The Double-Edged Sword of AI Use: Implications for Early Childhood Education

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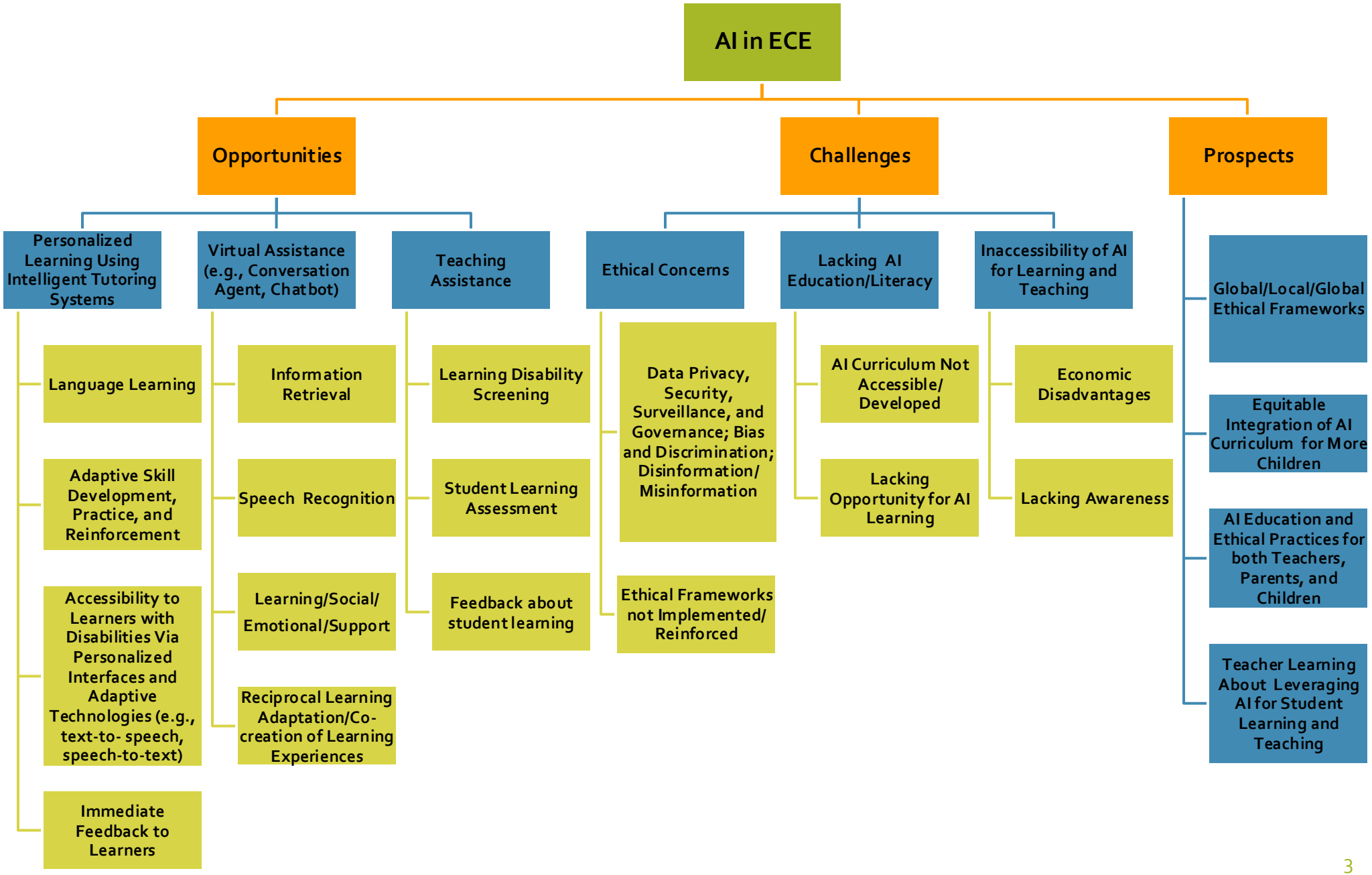
Overview

- AI in Early Childhood Education (ECE): Opportunities, Challenges, and Prospects
- **The Current State of AI Use: The Double-Edged Sword**
  - **Educational Benefits**
  - **Ethical Concerns and Considerations**
- Implications for ECE in the AI Era


AI in ECE
Opportunities
Challenges
Prospects
Personalized Learning Using Intelligent Tutoring Systems
Virtual Assistance (e.g., Conversation Agent, Chatbot)
Teaching Assistance
Ethical Concerns
Lacking AI Education/Literacy
Inaccessibility of AI for Learning and Teaching
Language Learning
Adaptive Skill Development, Practice, and Reinforcement
Accessibility to Learners with Disabilities Via Personalized Interfaces and Adaptive Technologies (e.g., text-to- speech, speech-to-text)
Immediate Feedback to Learners
Information Retrieval
Speech Recognition
Learning/Social/ Emotional/Support
Reciprocal Learning Adaptation/Co-creation of Learning Experiences
Learning Disability Screening
Student Learning Assessment
Feedback about student learning
Data Privacy, Security, Surveillance, and Governance; Bias and Discrimination; Disinformation/ Misinformation
Ethical Frameworks not Implemented/ Reinforced
AI Curriculum Not Accessible/ Developed
Lacking Opportunity for AI Learning
Economic Disadvantages
Lacking Awareness
Global/Local/Global Ethical Frameworks
Equitable Integration of AI Curriculum for More Children
AI Education and Ethical Practices for both Teachers, Parents, and Children
Teacher Learning About Leveraging AI for Student Learning and Teaching

AI is the Wave of the Present and the Future

- AI is the future.
- The future of AI is already here.
- *"If you can imagine it, you can create it. If you can dream it, you can become it."*

-- **William Arthur Ward**

AI in the Modern Home and Beyond

Digital voice/virtual assistants/conversational agents (e.g., Apple's Siri, Amazon's Alexa, Google's Google Assistant)

Image created by Adobe Firefly, October 3, 2024
Prompt: create an image of Amazon's Alexa

Intelligent household appliances (e.g., vacuum cleaner)

Intelligent smart home protection devices (e.g., Ring Video Doorbell)

Robots as assistants in many places (e.g., grocery stores, patrolling malls)

Robotic toys (Ruko 1088 below)

The *What*: The Use of AI in Early Childhood Education (ECE)

- **Early childhood education (ECE)** is defined as the educational programs and services provided to children from birth to age 8/grade 3 (Brillante, Chen et al., 2023; NAEYC, 2022).
- **Artificial intelligence (AI)** refers broadly to AI technologies and AI-powered tools (e.g., adaptive learning platforms, social robots, conversational agents).
- **Focus of this talk:** Benefits and concerns in the use of AI in ECE, which can also be applicable to education in general.

Brillante, P., **Chen, J. J.,** Cuevas, S. et al. (Eds.) (2023). *Casebook: Developmentally appropriate practice in early childhood programs serving children from birth through age 8*. Washington, DC: NAEYC.

National Association for the Education of Young Children. (NAEYC). (2022). *Developmentally appropriate practice in early childhood programs serving children from birth through age 8* (4th ed.). National Association for the Education of Young Children.

The *Why*

- **Children are growing up in an increasingly AI-ubiquitous world.**
- **AI as a catalyst** for educational innovation, and especially for enhancing teaching and student learning.
- **It's a choice with consequences:** Embrace AI or be left behind (and, by extension, leave the children behind).
- It's not a question of **if**, but **when**, and **how**.

The *How*

Chen, J. J., & Delaney, V. (under review, 2024). Leveraging artificial intelligence: Equity and ethical considerations, and policy recommendations for education leaders and teachers.

- **Personalized learning:** AI-powered tools (e.g., virtual assistants, adaptive learning platforms, social robots, conversational agents) can personalize educational and/or emotional content.
- **Interactive learning:** AI-powered tools can offer educational resources to children, such as those with special learning needs.
- **Language learning:** AI-powered tools can assist language learning for all children, especially those who need it.

The *How* (an example)

Chen, J. J., & Perez, C. (2023). Enhancing assessment and personalized learning through artificial intelligence. *Childhood Education*, *99*(6), 72-79. https://doi.org/10.1080/00094056.2023.2282903

Intangible AI Technologies for Predicting/Classifying Children's Conditions: The use of "Amira," an AI tutor system and adaptive learning platform to provide personalized learning experiences for English-Spanish bilingual children and predict their risk for dyslexia.

ChareMone' Perez and I will be presenting a virtual workshop on the use of "Amira" at the Educational Technology Conference at William Paterson University, NJ

(9:50 am – 10:50 am (EST) on Friday, November 15th, 2024).

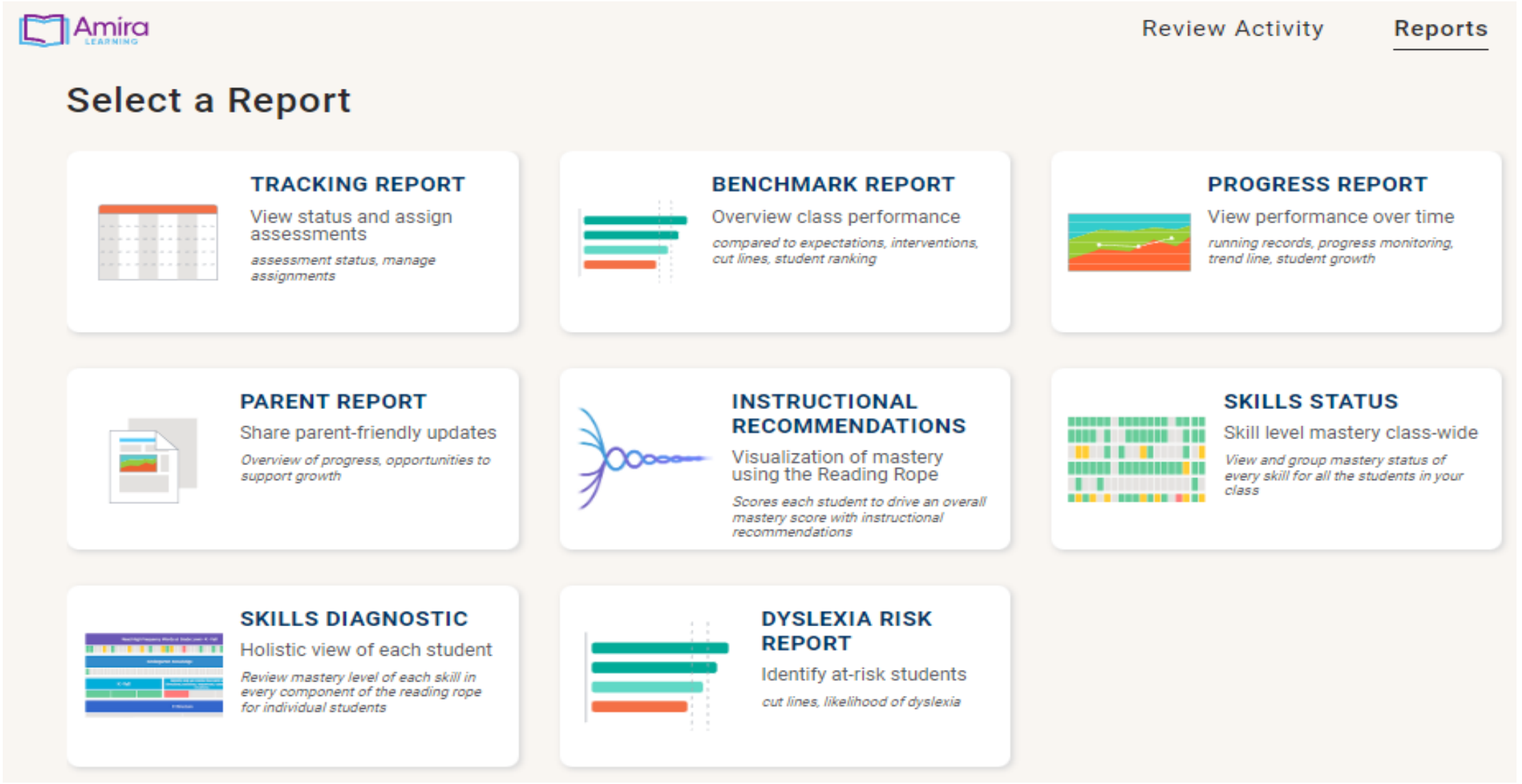


Figure 1: The display of a list of reports that are generated by Amira for the teacher to review and utilize for instructional purposes.

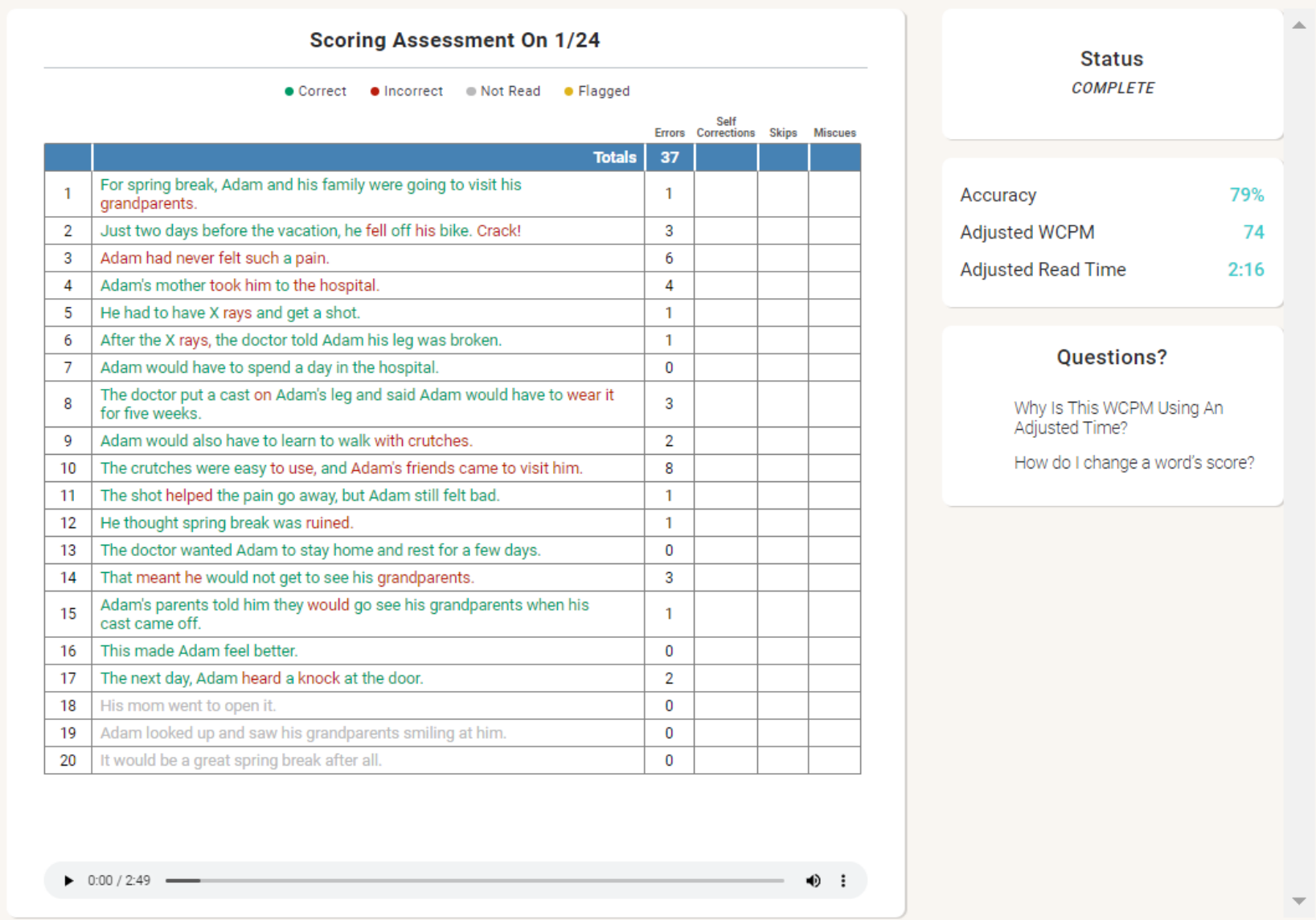


Figure 2: The scoring assessment after the student has completed the independent practice using Amira.

Figure 3: A student's progress report displaying the data that represent his growth over the year.

The *How*: An Example of Integrating Robots in AI Curriculum in ECE

PopBots AI Curriculum in ECE for children ages 4-6

developed by researchers at MIT

The *How* (Three Recommendations)

Delaney, V. D., & **Chen, J. J.** (in press, 2024). Developmental considerations and practical recommendations for parents and early childhood educators in the age of AI. *Policy Brief.* Stanford Graduate School of Education: Public Scholarship Collaborative.

Recommendation #1: Choose AI Tools that are Tangible and Embodied

AI-curious parents should:	AI-curious ECEs should:
1. provide children with AI toys that are designed to resemble living species. Examples are the Ruko 1088 and Follow Me robot toy dog. 2. encourage children to play in ways that develop their prosocial skills with tangible robots, such as asking questions, mimicking human conversations, and giving logical directions.	1. design collaborative tasks between small groups of children and humanoid robots that build communication skills. For instance, children can work together to create movement and/or dance routines for robots, and then enact them together. 2. have children brainstorm and share limitations of robots, calling attention to tasks where humans excel. A teacher may ask children, "What can you do better or more easily than your robot, and how?

Note. ECEs = early childhood educators

Recommendation #2:
Interact with AI tools in Ways that are Synchronous and Adult-Mediated

AI-curious parents should:

1. co-construct interactions with non-embodied AI devices and children.
2. encourage children to follow humanistic social norms when conversing with AI tools, such as waiting until the speaker is finished.
3. talk with children about their misperceptions about AI (e.g., Do you think the AI inside the smart speaker can think and talk like us?).
4. avoid non-embodied AI devices for children under age three.

AI-curious ECEs should:

1. create shared opportunities for dialogue between the teacher, children, and AI devices that follow conversational norms.
2. offer high-level explanations of how AI works (e.g., "The AI in Alexa is searching for an answer to the question we just asked!)
3. discuss with children about their misperceptions about AI to understand the differences between AI and humans (e.g., "The computer is not thinking like we do. It is looking through a lot of information for an answer to our question.").
4. avoid smart speakers in preschool classrooms because they might provide developmentally inappropriate responses to children's questions.

Recommendation #3:
Situate AI in Relationship-Driven Communities of Humans

AI-curious parents should:

1. engage in activities together involving AI, such as playing games against AI agents or using generative AI to develop and test new recipes.
2. intentionally design playful experiences where AI tools will likely fail, such as asking, "What can I get my best friend for her birthday?" and brainstorm why AI tools are generally worse than humans at these tasks.
3. insert more human interaction during personalized learning when possible. For example, parents can ask their children to "teach" them or their sibling to build confidence and mastery of human interaction.

AI-curious ECEs should:

1. use AI curricula in small-group activities where children interact with agency over AI, such as the "Popbots" curriculum.
2. reinforce that children's mastery of a topic means that they do not rely on AI tools, but rather have gained the knowledge and/or skills themselves.
3. adopt personalized learning and generative AI tools in classrooms to build norms with children that prioritize their collaboration and leverage AI as a strategic tool for learning.

The *What, Why, and How* ("Ethical Minefields")

Chen, J. J. (under review, 2024). Navigating AI ethical minefields for children: Potential child-centered and developmentally appropriate solutions for parents and teachers.

AI Ethical Minefield	Potential Solution (child-centered and developmentally appropriate)
Data Privacy, Transparency, and Protection 1. Data collected can be breached and misused, thereby jeopardizing privacy and security. 2. The lack of transparency or minimal transparency in how AI operates can lead to issues, such as misuse, unauthorized access, and improper handling of data collected from children.	• Parents and teachers can provide feedback to tech companies. • Parents and teachers should review data privacy policies from relevant tech companies to ensure that data are anonymized, confidential, and protected. • Parents and teachers should supervise and educate children about potentially harmful or questionable AI applications, tools, and systems and their rights to data privacy and security. • Parents and teachers should only use AI applications, systems, and tools that offer transparency about the process and nature of data collection from children. • Parents and teachers should be educated or informed about national policies and regulations.

AI Ethical Minefield	Potential Solution (child-centered and developmentally appropriate)
Psychological, Social, and Emotional Impact **Overuse of AI:** Excessive use of AI can negatively affect and limit children's ability and time to develop social skills and interactions with other children and adults. **Overreliance on AI:** Overreliance on AI can reduce children's autonomy and agency. **Trust, mistrust, and overly trust:** Children might trust, mistrust, and overly trust AI. **Emotional anthropomorphism of AI:** Children might attribute human-like emotional qualities and intentions to AI.	• Parents and teachers can monitor children's AI use (what AI applications, systems, and/or tools they use, why, how, and for how long). • Parents and teachers can implement child safety monitoring measures, such as setting boundaries about digital screen time and AI use, and restricting access to certain AI systems or AI interactions. • Parents and teachers can educate children about the limitations as well as potential risks and untrustworthy aspects of AI, and about the differences between interacting with AI and with humans.

AI Ethical Minefield	Potential Solution (child-centered and developmentally appropriate)
Safeguarding of Children's Welfare **Bias and fairness:** AI applications, systems, and tools for children must be developmentally appropriate and contain only child-suitable content and language. **Developmental inappropriateness:** A conversational voice assistant might offer developmentally inappropriate suggestions or responses that place children's welfare at risk.	• Parents and teachers can help monitor AI applications, tools, and systems used by children, flag any that are inappropriate, and report them to the companies responsible for their development and deployment. • The "do no harm" principle also applies to the safety and safeguarding of AI use by children. The goal is to prevent harm to child users and mitigate ensuing effects (e.g., misinformation or inappropriate suggestions).

AI Ethical Minefield	Potential Solution (child-centered and developmentally appropriate)
Safety and Security Despite AI's powerful and beneficial capabilities, it can be vulnerable to hacking, data breaches, and unauthorized access, thereby putting child users' safety and security at risk (e.g., information shared, data collected).	Parents and teachers should: • avoid AI applications, systems and tools that lack safety and security measures; • supervise children while they engage with AI; and • educate them on how to detect and report unsafe behaviors, such as the elicitation of sensitive information from them and the experience of harmful interactions with AI.

The *How* (the POWER Framework)

Chen, J. J., & Lin, J. C. (2024). The double-edged sword of artificial intelligence: Wielding the POWER principles to maximize its positive effects and minimize its negative effects. *Contemporary Issues in Early Childhood*, *25*(1) 146–153. https://doi.org/10.1177/14639491231169813

POWER: Purposeful, **O**ptimal, **W**ise, **E**thical, **R**esponsible (not mutually exclusive)

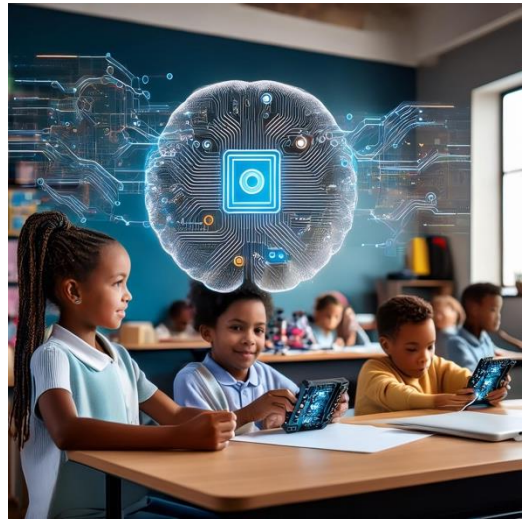
Table 1. The POWER principles: Concepts, questions to consider, and examples of application.

POWER concepts	Sample questions to consider	Examples of application
Purposeful (to act in a manner that demonstrates clear intention, motivation, and understanding of what one wants to achieve, why, and how to achieve it)	• Why do I use this specific AI-powered tool? • What positive outcomes/results can this tool help achieve? • How can I use this tool with the intention of achieving positive outcomes/results?	Under adult supervision when needed, young children may access the aforementioned child-friendly travel chatbot, Octa, which provides travel information and advice about fun places to visit in any city in the world through its automated messaging-based services.
Optimal (to act in a manner that leverages a technology to its full potential in the most efficient and effective ways to achieve the best outcomes/results)	• What can this specific AI-powered tool do best? • What functions does it serve best? • How can I wield the power of this tool to help achieve the most favorable outcomes/results?	Young children can use PopBots (a hands-on AI tool kit and curriculum) to learn basic AI concepts (Williams et al., 2019). Similarly, young children can leverage Zhorai, a conversational agent and curriculum, to understand how machines learn (Lin et al., 2020).

Wise (to act in a manner that demonstrates thoughtful reflection, good reasoning, and sound judgment by considering various factors, such as advantages, disadvantages, and ethical concerns)	• What developmentally appropriate AI-powered tools should I leverage, and why? • What potential benefits and limitations/drawbacks should I consider?	The use of intelligent tutoring systems, based on deep learning methods, can wisely offer children individualized constructive feedback and personalize study plans to track their learning performance, progress, and needs. The personalized nature of such AI-powered tools has been found to enhance student learning and educational equity (Ma et al., 2014; Minn, 2022).
Ethical (to act in a manner that is consistent with a set of moral principles or values, such as honesty, integrity, justice, and equity)	• How can I use AI-powered technologies to assist in achieving desirable outcomes/ results in an ethical manner? • What ethical issues should I consider?	Parents, teachers, and children should receive AI ethics training to better understand how to use AI-powered tools ethically, such as critically examining and using the ideas produced by AI merely as a source of guidance or inspiration for developing one's own.
Responsible (to act in a manner that shows good judgment, such as making decisions and choices with safety and accountability in mind, and focusing on doing good and not harm)	• How can I use AI-powered technologies in developmentally, culturally, and linguistically appropriate manners? • How can I use AI-powered technologies to yield good and not harm?	Under adult supervision when needed, children may use AI-generative tools (e.g., ChatGPT; DALL·E 2, https://openai.com/product/dall-e-2) for learning purposes. However, both adults and children should also learn to be mindful and critical of possible inaccurate, biased, irrelevant, or outdated information, responses, and products provided by these tools.

AI's Images of Children Using AI in the Classroom: What is your image?



Images created by Adobe Firefly, September 30, 2024
Prompt: children using artificial intelligence in the classroom

Implications:
The Roles of Stakeholders

It starts with education:
All stakeholders should be educated about the benefits and concerns about AI use.

Children should:
- Learn about and with AI
- Learn how to teach AI

Educators should:
- Acquire and model AI literacy
- Empower students with an AI education and AI literacy acquisition
- Implement effective AI pedagogy that considers the ethical use of AI

Education leaders and policy makers should:
- Invest in AI use in the classroom
- Support teachers in AI learning and teaching
- Address inequities in AI use (e.g., AI divide)

Implications:

"The Right Time, The Right Place, and the Right People"

Chen, J. J., & Li, H. (2023). *Tian Shi (timing) Di Li (context) Ren He (human capital): A new theoretical framework for analyzing the implementability of imported early childhood practices and making a case for a hybrid model. Journal of Research in Childhood Education, 37(2), 292-309.* https://doi.org/10.1080/02568543.2022.2107588

This three-pronged theoretical framework is derived from Chinese philosophy: (1) *Tian Shi* (timing), (2) *Di Li* (context), and (3) *Ren He* (human capital): colloquially interpreted as "the right people at the right time in the right place doing the right thing."

- ✓ *Tian Shi* (timing): Is this the right time?
- ✓ *Di Li* (context): Is this the right place? Are the conditions of the childcare center, school, or school district optimal?
- ✓ *Ren He* (human capital): Are these the right people? Are the teachers equipped with the appropriate knowledge, skills, and dispositions)?

Thank you for listening!

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