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*(Author's Note: The following introduction, essay and closing are excerpted from  
the full weekly issue of the Strategic News Service newsletter.)*

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*Publisher's Note:* Technology and Education: two ideas that cannot be separated, and that have yet to be properly merged. In the firmament of veterans in this sector who have the combination of history and technical chops to properly assess our current situation, there are few as capable as SNS Member Frank Catalano.

We have been following Frank's thoughts and writing on the subject for many years, and decided that enough had transpired to ask him for a clear assessment of what has been achieved to date, what is left to do, and what lies in the way of doing it.

And, although cynics will appropriately suggest that it is the system itself that is in the way, Frank's comments about the age of the new teaching force will cause a slight flutter of hope to beat, even in the most scarred of hearts. He seems to be echoing the words of Thomas Kuhn in his famous paean to paradigm shifts in science: this isn't about changing minds; it's about waiting until the Old School dies away.

If that is where hope lies, I'll take it. Those who have been following SNS Project Inkwell know the number of years we have all spent on this project, and I am pleased to say that we are nearing a new Inkwell-driven initiative that flows directly from what you will read here. Suffice to say, times really have changed, and there is still hope that we may create the revolutionary educational system this new century demands of us.

– mra.

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## THREE DRIVERS OF THE DIGITAL CLASSROOM

By Frank Catalano

Digital K-12 education is finally coming into its own.

This simple statement may evoke disbelieving cries of "What - again?" Those of us who have been around the Lego block a few times recall similar statements during the boom-bust cycles of packaged personal-computer software, multimedia CD-ROM, and dot-com, bringing to mind pioneering names like Oregon Trail, Number Munchers, and Knowledge Adventure.

The assumption during each cycle was that consumer trends in personal computing were so compelling that they would force their way into K-12 classrooms. The reality was that consumer tech was a much less irresistible force than the classroom was an immovable object - immovable, in that it had been largely unchanged since the '50s. And I don't mean the 1950s.

Two developments may make this decade the charm: consumer-level expectations about technology among educators and their influencers, which set the stage; and three rapidly evolving digital trends that are unique to education.

### » The Consumerization of Edtech

I've worked in both education and consumer digital technology for nearly 20 years. When I straddled the abyss, I was told that being in education technology was great. After cool new digital products were introduced in the consumer market, the education market would figure it had a decade to determine how or whether to adopt and integrate the technology. As a result (the reasoning went), only proven, winning technologies would be selected (and, uh, the LaserDisc). The downside, of course, was that education would always be a decade or more behind everything else.

Enter the digital natives. Not the students. The teachers.

If you're under the age of 30, you probably don't recall life without the personal computer. If you're under the age of 20, you've never *not* known the Web. Many new teachers sit in this delta. They are used to and expect ubiquitous personal technology. So do many administrators, parents, state legislators, local school board members, and an ever-widening sphere of K-12 education influencers.

It's a demographic sea change in expectations that has caused some of the largest and most established educational publishers to re-think how they develop products.

Consider the annual Ed Tech Industry Summit, hosted this May in San Francisco by the Software and Information Industry Association (SIIA). Scholastic Education president Margery Mayer revealed in her keynote speech that to model data dashboards for new educational technology

products for schools, Scholastic reviewed Mint.com, WeightWatchers.com, and NikeRunning.com - all unabashed consumer websites.

Mayer also stated that consumers would increasingly be part of education buying decisions, and education products must appeal to them - in essence, as much to the individual as to the institution.

When I asked where education companies should turn to find this kind of tech inspiration, Mayer replied, "I say, look at everything except stuff that sucks."

This expectation of a consumer experience for education technology has resulted in time compression. Remember that decade lag? Instead of a decade behind, education is now only two to four years behind consumer technology at most, and the more optimistic would say one to three years.

This is because consumer tech is no longer being pushed into education. The education market is now *pulling* it in - along with consumer models of Web- and subscription- based products and services.

### » Edtech's "Popular Trend" Clique

Before I introduce three digital technologies changing education about which you may never have heard, it's important not to dismiss many more high-profile, publicly popular digital learning trends - most with equivalents in consumer- or business-information technology.

Each of these got its moment in the sun in the triumvirate of late spring-early summer, education-technology-focused national conferences, including SIIA's Ed Tech Industry Summit, the Association of Educational Publishers' Content in Context Conference in Washington, D.C., and the International Society for Technology in Education's ISTE 2011 conference and exposition in Philadelphia (formerly known as NECC, the National Educational Computing Conference). It's worth noting that each of these edtech events apparently met or exceeded the previous year's attendance - in some cases dramatically.

Those digital education initiatives of which you inevitably have heard - and recent data points on progress (or lack thereof):

- **Distance learning** continues to be the BMOOC (Big Movement Off Campus), driven largely by a desire to increase graduation rates through credit recovery and remediation and by reduced budgets, making either fully online courses, or hybrid/blended courses with a face-to-face component, more attractive to school districts.

Policy changes are making online learning more attractive as well - or required. For example, in July the New York State Education Department's Board of Regents eased the rules that specify how long a student has to physically be in a classroom to earn credit for courses. At almost the same time, Florida made it possible for students to enroll in the

online Florida Virtual School without having to first enroll in their local district. And several states either mandate, or are considering mandating, that at least one online course be taken for graduation.

- **One-to-one computing** initiatives continue to limp along in something of a raisin-muffin distribution, with intense pockets of activity stuck in a generally diffuse K-12 whole.

I moderated the opening keynote at the Association of Educational Publishers' (AEP) Content in Context conference on what forward-thinking educators are doing with technology, demonstrated through a panel discussion and detailed educator videos. The session clearly illustrated the challenge facing anyone looking for consistency in implementation - "one-to-one" can mean netbooks, tablets (iPad or Android), or traditional laptops and can happen at the school or district level.

No state since Maine has implemented anything on a larger scale, and Maine approved its program in 2001 - a decade ago. As Fairfax County (VA) Public Schools technical architect Jim Siegl commented in the AEP session, when it comes to computing devices districts have to prepare for, "it's any device, and any device that comes in through the door."

- **Digital textbooks**, though, are on the rise, and this digital content may be how one-to-one hardware finally gets the push to become mainstream. Some schools are doing the math and determining that the cost of a device plus digital instructional materials may be equal to, or less than, buying new paper textbooks for every student over that textbook's lifetime.

Policy is helping here as well. Florida recently passed a law requiring that at least 50% of textbook budgets be spent on digital materials by 2015-16. Yet that's nothing compared with South Korea, where the education ministry has called for all-digital curricula in either 2014 or 2015, depending on the grade level.

Still, many digital texts lack features that students say they expect. At the AEP conference opening session, one group taking part in a tablet pilot noted that their e-textbooks were missing electronic bookmarks, highlighting, printable pages, resizable fonts, and text-to-speech capability. There's also anecdotal evidence that high school and college students are less willing to change their habits and activities for digital texts than are younger students - a potential behavioral barrier to overcome.

- **Game-based learning** is currently in a popular phase, continuing its cyclical revival every roughly five or six years, apparently returning each time a new delivery platform is introduced (floppy disk, CD-ROM, Web, social media) and memories of the last failure have faded. That isn't to say that this won't be the time game-based learning is widely accepted; and there are some remarkable new efforts.

BrainPOP, for example, at ISTE introduced [BrainPOP GameUp](#), which integrates simulation games from partners such as Filament Games and iCivics (of retired U.S.

Supreme Court Justice Sandra Day O'Connor fame) with BrainPOP's whimsical instructional animations and lesson plans to create full classroom units. [Sokikom](#), a startup in the Phoenix area, also launched at ISTE what it calls a "massively multiplayer online social learning game" for math, for grades 1-6, in which teams of students can compete with one another in real time. And at SIIA's Summit, Genevieve Shore, Pearson plc CIO and director of Digital Strategy, stated flatly, "Games will be vitally important over the next few years."

But one-to-one, online, digital textbook, and game-based learning initiatives are well-known and extensively covered outside of the education industry. That's not the case with three other trends in what you might call "mass niche" technologies - technologies and applications that will be huge factors in classrooms this decade, but may never be discussed over a Genius Bar.

### » **Three of These Trends Belong Together**

Let me slightly qualify the next three trends. None of these will, nor should they, be a surprise to anyone working in schools or the education industry. But each is a real trend, long in the making, that simply hasn't bubbled up to the popular culture surface. They are: interactive whiteboards, Open Educational Resources, and adaptive instruction. All are changing the form education takes - and, in the right hands, have the potential to improve it.

#### *I. Interactive Whiteboards*

Interactive whiteboards (IWBs, as they're abbreviated in schools), as chalkboard replacements or dry-erase whiteboard enhancements, are not new. They display what's projected onto them from a computer, allow interaction with the projection through touch or special styli on the surface, and capture that whiteboard activity to the computer. I reviewed an early Mimio model on-air when I was doing regular technology commentary and analysis for a Seattle television station in June 2000 (complete with suction cups to attach the device to the whiteboard, and a serial port adapter to connect the desktop computer). But the focus of this particular IWB tech then was the corporate meeting room, which gave it a lukewarm response at the time.

Schools, however, embraced interactive whiteboards, partly because they allowed combining projected Web and computer content with touchscreen-like student interaction on the board, and partly because they didn't scare teachers comfortable with "sage on a stage" classroom control. Education's embrace was so firm that a 2011 Education Market Research study notes IWBs from various manufacturers, including market leaders SMART and Promethean, are in the hands of 63% of U.S. K-12 teachers. While other studies tout varying statistics and penetration rates, it's clear that interactive whiteboards are a rapidly increasing presence, heading toward ubiquity.

But interactive whiteboards themselves aren't the news. The real change on the horizon - and the first digital trend applying primarily to education - comes now that IWBs are in a large proportion of classrooms. They provide enough of an installed base to become a platform and focal point for tying other proprietary and non-proprietary classroom hardware together (such as

"clickers" - officially known as "classroom response devices" - and consumer-grade iPads, Android tablets, and smartphones).

The IWB is evolving into more than a chalkboard replacement. It is turning into a delivery system for high-quality, interactive, multimedia instructional content, reflecting an emphasis that is starting to shift from the interactive whiteboard itself to an interactive classroom.

That's the apparent reason DYMO/Mimio (formerly just Mimio) recently bought Seattle educational software company Headsprout, and why Promethean earlier bought Seattle's Synaptic Mash. At ISTE, Mimio officially announced its MimioLearn product line, leveraging Headsprout's Web-based reading instruction software to provide full classroom reading instruction on the whiteboard and individual adaptive practice on student computing devices online, at school or at home. Promethean, for its part, integrated Synaptic Mash's cutting-edge assessment products into its interactive classroom hardware and branding, renaming the suite ActivProgress.

It's not only interactive whiteboard hardware companies that see the richer platform potential of IWBs. ISTE also was the launching pad for "McGraw-Hill Studio Space: ArtTalk," which puts masterpieces by Van Gogh and others artists on a "class wall" side-by-side with uploaded high school art portfolios for full class whiteboard and online critique. "Britannica Pathways: Science" takes middle school students through the scientific process in 10 subject areas, introducing the subject to the entire class on the IWB, allowing each individual student to propose a hypothesis and find supporting evidence from Britannica's digital resources, and then sharing student conclusions on the IWB and letting the class vote with clickers on each student hypothesis and conclusion.

These are only a few examples of how IWBs may go beyond a role as chalkboard replacements that display teacher-created lessons or Web content. Instead, they may be the hardware that drives the transition to a true interactive classroom, in the way one-to-one computing initiatives earlier tried. The whiteboards themselves may have increasingly less prominence as the center of instruction and become another tool of equal importance to student netbooks or tablets, smartphones or clickers, all interconnected, some with overlapping functions and use based on teacher comfort and district/school need.

Trojan whiteboards, if you will.

## *II. Open Educational Resources*

What open source in the enterprise has done for code, Open Educational Resources in education is doing for content. As the second digital education-only trend, OER goes beyond "free" instructional content, though that certainly is a driver in tough school budget times. Better-known examples include the [Khan Academy](#) videos, professionally produced materials from NASA and the Smithsonian, and teacher-created lesson plans and supplements.

Good OER is granular down to the lesson or concept, and can be mixed-and-matched with other free and paid instructional materials seamlessly. Both the [U.S Department of Education](#) and the [Gates Foundation](#) have recently taken steps to encourage OER.

At the SIIA Summit, Karen Cator, director of the Office of Education Technology for the U.S. Department of Education (and an Apple alum), said Creative Commons would be assisting with the major issue of licensing OER content for use and reuse. Her perspective? OER is a way to leverage government resources, and that educational content being created with government dollars should be available for others to use and build upon.

For its part, the Gates Foundation announced funding in April to support development of four courses - two each in Math and English Language Arts. These will be aligned to the new multi-state-led Common Core State Standards for curriculum materials and be available to schools, online, at no charge.

Neither of these efforts is trailblazing. The Monterey Institute for Technology and Education, for one, already has a collection of OER courses available through its delightfully named HippoCampus.org website. But it puts significant weight behind OER's momentum in K-12.

Yet, like open source code, OER is free like a puppy, not free like a beer. Schools and teachers are challenged in how to find it, sort it for quality, and integrate it into what they already do.

Nowhere were these conflicts more visible than at ISTE, where nine K-12 educators and administrators, ranging from state officials to school leaders, gathered at the behest of SIIA and CoSN (the Consortium of School Networking, an edtech leadership group for educators) in an OER feedback forum. They faced an audience of interested, and somewhat apprehensive, education industry execs.

As a group, these educators defined OER's core components as content that is "free, or relatively free, and shareable." That perception wasn't surprising (and perhaps the "relatively free" part was comforting to this audience).

What probably was news was the subtle vitriol they aimed at traditional educational publishers. The educators tended to find OER resources more straightforward and less complicated than most option-studded publisher textbook programs. OER, said one speaker, is "very NOT intimidating." Noted another: "We feel that many (publisher's) programs insult teachers' intelligence" by being overly prescriptive and, by implication, patronizing.

When somewhat creatively prompted by the moderator to "tell us more about 'free' and what you're willing to pay for it," the forum panel gamely offered that they'd pay for student personalization of content, aligned tests and assessment, accommodations for Special Education students, and solid instructional scope and sequence. Said one state official on the need for such curriculum direction among educators using OER, "No [teacher] is down in their basement at 2am, saying 'I've got to crank out this scope and sequence.'"

For-profit education companies are, in some cases reluctantly, going along with OER's momentum, apparently to avoid being crushed should it roll in their direction. Asked at an SIIA Summit session if their firms plan to directly compete with, integrate, or ignore OER, the company presidents who chose to respond said "Integrate." Several have already delivered.

Learning.com is one. At ISTE, it showed off a new "Marketplace" button it has added to its Sky digital learning platform, allowing teachers who use the Sky environment to pull in and integrate free resources alongside the fee-based ones provided by Learning.com or its partners.

Pearson, which debuted its Pearson Online Learning Exchange at ISTE, is another. Initially available for Texas middle and high school science, OLE allows combining Pearson and OER digital content along with content from partners such as Getty Images.

It appears that the future for education companies, when it comes to OER, is all about glue. Or to be more precise, being the glue - for a price.

While individual educators may be able to find and assemble open educational resources, it's an effort that one SIIA/CoSN feedback forum participant admitted was "not scalable." And for the foreseeable future, there will be teachers who simply aren't comfortable playing the "choose your own resource adventure" game solo. They'll likely want and need the option of having appropriate guidance and some structure.

Expect, as the OER trend accelerates, that digital learning objects from both fee-based and free sources will co-exist and be woven together on any of a number of platforms, both open source or proprietary. Digitally savvy - or cash-strapped - educators will be in the lead.

### ***III. Adaptive Instruction***

We can probably all recall a computer-based test which bluntly adjusted the next question based on whether we answered the immediate question correctly or not. But if you fine-tune that adaptation, apply it to Web-based instructional materials, and combine it with a push to better "personalize" instruction in increasingly crowded and diverse classrooms, what you get is a third, primarily digital, trend of adaptive instruction - instruction that changes the lesson, and creates a learning plan, based on how well a student understands the digital content.

Companies in this space, such as the aforementioned Headsprout (acquired by DYMO/Mimio), are gaining in prominence. There are many others, both established and nascent. A few are drawing big-name backers. For example, Headsprout's Seattle neighbor DreamBox Learning, which has a current focus on math instruction, was acquired last year by the nonprofit Charter School Growth Fund and Netflix co-founder and chair Reed Hastings. Hastings also now chairs DreamBox.

Adaptive instruction itself is far from new in education, but it hasn't been fully mainstreamed, either. That appears poised to change due to shifts in the underlying technology and a broad array of new products and services that utilize adaptive engines.

Take startup [Root-1](#). Founded by refugees from Google and the two original founders of educational device maker AlphaSmart, Root-1 introduced Word Joust, an adaptive SAT vocabulary prep iOS app, at ISTE. It might be easy to dismiss it as yet another language-drill product that uses game mechanics. Until you check under the hood.

There sits, according to the founders, a back-end "intelligent hub." The adaptive engine for Word Joust lives in this hub, not only offering up new content based on what the student clearly does or does not understand, but also monitoring the level of engagement the player has with the program, then changing the presentation of the content to increase that engagement. By monitoring behavior as well as knowledge, Root-1 is focused on creating a system that adapts to you, and one that adapts based on not solely your pattern of response but also on how your pattern is similar to that of others who have played, anticipating where you might get stuck.

And Word Joust is just the first app Root-1 has introduced. By the end of the year, it plans to have a half-dozen apps for iOS, Android, and the Web in different subjects that all are connected to the same adaptive engine and back-end intelligent hub. Root-1 also plans to make its adaptive engine API available to other developers.

All these apps will be able to leverage the aggregated history of all the player pattern data stored in the intelligent hub to help determine - based on how you, individually, now interact - the best way to help you learn the educational content.

This is not your father's blunt-edged adaptive instructional vehicle.

A similar attempt to differentiate newer adaptive products from, well, old school, is being undertaken by DreamBox. It emphasizes that its adaptive engine captures every mouse click to personalize learning not just on correct or incorrect answers, but also on the strategy the student appears to be using, modifying (as it claims on its website) "level of difficulty, scaffolding, sequencing, the number and type of hints given, pacing, and much more."

Headsprout, Root-1, and DreamBox have lots of company. In a program it calls the Innovation Incubator, the SIIA Summit made it a point to highlight [products and services](#) in which personalized learning was assumed, perhaps implicitly shifting the teacher's role from knowledge source to knowledge guide.

### » **The Elephants in the Classroom**

What this type of instruction may not be able to adapt to is the still-lackluster, uneven uptake of computing devices for each student.

It is possible that resolution to this digital education "last mile" problem could come as the combined result of the rise of digital textbooks, distance learning, and interactive classrooms. Or it could come from a seemingly unlikely source - the wholly computer-based Common Core State Standards tests for Math and English Language Arts, set to be released in 2014, and for

which almost every state is involved in creating or adopting. (Some of these assessments, coincidentally, are being designed as adaptive.)

Any one of these other trends could provide the infrastructure boost that digital adaptive instructional materials need.

What other obstacles could hamper the digital classroom's evolution?

There are at least three other considerations the drive to digital learning is casting light upon, but not yet resolving:

1) **Bandwidth.** As more schools and districts move to Web-based curricula, testing/assessment, and administrative office services (such as online gradebooks and student information systems), Internet infrastructure is increasingly strained. A school full of students streaming video for a lesson can bring a Wi-Fi network to its knees.

The release of the National Broadband Map of broadband availability down to the school level (<http://data.ed.gov>) and an analysis of broadband needs by the State Educational Technology Directors Association (<http://setda.org>) taken together make it clear that many, if not most, districts simply don't have enough bandwidth to support widespread implementation of Web-based digital learning - including the upcoming Common Core State Standards assessments. Fairfax County's Jim Siegl also noted at the Content in Context Conference that "a day doesn't go past" when bandwidth isn't an issue in his district.

2) **Battery life.** As digital education increasingly moves to mobile devices that aren't as convenient to keep plugged in - such as tablets and, perhaps, smartphones (unlike laptops and netbooks) - battery life becomes more of an issue. Especially when dealing with processor- or disk-intensive activities, such as streaming video.

3) **Filtering software.** Originally installed to keep kids away from porn and distractions online, and later to comply with federal law, Web blocking/filtering software has turned into a double-edged sword for technology-forward educators.

A survey released just prior to Content in Context - and the subject of a session at the conference - revealed that: a) the most-used social media tools by education technology organizations are Facebook, Twitter, and YouTube; and b) the most-blocked sites by schools are Facebook, Twitter, and YouTube. (Even the highly touted Khan Academy videos are hosted on YouTube - and sites like HippoCampus.org have to mirror them so schools can get to them.) The issue of filtering/blocking software came up so often during the opening session of Content in Context that all the panelists could do was nod knowingly. And, it seemed, sadly.

Solutions to all three obstacles vary. A fix for the first is boxed in by district budgets, ISP capacity, and bandwidth-hogging applications that don't allow intelligent caching. For the second, the fix is technology. And for the third, it's law and policy. Yet all need to be addressed for these three primarily digital education trends to be fully realized.

## » The Future Interactive Classroom - Or Not

It is the three digital trends not necessarily well known to those who aren't edugeeks - interactive whiteboards, Open Educational Resources, and adaptive instruction - that will increasingly touch students and teachers directly. And force their way through the semi-permeable K-12 membrane into the rest of society, much like two of the more public digital education trends - digital textbooks and distance learning - worked their way down into K-12 from higher education.

Aside from the barriers mentioned here, more barriers remain, including: federal, state, and local/district policy; budgets; technology interoperability; inertia; and - perhaps the largest and most common - fear of the unfamiliar. After all, we're all experts in what's best for education because we've all been to school. As Adrian Fenty, former mayor of Washington, D.C., wryly noted during his AEP Content in Context speech: "If you're trying to figure out how you'll get re-elected, you'll never change the school system."

But if these trends come together, it may demonstrate that the best way to innovate digitally in K-12 isn't to force outside solutions into the classroom, but to leverage the increasingly digital expectations of those responsible for education - and then let them fashion a new solution out of the same raw pixels and bits.

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### **About the Author**



Frank Catalano is an industry consultant, author, and veteran analyst of digital education and consumer technologies. As principal of [Intrinsic Strategy](#), he works with companies large and small on marketing and product strategy. He is a former senior vice president of marketing for Pearson's U.S. K-12 assessment and education businesses.

Frank serves on the SIIA Education Division Board, maintains his edugeek cred by tracking - and advising on - industry trends as a consulting senior analyst to the EdNET Insight market research service, and recently gave the opening keynote speech at the Education Industry Association's EDVentures conference. His more consumer-focused and cranky "Practical Nerd" commentary columns appear regularly on the tech news site [GeekWire](#). He lives in Seattle and tweets, mostly about edtech and digital learning, at [@FrankCatalano](#).

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I would like to thank Frank for describing an extremely chaotic landscape in terms that have all the aspects of order. Perhaps if we could put Frank directly in charge of this very-slow-motion revolution, things would proceed a bit more apace. As it is, one need do no more than recall the arguments, intractable positions, and on-the-ground memories of K-12 classrooms a decade ago to realize that things are indeed changing in how we bring technology and education together, and probably more quickly than we'd admit. If so, the merger could not come quickly enough; we are already perhaps 40 years behind where we need to be, so acceleration is good. Let's say, right --- now.

I would also like to thank Editor-in-Chief Sally Anderson for another fine effort and result.

Your comments are always welcome.

Sincerely,

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