WHITEPAPER

In Pursuit of Disruptive Tech Integration for Meaningful Learning

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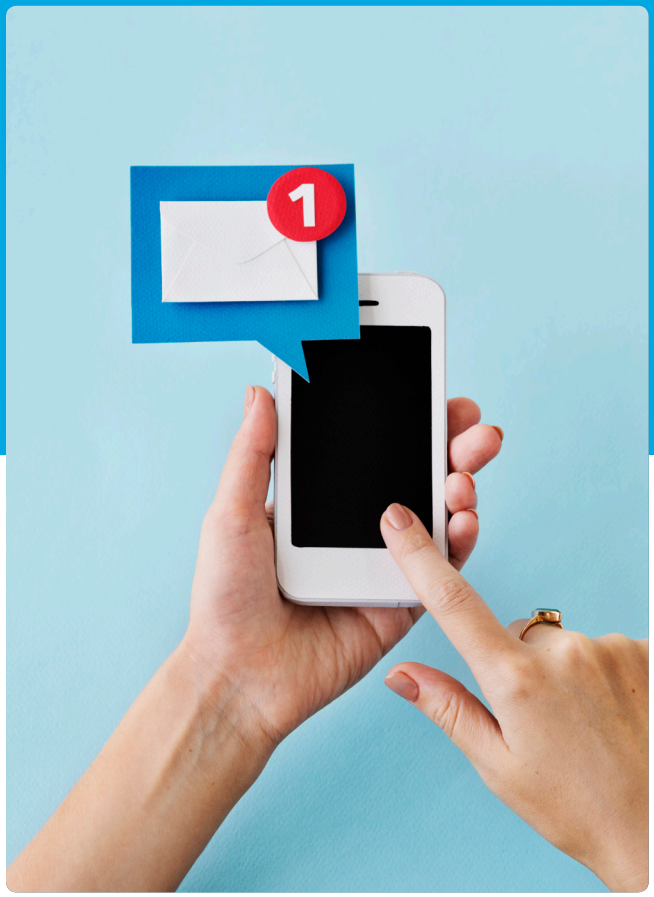
A LETTER TO THE READER

what constitutes meaningful tech integration?



Dear Reader,

This whitepaper started as a simple question: *what constitutes meaningful tech integration?*

I've spent the better part of the past year interviewing colleagues, teachers, district leaders, consultants, and subject matter experts about the evolution of future readiness and how educators can best equip students with the skills, qualities, and knowledge they need to be successful in their future. We've talked about standards, cognitive science, media literacy, digital skills, computer science, makerspaces, STREAM, design thinking, algorithms, social and emotional learning, digital wellness, arts, and – to use a cliché – so much more.

Despite the different perspectives, approaches, and strategies for cultivating future readiness in students, a central theme that wove through all was meaningful tech integration. Every conversation affirmed that tech integration not only modernizes education but offers entirely new opportunities for contextualizing and personalizing instruction. And through authentic, collaborative, and student-led learning, students build a deeper and conceptual understanding of key ideas and transferable skills.

Tech integration is a key to unlock new educational experiences and reimagine pedagogical approaches to teaching and learning, *an opportunity to rebuild and advance.*

With so much seemingly riding on the quality and efficacy of this effort, my question, *what constitutes meaningful tech integration*, arose. I'm certainly not the first person to ask the question – actually, I'd imagine most of you are asking too. So, this is an invite for you to join me as I venture to propel my quest for lifelong learning, to seek and share new understanding, and to inspire others along the way.

Cheers,

Anna

The Disruptors

Let's talk about disruptors. No, I don't mean an especially rambunctious student – I mean disruptor in the snuffy silicon-valley way.

What is a disruptor? It's a company that upends market incumbents by creating a new market and value network (i.e. digitizing a product or service). Generically, a disruptor develops a better, more efficient, and digitized way of doing something and, in doing so, dethrones a long-standing, less optimized approach.

Far beyond business, however, disruption is also taking hold in classrooms:

- The projector disrupted the blackboard.
- The smartboard disrupted the projector.
- The tablet disrupted the Smartboard.

And so on…

What does the evolution of edtech mean? No more screeches on chalkboards? (Are you cringing like me?) No more dry ink on the sides of hands? Yes, and yes. Hooray! More seriously, advances in technology are also driving significant shifts in instructional methods, such as flexible seating, maker education, adaptive instruction, and experiential learning.

Stoked by tech integration, the result is education reimagined.

Image Source: HBO Series, Game of Thrones

The potential for technology to transform teaching and learning resembles how Netflix transformed the experience of watching movies, Airbnb for traveling and exploring new places, and Amazon for doing most anything.

And with this idea of transformation in mind, we will set out in this whitepaper to conceptualize disruptive tech integration; assess approaches for developing impactful tech-driven learning experiences; and equip educators with strategies to integrate technology meaningfully, effectively, and disruptively.

The good form of classroom disruption.

Disruptors in The Classroom

The Foundation for Disruptive Tech Integration

What Is Tech Integration?

Tech integration goes much further than simply using technology; it fuses instructional content with digital tools to reshape the framework of teaching and learning. Tech integration is a pedagogical change in education that supplants traditional teaching methods, changes the student-teacher dynamic, and delivers learning in new and better ways.

Specifically, tech integration is learning immersed, learning bolstered, learning facilitated, learning modernized, and learning redesigned.
Learning disrupted.

Why Is Tech Integration Important (especially for disruption)?

Disruption is a part of a decades-long movement founded on:

Shifting concepts of future readiness.

Advancing research in learning sciences.

Expanding access to technology in the classroom.

Shifting Concepts of Future Readiness

In the OECD's *Learning in the 21st Century Research, Innovation and Policy*, R. Keith Sawyer, Professor at the University of North Carolina Chapel Hill, explains that the standard schooling approach founded in the 19th and 20th centuries was designed to prepare graduates for an industrialized economy.

In this model, knowledge was considered a collective group of facts and procedures that teachers were tasked to transmit to students. Efficacy was then measured through assessments that tested student acquisition of memorized content.

While the model supported the needs of the industrial economy, Sawyer emphasizes that today we are immersed in an entirely different economy known as the knowledge economy, which accentuates "creativity, innovation, and ingenuity."

And as future readiness for workers and citizens evolves, so must teaching and learning. Sawyer writes: "The standard model of schooling is particularly ill-suited to the education of creative professionals who can develop new knowledge and continually further their own understanding."

> **"Today we are immersed in an entirely different economy known as the knowledge economy, which accentuates 'creativity, innovation, and ingenuity.'**

Advancing Research in Learning Sciences

At the same time, burgeoning cognitive sciences offer insight into how learning occurs and how it is maintained through the process retention and recall, which is aided through deep learning that builds expertise, metacognition, and problem-solving skills.

In *The New Science of Learning*, R. Keith Sawyer outlines the six characteristics of deep learning environments:

- Learners relate new ideas and concepts to previous knowledge and experience.
- Learners integrate their knowledge into interrelated conceptual systems.
- Learners look for patterns and underlying principles.
- Learners evaluate new ideas and relate them to conclusions.
- Learners understand the process of dialogue through which knowledge is created.
- Learners scrupulously examine arguments.
- Learners reflect on their own understanding and their own process of learning.

In other words, deep learning necessitates constructive experiences, conceptual understanding, transferrable knowledge and skills, critical thinking, communication, and reflection.

Expanding Access to Classroom Technology

To develop learning progressions instilled with these necessary practices, cognitive scientists laud technology. In addressing this, Sawyer writes:

"The computer should take on a more facilitating role, helping learners have the kind of experiences that lead to deep learning – for example, helping them to collaborate, or to reflect on their developing knowledge."

The deployment of digital devices allows instruction to root itself in cognitive science and makes deeper learning experiences accessible by enabling students to:

- Demonstrate knowledge and skills in multi-modal ways.
- Collaborate with peers beyond the bounds of classrooms.
- Reflect on learning progress by understanding their growth and gaps.
- Lead their process through self-paced and adaptive content.
- Represent abstract concepts concretely.
- Build and assess knowledge independently through research.

And as access to classroom technology expands, so do the opportunities for learning enhancement.

The Takeaway

Through instruction optimized according to the learning sciences, technology in the classroom elevates learning so it equips students with future-ready skills rooted in creativity and innovation.

A Disconnect in Current Tech Integration

The benefits associated with tech integration resonate with educators:

63% of teachers think technology accelerates learning[1]

90% of principals believe technology is integral to student learning[2]

75% of educators foresee digital content entirely replacing textbooks by 2026[3]

The disruptive capabilities of tech integration are largely recognized by educators as well. Yet, when surveyed*, a disconnect arises between seeing value in the disruptive benefits when compared with the application of them.

Essential characteristics of tech-driven learning, like collaborative, student-led, and customized instruction, are often not actualized in classroom settings. In trying to understand the barriers to tech integration, we repeatedly found that a lack of teacher training and adequate PD ranked as the top factors.

While value is seen in using classroom technology, there is still more to fulfilling its potential, and teachers need the resources and investment to resolve this. In the following sections, then, we hope to move from a conceptual understanding of disruption in classrooms to more actionable insights and strategies that can inform tech integration efforts, so readers can become disruptors, innovators, and architects of new approaches to learning.

**Below is data from teacher surveys studying the nature of tech integration in classrooms.*

Technology makes learning more interesting

79% BELIEVE IT MAKES A BIG IMPACT VS **57%** ACTUALLY USE IT THIS WAY

Technology provides opportunities to learn outside of the classroom

74% BELIEVE IT MAKES A BIG IMPACT VS **33%** ACTUALLY USE IT THIS WAY

Technology allows students who have mastered topics to move on

76% BELIEVE IT MAKES A BIG IMPACT VS **38%** ACTUALLY USE IT THIS WAY

Technology allows students to work at their own speed or pace

73% BELIEVE IT MAKES A BIG IMPACT VS **41%** ACTUALLY USE IT THIS WAY

Technology creates a customized learning experience

72% BELIEVE IT MAKES A BIG IMPACT VS **38%** ACTUALLY USE IT THIS WAY

Technology allows students who are behind in school to catch up

66% BELIEVE IT MAKES A BIG IMPACT VS **36%** ACTUALLY USE IT THIS WAY

[1]Source: 63% of teachers think technology accelerates learning.
[2]Source: 90% of principals believe technology is integral to student learning.
[3]Source: 75% of educators foresee digital content entirely replacing textbooks by 2026.

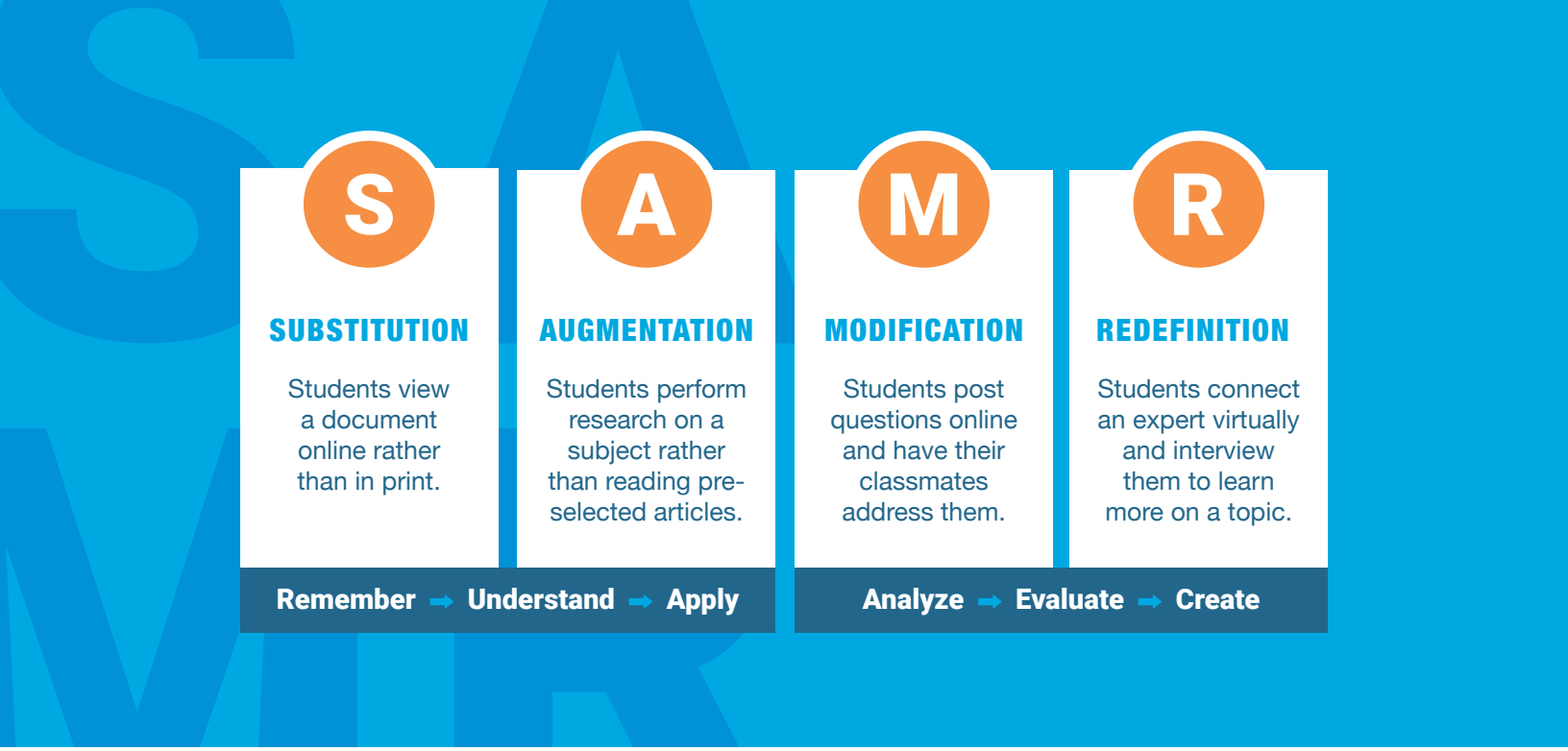
Disruptive Qualities Found in Tech Integration Models

What does tech integration that fosters deep learning look like?

How can educators drive future readiness with research from cognitive science?

How do teachers and leadership partner to develop intentional, authentic, and connected learning experiences with technology?

With abundant tech integration models, we decided to first look there to begin to conceptually understand what disruptive tech integration looks like. The different models offer insightful perspectives for approaching tech integration and creating meaningful learning experiences with digital tools. We've identified a few worthwhile models to include here and summarized their characteristics, benefits, goals, and disruptive qualities.



SAMR

SAMR is a four-part framework developed by Dr. Ruben Puentedura that categorizes the level of integration on a four-part scale shortened to the acronym SAMR.

- **Substitution**: Technology directly substitutes a non-technical function.
- **Augmentation**: Technology functionally improves a task while serving the same purpose.
- **Modification**: Technology redesigns the learning task altogether.
- **Redefinition**: Technology creates entirely new learning experiences.

Ultimately, the goal is to get to those deeper levels of tech integration in the classroom – modification then redefinition – rather than just substitution and augmentation. Though, substitution and augmentation should not be discarded and are effective in some cases.

To conceptualize the depth of integration and learning, SAMR can be aligned with Bloom's Taxonomy as shown in the image above. The lower levels of Bloom's – remembering, understanding, and applying – fit with substitution and augmentation. As tech integration deepens, so do the ways we engage students with content, which aligns well with analyzing, evaluating, and creating.

What are the benefits of this model?

SAMR focuses on the depth of technology in the classroom and the functional role it is playing in the context of student learning.

What is the goal of this model?

Learning immersed: use technology to transform the very nature of learning

What does this model teach us about disruption?

Embodied in the approach is the disruptive capacity of technology to create authentic and student-led learning opportunities that utilize the adaptive, personalized, and interactive features specific to technology.

THE FIVE CHARACTERISTICS OF MEANINGFUL LEARNING ➡

⬇ THE FIVE PHASES OF INTEGRATION	Active	Collaborative	Constructive	Authentic	Goal-Directed
Entry		✓			
Adoption				✓	
Adaptation	✓				
Infusion		✓			
Transformation				✓	✓

Technology Integration Matrix

Developed by the Florida Center for Instructional Technology (FCIT) in 2005, the Technology Integration Matrix, which is now in its third edition, is a 25-cell grid mapping the deployment of technology in the classroom alongside five characteristics for deep and meaningful learning.

The five phases of integration are:

- **Entry**: Technology is initially introduced in the teaching process.
- **Adoption**: Students are introduced to the functionality and process of different tools.
- **Adaptation**: Students independently use tools in self-directed ways.
- **Infusion**: Students identify the tools needed to satisfy the learning task at hand.
- **Transformation**: Technology opens up entirely new possibilities for learning.

The five characteristics of meaningful learning are:

- **Active**: Learning experiences are founded in the use of technology as opposed to the passive consumption of content through it.
- **Collaborative**: Learning centers on student collaboration and work between students.
- **Constructive**: Learning builds upon prior knowledge and is scaffolded in conjunction with students' developing skills.
- **Authentic**: Learning is rooted in real-world contexts and extends beyond the bounds of the classroom.
- **Goal-Directed**: Learning goals are set by students, and they actively monitor their progress toward them.

Each phase of integration has a corresponding cell aligned to each characteristic, so teachers can see opportunities to make learning meaningful as they integrate technology.

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Each phase of integration has a corresponding cell aligned to each characteristic, so teachers can see opportunities to make learning meaningful as they integrate technology.

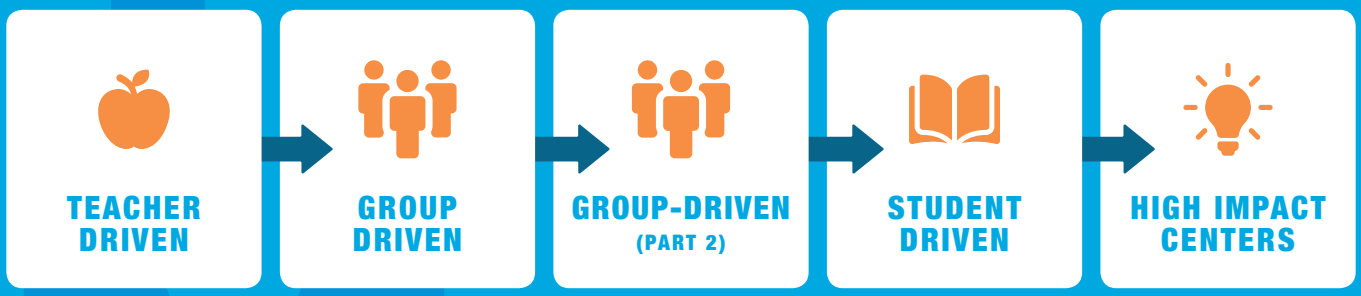
What are the benefits of this model?
The Technology Integration Matrix serves as a useful reference for teachers looking to integrate technology and set realistic goals at each phase.

With specific examples and ideas for each cell in the matrix, teachers can be strategic as they plan the deployment of technology and build tech-driven learning environments in their classrooms.

What is the goal of this model?
Learning bolstered: optimize tech integration for deep learning

What does this model teach us about disruption?
With alignment between the phases of integration and essential characteristics of effective learning, the matrix accentuates elements of active, collaborative, scaffolded, authentic, and student-directed learning throughout phases of tech integration.

	Active	Collaborative	Constructive	Authentic	Goal-Directed
Entry					
Adoption					
Adaptation					
Infusion					
Transformation					



Instruction and Technology Integration Model

The Instruction and Technology Integration Model outlines key instructional modes in a blended learning environment. This model was created intentionally to answer 'the how' for tech integration. With a focus on closing the achievement gap and fostering equity in our education system, the model hones student engagement through effective tech integration in optimal learning environments.

At each phase, the model offers the primary role, key actions, format, responsibilities, tech integration options, and research to support the approach.

The key modes are:

- **Teacher-Driven**: Teacher introduces new concepts and demonstrates to the class.
- **Group-Driven**: Teacher facilitates learning with technology and offers feedback to students.
- **Group-Driven (Part 2)**: Teacher facilitates learning with technology, and students work in differentiated groups.
- **Student-Driven**: Students work independently, and teacher provides feedback as needed.
- **High Impact Centers**: Students work in groups and independently in a project-based environment; the structure of the class depends on students' abilities.

What are the benefits of this model?

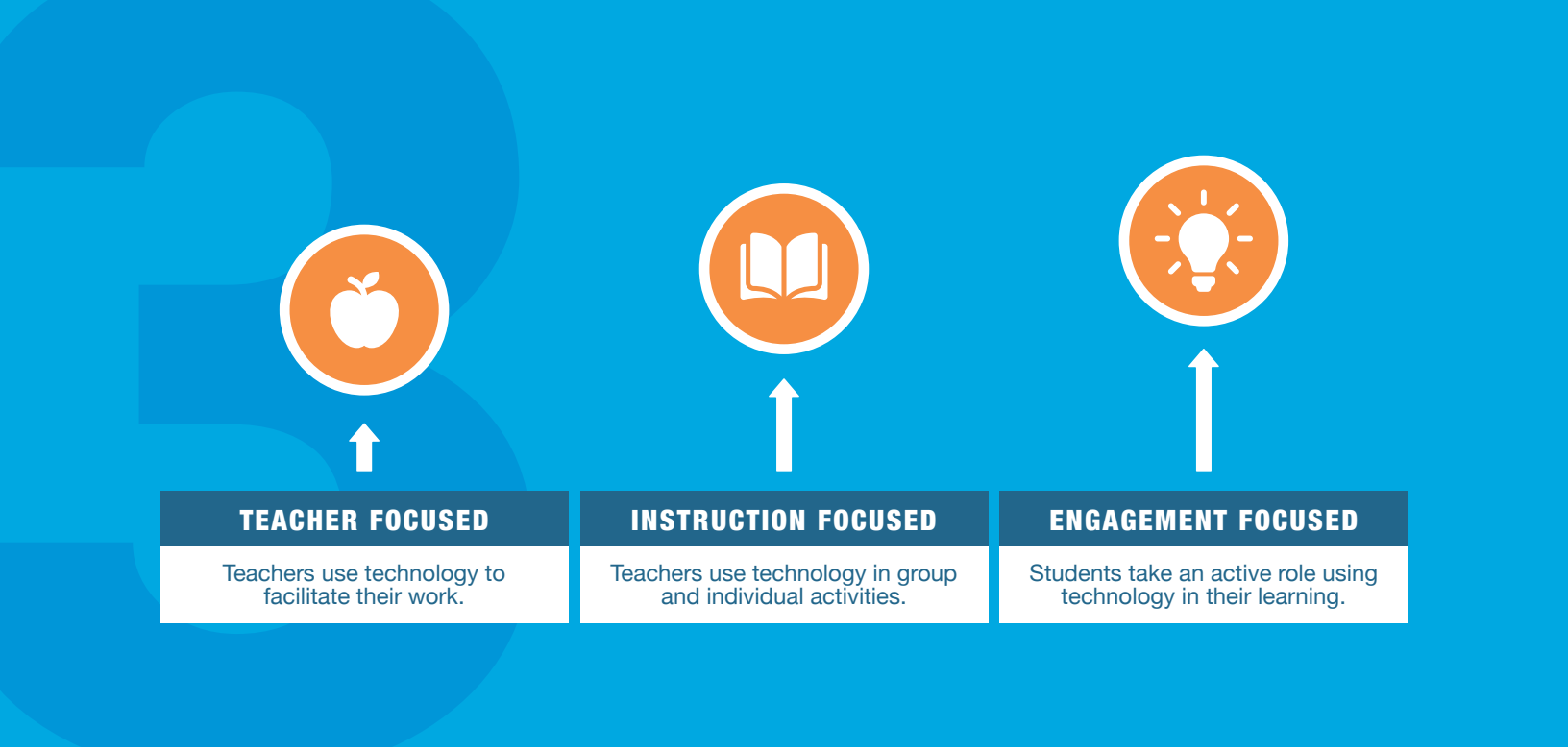
The Instruction and Technology Integration Model offers concrete actions teachers can take to enhance learning through tech integration. With implementation examples, teachers are equipped to leverage this approach for their classrooms.

What is the goal of this model?

Learning facilitated: guide students to understanding through constructive support that closes gaps

What does this model teach us about disruption?

The disruptive effect of blended learning with elements of collaboration, differentiation, and hands-on practice immerses students in accessible and impactful learning.



Three Tiers of Technology Integration

Originally released by Washington State's Office of Public Instruction, the Three Tiers of Technology Integration illustrate the depth of technology in classrooms.

The tiers cover the different functions of technology in learning environments and each progressively enhance the quality and depth of technology's role.

- **Teacher Focus on Productivity**: Technology helps teachers enhance their productivity and supports with classroom management and administrative functions.
- **Instructional Presentation and Student Productivity**: Technology facilitates learning by delivering instructional content and providing tools to perform work.
- **Powerful Student-Centered 21st Century Learning Environment**: Technology engages students in collaborative and student-led learning experiences.

What are the benefits of this model?

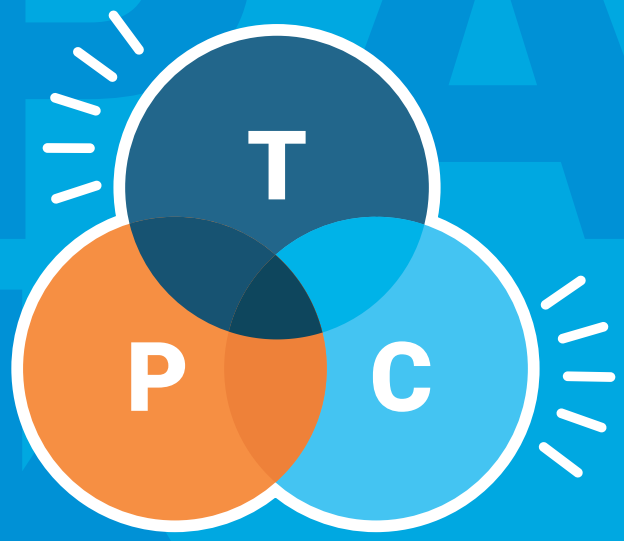
The tiers illustrate the different performative tasks technology supports in classrooms and the value it provides in each capacity.

What is the goal of this model?

Learning modernized: leverage technology as a strategic tool for teaching and learning in the 21st century

What does this model teach us about disruption?

By advancing how students learn through tech, the approach illustrates the disruptive capacity of technology in collaborative and student-led learning.



TPACK

TPACK is a three-part Venn diagram illustrating the diverse intersections of technological knowledge, pedagogical knowledge, and content knowledge:

Dual Intersections:

- **Pedagogical-Content Knowledge (PCK)**: The intersection of the pedagogical and content knowledge sets represents how instruction is facilitated in content areas. This used to be the standard approach to instructional design.
- **Technological-Content Knowledge (TCK)**: The intersection of the technological and content knowledge sets represents how technology is integrated in content areas.
- **Technological-Pedagogical Knowledge (TPK)**: The intersection of the technological and pedagogical knowledge sets is how technology is selected and managed throughout the learning experience.

Individual Sets:

- **Technological Knowledge (TK)**: How technology is selected and used, as well as the quality of content delivered through the tool
- **Pedagogical Knowledge (PK)**: How learning is planned and facilitated
- **Content Knowledge (CK)**: What teachers know about a particular subject or topic

Finally, the intersection of all three sets of knowledge bases is TPACK, which refers to the teachers' selection and integration of digital tools to enhance the learning experience and provide opportunities for deep and lasting learning in content areas.

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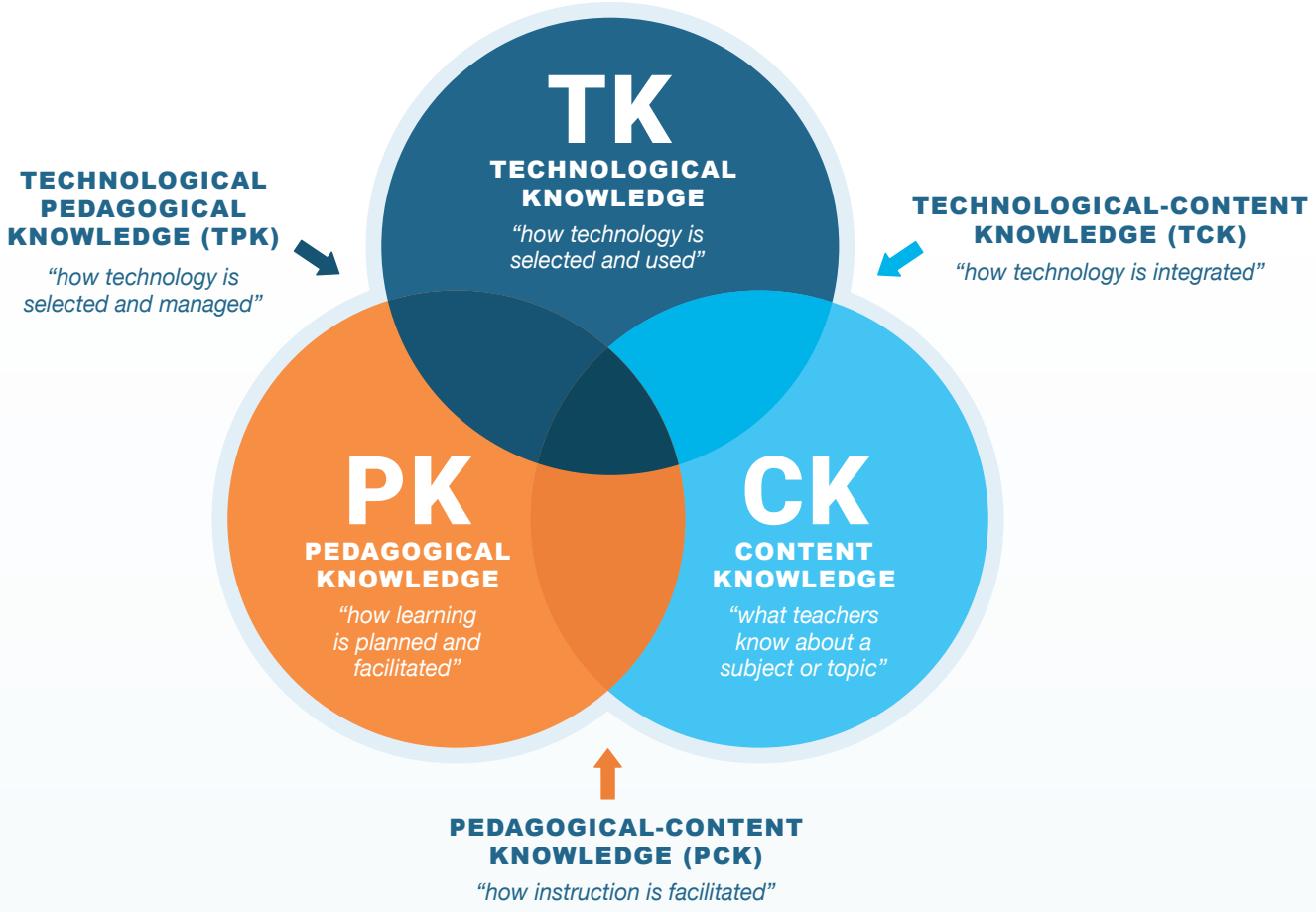
Enhance the learning experience and provide opportunities for deep and lasting learning in content areas.

What are the benefits of this model?
TPACK builds upon more traditional approaches to instruction, making tech integration an enhancement to existing instructional design processes. By blending technology with both content and pedagogy, TPACK helps teachers develop holistic and intentional strategies for the application of digital tools.

What is the goal of this model?
Learning redesigned: develop tech-driven learning experiences optimized to fit pedagogical/content needs

What does this model teach us about disruption?
Depending on the depth of tech integration, the model could involve any number of disruptive qualities to hone existing pedagogical approaches like active, authentic, and collaborative learning.



Definitive Qualities of Disruption

The above models share the common goal of deepening tech integration in the classroom and focus on how teachers can meaningfully build tech-driven learning experiences. Keep in mind that the models aren't mutually exclusive; they can be followed in tandem, modified and combined, or just serve as #techinspo and references to spark ideas in your coffee-fueled classroom planning sessions.

What I find to be most important about the tech integration models we researched is they don't talk about the types of tools educators need to be using; rather, *they focus on the qualities a digital tool or program brings to the learning experience.*

In a lot of ways, it levels the playing field between Google Earth and VR goggles or 3D printers and – well – normal printers. Tech integration doesn't mean having to have cutting-edge technology (but it doesn't discount this either); it means finding opportunities to *optimize, enhance, and transform learning*.

We are seeing these opportunities, inspired by digital capabilities, take hold in education. Besides the aforementioned blended learning, there are others like project-based learning and maker education.

And online instructional content is also popularizing computer-based learning. These and other approaches are all coming about in response to instructional shifts founded in technology and the need to design learning that builds conceptual knowledge and skills. This brings us back to our earlier section on future readiness and cognitive science's characteristics of deep learning.

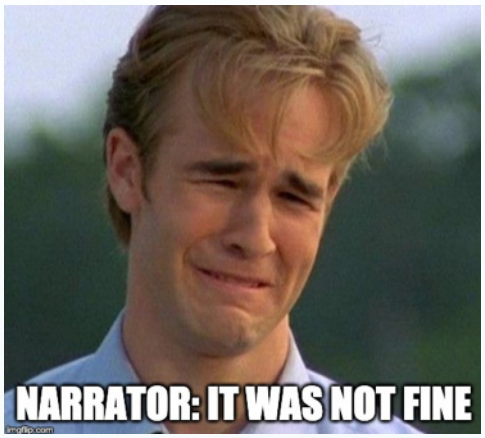
Based in research and actualized through tech integration, effective learning environments are personalized, provide access to diverse sources, offer collaborative learning opportunities, scaffold problem solving, design authentic learning opportunities, and assess for deeper and conceptual understanding.

To meet this, tech integration's goal must be to enhance and transform the learning process so that it is effective for today's students and their futures. In whatever model, disruption is the North Star. ✨

The Four Adaptations of Education Disruptors

I want to return to the question that prompted this paper: *what constitutes meaningful tech integration?* As we spoke with educators and poured through articles, we've come to realize the immense value in aiming for disruption and measuring the quality of tech integration through the disruptive behaviors it fosters: the ability for educators to reimagine instruction and redesign learning experiences through it. To capture this, we've identified four adaptions emblematic of disruptive tech integration in classrooms.

This final section is modeled after a talk Brian Halligan, the cofounder of HubSpot, gave at their annual conference in 2019. The talk had nothing to do with education, but if you are interested in business, marketing, or doodles in Spiderman costumes here's a link for your enjoyment. If you want to learn about disruptive tech integration in education, I'd recommend you stay here – or don't. I'll miss you, but whatever. I'm *fine*. It's *fine*.



As we venture into entirely new approaches of teaching and learning with tech integration, these disruptive adaptations can serve as a guide. By using tech integration to reimagine skill development and content acquisition, we also find new ways to enhance learning by imbuing it with relevance and steeping it in efficacy so that it meets the rising expectations of future readiness.

Disruption is coming.

1 Disruptive tech integration enables teachers to become facilitators and act as a partner and guide for students.

Disruptive tech integration is not learning about technology or learning on technology, students are learning through technology. With hands-on and computer-based learning, technology redesigns the learning experience and the student-teacher dynamic.

At the same time, tech integration also makes teachers learners too. Advancements in tech capabilities and access to near infinite resources make lifelong learning more critical than ever and compel teachers in tech-rich environments to model this for their students.

Example

In a project-based learning environment a teacher acts as a guide on the side as students work collaboratively in groups, ask critical questions, research, connect with experts, innovate, and create. Teachers help facilitate this but also make it a chance to dive into obscure, imaginative, and critical topics, finding understanding as well as discovering new ways to seek understanding through technology.

2 Disruptive tech integration leverages tech-enhanced assessment for authentic and formative feedback

The ability to integrate authentic and real-time formative assessment enables schools to develop a more complete understanding of student learning. Integrated assessment also offers students more constructive feedback that enables them to better set learning goals, guide their process, and reflect on their growth.

Example

In computer-based learning environments, assessment is often embedded in the interactive features of the content. This makes formative assessment real-time with immediate feedback for stakeholders; it is also more nuanced with richer question types (e.g. graphic response, hot text, and equation response) and specific with adaptive capabilities to address the personal knowledge and skill level of every student.

3 Disruptive tech integration busts traditional models of instructional delivery, making learning something that is experienced and lived

Tech integration overhauls traditional models of education. Content and skills are no longer simply acquired, they are learned and lived. Learning is experiential and founded in innovation and creativity.

Example

Maker-based learning seizes on this form of disruption. Learning is experienced in hands-on activities; it is acquired through creative making processes; and it models the same contextual ways knowledge and skills are practiced by experts. This is a process of discovery that pushes students to practice problem-solving approaches like design, algorithmic, and computational thinking.

4 Disruptive tech integration personalizes learning and empowers students to be leaders in this process

Technology empowers students to take agency in their learning. Content is adapted to where a student is in their skill development, and personalized content helps students to grow and learn. Instruction is no longer a one-size-fits-all process that works toward an adequate understanding of content. Instead, students lead their learning and build contextual understanding of content in a way that best suits them.

Example

Blended learning is emblematic of this. In a blended learning environment, students access resources where and how it fits them and at a pace they determine. They collaborate with peers online and in person to build understanding.

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