Issue Brief

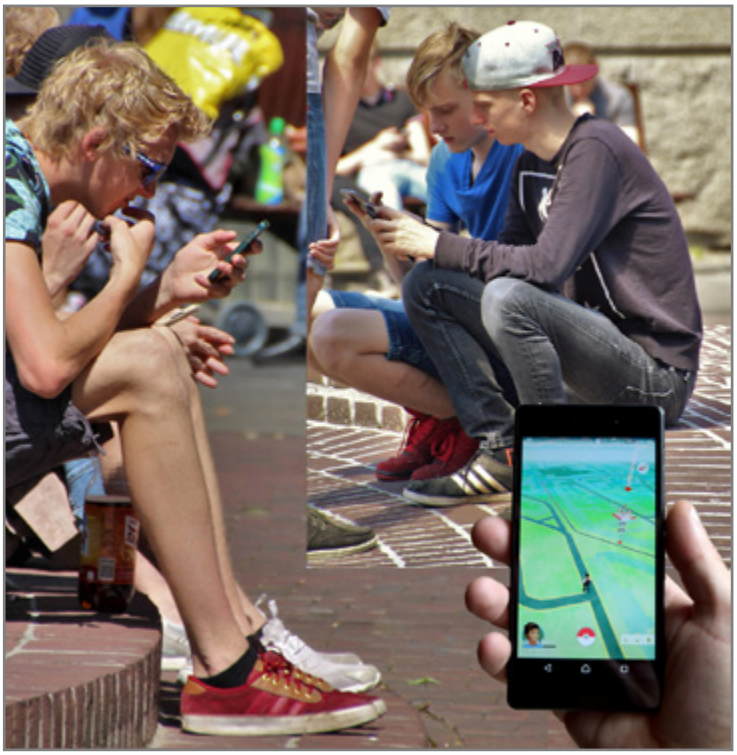
Getting Ready for The Age of Experiential Education

Executive Summary

Do you need an advantage for your school? For your teaching? A new point of leverage is emerging for schools using advanced networks and anything connected to the Internet for lessons that transcend school buildings and drive unavoidable relevance to your curriculum.

The concept is called "Digital Cohesion," and it's already here. This is more than geo-aware education applications. It is a number of "micro-applications" coming together to form a spontaneous and immersive education experience.

Let's put this in perspective. Digital Cohesion in education means using the world and the things in it to interact and drive *experiential learning.*



"The art of teaching is the art of assisting discovery."

Mark Van Doren

Digital Cohesion Definition:

A digital reality in which applications connect and self-assemble to deliver compelling mega-services that enhance our lives. In education, this means a move from:

- In-building services ➜ holistic mega services anywhere.
- Instructor initiated tasks ➜ predictive and autonomously learner-triggered with teacher as guide.
- Static ➜ adaptive.

There are things you can do now to prepare your networks for this next level of student connection with their learning.

Questions arising are: Does the network offer the right level of performance to deliver the desired end-user experience? Can it cost-effectively scale? Is it reliable? Is it protected from evolving cyber threats? Can network operational workflows be simplified to reduce the burden to manage this network of the near future?

Revelations from Pokémon Go & iGen

The run-away popularity in 2016 of Pokémon Go shows us that the power of location can be harnessed. Through a balanced combination of social, location and gaming, the app developer Niantic got millions of people outdoors, socializing with other players, and experiencing a game by exploring the world around them with just their phones. The app itself used location and presence of the players to create specific interactions,

triggering character collections and status "fights" when more than one player arrived at specific places, like parks and monuments. This sort of thing is also in use in the tourism trade for location-ware city-guide apps, informational museum apps and more.

The next layer is using the *things* in the place to provide points of interaction that are non-static and adaptive. Games already use point systems, why not lessons that use a wirelessly-linked toothbrush or dishwasher to know if a young student is accumulating bonus character points for chores well done? Why not incorporate lessons that use a supermarket's wireless to interact with the inventory, providing a math lesson with a budget for shopping linked to a calculator using devices like Google Glass or other optical head-mounted display designed in the shape of a pair of eyeglasses?

What could education look like in the Digital Cohesion era? Take an inside peek at the technology and systems that come together in just 13 milliseconds to whisk Timmy's boredom away. Watch the video: *https://www.youtube.com/watch?v=lK6OseGqhZ4*

Legend has it that a young Isaac Newton was sitting under an apple tree when he was hit on the head by a falling piece of fruit, a 17th-century "aha moment" that prompted him to suddenly come up with his law of gravity. Why not a lesson on gravity triggered in any park with an apple tree, or college quad? Lessons in food management could be triggered by an empty refrigerator or when a child is in the grocery store with a parent.

When other elements in the landscape "cohese" with on-demand digital lessons, the options for health and fitness, for financial management and math, for using transportation objects as pivot points and public wireless for history and ecology lessons, for literature and reading references, are endless.

Pretend you wanted to teach a lesson in modern space planning that would include use of math and more. Sensors on campus, for example, could help combine observations of weather, traffic patterns of students, comings-and-goings of staff as tracked by their mobile signature, and in-building heat signatures and utilities. In the lesson, students input notes that help them develop a plan over time, graphing the ideal parking and schedule for the school to maximize space and provide the optimum experience at lowest cost.

In another example, waiting a long time at a bus stop might trigger a link to a seminal work of twentieth century drama, "Waiting for Godot," Samuel Beckett's first professionally produced play that opened in Paris in 1953, seen as an allegory of the Cold War or of

the French Resistance to the Germans, and meanwhile using bus schedules and a mobile phone's clock to indicate how much reading you can get done while waiting.

A student might use their *Apple HomePod*, *Amazon Echo* or *Google Home* to check weather, school schedule, and access school apps to drill foreign language lessons or take a social studies pop quiz while getting breakfast.

Why Digital Cohesion is Important

Research indicates that student engagement declines as they progress from elementary grades to middle school, reaching its lowest levels in high school. Some studies estimate that, by high school, 40-to-60 percent of youth are disengaged.[1] Given the serious consequences of disengagement, more educators and school administrators are interested in obtaining data on student engagement and disengagement for needs assessment, diagnosis, and preventive measures.

Just using the properties of Digital Cohesion to do frequent formative assessments triggered by sensors, could be revolutionary in these matters. Kathy Dyer, writing for the Northwest Evaluation Association™ (NWEA™), in her article, *Research Proof Points – Better Student Engagement Improves Student Learning*, September 17, 2015[2], cited numerous primary research articles, and stated:

"We've posted research that has shown that using formative assessment can improve student learning. One of the ways that formative assessment does this is by improving student engagement, a challenge for any teacher. ... Research has historically indicated strong correlations between student engagement, typically defined as attention to the area of focus, active participation in learning, and time on task, and student achievement. These correlations remain strong for all levels of instruction, across all subject areas, and for varying instructional activities."

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However, the issue of student engagement is deeper than any simple pedagogical fix according to other research, and the implications are emerging because of the increase in iPhones already.

A recent article in The Atlantic, *Have Smartphones Destroyed a Generation? More comfortable online than out partying, post-Millennials are safer, physically, than adolescents have ever been. But they're on the brink of a mental-health crisis,* by Jean M. Twenge, cited important facts about the iPhone Generation.[3] "High-schoolers today who grew up with the iPhone, colloquially called the iGen, are showing radically different social behavior. A new imperative to engage through the screen, to draw students out into the world and human interaction could not be overstated. Twenge states, "The allure of independence, so powerful to previous generations, holds

less sway over today's teens, who are less likely to leave the house without their parents. The shift is stunning: 12th-graders in 2015 were going out less often than eighth-graders did as recently as 2009." Twenge also cited that in the mid 2010's only 55 percent of high schoolers were taking jobs of some kind, down from 77 percent in the 1970's. This hasn't bounced back since the recession despite job availability recovering.

Digital Cohesion promises interaction with people and the world for greater survival in life and work. It promises to take the iPhone generation out into meaningful human and world interaction.

Today's teens are also not interacting at home, and instead are replying just, "Okay, okay, whatever," to parents' attempts to engage, while remaining riveted to their phones.

Twenge's article references a well-known teen survey, *Monitoring the Future*, funded by the National Institute on Drug Abuse and designed to be nationally representative. The survey asked 12th-graders more than 1,000 questions every year since 1975 and queried eighth- and 10th-graders since 1991. The survey queries teens about how happy they are and how much of their leisure time they spend on various activities, including non-screen activities such as in-person social interaction and exercise, and, in recent years, screen activities such as using social media, texting, and browsing the web. The results could not be clearer: "Teens who spend more time than average on screen activities are more likely to be unhappy, and those who spend more time than average on non-screen activities are more likely to be happy," Twenge wrote.

It is for this reason that Digital Cohesion should be enabled by all schools. It promises something beyond static single-function learning solutions. It promises interaction with people and the world for greater survival in life and work. It promises to take the iPhone generation out into meaningful human and world interaction.

Let's count-up just a few potential advantages for Primary and Secondary Education.

1. Distance interactive orientations, which could not only expose way more students to potentials in far- away places with digital familiarity, but could reduce costs for all parties.
2. Enhanced student learning personalization, including the added physical dynamic.
3. Added dimension to recruitment through extra-limital attendance via autonomous robots.
4. A more engaged student is a more successful student and thus improves student retention—your spending less on retention initiatives by helping to remind and service students.
5. Digital Cohesion will enable campus-wide distributed learning, autonomously using software-driven resources without a whole lot of administration for things like copier use and security.

6. Real community and alumni engagement will be possible when networks allow for programs to access interesting real-time data as the community drives by, or alumni check in to see how their alma mater is doing.

The Inception Point

The starting point of the technology industry's thinking prior to Digital Cohesion was the "Internet of Things," or IOT. Major advertisers are already citing IOT as if everyone understands it because, in the ecommerce arena, digital sensors to track goods are a major trend. The fact is, very soon the idea of a smartphone as an e-commerce device could be old news as commerce moves beyond simply portable consumer devices to include durable goods, such as refrigerators, washing machines or automobiles.[4]

Over 35 billion devices are forecasted to be connected to the internet by 2020. These will range from tiny, low powered devices embedded in building materials to medical devices small enough to be implanted in your body. They will also include devices that monitor industrial equipment, pollution levels and illegal deforestation. In the Digital Cohesion era, these devices will provide the data on context, position, bio-feedback, home/office device status and more, to provide a range of services.

Speed of Ascension

When you stop to think about the emerging "Internet of Things," the ubiquity of wireless, the fact of Digital Cohesion is inevitable. Since Digital Cohesion is several "micro-applications" coming together to form a spontaneous and immersive education experience, it's important to realize what is already "here" to make the wave of new educational utility real.

Right now, Digital Cohesion could utilize a child's PS4 app connecting with a curriculum app at his grade level, and both things connecting with analytics of his learning work. With adaptive machine intelligence, the PS4, the curriculum app, the analytics and an alert message with directions on the student's mobile phone cohese together to provide a personalized educational experience within his favorite PS4 game.

The path to arrival of Digital Cohesion is short. Already the speed of change in the education market is exceeding a 4-years-to-1 of change, in comparison to 2012 device adoption rates in K12.[5] The consumer markets are presently offering smart Bluetooth key tracker tiles, smart bike locks and trackers, smart home apps to control

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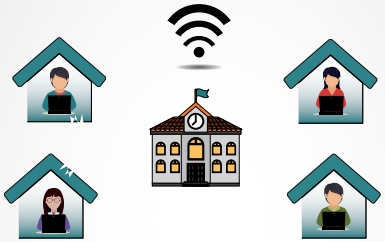
TIMELINE TO REACH "EXPERIENTIAL" EDUCATION

2017-2018

Reach Institution-Wide Access: This means your networks need to be built to handle all students accessing beyond classroom-only and up to institution-wide, including common areas.

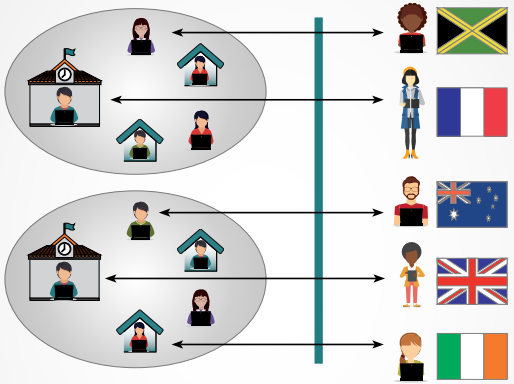


The reasons why:

- Every student and teacher needs seamless and instant access to facilitate the education experience — like every other consumer level experience they already expect.
- Opens network bottlenecks to access interactive eBooks, office documents, some digital courseware and denser files — especially transfers and uploads to cloud storage.
- Allows the network to accommodate large digital collections, skype and any gaming learning.
- Provides for remote access and video access from everywhere.
- Provides for more-devices.

2018-2019

Enable Social and Community-Wide Access: This means the network can manage the density of "always-on" high frequency multi-model streaming. You'll need this because students each have multiple devices and most software is providing a more significant load.



The reasons why:

- Denser courseware and animation graphics rich creation. Schools are averaging twenty-five to fifty apps for students, and within those programs developers are adding more sophisticated user design and algorithms.
- Allows for "extra-limital" learning where many students are skyping in or using remote-controlled robots to attend.
- Creates sophisticated routing for security/access where security policies are dynamic with a view and enforcement across the whole network, important for high-stakes testing and accessing a host of cloud-based education applications.
- Establishes multiple numbers of devices per student without slowing down – which takes some very complex network equipment.

2019-2020

High Density Net Ecosystem: This means your network has leveled up to the "Internet of Things" and is ready to handle all those "things" and the applications appearing out of the fast-changing software field. Once connected, those billions of devices will be producing huge amounts of data. It is forecasted that by 2020, global IP traffic will reach 2.3 zettabytes per year, more than double what we have today.[10]

The reasons why:

- Allows a "binge-on" network ecosystem for students, teachers and allowed visitors.
- Creates sophisticated visitor access, especially for universities where shared-environment data operations are taxing networks enormously.
- Impressive levels of multiple device access from anywhere, including numerous things students and staff walk-by or access on demand from anywhere.

Sources: Learning Counsel Digital Curriculum Strategy Survey and Assessment Tool 2016; "Digital Cohesion: The Era Beyond Disruption," Juniper Networks, 2016.

Prepping for The Wave

Schools need to move fast to ready their networks for the inevitability of Digital Cohesion. Right now, education is already dramatically accelerating in adoption of digital technology. Schools of all kinds are deeply invested in digital devices, and more importantly, very sophisticated software stacks.

While there are many schools just getting started with device use for learning, most students already have mobile smart phones and are using them whether the school has officially sanctioned their use or not. Consumer software companies are already selling more learning apps, courseware and books directly to learners than the entire K12 sector spends. Adding in the higher-ed sector, and the two markets, consumer versus institutions are neck-and-neck.[10]

thermostats and video cameras, energy use, propane tanks and lights, kitchen appliances, and even irrigation systems.[6]

Apps and LMS's need only add a scenario or geo-trigger field setting for student profiles. As a starting point, software analytics can already tell instructors when and precisely on what a student is struggling. Additional software fields can preset lesson setting choices such as "ball game," "grocery store," "kitchen," "museum," "restaurant," "park," or any sort of environment preset that a teacher wants to build a lesson or group of lessons around.

This short path can use existing software infrastructure with minor coding changes. Already pre-written code plug-ins for geo-awareness are easily obtainable, and free in many of the major languages, online. Right now, schools can use geo-aware game-builders to create learning games and provide them to students or to teachers to assign. *Aris* provides a make-your-game app and has the important future relevancy of helping explore geo-location using smart-phones which is the world of making apps that "cohese" real-world with virtual information and learning.

Science labs already have wireless devices such as *Pasco Scientific's* spectrometer, conductivity sensor, robot-like smart cart, pH sensor, and gyroscope. With new station-walk teaching, all these devices can interact in a widely-dispersed area, even multiple classrooms across a whole campus to create digital tour experiments.

Robotics devices for telepresence are already in use at schools such as Virginia Beach City Public Schools and the Nexus Academy of Columbus.[7] This explosion of already Wi-Fi aware devices used in learning in K12 far exceed those in Higher Ed, but a whole other range of applications are also close for large campuses. Take for example, how Duke University is using telepresence robots for clinical simulations in their School of Nursing.[8]

And finally, the remaining piece is standards. To let some applications hook into others, requires a lot of trust. Groups like IMS Global and the Ed-Fi Alliance are working on these trust infrastructures and interoperability, and have made very significant headway. A new commercial-grade identity recognition standard between institutions and apps is being created through a Learning Counsel initiative with a separate non-profit called the Learning Commerce Administration. It will give all institutions and learning objects an identity code like the UPC barcode structure, enabling a trusted digital identity for trading.

What School Networks are Today

The majority of schools today are equipped to some degree for digital learning. With the Federal E-Rate support and state leadership as major drivers, schools are getting hardware-ready and high speed

broadband ready, at least at the most foundational level. IT Directors today are increasingly considering cloud-based technology services and how they must be managers of service contracts and service level agreements. This is in contrast to the hands-on managing of IT assets.

The most recent *Education Superhighway State of the States report* cites great improvements to having school networks ready for digital learning, 94% of school districts are now ready for digital learning, 88% of schools report having sufficient Wi-Fi in their classrooms. [9]

Many school districts are edging up to higher levels of connectivity and are considering institution-wide and remote wireless access. However, hardware installations and Wi-Fi capability is really just a first step. Today's teacher and learner expectations are shifting dramatically as consumer tech shifts real-world and career realities. Here are the stages and where things will go, the timeline to act, and why.

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Timeline for Action:

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Your Digital Cohesion Network Readiness

The economics of any school or university's transition for the network technologies needed are part of the leveling up for true digital transition. The important consideration is that, beyond the advantages noted already, there are significant *cost savings* promised as teaching and learning are automated with high-value software and use the full potentials of the Digital Cohesion.

The national education market is already starting to reconstruct itself similar to the banking field with lots of back-office automation that enables the remaining high-touch customer support through careful manipulations of huge volumes of data to create deep personalization. A gradual reorganization, starting in the more innovative schools, has allowed efficiencies and reduced costs that have traditionally been embedded in secretarial and administration, marketing, recruitment, retention, managing interventions, and much more. As learning accesses Digital Cohesion autonomously, your subject experts can be leveraged in streamlined new ways.

Finally, whether you are at the early stages of your digital transformation or getting ready for the Digital Cohesion future, there is good reason to assess your network readiness now. Probe these areas by asking key questions about your institution:

- How is network performance for our users and for their user experience? When was the last time we asked? What's changed so far?
- What is the general condition of your network infrastructure? Is it ready to support our digital transformation over the next three to five years? How is our service coverage?
- Can we economically scale our high-speed broadband connections as traffic demand grows?
- How is the infrastructure security? When was the last time we did a network security assessment? Do we know enough about what's new in network security? ■

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the LEARNING COUNSEL
Research & Context on the Shift to Digital Curriculum

The Learning Counsel helps our subscribing 215,000+ education professionals in the K12 and Higher Ed sector gain research and context on the digital education experience. Our mission is to help districts and schools reach real transformation through strategies for digital content & curriculum. Through consulting services and research, to events, custom publishing and online editorial, the Learning Counsel provides dynamic and diverse opportunities for private and public-sector leaders to collaborate for positive change.

LeiLani Cauthen
CEO & Publisher
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Well versed in digital content and curriculum change, the adoption process, successful strategies, and helping schools understand what's available and what will work, LeiLani often writes on the changes and future of the education space. She is a media, research, marketing and sales professional with 26 years of experience in the high tech, government and education sectors.

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Get Your Network Ready for the Digital Cohesion Future

As the world shifts beyond the era of digital disruption, education institutions must be poised to move to a network of the future—one that is already taking shape. This is a network that can automatically adapt to student and teacher behavior, where user interfaces become natural, and learning curves are eliminated. In this new era, applications act on their own, connecting with each other spontaneously.

Augmented reality technology combined with visual recognition, sensors and learning services will present people with real life "classes" that present math, history, language and other lessons in real-time based on their current location and context.

Digital Cohesion Readiness Checklist

What to look for today and for the Digital Cohesion future:

- What are the architectural and design considerations to cost effectively scale our network?
- How can we ensure student data, instructional and school IT operations are protected from known and unknown threats including ransomware, phishing and denial of service attacks? How do we keep up with the evolving threat landscape?
- What areas of network vulnerability do we have that can create single points of network failure or traffic bottlenecks that can impact or stop digital learning?
- Our network staff is extremely busy keeping up with digital learning traffic demands. How can we reduce today's manual, slow operational workflows to ones that are simplified and responsive for the Digital Cohesion future?

Ready your school or institution to truly support students, parents, teachers and the administration today and in the Digital Cohesion future with Juniper Networks. Learn more by visiting www.juniper.net/digital_cohesion.

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