



Generation 3: Turning The Page To Edtech With Real Effect

An Amira White Paper For Educators:
Thought-Leaders & Policy-Makers

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Abstract:

Edtech's impact on student growth has been microscopic to this moment.

This sad fact is the logical, inevitable consequence of edtech's current limitations. Just over the horizon, however, a new generation (Gen 3) of edtech promises to finally deliver game-changing student growth.

This paper describes the ingredients that will define this third wave, delineating the capacity of AI and VR to usher in a new era of **Intelligent Instruction**. The Gen 3 thesis is that edtech apps will climb a ladder of 6 critical capabilities, each step on that evolution enabling a more engaging and efficacious student experience.

Amira, the Intelligent Reading Assistant, is the first Gen 3 edtech to achieve scale. Amira is a case study in the power and potential of Intelligent Instruction. Through the prism of Amira's capabilities, we can discern a future where edtech becomes the teacher's indispensable junior partner, forging tomorrow's classroom.

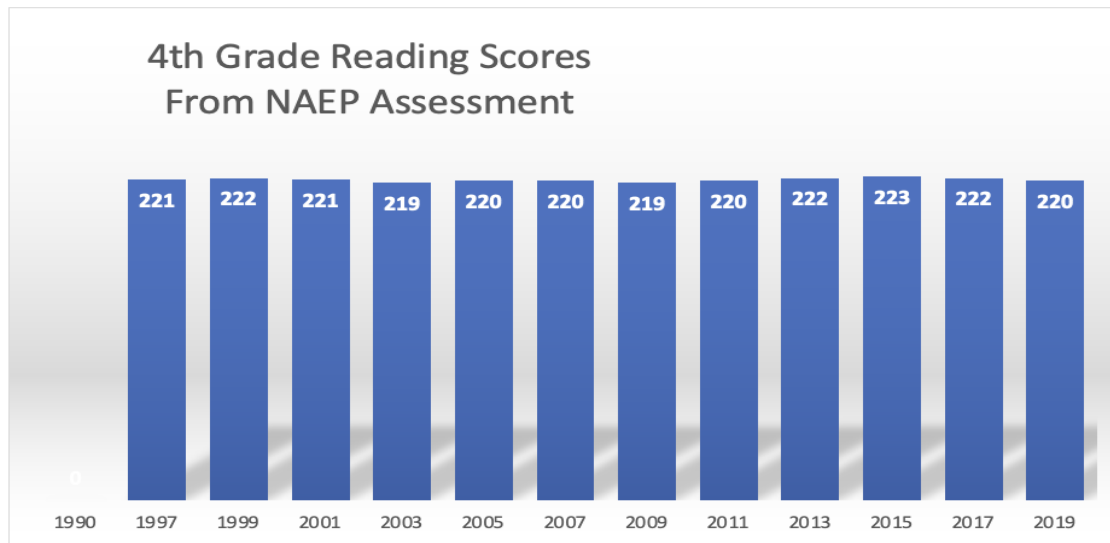
This "co-instruction" partnership between smart tech and smart teachers will turbo-charge student growth & achievement.

Section 2: Edtech Is Ubiquitous, But Ineffective (So Far)

Edtech began creeping into classrooms as the 21st century dawned. Twenty years later, edtech is nearing ubiquity – the student to device ratio is ~1:1, the average District deploys 80+ apps, screen time consumes big chunks of the student day.

Adoption has happened, but is Edtech doing any good?

In the years since the rise of Edtech, test scores have gone absolutely nowhere.



In fact, the evidence for Edtech's impact is as hard to find as polar bear in a snowstorm:

1. Recent McKinsey research tracking test scores around the world found that the optimum time for students to spend on math software was precisely zero. Any time students spent on math apps harmed growth. Reading apps fared little better in McKinsey's analysis. Highest scores came from just 10 minutes per day on early literacy software – usage beyond the nominal crushed progress.
2. Overall, study after study has concluded that edtech is a non-factor in student success. Hattie's seminal research identified 256 interventions with significant evidence of impact. The highest rated intervention related to technology is 57th on the list. Technology's influence on outcomes ranked far below not only Teachers, Students and Parents, but below Peers and Schools.
3. K-12's single most appalling failure is a 27% success rate in getting 3rd graders to reading proficiency. Pause and consider:
More than 2 in 3 kids spend 4 years learning to read and end up non-proficient.
Longitudinal research shows these students will have less prosperous and positive life journeys, earning some 30% less. Children losing the race to early reading

proficiency is not new. But the introduction of early literacy technology into K-3 classrooms has coincided with reading scores falling to new lows.

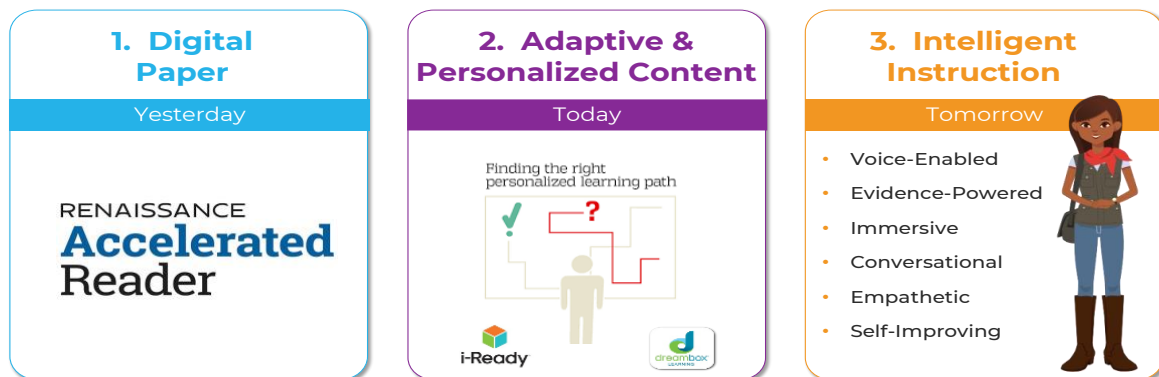
4. The Utah Department Of Education recently conducted an RFP process to approve early literacy software. All widely used software was submitted and reviewed. Not a single program (other than Amira) provided the State with evidence of large effect size.

While this litany of failure is shocking when viewed thru the prism of software's transformative impact on every other aspect of our lives, these dismal results are entirely logical. The truth is that today's edtech is simply not very capable.

Section 3: Anatomy Of Failure

What's at the root of edtech's failure to make a difference? Before we give up on our best hope to transcend decades of static test scores, let's recognize that edtech is closer to being a kindergartner than a high schooler. Edtech is only now transitioning from primitive beginnings (which we'll call Gen 1) to a disappointing adolescence (Gen 2) to a much more promising future (the Third Generation Software we will describe in the next section).

Time For A Third Gen of EdTech



For many years, a typical edtech app was more like a 90's web site than sophisticated software. First generation Edtech = digitized paper. In fact, the Amira team helped build one of the most successful of those primitive solutions – Accelerated Reader. Accelerated Reader (AR) was an exemplar of Edtech's initial wave: spread by word of mouth, beloved by teachers and serving 1 in 2 elementary students at peak usage. But, like other 1st Gen Edtech,

AR was not much more than paper digitized -- a giant collection of hand-crafted paper quizzes turned into software.

Most edtech was initially developed by the same firms who published textbooks and instructional content. Their natural impulse was to see software as simply “digital content”. To a meaningful degree, this content-centric mindset persists to this day.

Starting ~10 years ago, edtech evolved. “Adaptive and Personalized” apps stopped delivering content as though the student was still sequentially turning the pages in a virtual book. Instead, 2nd Gen edtech placed a student on an appropriate “learning pathway”. This was a huge step forward. Yet, distill away the marketing jargon and what remains is a straightforward movement from a pile of content presented serially to a pile of content shuffled around to suit a particular learner. This second wave of edtech currently dominates classrooms, led by exemplars such as iReady, Dreambox and Newsela.

There is nothing “wrong” with either Gen 1 or Gen 2 edtech, any more than there was something wrong with dial-phones in the 80’s or blackberries in the 90’s. However, like voice technology before the Smartphone, today’s edtech is, in a word, stupid.

Try this thought experiment:

- Imagine a teacher who lacked the ability to understand a student when they talked.
- Then, suppose this teacher rigidly followed a simple algorithmic approach to creating lesson plans.
- Our teacher consequently refuses to respond to student questions and is unable to dialog, blindly following a script.
- Make the teacher completely tone-deaf, insensitive to a student’s emotions and incapable of expressing believable empathy.
- Now, assume the teacher is boring, with no sense of humor.
- Finally, render your imaginary teacher a glacially slow learner.

Would we be surprised if our hypothetical teacher failed her students? In fact, we’d be shocked if kids were able to learn from such a limited instructor.

Here’s the thing: today’s edtech, undeniably & precisely, personifies the description above.

Gen 2 software:

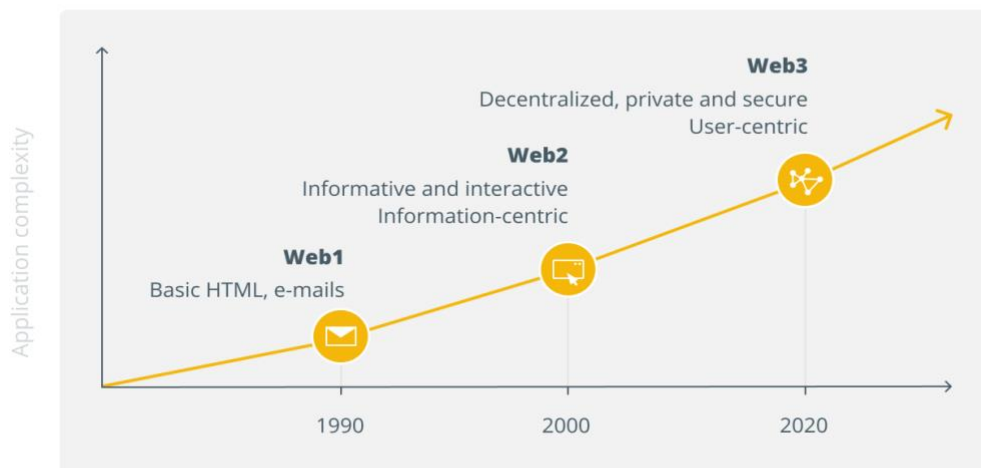
- only communicates via the keyboard (the software can’t listen),
- delivers 2-dimensional text-centric experiences (edtech is tedious), and
- lacks any capacity to converse (the software is super-rigid),
- has no capacity to sense a student’s emotions (apps aren’t convincingly empathetic),
- ⊖ improves at snail’s pace, usually via 1 new feature release a year-

Given these hyper-limitations, Gen 2's inability to deliver effect size is no surprise. Thankfully, innovation is about to sweep these deficiencies into the dustbin.

Section 4: Web3 – Tech's Next Inevitable Revolution

Software is eating the world, per Marc Andreessen. And its hungry for more. Our lives will be reshaped once again by Web3: the new confluence of the block chain, Virtual Reality and Artificial Intelligence. The impact of Web3 tech will, whether we like it or not, dwarf even the impact of the Internet/smart phones (Web1) and social networks (Web2). The Web3/Metaverse hype is gargantuan for a reason – VR software can regenerate reality; AI software will make real-world, real-time decisions powered by evidence; the block chain will deliver secure but anonymous transactions. You don't have to understand these technologies to appreciate their potential. You don't have to like these technologies to realize that they can do some good.

The history of the internet



 | cointelegraph.com

source: 101 Blockchains

Edtech has always and will always evolve in Webtech's wake. The twin engines of emerging innovation shaping Edtech Gen 3 are Virtual Reality (VR) and AI.

Is there any kid who hasn't sat, metaphorically chained to their tiny desk, staring out the window and wishing to be anywhere but locked inside that dreary classroom? Virtual Reality is the magic machine that will free students to explore infinitely varied, realistic, and safe learning worlds. The artificiality of instruction in a concrete pillbox is a big-time reason students tune out and are left behind. Since the prairie schoolhouse, children have been

trapped in the strangest of places to learn: a little room littered with physical barriers, burdened by incredible density. VR is transformative, creating immersive worlds where students can work independently, interact with their classmates or collaborate with kids across the globe. Virtual Reality will also allow for truly multi-sensory experiences. Instead of today's flat 2-d software, students will work in 3-d spaces where touch, movement and direction will make learning come alive. The Metaverse is about to bring magic to the classroom, enabling truly engaging edtech.

AI will put the "Intelligent" in intelligent instruction. Machine learning is the capacity to take a mountain of data and turn it into an algorithm that spits out decisions based on evidence. AI is gradually but steadily gaining ability. Today, AI is adept at image recognition – enabling software to detect tumors and power robots. AI is nearly human-like in speech recognition – resulting in billions of Alexa devices. Machine Learning (aka DeepLearning) is driving breakthroughs everywhere, and the classroom is next.

Edtech will evolve in the wake of Web3 just as it has grown up in the shade of web1 and web2. The difference is that this time, the strengths of Web3 will provide the missing ingredients enabling edtech to finally generate effect size.

Section 5: Intelligent Instruction -- Edtech With Real Effect

Hattie's seminal research provides a fantastic framework for linking effect size levels to what really matters. His findings show that the levers of change with real impact register effect sizes between 1.0 and 1.3. Driving student growth to this degree will require eradicating the gaps that render today's software both stupid and sterile. As these gaps diminish, Gen3 Edtech will earn the moniker "intelligent". Think about this in the context of the phone you carry. "Smartphones" not only rendered dumb phones obsolete, the iPhone plays a profoundly greater role in our life. Similarly, "Intelligent Instruction" will be such a phase shift in competence that tech's role in the classroom will be seismically uplifted.

How can we be sure? The innovations that will power needle-moving gains already exist. To finally help kids with tech, we simply need to marshal and fit their evident power for the instructional purpose.

Voice-Enabled via Speech Recognition

The first step towards Intelligent Instruction is to escape the straight-jacket of the keyboard. Animals generally are voice-centric; human evolution is almost defined by adaptation to spoken language. To really help children learn, software must adapt to the world of speech, instead of requiring students to adapt to the keyboard.

This barrier between students and machines has been daunting but is now essentially historical. There are now 4.2 billion Alexa or Google Assistant devices in use. Following the

advances in adult speech recognition, voice-based edtech is rapidly emerging. While getting speech recognition to work for 5-year-olds is a genuine challenge, enabling tech to step into the nuanced & natural world of spoken language is an essential first step to intelligent instruction.

Evidence-Powered via Machine Learning

A student commits a miscue – how do we know how to help? This is the moment of truth in the instructional process. Great teachers have through long experience and sharpened intuition tremendous feel for the “root cause.” Their chief ability lies not in knowing that the student needs help but in understanding why the student is struggling. That knowledge of the “why” is what makes them teachers.

The AI revolution we are experiencing in our lives is driven by machine learning (ML). For edtech, the promise of Machine Learning is that software will be able to use evidence to make instructional decisions, employing a small fraction of the skill that teachers rely on.

Machine Learning is about accumulating massive quantities of data associated with a decision, and then using that accumulated evidence to make good decisions going forward. Give an ML algorithm mountains of data about tumors, along with expert judgment about which are malignant, and the Machine Learning process will figure out what evidence distinguishes the malign from the benign.

ML is a mature technology, fortifying the web sites and products we rely on every day – Google Search, Amazon shopping, Netflix recommendations. Now, this capacity to use evidence to make good real-time decisions is powering 3rd gen edtech.

Immersive with Web3/VR

Per the earlier discussion, Virtual Reality will let students immerse themselves into 3-dimensional digital worlds. While no new technology ever reveals its full power & potential until mature, immersion will be one of those innovations, like online maps, Google search, twitter, iPhones, eCommerce, and Instagram, that profoundly changes daily life.

Already, Virtual Reality is re-inventing what’s possible in the classroom. Labster enables students to work in a virtual lab, running experiments that would be expensive and potentially unsafe in yesterday’s lab room. Even better, Labster enables a near infinity of experiences, many of which could never be delivered in a physical school.

Gen3 Edtech will rely on virtual reality to fight the artificiality of classroom learning. Students will put the senses of touch, sight & hearing to work, navigate thru fully spatial environments, and interact with virtual “friends”. Freed from the constraints of distance and physical danger, students will forge bonds around the world, interact with ecologies across every continent, build anything and everything. Even time will take on a new

reality, enabling students to explore the past almost as though it were the present. The hermetic, static museum will give way to a virtual time machine.

Immersion is the answer to the engagement problem. VR will put the universe, from quantum-micro to galactic-macro scale, at every student's fingertips.

Conversational with Natural Language Processing

The power of voice, VR and the intelligence of science-powered decision-making are ready to aid children and teachers right now. Apps like Amira, as we'll discuss next, are already putting the new tech of speech recognition and machine learning to work. Gen 3 will soon go even further.

Cutting edge research in the field of Natural Language Processing is slowly turning primitive chatbots into conversational avatars. Plodding progress still means that we're aways away from Intelligent Tutors dialoging naturally with students. Still, apps in the research lab are already pretty good at generating interactive, back-and-forth conversations to drive student thinking. Conversation-based intelligent instruction is likely only a few years away.

Empathetic with Emotion Detection

Watch a good teacher working with kids for 5 seconds – what hits you full force is that learning is an emotion-fest. Wonder, excitement, curiosity, self-satisfaction, frustration, embarrassment – learning provokes a kaleidoscope of feelings. The research tells us that managing and channeling that emotion is vital a student's success.

The most telling critique of edtech is that software lacks emotional competence. Saccharine voice-overs and dancing bears don't disguise the reality that underneath the veneer of interaction is absolutely nothing. Software today has zero awareness, much less understanding, of the sensitive beings peering into the screen.

Change is coming. A range of new tech is ready to process emotive signals. AI models are now pretty good at "reading" facial expression. Software created for call centers is adept at deciphering tone of voice. The same NLP that is creating conversation-ready apps can facilitate judgements about the emotions behind the words. Reinforcement Learning, the newest form of AI, is ready to transform those signals into a far more effective digital experience, using the student's emotional state as a critical input into the software's decision process.

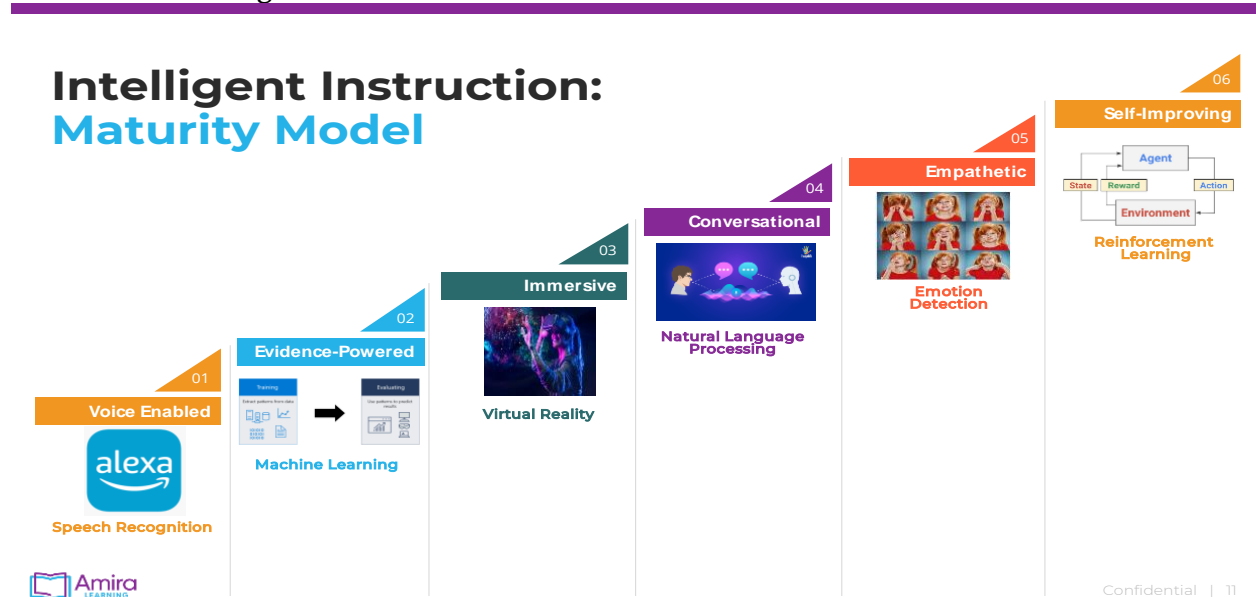
While the teacher and a student's family network will always be the critical pillars of emotional support, software can't be insensitive and punishing without jeopardizing its goodness. Just as reading mastery requires both Comprehension & Word Recognition, generating effect size needs both IQ and EQ. When an app insists on frustrating, boring, or infuriating the learner, no amount of instructional chops can compensate.

Self-Improving & Easy with Reinforcement Learning

People are highly evolved learning machines. We respond instantaneously to our experiences, adjusting continuously to pain and pleasure, success, and failure. Every night's sleep is a learning process. REM sleep organizes the chaos of daily events, shaping our brain to absorb life lessons.

By contrast, today's edtech learns at a snail's pace. Reinforcement Learning (RL) is a new branch of AI that enables software to improve all the time, learning from every interaction. Reinforcement Learning powers Google Go, the app that defeated the best human players. RL is the intelligence in self-driving cars. Reinforcement Learning will be the engine inside Intelligent Instruction, ushering in genuine personalization while making edtech far easier to use.

Intelligent Instruction will integrate and align these 6 powerful capabilities into applications that change the way children learn. As shown below, the Maturity Model that will define Gen3 is clear enough.



Not every app will climb the ladder to intelligence in precisely the same sequence. Not every app will necessarily need to incorporate all 6 capabilities. But, in 3 to 5 years, the classroom will be filled with edtech that can legitimately be described as:

- Voice-Enabled
- Evidence-Powered
- Immersive
- Conversational
- Empathetic and

- Self-Improving.

Section 6: Amira Exemplar

Intelligent Instruction's trail blazers are already at work in classrooms.

Amira is the first intelligent reading assistant. Amira is able to listen to students read out loud, assess mastery and deliver 1:1, personalized, Science Of Reading coaching. Amira is also the first Gen3 app to attain scale. Students have read more than 1 billion words to the software, with recent usage hitting 2+ million minutes per month, spanning nearly a million students in all 50 states.

Amira is the First **Intelligent Reading Assistant**



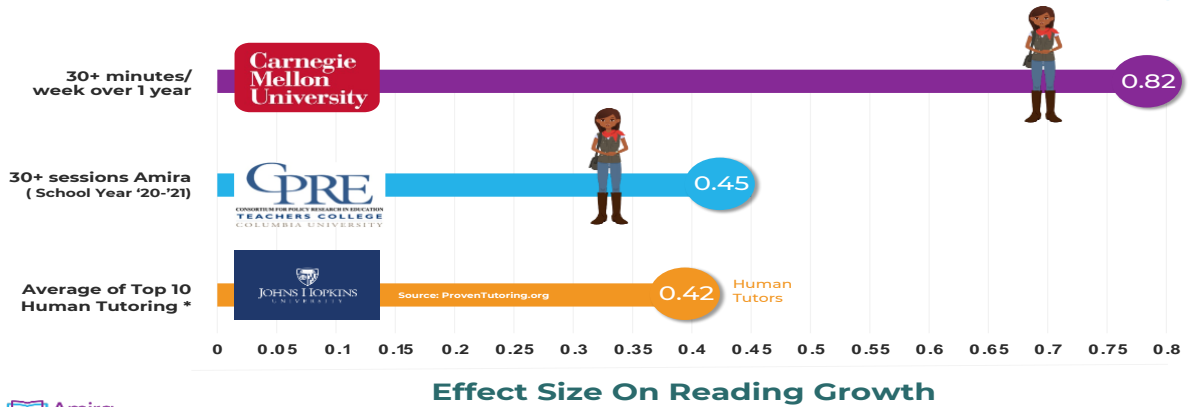
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The single most important thing to know about Amira is that the software is generating unprecedented impact. Here are a few recent highlights:

- a .45 effect size in 30 sessions, in research conducted by Columbia Teachers College during the 20/21 School Year.
- an effect size equal to a cycle of human tutoring from the best reading tutoring programs in roughly the same amount of time, per published research by ProvenTutor.org.
- effect sizes ranging from .65 to .91 in research conducted by Carnegie Mellon University, demonstrating large uplift across a range of reading skills.
- The Utah State DOE reviewed the evidence for efficacy for all major early literacy programs and found that only Amira met their threshold for large impact.
- In most Districts, the data shows that students working with Amira about 30 minutes a week double typical fluency growth.



Research by Columbia Teacher's College Shows Amira's Impact Matches Human Tutoring

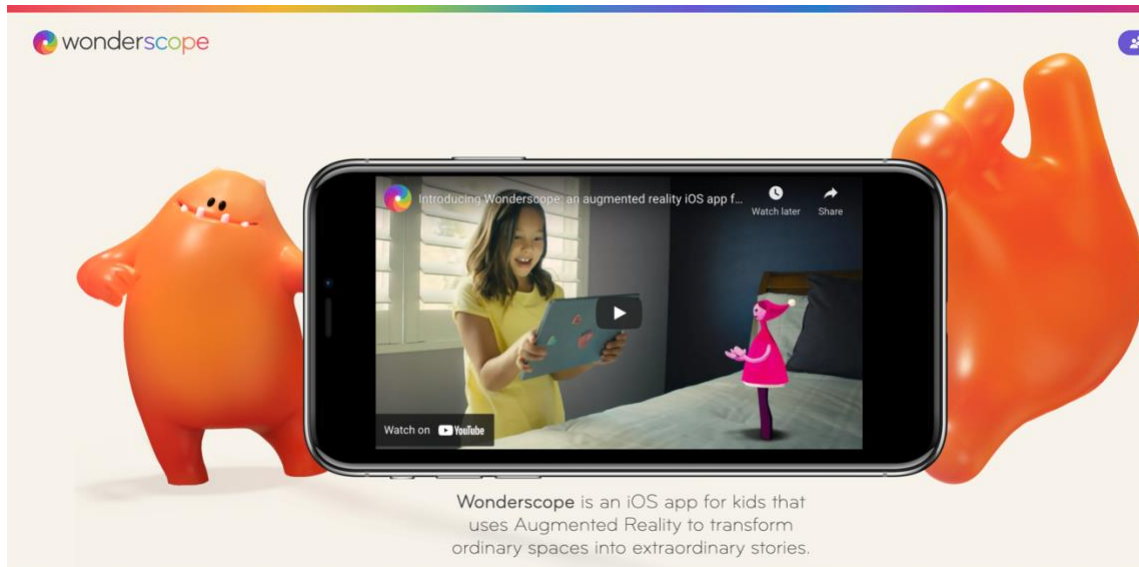


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Amira is the only edtech on the Forbes 50 AI list for good reason. The software is essentially a “stack” of Artificial Intelligence. The top of the stack is voice enablement, a form of speech recognition. Amira uses state-of-the-art “DeepLearning” trained to recognize the unique speech of 5- to 10-year-old children. Behind the DeepLearning is a highly proprietary ML classification model that replicates teacher judgement about reading error vs. reading correctly, distinguishing dialect from skill gap.

The next layer of AI is an early instantiation of the intelligence that will come to define the Third Gen of Edtech. When a student makes a mistake, Amira must decide how to help best. This is the moment that is at the heart of the instructional process. What does the tutor/coach/teacher do to instill mastery? Amira has an arsenal of techniques to build reading skills, from sounding out words, to asking riddles, to doing rhyming exercises, to providing definitions. In all, Amira draws from 47 different tutoring techniques to help build skills.

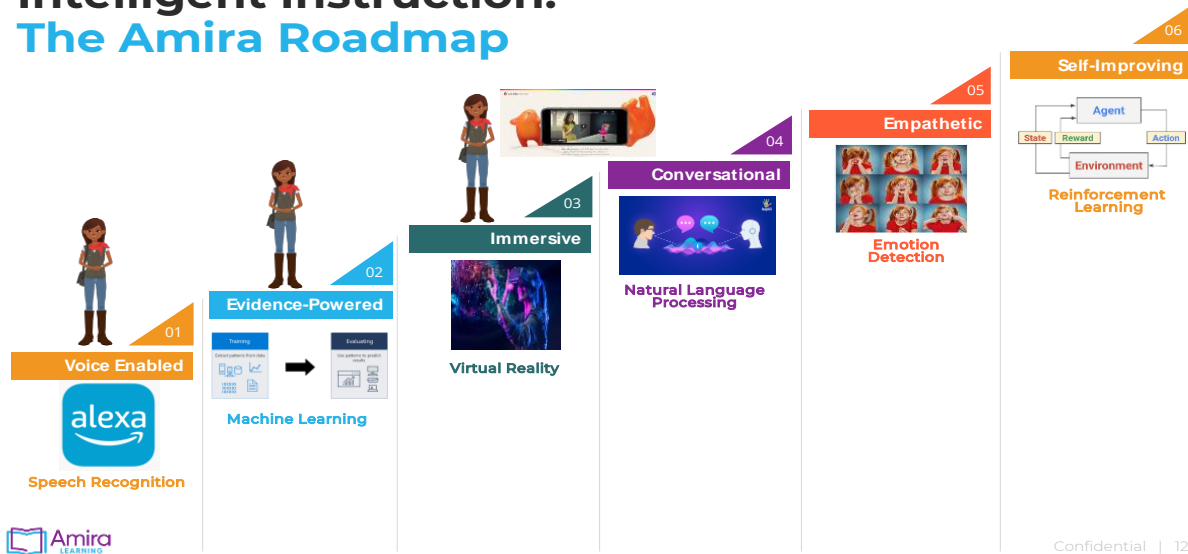
Coming soon, Amira will live in Virtual Reality. Wonderscope is an acclaimed Augmented Reality application that immerses young readers inside an unfolding story.



Amira Learning has acquired Wonderscope and will soon release an integrated app.

Amira is producing unprecedented effect size right now utilizing just two of the 6 Intelligent Instruction tools. A third capability (VR/AR) is imminent. Amira’s roadmap to even greater intelligence means adding conversational dialog and empathy.

Intelligent Instruction: The Amira Roadmap



Section 7: Co-Instruction

Weirdly, even as we thrive in a world packed with useful but not hyper-competent tech, people persist in viewing software as either utterly stupid or godlike. Any suggestion that an edtech app is modestly “Intelligent” instantly provokes the question of whether the goal is to replace teachers.

The obvious, correct answer is NO.

Software will never substitute for teachers!!!

Most knowledge workers today (doctors, wall street traders, software engineers) operate in a technology cocoon. Traders spend their day staring into a dual-screen Bloomberg terminal. When doctors want to figure out what's wrong with you, they put you into a digital MRI to see inside your body. Nowadays, Virtual Medical Assistants are adept at scanning the MRI, identifying malignant tumors. When the doctor is ready to prescribe, she dictates directions into the medical record keeping system or shoots out a prescription on an iPad. But, as vital as technology has become to the health care process, the demand for health care workers has done nothing but grow.

And, so it is across the board – if a job requires judgment and EQ, people have proven irreplaceable. If there is any knowledge worker whose skills are difficult for software to emulate, meet the teacher.

Given that teachers are the indispensable core, what will tomorrow's classroom look like? Today's AI-enhanced workplaces point to the answer. In sectors where software has been useful, people and tech have evolved towards co-dependence. Because software's strengths are 180 degrees opposite from human talents, optimal outcomes come from partnership. AI has achieved its peak utility on the factory floor, where decision-making and EQ are not at a premium. But, even in the relatively simple & repetitive manufacturing domain, smart tech has done best when explicitly designed to work with and for people. In fact, smart factory tech is called a "co-bot". The idea is that the AI is designed to work in a human-dominant process but aims to take over the tasks that are software-friendly and human-hard. The end result is both greater productivity and happier people.

Generation 3 edtech will evolve towards a similar role. We can expect software will:

- do a lot of scoring and grading
- consolidate teacher instruction with scaffolded practice
- handle routine communications and reporting
- deliver 1:1 tutoring at each student's level, targeted to each student's needs
- create the virtual worlds where learning can unfold in the metaverse.

In short, Gen 3 Edtech will evolve into the teacher's indispensable assistant, the junior "co-instructor".

Conclusion

Vitamins make us better. Edtech has failed to generate effect size due to its immaturity and lack of intelligence. So, educators have had no reason to see edtech as an essential vitamin in

the instructional regime. Aspirin squelches our pain. While edtech has reduced the difficulty of managing the learning process, the impact on teacher time has been less positive. Implementation challenges have made most edtech more of a pain-generator than a pain-killer for teachers.

Intelligent Instruction will be both a student growth stimulant and massively easier to use for teachers. For the first time, edtech will be both a vitamin and an aspirin.

In the wake of COVID,

- already depressed scores have taken a hit,
- declining enrollment has accelerated into crisis territory,
- shaky parental confidence has fallen further.

The premise for educator's decision-making needs to be:

We cannot afford to keep doing the same old things and expect different outcomes.

While teacher professional development is inarguably a good thing, teachers will be the first to tell you that they need tools and supports that make their jobs more doable. The decades-old idea of cramming in more training is not a silver bullet.

While pouring more human capital into schools with programs like high dosage tutoring can help, will the K-12 classroom alone have a future without deep reliance on technology?

A new Third Gen of Edtech is here. Apps like Amira are beginning to make a real difference. We can use the 6-stage Intelligent Instruction maturity model of to understand how radically different these apps are from the tech in most classrooms today. And, we can see via that same 6-step model how far they still can go.

In a world of teacher shortages, falling scores, digitally native children and declining enrollment, Intelligent Instruction pairing teachers & tech in a new partnership represents our best hope for success.