

The Internet of Learning Things



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Technology is just one of many disruptive influences in education. We live in an era where a wealth of data is challenging institutions to rethink teaching and learning on a global scale. With technology acting as a catalyst, education is moving from a knowledge-transfer model to a collaborative, active, self-directed, and engaging model that helps students increase their knowledge and develop the skills needed to succeed in the “Learning Society.”¹

Research shows students learn by being actively engaged in relevant and authentic activities—and technology makes this increasingly possible. Learners are also becoming more adept at using social networks such as YouTube and Facebook to text message; post videos, blogs, and images; and collaborate and socialise regardless of time or place. More and more, classrooms are becoming “open” through voice, video, and text-based collaboration, and teachers now have a wide range of technology solutions such as multimedia, games, and animation at their disposal to enhance lessons.

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What is the Internet of Everything?

According to Cisco, IoE brings together people, process, data and things to make networked connections more relevant and valuable than ever before—turning information into actions that create new capabilities, richer experiences, and unprecedented economic opportunities for businesses, individuals, and countries. Yet, based on Cisco research, 99.4 percent of physical objects that may one day be part of IoE are still unconnected.³

The Internet is now connecting physical objects as well as people. Using sensors, physical objects can “talk” (transmit data) to each other and even command each other to perform a physical act. Imagine how many ways a learner’s performance could be measured and improved through IoE. It will connect people in more relevant ways, delivering the right information to the right person or machine, efficiently and effectively.

1. “The Learning Society,” Cisco, 2010, <http://bit.ly/a1YSqY>.
2. “Internet of Learning-Things,” Edutech Associates, August 2013, <http://bit.ly/1g3wPGP>.
3. “Embracing the Internet of Everything To Capture Your Share of \$14.4 Trillion,” Cisco, 2013.

IoE in Education

Higher education programs need technological systems that reflect our altered expectations of openness and participation. The challenge is to develop new forms of scalable education that accommodate large numbers of students around from the world, attract potential students with various interests, and deliver an innovative curriculum that reflects the radical changes in computing technology.

The 2013 Horizon Report predicts smart objects will become ubiquitous in higher education by 2017 and with user-friendly technology already on the market, this may come even sooner.

Implications of IoE in Education

Massive adoption of technology in education will unleash the power of IoE making learning more authentic, and engaging beyond the classroom.

Educational institutions can no longer rely solely on teacher knowledge. Instead, they must embrace—not prohibit—the devices that learners bring into the classroom and allow students to use them as learning tools to capture intelligence faster and accelerate learning.

The proliferation of mobile devices will also enable educational institutions to collect data to interpret a learner's behaviours and activities. Used intelligently, such data will result in personalised learning targeted to individual needs, learning styles, and aspirations. IoE has the potential to integrate technology with learning in many ways.

Four Pillars of IoE in Education: People, Process, Data, and Things

IoE in education is in the early stages, but some institutions are leading the way in showing how IoE can be used effectively in educating people of all ages. This section explores the impact each pillar has on education and what is needed to support, build, and scale some of the practices currently being planned or adopted.

People and IoE

Today, most people connect to the Internet using multiple devices and social networks. While it is impossible to predict the channels people will use to connect to the Internet in the future—what is certain is that through such channels, people will be hyper-connected.

In this way, people will share ideas, discuss research/the latest developments in their area of study, and develop increasingly connected communities of practice. Experts in a specific area will be sought to teach classes anywhere in the world, and sharing information via streaming or live video will become the norm.

The advent of massive open online courses (MOOCs) is another step toward The Internet of Learning Things. Some of the world's leading universities are making their top professors available free of charge, and online forums that are linked to MOOCs will become spaces for new networks to develop and grow, connecting people from all walks of life and giving education to those who do not have access to high-quality content or instructors in their own locale.

Free educational resources have spawned the debate on “flipped classrooms” where learners watch videos on the subjects they are studying either at home or elsewhere outside the classroom. Teachers then use class time to discuss problems, work on ideas, and encourage group collaboration. The impact such resources have

on all phases of education could be significant in emerging economies where access to high quality educational resources will help support and improve teaching and learning.

The data generated by MOOCs will reveal how much time people spend on course materials and in forums, to help determine which factors – demographics, content, and topics – are most appealing and appropriate. It will help institutions to develop programs with a more individualised approach to teaching, helping to prevent students from dropping out of courses and enabling educators to align curriculums to students’ needs and learning preferences.

Across the education system, the ability to find experts and bring them into classroom in real time or through recorded video is another way to increase the quality of education. IoE will help connect learners who are home-bound or disabled participate in classroom courses and have access to high-quality learning and peer-to-peer interaction.

“As soon as they come in, they are incredibly excited, and when they realise they can ask questions directly to someone in a diving suit underwater, they are just fascinated...anything that is going to excite students is going to excite teachers.”

–Amanda Paterson, Head of Science,
Pymble Ladies’ College, Australia

Students Experience Virtual Diving across Continents

Pymble Ladies’ College in Australia comprises five schools with a total of more than 2,100 students who expect to connect anywhere in the world, anytime and from any device. The need to make video available seamlessly across platforms prompted college directors to adopt Cisco video technologies—allowing students to connect “in-person” with experts and peers, expand knowledge frontiers, and embark on virtual tours such as visiting and interacting with a diver on the Great Barrier Reef.

Process and IoE

Process plays an important role in how people, data, and things work together to deliver value in the connected world of IoE. Ensuring that young people have access to learning opportunities that meet their needs will make education more efficient and motivate learners.

For example, a learner could observe his or her ranking in real time against peers studying at the same level. This process could eliminate examinations used to measure and compare learners’ performance and achievement. The model of measurement could be accurate at any moment in time, providing ongoing, targeted, and personalised feedback on what a learner must do to improve his or her understanding and performance.

Within IoE, educational institutions will work with cultural organisations, governments, and businesses to link people, process, data, and things to maximise the relevance of education and to provide skills to the next-generation workforce.

Process is also key in tracking attendance and use of virtual learning environments, book purchasing, study habits, and managing physical access to areas on campus. Ultimately, this data can be incorporated into a full-fledged analytics system to customise education.

Connecting people, data, and things requires efficient processes not only to evaluate the outcomes of those interactions, but also to enable people to make better/more informed decisions that capitalise on efficiencies, costs reductions, energy savings, and lean management.

100-Year-Old College Applies IoE to Physical Access Process

At Bournville College in the United Kingdom, Cisco Physical Access Control technology simplifies the process of managing access to classrooms, offices, common areas, school cafeteria and convention centre, and more while monitoring foot-traffic patterns on the main campus. Students, faculty, and staff are given badges at the beginning of the school term, and visitors receive temporary badges when visiting. Each group is assigned different privileges, enabling the college to protect people from wandering into restricted areas. The system also keeps a log of attempts made to access areas where the badge holder is not allowed and then sends the data to the college's management team for investigation.

Council Rock School District Saves \$8.8 Million on Energy

The Council Rock School District (CRSD) is the ninth-largest in Pennsylvania, with 1,400 full-time staff and 12,000 students. As part of its 'Go Green' program it used state-of-the-art networking infrastructure to integrate its heating, ventilating, and air conditioning systems to monitor, control, and report energy use of network devices and facilities equipment. The process enables IT departments to power-off devices and computers remotely at a given time, wake up devices for maintenance work, or turn off devices during holiday and vacation periods. Since the program was launched in 2003, the district has cut power consumption by more than 40 percent, saving \$8.8 million in 2012.

Data and IoE

As things connected to the Internet evolve, they will also become more intelligent, thereby providing more useful information. Rather than just report raw data, connected things will soon send higher-level information back to machines, computers, and people for further evaluation and quicker decision making.

The implications of this in education are enormous. For example, as part of their studies, learners could tag physical objects, collect data about those objects, and then feed that information to other programs for analysis, improving the accuracy of their research. Learners could also access data from research initiatives, monitor programs on oceanography or climate change, or watch animals in their natural habitats via live webcams then collect data on their movements through sensors attached to the animals' bodies.

In addition, learners could also contribute their content to data banks, becoming members of expert communities in various research projects—from climate change, species identification, and archaeology to more. Sharing datasets with others around the world will enhance and extend students' learning experience, authenticating their research through active engagement with other researchers.

Learners can also use sensors to monitor their daily activity by collecting data on how far they walk or run, their heart rate, and other metabolic functions. As a class project, human biology comes "alive," and classes become more interesting as learners use the data to motivate each other to adopt healthier lifestyles.

Making Cities Smarter, Safer, and More Sustainable

Through its Future City⁴ program, the city of Glasgow is developing a school mapping project that will enable young people, parents, and teachers to map out which mode of transportation they use, the routes they take, and the distance they travel to school—and then combine the data to create a comprehensive visualisation of the school’s travel network. Tools such as mobile apps, interactive games, and an online school travel planner will inform schools and communities on local changes in travel arrangements to encourage active modes of travel. The maps will be published online with the council’s open data manifesto, and will allow schools, local authorities, community councils, and transportation agencies to make smarter decisions on road safety and “active travel” programs.

Things and IoE

Things refers to physical items that can be connected to both the Internet and people via sensors. Sensors give things a “voice”: by capturing data, sensors enable things to become context-aware, providing more experiential information to help people and machines make relevant and valuable decisions.

In education, IP-enabled sensors could be attached to artefacts monitor temperature readings, condition, or location of the object in real time, providing a constant stream of information to archaeology or history students.

Sensors also play a pivotal role in the area of student safety. In Oakland, California, security cameras and motion sensors are integrated into the schools’ networks to monitor facilities, making sure the learning environment remains a danger-free zone for students, teachers, and parents.

Special education is another area where sensors can have a huge impact. In Australia, sensor gloves are being explored to provide feedback to children learning Auslan sign language from a computer. A learner attempts to sign while wearing the glove; the information is fed back to the computer, which gives the learner feedback on the accuracy of his/her signing.

Headsets are helping learners who have Attention Deficit Hyperactivity Disorder (ADHD) and/or are easily distracted. Equipped with sensors, the headsets detect brain activity and offers rewards when a learner demonstrates improved concentration. The link between real objects (things) and web-based information about them is a significant step for education and will create deeper understanding across curriculums.

Safer Schools Increase Student Attendance

For the citizens of Oakland, California, the safety and security of their young people is top priority. In 2005, violent incidents throughout the city negatively impacted student attendance. Students within the Oakland Unified School District were becoming disengaged and skipping classes because they felt their school was an unsafe learning environment. Through the implementation of Cisco surveillance technology, special cameras and sensors were placed in schools, allowing principals, security officers, and operations leads to preconfigure school surveillance cameras remotely to increase accuracy and timeliness of emergency responses. By connecting these devices to school networks, school administrators have excellent coverage of all entrances, exits, public areas, parking lots, bus lanes, and sport facilities—making students feel more secure and less likely to skip class.

4. <http://futurecity.glasgow.gov.uk>.

Three Key Factors for Successful IoE in Education

IoE has huge potential in education but to ensure widespread and successful adoption, three main factors must be addressed:

- 1. Security** - IoE security will become an enormous issue across all markets—particularly in education. Information must be available—yet confidential, with the owner of the information deciding which people, groups, or organisations may have access to it. Personal and communal data will need to be treated differently, and the individual’s privacy will have to be respected.
- 2. Data Integrity** - Integrity of data must also be assured, as well as its accuracy, authenticity, timelines, and completeness. Success will be predicted on an “open platform” that allows all partners working together to use the same baseline technologies.
- 3. Education Policies** - Policies that encourage adoption of technology in the classroom and its effective integration into curricula are crucial. Professional development programs for educators should incorporate IoE tools to encourage early adoption and help educators develop innovative methodologies and appropriate pedagogies for the learning environment.

Conclusion

There is tremendous value in connecting the unconnected with intelligent networks across education. This paper demonstrates IoE’s potential impact on making education more relevant, engaging and motivating learners, and enabling faster time to mastery. However, to realise the benefits from connecting people, processes, data, and things, reliable connectivity and continuous access must be guaranteed.

This paper is a summary of the ‘Education and the Internet of Everything’ whitepaper by Michelle Selinger, Ana Sepulveda and Jim Buchan available here: http://www.cisco.com/web/strategy/docs/education/education_internet.pdf

For more information on the Internet of Everything, please visit: <http://www.cisco.com/web/about/ac79/innov/loE.html>

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