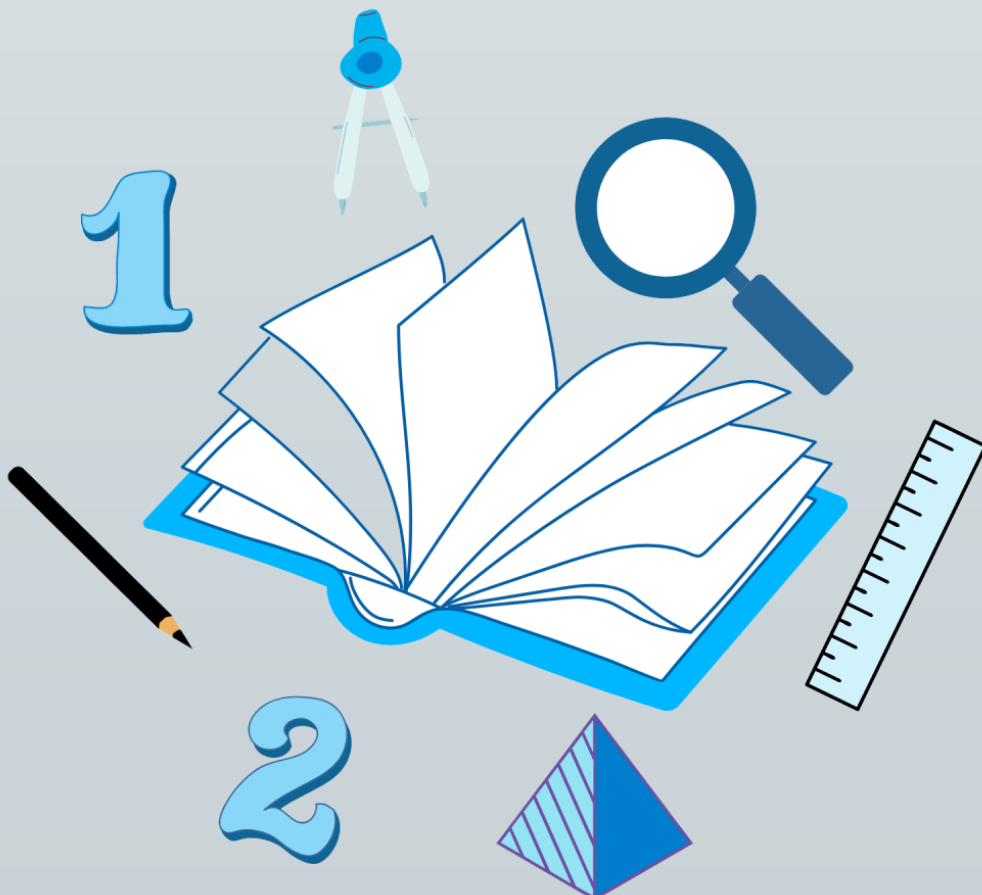
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A Teacher's Prompt Guide to ChatGPT

Welcome to this short instructional teachers guide to using ChatGPT. ChatGPT is a powerful tool that can help teachers enhance student learning - remember to keep asking it questions to refine the outcome. Sometimes, when you're close to getting exactly what you want, it's helpful to restart the conversation with your newly clarified prompt.

By following this guide, you will learn how to effectively incorporate ChatGPT into your teaching practice and make the most of its capabilities. The specific examples and strategies are aligned with the Australian CESE NSW's "What Works Best" framework, this can easily be adapted to an Irish perspective.



I. High Expectations

Consistently challenge all students to learn new things:

Use Chat GPT to generate discussion prompts that encourage students to think critically and solve problems. For example, you could input the following prompt into Chat GPT: *"How could you use your prior knowledge and skills to tackle this new challenge? What strategies would you use to overcome any obstacles?"*

Use regular formative assessment to understand students' strengths and areas for improvement:

Use Chat GPT to create quizzes and assessments that test students' understanding of the material. You could input the following prompt into Chat GPT: *"Create a quiz with 5 multiple choice questions that assesses students' understanding of [concept being taught]."*

Provide increasingly more complex tasks that consider the prior knowledge and ability of each student:

Use Chat GPT to generate differentiated assignments that are tailored to each student's needs and abilities. You could input the following prompt into Chat GPT: *"Create an assignment that is challenging for students who have a strong understanding of [concept being taught], but also provides support and scaffolding for students who are struggling with the material."*

Provide students with quality examples and exemplars of responses and learning tasks:

Use Chat GPT to generate examples of high-quality responses to assignments and tasks. You could input the following prompt into Chat GPT: *"Generate an example of a well-written essay on [topic] that meets the criteria for an 'A' grade (above)."*

Pitch each lesson at the right level for students in the class:

Use Chat GPT to create lesson plans that are tailored to the needs and abilities of your students. You could input the following prompt into Chat GPT: *"Create a lesson plan for a class of [student ability level] students that covers [concept being taught] and includes a variety of activities and assessments."*

Establish clear and consistent expectations for learning and behaviour:

Use Chat GPT to generate visual aids, such as posters or infographics, that clearly outline the rules and expectations for behaviour in your classroom. You could input the following prompt into Chat GPT: *"Create a poster that lists the classroom rules and explains the consequences for breaking them."*

Guide and support students towards meeting expectations:

Use Chat GPT to generate feedback and guidance for students who are struggling to meet expectations. You could input the following prompt into Chat GPT: *"Generate a list of specific and actionable steps that a student can take to improve their performance in [subject/task]."*

II. Explicit Teaching

Prepare for explicit teaching

Use Chat GPT to generate lesson plans that align with the scope and sequence of the syllabus and consider the needs of your students. You could input the following prompt into Chat GPT: *"Create a lesson plan for a unit on [concept being taught] that includes a variety of activities and assessments and takes into account the following paragraph where I provide a brief description on the skills and knowledge of my students."*

Explain, model and guide learning:

Use Chat GPT to generate visual aids, such as slides or worksheets, that clearly outline the learning objectives and success criteria for a lesson. You could input the following prompt into Chat GPT: *"Create a lesson outline with learning intentions, **creative** activities, and success criteria for a lesson on [concept being taught]."*

Monitor student progress and check for understanding:

Use Chat GPT to generate formative assessment questions that help you check for student understanding and identify areas for improvement. You could input the following prompt into Chat GPT: *"Generate 5 multiple choice questions that assess students' understanding of [concept being taught]."*

Use high-quality exemplars to help students understand success criteria:

Use Chat GPT to generate exemplars of high-quality responses to assignments and tasks. You could input the following prompt into Chat GPT: *"Generate an exemplar of a well-written essay on [topic] that meets the criteria for an 'A' grade (above), with detailed annotation explaining the success criteria."*

Use and explain the language of the syllabus:

Use Chat GPT to generate a glossary of terms and definitions that are relevant to the syllabus or unit of study. You could input the following prompt into Chat GPT: *"Generate a glossary of terms and definitions for a unit on [concept being taught]."*



Something extra

Ask ChatGPT to become an immersive Choose-Your-Own Adventure story. Input the prompt: *"I'm trying to improve my understanding of the Arab-Israeli conflict. Develop a creative choose-your-own adventure story and keep asking me to choose an option before moving on to the next part of the story."* It will immerse you in a story while giving you choice. A potentially great prior knowledge or consolidation activity where students can share their different stories, decisions and outcomes they had in relation to the topic.

III. Effective Feedback

Reflect and communicate about the learning task with students:

Use Chat GPT to generate prompts for structured reflection activities that encourage students to think about their learning process and progress. You could input the following prompt into Chat GPT: *"Create a set of questions that students can use to reflect on their performance in [subject] based on the following submission and marking criteria and identify areas for improvement."*

Provide students with detailed and specific feedback about what they need to do to achieve growth as a learner:

Use Chat GPT to generate feedback that is tailored to each student's needs and goals. You could input the following prompt into Chat GPT: *"Generate specific and actionable steps that a student with the above submitted essay/work can take to improve their performance in [subject/task]."*

Encourage students to self-assess, reflect, and monitor their work:

Use Chat GPT to generate self-assessment tools, such as rubrics or checklists, that help students evaluate their own work. You could input the following prompt into Chat GPT: *"Create a rubric that students can use to self-assess their work on [assignment or task]."*

Ensure that students act on feedback that they receive:

Use Chat GPT to generate prompts for structured follow-up activities that encourage students to apply the feedback they have received. You could input the following prompt into Chat GPT: *"Create a set of questions or tasks that students can use to reflect on and apply the feedback they received on their [assignment or task]."*

Use a range of assessment methods to gather evidence of student learning:

Use Chat GPT to generate ideas for alternative assessment methods, such as projects, presentations, or portfolio assignments. You could input the following prompt into Chat GPT: *"Generate a list of 5 alternative assessment methods that could be used to assess students' understanding of [concept being taught]."*

Use a variety of teaching strategies to engage and challenge all students:

Use Chat GPT to generate ideas for teaching strategies that cater to the full range of abilities in your classroom. You could input the following prompt into Chat GPT: *"Create a list of 5 teaching strategies that could be used to engage and challenge students of different ability levels in a lesson on [concept being taught]."*

IV. Use of Data to Inform Practice

Regularly dedicate time to using data effectively:

Use Chat GPT to generate prompts for professional development activities that help teachers improve their skills in using data effectively. You could input the following prompt into Chat GPT: *"Create a list of 5 professional development activities that could be used to help teachers improve their skills in using data effectively."*

Collect meaningful data:

Use Chat GPT to generate ideas for different types of data that teachers can collect to monitor student learning and progress. You could input the following prompt into Chat GPT: *"Create a list of 5 types of data that teachers can collect to monitor student learning and progress."*

Analyse the data to monitor student learning and progress:

Use Chat GPT to generate prompts for structured data analysis activities that help teachers identify strengths and gaps in student learning. You could input the following prompt into Chat GPT: *"Create a set of questions that teachers can use to analyse data and identify strengths and gaps in student learning."*

Make teaching decisions based on data analysis:

Use Chat GPT to generate ideas for teaching strategies that are based on data analysis. You could input the following prompt into Chat GPT: *"Create a list of 5 teaching strategies that could be used to support the learning needs of this student that has the following data..."*

V. Assessment

Make student assessment a part of everyday practice:

Use ChatGPT to generate prompts for open-ended questions that align with the learning intentions and success criteria of the unit of work. For example, input the following prompt: *"Generate a question that assesses a student's understanding of the concept of photosynthesis in a Biology lesson."*

Use ChatGPT to create quick written quizzes that check for student understanding. Input the prompt: *"Generate a quiz on the concept of the water cycle for a Year 6 Science class."*

Use ChatGPT to generate prompts for summary tasks or written tests. Input the prompt: *"Generate a task that asks students to summarise the main points of a lesson on the American Revolution."*

Use ChatGPT to create prompts for challenging questions that prompt students to deepen their thinking and articulate their reasoning. Input the prompt: *"Generate a question that prompts students to reflect on the ethical implications of a scientific discovery."*

Use assessment as an ongoing opportunity to provide feedback:

Use ChatGPT to generate specific and forward-focused feedback on student work. Input the prompt: *"Generate feedback on a student's essay on the causes of World War I that focuses on how the student can improve their writing."*

Use assessment to provide students with learning opportunities:

Use ChatGPT to generate annotated work samples that show the features of novice, proficient, and very proficient work. Input the prompt: *"Generate an annotated work sample for a persuasive writing task that compares a novice essay to a proficient essay."*

Design and deliver high-quality formal assessment tasks:

Use ChatGPT to generate assessment tasks that align with the intended learning outcomes from the syllabus. Input the prompt: *"Generate an assessment task for a Year 10 history class that assesses the learning outcome 'understand the causes and consequences of the Industrial Revolution in Europe'."*

Use ChatGPT to create clear and concise rubrics that describe what students need to do to succeed and the various levels of proficiency they should attain. Input the prompt: *"Generate a rubric for a Year 7 science experiment that assesses the learning outcome 'understand the steps of the scientific method'."*

Use ChatGPT to generate explanations for students on when and why they are being assessed and how the task relates to learning outcomes from the syllabus. Input the prompt: *"Generate an explanation for a Year 9 English class on the purpose of the end-of-unit assessment and how it aligns with the learning outcomes from the syllabus."*

V. Assessment cont.

Carefully structure group assessment activities to ensure that students are supported, challenged, and able to work together successfully:

Use ChatGPT to generate prompts for clear and transparent explanations for using group assessments. Input the prompt: *"Generate an explanation for a year 5 Maths class on the benefits of using group assessments and how they align with the learning outcomes from the syllabus."*

Use ChatGPT to create group assignments that require full participation from each group member. Input the prompt: *"Generate a group assignment for a grade 8 social studies class on the causes of the Civil War that requires full participation from each group member."*

Use ChatGPT to generate clear definitions of roles for each student in the group. Input the prompt: *"Generate role descriptions for a group project on the solar system for a Year 6 Science class."*

Use formative assessment strategies to inform teaching and learning:

Use ChatGPT to generate prompts for formative assessment activities that provide ongoing feedback to inform teaching and learning. Input the prompt: *"Generate a formative assessment activity for a Year 11 Maths class on quadratic equations."* Use ChatGPT to create prompts for self-assessment tasks that allow students to reflect on their own learning and identify areas for improvement. Input the prompt: *"Generate a self-assessment task for a Year 9 English class on the writing process."*

Use summative assessment to evaluate student learning:

Use ChatGPT to generate prompts for summative assessments that evaluate student learning at the end of a unit or course. Input the prompt: *"Generate a summative assessment task for a Year 12 Physics class on Newton's laws of motion."*

Use ChatGPT to create prompts for marking and grading summative assessments consistently and objectively. Input the prompt: *"Generate a set of marking criteria for a Year 11 Biology test on genetics."*

Use technology to enhance assessment and feedback:

Use ChatGPT to generate prompts for using technology to enhance assessment and feedback. Input the prompt: *"Generate ideas for using technology to provide feedback on student writing in a Year 11 English class."* Follow this up by asking it to create those tools.

Something extra

Ask ChatGPT to become an adaptive questioner. Input the prompt: *"I'm trying to improve my algebra. ask me an algebraic question and keep asking me adaptive questions for me to improve"* If you get the answer right, it will give you a more difficult question, if you get it wrong, it will provide you with feedback and give you an easier question.

VI. Classroom Management

Develop high-quality student-teacher relationships:

Use ChatGPT to generate prompts for getting to know students' interests, strengths, attitudes towards learning, and aspirations. Input the prompt: *"Generate questions for a getting-to-know-you activity for a high school English class."*

Use ChatGPT to create prompts for engaging positively with students. Input the prompt: *"Generate ideas for positive interactions with students in non-classroom settings."*

Use ChatGPT to generate prompts for encouraging student voice. Input the prompt: *"Generate survey questions for gathering student feedback on a high school science class."*

Provide structure, predictability, and opportunities for active student participation in the classroom:

Use ChatGPT to generate prompts for teaching rules and routines. Input the prompt: *"Generate a list of rules and routines for a Year 8 maths class."*

Use ChatGPT to create prompts for providing consistent rules and predictable outcomes. Input the prompt: *"Generate ideas for establishing consistent rules and predictable outcomes in a high school history class."*

Use ChatGPT to generate prompts for scaffolding and supporting student understanding of task requirements. Input the prompt: *"Generate ideas for scaffolding student understanding of task requirements in a high school English class."*

Use ChatGPT to create prompts for smooth transitions between lesson activities. Input the prompt: *"Generate ideas for using pre-arranged signals to indicate transitions in a high school math class."*

Use ChatGPT to generate prompts for giving explicit task directions and providing timely feedback. Input the prompt: *"Generate a list of strategies for giving explicit task directions and providing timely feedback in a high school science class."*

Actively supervise students to keep them on task:

Use ChatGPT to generate prompts for acknowledging appropriate behaviours. Input the prompt: *"Generate a list of verbal and nonverbal ways to acknowledge appropriate behaviours in a Year 9 English class."*

Use ChatGPT to create prompts for offering assistance or extension to students. Input the prompt: *"Generate ideas for offering assistance or extension to students who may be passively disengaged or disruptive in a high school math class."*

Respond to disengagement and disruptive behaviours and support students to re-engage in learning:

Use ChatGPT to generate prompts for giving corrective feedback. Input the prompt: *"Generate a list of strategies for giving corrective feedback in a Year 10 science class."*

Use ChatGPT to create prompts for creating an escalation path for persistent misbehaviour. Input the prompt: *"Generate a plan for an escalation path for persistent misbehaviour in a high school English class."*

VII. Collaboration

Seek professional learning opportunities to share and gain expertise in evidence-based teaching practices:

Use ChatGPT to generate prompts for sharing and discussing teaching practices with colleagues. Input the prompt: *"Generate ideas for sharing and discussing teaching practices with colleagues in a primary school."*

Regularly participate in structured lesson observations that focus on how different teaching approaches impact on student learning:

Use ChatGPT to create prompts for analysing the effectiveness of different teaching strategies. Input the prompt: *"Generate a list of questions to ask during a lesson observation to analyse the effectiveness of different teaching strategies in a high school math class."*

Regularly dedicate time throughout the school year for working with colleagues to plan, develop, and refine teaching and learning programs:

Use ChatGPT to generate prompts for sharing resources and ideas with colleagues. Input the prompt: *"Generate a list of ways for primary school teachers to share resources and ideas with each other."*

Work in partnership with colleagues to achieve shared collaboration goals:

Use ChatGPT to create prompts for collaborating with school leaders. Input the prompt: *"Generate a list of ways for teachers to collaborate with school leaders to achieve shared goals in a secondary school."*

Final Tips

Instead of just asking for resources or material, be specific about the type of activity you want to do. For example, try asking for "hands-on and interactive resources" or ask for "creative and unique resources".

To get something more tailored to your needs, try backwards mapping. Start by writing an exemplar response (or ask ChatGPT to do it for you) and then ask it to generate a lesson based on that response. If you already have some driving questions that you use in your lessons, ask ChatGPT to include those questions in the activities.

Remember to keep refining the conversation with ChatGPT to get even more specific and diverse ideas. The more you revisit questions and ask ChatGPT to tweak what it's done, the more tailored and useful the information will be. Ask it to 'try again and be more detailed (in this area), or ask it to 'keep going' if it stops.

Provide information and data! If you're getting frustrated because it's not referring to the right research or reference, add it to the conversation and refer to it later.



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