EdTech Mindset

your must-have educational guide to the future

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SPECIAL EDITION

from
schooling
to learning

shaping 4
the future

edtech summit

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Changing Education Mindset

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Content

The Editorial

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This issue of EdTech Mindset is dedicated to a very special event, "Shaping the Future 4: From Schooling to Learning" (March 27 – 30, 2017, Israel).

This EdTech Summit attracted people from all the six continents and a wide range of industries. The incredible energy generated by this unique assemblage brings us hope: All came ready to open their eyes, to exchange ideas, and collaborate humbly and transparently. Participants shared their doubts, their projects and their dreams. It was quite extraordinary.

All too often, learners who are disappointed and disinterested with the current education system build alternative learning systems. They develop expertise that's relevant to their immediate needs. They leave school behind to navigate freely and unprepared through an unknown, ever-expanding world, developing survival skills along the way. They become active citizens of a society, which itself has unprecedented question marks.

This special issue of EdTech Mindset presents the considerations, strategies and programs of brilliant minds who gathered in Israel in order to support the EdTech industry worldwide in our desire to provide the relevance and significance educators should have in our society.

I hope you feel the energy and excitement of these ideas, that they ignite your own ideas, and that you are further motivated to join this new generation on its journey from schooling to learning!

Dr. Lea Cecilia Waismann, Editor

The Hidden
Revolution
From Schooling to Learning

Avi Warshavsky

Consider the following image, almost a caricature of today's startup scene. A young, enthusiastic entrepreneur stands of the stage and, accompanying his words with animated gestures, declares that his initiative will disrupt the industry in which he is working. This word, "disruption," has undergone a fascinating transformation in terms of the connotations that is generates. From a disquieting term identified with crisis, it has become – thanks to a theory developed by Clayton Christensen in the late 90s – a term identified with innovation, creativity and progress. Almost every industry and category around us has been disrupted and redefined over the past two decades, thanks to revolutions created by technological innovation. Whole professions have disappeared, new ones have been created, and almost every profession has been redefined. How has education been influenced by this technological innovation? We commonly say that it has hardly been affected. A graphic artist who was trained 30 years ago, but who has not updated his skills since, will probably not find work in today's labor market. On the other hand, a teacher who was trained 30 years ago and who has not kept up to date, should still be able to integrate easily in an educational environment that also has almost not changed its appearance or structure. The commonly held view, that education has undergone almost no change, is based to a large extent on our expectations of revolutions, and our notion of how they progress. We tend to imagine revolutions in the spirit of Malcolm X's statement, "A revolution is like a forest fire. It burns everything in its path." Sometimes, however, revolutions take place beneath the surface, without us realizing their power. Clayton Christensen's theory, which redefined the idea of disruption, also taught us that one of the characteristics of disruptive innovation is the "dead zone" or "blind spot" –

disruptive innovation generally takes place somewhere that we aren't looking, and among users who are not the typical group of users. It would seem that this is also the case regarding the revolution in education. It is taking place at this very moment, powerfully, but not where we usually look.

The Revolution that We Don't See

We are used to seeing schools and institutions of learning as the focal point for education, but this revolution is taking place within other frameworks and along other axes to which we do not devote sufficient attention. The world of educational technology can be divided into two technology families: the schooling family and the learning family. Schooling technologies are those that come primarily to serve the school and the way in which it is run. As such, they reinforce and attempt to assist the existing structure of the school. Hence, we see quite a few technologies that perpetuate the structure of the school, and offer ways of reinforcing it. In place of a chalkboard, we use an interactive smartboard; in place of printed textbooks, we use digital textbooks; and instead of a teacher standing in the front of a classroom with a few dozen students, we now have teachers on the screen talking with a few dozen students. Another characteristic of the schooling technologies is the fact that they try to make the existing system more efficient.

For example, learning management systems sometimes place great emphasis on the management-administrative-report production aspect, on access permissions, and on organizing information in folders, at the expense of those needs related to the learning process itself.

However, over the past decade, we have witnessed a growth in technological solutions whose starting point is not the structure of the school or the needs of the system, but the learning process itself. These solutions generally develop outside the world of the school, and so are not something that we focus on.

At *Shaping The Future 4*, we dwelt on three such phenomena, each of them driven by different processes and motivations, but all of them closely related to the startup movement in education, a set of initiatives whose center of gravity does not come from within the system, but rather from independent entrepreneurship that is able to look directly at the learning process, without the "filter" of the school's structure and considerations.

Technology: Smart Machines

The first trend that we reviewed was the development of "smart machines." This heading covers a broad range of phenomena, from adaptive learning, which has already been with us for some years, through to artificial intelligence, the great promise that, in part, is coming to fruition in areas such as marketing and medicine, and is taking its first steps in education as well. What is common to the various tools that belong to the "smart machine" family is the promise of individualization of learning. These systems get to know us, and offer us the appropriate progress path, at an appropriate pace and in line with our own inclinations and preferences.

This vision addresses the eternal challenge involved in learning in a group – the heterogeneous class. In order to understand the enormous potential of this trend, all we need to do is look at present day practices in marketing and advertising. Personalized marketing has become so ingrained in our lives, and is so powerful and sophisticated, that it has become almost transparent. What will a learning culture look like if it gives broad expression to these trends?

Culture: Amateurs as the New Professionals

The second trend is a fascinating cultural trend that, over the past five years, has begun to gain momentum. It is a trend in which learners choose alternative teachers, generally amateurs who are not institutional representatives of the system. A clear instance of this phenomenon is that of "YouTubers" – YouTube stars, usually young, often only in their teens. Such stars are, first and foremost, teachers who teach their adolescent followers a variety of fields. Someone who follows a YouTuber generally follows them as a persona, a kind of rock star, rather than in connection with the specific field that the YouTuber teaches. Thus, on one day the YouTuber may teach about some chemical principle, another day the use of video editing software, and the next day something connected to games.

What drives the learning is the charisma of the speakers, and their social virality. And the outcome addresses one of the major challenges of the world of learning – how to create motivation among learners.

Learning from YouTubers is totally learner motivated – there is no external coercion that makes the learner learn from the YouTuber.

Society: Closing the Training and Employment Gap

The third trend is initiatives that attempt to bridge the gap between training institutions and the world of employment. This gap is an ancient one that came into being almost as soon as formal educational systems began to operate. By its nature, an educational system finds it difficult to keep up with the pace of developments in the "outside world," particularly if we are speaking of our own era, in which professions and trades are disappearing, and new ones are being born, often over a time span of less than a decade. In the face of this gap, we are also witness to a series of startups that offer training that is precisely in line with the needs of specific employers.

These initiatives offer learning focused exactly on what is needed to be taken on at one's next place of employment – often in deliberate coordination with those places of employment.

What these initiatives are responding to is, for example, the need for a course in a specific programming language, rather than completion of a full degree program in computer science. Combining this trend with the flexibility of online access and with information obtained from the wide variety of activity on the web has led to a development that may threaten institutions of higher education in the short term, and even high schools in the longer term.

The Line Joining all the Dots

Each of these trends brings with it the opportunity to address a fundamental, almost eternal, problem of education systems – smart machines address the challenges of the heterogeneous classroom, learning from amateurs addresses the challenge of generating motivation, in that it creates a "knowledge economy" that is based on purely individual motivation, and initiatives that offer professional training that bypasses institutions address the problem of the relevancy of educational institutions.

Each of these trends also brings its own challenges and reasons for concern. A focus on smart machines tailored to each individual learner may come at the expense of group learning, which itself is very important. Learning from amateurs comes at the high price of losing the criterion of professionalism, and surrender to the bottom line of popularity and the culture of consumption. And bypassing institutional learning may lose us a cultural sounding box, and the connections that build an infrastructure for the long term.

During *Shaping The Future 4* we attempted to touch on both the opportunities and the challenges that each of these trends calls forth. But apart from the specific aspects of each of these developments in itself, it is important to look at the line that is taking shape as we join all these dots together – a line delineating a revolution that is quiet, but which potentially has enormous influence, a line that points to a type of learning in which the learner, not the system, is at the center and in which learning becomes more dominant than schooling. ■
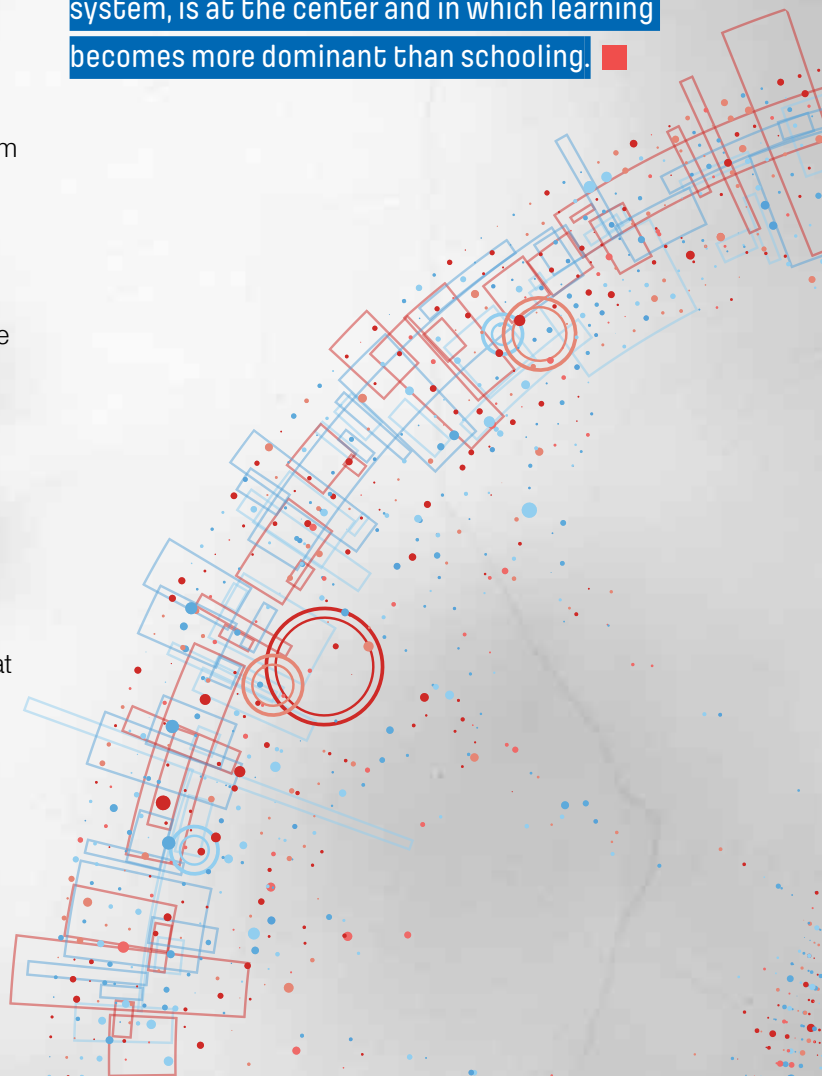
Q&A

with Professor Renee Hobbs

Director of Media Education Lab at the Harrington School of Communication and Media, University of Rhode Island

» Tell us about the Digital Learner of the 21st Century.

Let me tell you a little about myself as a digital learner. I have a fascination with how to use the powerful tools of technology for communication, expression and advocacy. It seems to me that right now, the most powerful tool in our educational tool box is the cellphone. Most of us have one, and it connects us instantly not just to our friends, but to a whole world of information and ideas. More than just a tool for receiving information, the cellphone is a tool for creating messages, sharing ideas, composing and using images, language, sound and multimedia.

Today, there are not just a few experts and professionals who are able to express and share ideas. All of us, amateurs, are sharing ideas that inform our understanding of the world. This means that the learner is not only consuming, the learner is creating. And this pedagogy, of creating in order to learn, of using media production to demonstrate one's mastery of academic content, is really a powerful thing. Once you've created media about something you've learned, you've really learned it. This is the same idea as, "If you want to learn something well, teach it to someone else."

Because we have 24-hour access to powerful tools that are right in the palms of our hands, we need to think differently about how to use time and space in the school learning environment.

There's a real opportunity to break outside the boundaries of the 45-minute period and the rigid disciplines of science, math, social studies and language. There's a real opportunity to use the human's natural tendency to ask questions, our natural curiosity to ask about the world. There's a real opportunity to use this natural curiosity to promote inquiry. Because when people discover how fun it is to ask questions and to learn and then to ask better questions, well that's how you become a life long learner.

--- Enabling clever machines to reinvent the learning space ---

A HACKATHON EXPERIENCE

A dream team of 120 experts from all around the world set out for an intensive 36 hrs to re-imagine the future learning space
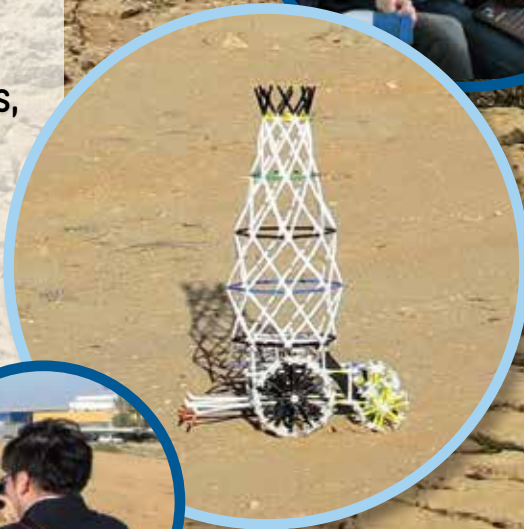
A select group of experts from 24 countries (researchers, developers, students, investors, bloggers, artists, educators, administrators) passionate about education, together and collaboratively, envisioned, shared, designed and offered new learning environment solutions.

Q&A

with **Dr. Martin Dougiamas**

Founder and CEO of Moodle

» Can you tell us a little about your personal learning experience?

For the first twelve years of my life I grew up in central Australia. It's a big desert, lots of sand, not many people and I was the only European descendant in this little town. My school was on the radio. We had a school system called "School of the Air". Every morning I'd get on a shortwave radio and talk to my teacher, who was about a thousand kilometers away, and we'd have a half hour or so morning session. The other students were spread in an area about the size of Spain. After the session I'd be doing homework, worksheets, my parents would be helping. And every two weeks a little airplane would come and deliver papers and take my assignments back. And I did this until high school, basically.

When I got to high school I was a year ahead of the children my age, so I actually jumped ahead a year. It wasn't until after I developed Moodle that I realized how influential that early period of my life was. I realized I was very interested in distance education -- on improving the bandwidth for people to communicate through a technology medium.

» Which characteristics of your learning experience did you want to reinforce when you created Moodle?

There were two main things. One was the importance of the human connection. **My teacher was really good at being a person on the radio.**

Once a year we would meet physically so we could get to know each other, and that really helped the online interactions. That's true still today. That's why I'm here in Israel.

The second is that there was structure and patterns in the online learning. It's important to work within a structure so people know how to interact and you can build on prior experience. If it's totally unstructured, it's like browsing through YouTube -- you see a lot, you don't learn a lot. Learning is a process of building and constructivism in the brain -- of constructing knowledge. I think "School of the Air" was very good at that.

» When you constructed Moodle, which ingredients did you want to bring to this new operating system? What was the structure you wanted to create?

I started Moodle because I was frustrated with the tools that existed at the time. I tried to use WebCT at the university where I worked. There were some good things about it, but it's a propriety product. **As a computer scientist, I couldn't change the code. I couldn't fix it. I couldn't make it better. I thought, if I was going to build something, it would have to be something that a lot of people could participate in, a lot of people could help with.** That's really been a key thing with Moodle, the open source nature of it.

Second, from the very beginning I made it multilingual. We focused on the international aspects from the very beginning. My parents are Greek and German, and I grew up in Australia. I regarded myself as a world citizen; I'm not particularly Australian. The first person to use Moodle was in Canada, and the next person

was in South America. So straight away, it was international. And that's been really important because the amount of input the project's had from people around the world is just incredible. It's led to the flexibility of the fundamental platform. It's used in very different ways around the world.

Third, if I had to add something, was the passion of the educators. I had passion from the beginning, and for a long time I was by myself. Once I released Moodle and other people started to join, it was just so much fun. And when something is fun, a lot of people get it and join, and it's still like that.

» **You mentioned three key elements: open source, community and enabling the user to be part of the process. How important are these elements for the learner today?**

I think the community and open nature of this project is very compatible with how educators think. Educators by nature are sharing people, they want to share their knowledge. If they have ideas about the software they use, they want to share them. A proprietary piece of software doesn't have the same soul to it.

I use whatever's best for the job, whatever works. For this particular case, for a learning platform, being open really works. It creates more value for everyone.

» **If you were able to create the ideal environment for learners today, what would it be?**

If I had to pick a single tool that was the best thing for a personal learning environment, it would be a computer. You cannot say one piece of software is going to be "the tool". With a computer, you can make your own tools. I built Moodle just on a computer that was in front of me. Everyone has that ability. Not everyone wants to write software. But the potential to create tools, and learn about the world while you are doing it, is there in a computer. And you also have access to everything the world provides.

There are many, many, many tools of all different kinds. You need some of them at some times and some of them at other times. You need that kind of flexibility in your learning. On top of that, I believe learners do need a basic curriculum and I think we need to reevaluate that curriculum all the time.

There's a real danger in what's going on in the world today. People are reacting against technology, against globalization, often from a lack of understanding. They don't understand "that new stuff" and its taking away jobs, it's affecting their culture, and people are reacting against it. You can see it in the U.S. elections, in Brexit, in many things.

I think there's a real need for us as educators to focus on what makes a good citizen. By "good", I mean a citizen who helps the world be a better place. It takes a lot of understanding, which needs to be informed by facts, by science. People need to understand internationalism and how cultures vary around the world. They need to understand that different cultures can and should coexist, and people from different cultures can work together.

These kinds of big issues are really important, but to get there you need to give people a grounding in philosophy, in science in all kinds of studies. And you need to make it compulsory, in my opinion, so you can go out and be somebody who is able to vote. How can you choose anything if you don't have the background?

Ido Keinan

Clever Machines
as the engine that enables
schooling to learning

Computers and robots with their artificial intelligence (AI) won't be replacing human teachers. The sigh of relief in the wake of this statement should be used to ask a follow-up question: If not our digital friends, who will help solve the problems of quality of teaching and teacher shortage? These topics were discussed in the "Clever Machines as the Engine that Enables Schooling to Learning" session at SF4.

Professor Rose Luckin (Learning-focused design, UCL Knowledge Lab) opened with a story: "Somebody called Joe, who has spent a few years living in the city of Nanjing, the silk capital of China, was really struggling to learn Mandarin and he can't communicate with his neighbors which is very upsetting because he is a social kind of guy. His neighbor Wu decides to help him, and introduces him to Prof. Chan from Nanjing University, where he has been studying intelligence and language learning and has developed a special language learning room. So Joe enters the language learning room, which is sealed; there are no windows, but there is a slot on one side of the room, and a slot on the other side. Joe sits in this room; there's a big rule book in front of him. He receives through the left-hand slot Chinese symbols, looks in the rule book and converts each Chinese symbol into an English symbol and passes them to the other side. Joe is in this room for a month. After a month, Prof. Chan opens the door, welcomes him out and rewards him with a beautiful book written in Mandarin, and waits for Joe to read. Joe can't read a word, because of course Joe doesn't understand Chinese; he can obey the rules and convert the characters, but he doesn't understand Chinese."

One doesn't need to be, or possess, an AI in order to understand that the referent of the parable is the subject of the discussion – "AI doesn't understand what it computes, either. It doesn't matter whether it is a rule-based system, a statistics-based system or a deep neural network. The AI has no self knowledge, no mental cognitive awareness, it does not understand." Thus, predicts Luckin, teachers' jobs are not at risk at the hands of AI: "If we take into account that AI does not understand what it knows, and has no mental cognitive abilities – humans do, a very important thing to remember – then where on earth is there a possibility of an AI replacing a teacher? Can you imagine an AI trying to explain to a parent why it has given a particular grade, trying to justify exactly what is happening, let alone having the capacity to understand the emotions and the motivations and everything being experienced by the learners, as well as having a perception of their wellbeing? So it's not a case of AI replacing teachers."
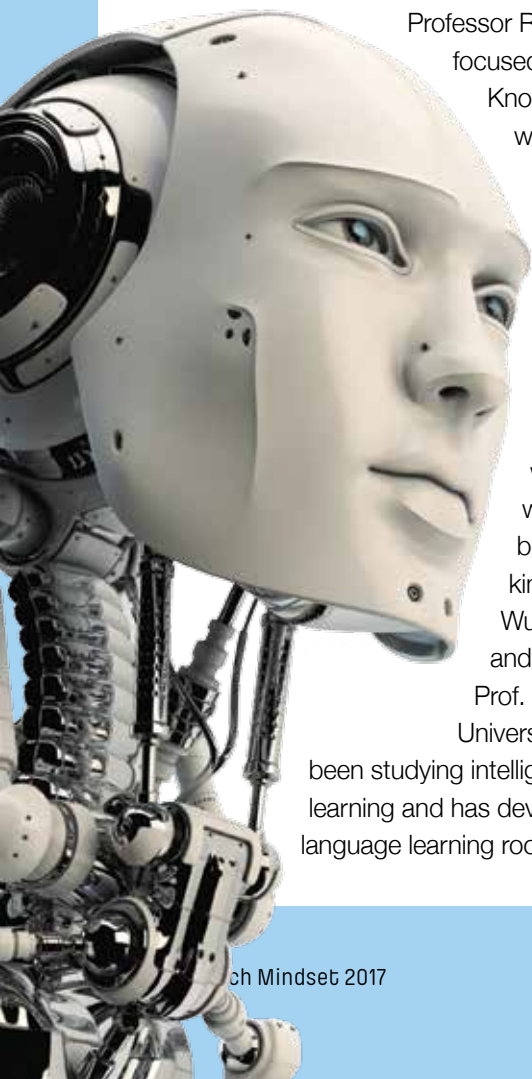
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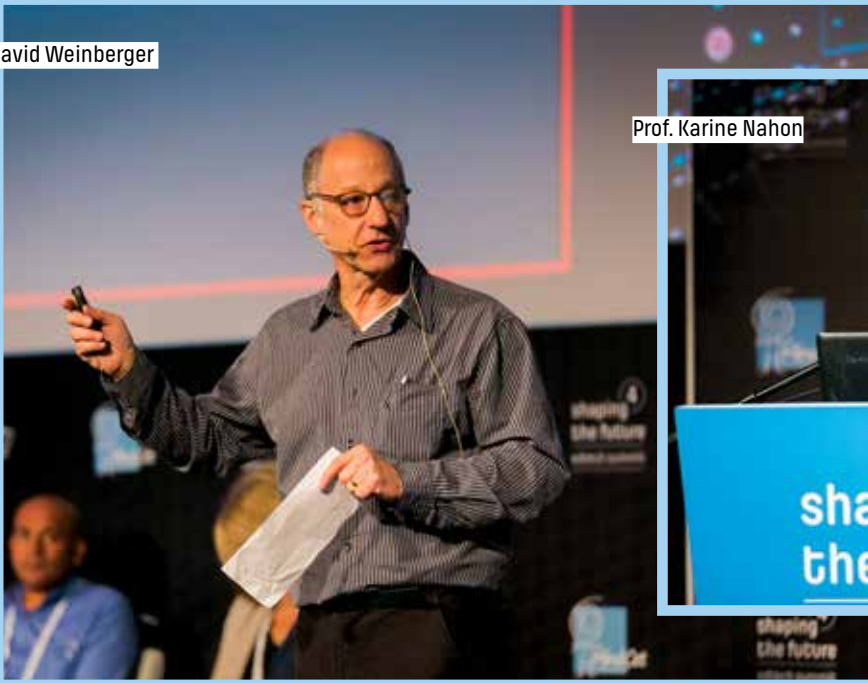
Prof. Karine Nahon

What AI can do, according to Luckin, is help teachers identify systemic problems:

"One of the keys to being a good teacher is understanding that all learners are different, they all see things differently, want to learn in different ways and need different sorts of support. What we need to do is understand the learners. AI cannot understand itself, but maybe it can help us to understand the learner.

AI, in combination with Big Data and smart visualization techniques, can help us to take on some of the biggest challenges in education

challenges such as the inequality in many education systems in which the most privileged can afford tutors and the best schools, and therefore can pass the exams, and therefore get on in society. The achievement gaps between those who can shine in the way that we choose to assess them, and those who don't get a chance to show us the brilliance that they have inside them – that's where AI can help."

She broke down this idea into practical examples: "Part of the reason that the system is unfair is because we only assess students on a small portion of what they need to learn and understand. We tend to assess them through exams and tests mainly on their knowledge of particular subjects, and that doesn't suit everyone. If we use the kinds of data that we can now collect – we can collect social networking data, TV surveillance data, data about how students have used their identity card to go into the library or buy lunch or buy books at the bookshop – it is the data that we can collect when they interact with

technology, but it's not just that data. If we use AI smartly to process by identifying the key questions that we need to answer through that data – because we know what we're looking for, in terms of what we believe signifies learning and progress – then we can start really to unlock the black box of learning; we can start to shine a light on knowledge whose importance those who support standardized tests want us to be able to acknowledge – we can look at whether they are good at math or history.

But we could also learn how over time learners deal with challenges – whether they are resilient, whether they can learn from the things that challenge them. We can use the visualization of this data to help students understand themselves, help them discuss with their teachers and parents where they're doing well and where they need help, and most importantly, we can help learners become effective learners. Because it's that self-learning ability that will be a key skill in the workforce of the future – not the routine cognitive skills and the knowledge we seem obsessed with testing at the moment. It can help us to detect the skills and abilities of many students, instead of only the privileged. It can help us to identify and value a wide range of skills, abilities and characteristics."

Dr. David Konopnicki

Prof. Rose Luckin

Professor David Weinberger, writer and senior researcher at Harvard University's Berkman Klein Center, explained the difficulty people have in understanding how AI works. He demonstrated this with AlphaGo, an AI developed by Google DeepMind, which defeats people in the elaborate game of Go. If we ask AlphaGo to explain a particular move, Weinberger said, it will tell us that we will start with node 1 – a possible move – examine the probabilities that result from that move, then continue to node 2, examine the probabilities and so on to billions of nodes. "We can't do that, it's meaningless to us," said Prof. Weinberger. "The only way we could figure out what that means for making the next move is to feed it back into a computer and have the computer do the calculations – which is where we started. This is an alien way of thinking. How do we know that it's thinking right? In the case of AlphaGo it's easy – it keeps beating us. It wins!

This sort of thinking is immensely powerful; it lets us address problems we simply couldn't before.

Many people are nervous about it, which I understand, because we have systems that are going to be guiding our autonomous cars, and they're going to make decisions like, 'OK, we're gonna have to slam your car into the side of the road, because that's the best outcome,' and you say 'Why?' and it says, 'Well, let's start with node 1.

' And it's troubling that we have machines that are making moral decisions, or decisions that have moral consequences, in ways that we cannot question or interrogate."

"We are developing deep learning systems," said Dr. David Konopnicki (Master Inventor at Information Retrieval Group, IBM Research). "It is very difficult to take what the system knows about somebody – which is really a mathematical model – and then come back to the user and say, 'OK, this is what we know about you. Do you agree? Or do you want to change it?'"

"For the past few hundreds of years, we've accepted a Newtonian model which says that there are universal laws, and they're very simple, simple enough that human beings can understand them. And what a surprise that the laws of the universe turn out to be entirely knowable by humans, which is a tremendous coincidence," said Professor Weinberger. "Our expectations have been shaped by our technology, and our technology, until recently, was epitomized by computers that were incredibly slow and could handle very little data, at one point embedded on punch cards," he said. "But now everything is a sensor – the things you carry in your pocket are sensors emitting tons of data. Sensors across the world, orbiting the earth, enormous amounts of data, enormous networks, enormous, high-speed computers are joined together in distributed computing networks which we could not imagine a couple of years ago. So if we want to ask about the alien intelligence, I think that if we balance the Newtonian view, that there are universal, simple laws that are knowable by humans, against the view we are now encountering in our deep learning machines, then we conclude that there is way too much data for a human brain and that relationships are way too complex. Now we can deal with this data in real time, deal with far more relationships and also deal

Prof. Jihad El-Sana

with the fact that in some practical sense, if you look at anything closely enough – everything is an exception. So if you want to know where the alien intelligence is, I would suggest that, at least for today, the human intelligence is more alien than the computer one. At this point, deep learning gives us a more accurate representation of how the world works. We have shaved off the details in the pursuit of universality and laws that we can apply top down."

This of course has implications for the way we learn, and Prof. Weinberger wasn't just talking about the aforementioned radical changes in perception:

"What does this mean for education? I have no idea. Maybe it means, and this is long term, that there won't be quite so much emphasis on students showing their work, because we're going to get more and more used to the idea that knowledge is something that we co-create with computers. We're already pretty well used to that – in truth, we've been co-creating with instruments, with things in the world, since the first time a shepherd carved a notch on a stick to count the sheep. Second, we have often tried to teach by providing universal theories and high-level abstractions and let students apply them, as if that's where the truth is. And of course there is truth in those abstractions, but they also tend to file away, sand down, the particulars and the exceptions."

A practical utilization of these ideas can be seen in the programming world, Weinberger suggested: "If you want to learn a programming language, you can take a course online or in a classroom, get the general principles and work your way down, and that will work for a lot of people.

But far more likely these days is that you'll go online, start a tutorial, get one chapter in, you'll start doing some work, you'll hit a 'how do I do this or that?' and you'll go out and ask any of the really excellent sites like stackoverflow, addressing very particular problems as they arise. And you can become a very good computer programmer that way."

A less abstract example can be found in the words of Prof. Jihad El-Sana (Dept of Computer Science Ben-Gurion University), who tinkers with augmented reality (AR) in his lab and presented a possible application: "If Avi [Warshavsky, MindCET CEO] is stuck with his car in the middle of the desert and would like to fix it – can we provide him with an interface so that he will take his phone, point to the engine of the car, and the computer will tell him, 'OK, unscrew these screws, take off this hood, do all these actions until you find the problem and fix it; we'll tell you step by step how to put it back.' This is one of the things we're trying to develop, and it's mainly not for Avi in the desert – imagine an astronaut in the space station who needs to fix something. Instead of resorting to heavy manuals, he will have it in his helmet."

Whether people of the future will need a YouTube video, an AR helmet or a direct transmission to their brain to tell them how to turn the screw or which line of code to debug so that the water generator in their hovercraft comes back to life – assuming it cannot self-fix – schools will have to learn how to teach us ways of learning new skills, and to know which of the existing ones not to discard, so that they don't end up dehydrating just because their AR helmet's battery got drained. ■

Q&A

with Dr. Goren Gordon

Head of Curiosity Lab at Tel Aviv University

» **What is the significance of robotics for learning?**

I work with a special kind of robot called social robot. The goal of social robotics is to assist in social rather than physical interaction. Hence, they are designed and used in a social context with humans.

An emerging field is socially assistive robotics (SAR), which emphasize the help these robots can provide. Usually this field focuses on the elderly, service robots and education, mainly for children. I focus on the latter.

SAR for children can be used as tutors, i.e. teaching children content by presenting a curriculum, similar to a teacher. The use of robots in this context has many benefits, mostly that robots don't tire, they are repeatable in execution and they can contain the recent advances in pedagogy research.

SAR for children can also be used as robot peers. These are portrayed as robotic companions and "play" or "learn" with the child. They are designed to behave as robot-companions and not tutors. This is my main research topic in social robots.

It has been shown that having a physical robot, as opposed to a virtual one, yields significant improvement in learning gains. It seems that the embodiment of the companion and its interaction in the physical and social world are important components in the social effects on learning.

How do you respond to the many misconceptions leading to skepticism about the relation between robots and the learner?

The social robot companions are designed to help learners learn and, even in some of my studies, enhance their meta-cognitive skills such as curiosity and mindset. They are not there to replace children companions, teachers or parents. They are meant to be used when all of the above are not there and instead of mindless passive TV-time, or other interactive yet non-social tablet-time.

» **How is human and technological interaction changing?**

Technology now comes into the social world in a myriad of ways, e.g. robots, virtual companions, VR, AR, etc. They will be used in many more ways in the new future. They can help in learning, managing the time and other helpful tasks.

» **Why Curiosity Lab? What is your vision?**

My vision of the Curiosity Lab is to better understand, promote and harness the power of curiosity. I want to have a working model of normative curiosity-driven behavior. I would do this by developing model-based quantitative assessment tools of curiosity and studying curiosity dynamics and social nature. Then, the vision is to build curious robots to better

understand how infants and children explore their own world. This, in my vision, will not only enable fully autonomous learning and adaptive robots, but also a better understanding of human curiosity. Using these social curious robots in educational scenarios will hopefully enable the affective personalization of socially assistive robots that promote curiosity in children.

Finally, after studying and better understanding normative curiosity-driven development, the model-based robotics approach will enable the performance of novel methodologies to studydevelopmental disorders such as ASD and ADHD. By "tinkering" with parameters in the normative model, we will try to re-create a robot with developmental disorders. This will enable us to shed new light on possible causes of these disorders. Furthermore, by having a "robot with ASD", we can perform
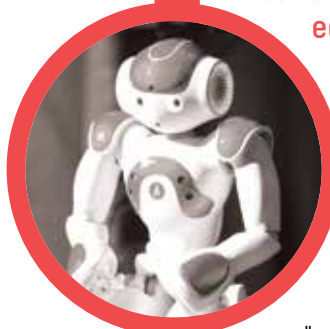
many interventions on it and select the best ones to try on ASD children. This can have a drastic effect on the search for proper interventions.

» **Curiosity is the "key" to motivate the learner, which has become a basic challenge to educators. How can robots contribute to change this serious current educational battle?**

Socially curious robots can serve as companions to children and play as "role-models" of the curious child. By socially interacting with such robots, children can be dis-inhibited from their prior experiences that caused their decline in curiosity. Hopefully, they will "catch" curiosity from their robotic peers and start expressing more curiosity. The goal is to have these robot companions both at home and in the classroom, to augment the teacher's role as educator and role-model.

Public Learning

If you learn something, it would just be selfish to keep that bird in your own private cage. Sharing what we learn is becoming the default.

Dr. David Weinberger

When Socrates is trying to think about what education is, he proposes to Thaeatetus that perhaps teaching something new is like handing a bird over to a student that he then tucks away into his birdcage. That metaphor turns out to be yet another of the dialogue's failed attempts at cracking the nut of knowledge, and the dialogue ends without a resolution.

But the dialogue does in passing give us Socrates' most famous formulation of education: Socrates is a midwife, helping people give birth to their ideas. Socrates does not propose this as an answer to the question "What is education?", but he demonstrates it while providing other answers.

The bird metaphor has not stuck. The midwifery one has, presumably because it accords the student some agency and dignity. Yet both versions of education have one thing in common: they see knowledge as a private between teacher and student, an act of primary benefit to that individual student.

We have held to that belief. We currently typically put a few dozen children into a room with a single teacher because that was the only way public education has been able to scale, but we test them individually because education aims at improving individuals. These enlightened individuals we hope and assume will go out and be good citizens, making a better society – a belief Socrates asserts when

defending himself from the charge of corrupting the youth of Athens by educating them. If corrupting the youth would make the city a worse place, Socrates says, who would knowingly make where he lives worse?

But if we look where we are learning today, we see something different. Go to Stackoverflow, where software developers ask each other often highly particular questions about how to do this or that in some particular programming language. Go to Quora where people pose questions so that can answer them. Go to Facebook where people write about what they know and ask about what they don't. Go to WikiHow where strangers have explained how to fix just about every object that can be broken. Go to YouTube and see if you can find out how to re-pack the grease that lubricates a KitchenAid mixer; there are over one thousand videos to help you. Go to the FountainPens discussion board at Reddit and ask why you have to squeeze a few drops out of a pen after you've filled it. Or go to the AskScience board then and ask how some planes can fly upside down if what's keeping them up is the Bernoulli principle.

Sites like these have been making a splash because people on them provide knowledge without first showing their credentials. Often the person providing the answer is an amateur. That's either frightening or encouraging, depending on one's point of view.

But, least as important, each of these sites exhibits a new commitment to learning as a public event. If you learn something, it would just be selfish to keep that bird in your own private cage. Sharing what we learn is becoming the default.

After all, learning in public used to be difficult. Even just a few years ago it would require setting up cameras in the classroom and distributing videotapes. Online, though, it is easier to keep things public than try to wall them off. As a result, we now not only see the results of what people have learned, but often see – and can participate in – the processes by which knowledge is developed: at Stackoverflow, we can watch developers argue about the best way to do things, and we can read the Talk pages at Wikipedia to see how people with different points of view got on the same page.

People engage in public learning for the same sorts of reasons humans have for doing anything, from the narcissistic to the altruistic. Just seeing this range of motivations reminds us that learning is not something to be walled off from the rest of life, but is a constant part of life.

It is even possible that learning together and sharing what we've learned are the most widespread forms of sharing on the Internet: not everyone posts podcasts or contributes to a blog, but lots and lots of the Earth's citizens are on the Web publicly inquiring and responding, publicly developing ideas with others,. That a couple of billion people are learning to share the process and results of education ought to make educators, and all of us, just a little bit hopeful.

Q&A

with Prof. Rose Luckin

Professor of Learner-Centered Design at the University College London Knowledge Lab

» **Can you tell us about your general approach to learning and the thinking behind it?**

I've become increasingly fascinated with the different ways we can use technology to support learning.

I struggled at school. I wasn't a particularly successful learner despite being a professor now. I learned how to do well, but it wasn't a smooth or easy ride. I went through some really tough times. This is what motivates me to help learners who struggle, to help them get recognition for the skills they have. I had a lot of resilience in overcoming problems, but there was no way to recognize that resilience; it's not something you can be tested for on an exam.

Today, I use artificial intelligence mechanisms, techniques and tools to try to unlock the black box. I try to find ways for learners to show their unique skills, knowledge and abilities. This allows us to support them more effectively. Most importantly, given the way the work place is changing, it allows us to help them understand what they're good at, what they need help with, where they're excelling. Then, we can help them show people what they're good at in ways we couldn't do in the past.

I'm on a mission to do more of that, to open up what's going on with learners so we can show the breadth of skills, experience and knowledge that every learner has.

» **When we are building a new learning environment, what are the most essential elements that should be there?**

I think the most essential thing is to understand what the learning environment is trying to achieve. I work in artificial intelligence, and a lot of people, when they think about artificial intelligence, they immediately think about robots or deep learning or a particular sort of technology. But actually, the most important part of artificial intelligence is identifying the problem that you are trying to solve and then unpicking and working out the solution. This happens before you even start thinking about the technology you might use.

I think the most important thing is to identify what we want from an education space. What kind of experience are we trying to create? Do we want to train people in a particular way? Do we want to open young minds to understand more about the world and how they can best interact with it? Once we've decided what we want to achieve, the next step is to work out the infrastructure for the data we're going to collect as people learn. This is the core of using smart algorithms -- to analyze the data and show people what they're achieving.

The next step is to decide on the technologies we want to use in the data-capture process. We consider the kinds of engagements we can gain by augmented reality, virtual reality or haptic technologies. It's important to keep in mind what we

want to achieve, the data we must capture to show we're achieving it, and to show people how they're performing – teachers, learners and parents. At that point, we start thinking about the technologies we should start putting in place.

» You mentioned three important stakeholders; can you expand on this?

Learners, teachers and parents are important, particularly parents with younger children. When children are teenaged, perhaps they don't want their parents to be so engaged, but the parents are still an important influence. We need to think less in terms of a simple learner-teacher relationship, and more about learning spaces as ecologies of resources that include teachers, parents and students. We need to use technology to bring the right people together at the right time.

A teacher with multiple learners in a class might be supported by an artificially intelligent assistant. I don't mean a robot, it could be something invisible like Siri or Alexa -- something in the background that helps support the teacher by highlighting what's happening with particular learners as they are learning. For example, it might highlight whether there's a dip in the positive emotions in the class, to remind a teacher about a child who's having a particularly difficult time at home so the teacher can create a communication link with other stakeholders in that particularly individual's life such as parents.

I don't see a particular learner- teacher role, I see a group of resources that are available to solve the problem of educating individual students and helping them help themselves to continue their education, to continue learning throughout their lifetime.

shaping 4
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PARTICI PATING

Bridging the gap between Schooling and the Digital Age Professionals

Maia Aron

Panelists foresee an ecosystem that works for a lifetime

T here is undoubtedly a large gap between the skills learned in school and the skills needed for employment. Bridging the two with EdTech products was the focus of this work-directed discussion.

Six panelists highlighted challenges and solutions along the entire path starting with K-12 education and moving through high school, college, vocational training, initial placement and lifetime employment. Couple this with careers that may span up to fifty years in a rapidly changing business environment, and you're climbing a steep hill.

"What does it take to really bridge the skills gap between the schools and the digital age professionals, and how do we best prepare learners for an uncertain future?" posited moderator Tony Wan, Managing Editor of EdSurge, a publisher that helps educators find and use the best technologies for their students.

Tony noted his personal story: He trained to be an historian but went to work in a tech startup.

"New opportunities and jobs are changing faster than ever," he said. "How will technology impact careers and industries, and which industries?" He noted a recent survey by The Economist that the top skills employers now seek are not directly in technology – those skills may be a given - but in non-cognitive areas such as critical thinking, collaboration and communication.

Bringing the right products into K-12 schools and getting the buy-in of teachers was the focus of Harold O. Levy, Executive Director of the Jack Kent Cooke Foundation, which supports high achieving, low income students.

Harold highlighted the Tech Ed Consortium, which he successfully funded through the Gates Foundation, and which created a community of 34 major K-12 school districts in the US to efficiently identify, purchase and utilize EdTech products.

"It is critical to supply training to teachers to incorporate the educational technology into their pedagogy," he said, warning that failure to do so is among the key reasons for the failure of TechEd startups.

In addition to the Tech Ed Consortium, he noted two initiatives that were funded directly by the Jack Kent Cooke Foundation: an online training course for teachers at the Columbia University School of Education and a Digital College Advisor Chatbox for direct use by students.

"Ed Tech is still primitive," he said, highlighting additional startup missteps such as failure to account for data privacy and overly rapid expansion. "It is up to the startups that gather here not to make these mistakes".

Advancing the discussion to higher education, Troy Williams discussed investment opportunities in ventures outside of four-year colleges that build pathways to lifetime employment.

Troy, Managing Director of University Ventures, concentrates on the continual need to update and learn new skills over multiple companies, industries and marketplaces over long working-life.

Front-loading a four-year degree may have been suitable when undergraduate students were not primarily concerned with job skills training, and still may be suitable for some students, but not for the roughly 90% who go to college in order to work, he said.

Matching this large student market with employers who require specific skill sets is where Troy targets the roughly $400 million under his firm's management:

"Student debt is now $1.3 trillion dollars and it's more than the entire credit card debt of all Americans; it's one fifth of the entire mortgage debt of the country," he said. "Much of this is based on the increasing number of students today who go to college but who wouldn't have in past generations. It used to be, over the last generation or two, that 20% to 25% of high school students went to college. It's now 50%. This new quartile is not getting a great result. They're graduating with a lot of debt and yet they're not able to find a job that's necessarily better than the jobs they used to have. In fact, we've seen a lot of jobs that didn't used to require a college degree that are now requiring a college degree."

His proposed solution is to create an alternative framework in which students can obtain skills-based training and certification in short intervals throughout their careers and employers are able to target prospective employees who have attained the skills they require. He referred to this as developing

"competency marketplaces" and "intermediaries" between prospective employees and employers. As examples, he noted two of his firm's recent investments, Galvanize and Futr.

All the panelists pointed to skills assessment as a crucial ingredient of the education-work ecosystem, and this was the focus of remarks by Norihisa Wada, Executive VP and Marketing Officer of Tokyo-based EduLab.

EduLab is responsible for Japan's national entrance exams and achievement tests under the Ministry of Education. More recently the company has been involved with EdTech investment, including relationships with CodeMonkey Studios and SpeakingPal, Ltd in Israel.

Norihisa described trends in Japan that mirror those in other countries. He noted that historically, entrance exam scores were the most important thing to students, while employers were most concerned with the university the student attended.

Today, there is a "huge" difference: Summative, high stakes assessments have become less important to employers than formative, mid/low stakes assessments based on their need to hire candidates with non-cognitive skills such as leadership and communications.

Panelists agreed that much work needs to be done in updating assessments so that they become more accurate and useful in targeting specific skills over an entire career span.

What about the perspective of students entering the workforce?

This was addressed by Shahaf Shakuf, VP and General Manager of Chegg in Israel and Wu Wensheng, CEO of Wanxin Media Group in China.

"The gap is so huge between what students learn and what they need to do when they start working,"

said Shahaf, whose Santa Clara based company

Left to right: Charles Wang, Wu Wensheng, Shahaf Shakuf, Norihisa Wada, Troy Williams, Harold Levy, Tony Wan

originally was devoted to textbook rental. Responding to the needs of its customers, Chegg soon found itself providing services such as study aids, tutoring, test preparation, internships and scholarships. The company's focus is on helping students with immediate educational and work-related needs.

Wanxin responded to similar needs, albeit half a world away.

"What you learn you have to be able to implement," he said. Originally a publishing company, Wanxin has deployed digital education capabilities and developed internship programs to reduce the time required for an employee's learning curve at a new job. Wanxin

technology is based in part on its relationship with CDI Systems in Israel.

The panel summarized with a discussion about the future of educational publishing – mainly how the digital publishing future is taking a long time to arrive. Impediments include the need of public companies to show short-term results; resistance to change among older-generation publishing executives and teachers, and proprietary content that does not lend itself to digital distribution.

As Harold Levy summarized, "New innovations are in this room." ■

Q&A

with Troy Williams

Managing Director at University Ventures

» **Can you tell us about your personal history in education, either as a learner or in your professional capacity?**
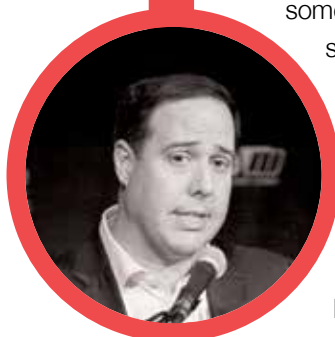
I grew up in a working-class family and ultimately finished Harvard law school, so education has made a big difference in my life. I believe deeply that education has a democratizing impact on society, and that a well-educated populace is key to a well-functioning democracy.

Professionally, in 1998 I founded one of the first E-book companies, which enabled people from all around the world to access books online. I ran it for a long time and have worked in education technology ever since. Today, I'm lucky to be able to invest in innovative companies that are having a major impact on student learning all around the world.

» **What would you say is the greatest challenge to focus on?**

One of the biggest challenges is overcoming the gap between ideas about educational technology and the efficacy of those technologies in their impact on student outcomes and learning.

I don't think there's a shortage of ideas; I think there's a shortage of execution. This breaks down into multiple layers: Execution on pedagogy and how teachers actually employ technology; the speed at which new and innovative platforms are introduced, and the lack of time to perfect educational technology before the next platform comes along.

There are many parallels between education and healthcare. It can take years to perfect something, yet we have an impatience in seeing the efficacy. We haven't been able to get there. When the internet came along we were working on things and now the mobile platform comes along and now we're starting to see virtual reality and augmented reality. However, in each advance, we haven't been able to maximize or get to an efficacious stage. The constant influx of new technologies presents a challenge.

We found in both education and healthcare, people don't want you to test things on their own children. So, with every new cohort of students, there's a lot of resistance -- not just from teachers or professionals, but also from parents. It becomes a challenge to innovate and figure out what works by utilizing new technology in the classroom.

» **You described the gap between schooling and the working world; how would you narrow it?**

I would focus primarily at the higher educational level. A four-year degree is simply not the best solution for many students. In the U.S., close to fifty percent of students enter the university; historically it was 10% or 15% percent. Many students graduate and begin jobs that are similar to those that people got a generation ago without a college degree. Meanwhile, today's graduates have spent four of the most productive

years of their lives at the university and it's been a very expensive cash outlay in addition to the opportunity costs of what they could have earned.

I think we should identify ways to get students who are at second or third tier universities into shorter degree programs – maybe four to six months long -- that get them to their first degree and first job.

I think the classic university is vital, but not for fifty percent of the population. The classic university is great at educating you for your fifth job, for middle management and upper management. But we need to move students out of the schooling environment with technical skills for their first jobs. This requires degree programs or credentialing that are narrowly tailored to areas in the economy with big employment gaps or skills gaps. I believe that technology solutions can provide this in a very scalable and flexible way.

» **How would this apply to the learning space? What changes would you make?**

I would want platforms that are capable of identifying the skills and outcomes that are needed for a particular job and can measure time in a competency-based way. We should use competency based solutions rather than measuring by time in seat or time in a course. Online and real-time assessments can indicate whether the student has mastered certain soft or hard skills. We can move students through an entire curriculum, as fast as they can possibly move, in a personalized way.

We've found that there is no average student. There is no student who is fast at everything or slow at everything. Different students are faster in certain things and slower in other things. If we require every student to move along in lock-step fashion, we slow everyone down. Even the fastest student or even the slowest student slows down in that environment. So, as we personalize the adaptive environment and really assess the credentials and the needs, we are able to speed up everyone. Further, if we tie the overall program to the needs of individual students and the needs of the particular jobs for which they're training, we can help place them faster and at lower costs. It would have a beneficial result for all of society.

A generation that has taken learning into its own hands

Cecilia Waismann

We live in challenging times for educators. Teachers strive to observe best practices while in total disbelief that their students are interested, motivated or even "speaking" the same language. We currently face an uncomfortable yet undeniable reality: We have to accept that we are losing our students. The superficial explanations relate to students' lack of motivation or the common and threatening "attentional deficit epidemic!"

The fact is, we are losing the main reason for which this whole system has been built. It is already common and over-used to see the typical picture of the bored student as an example of educators' main concern in every educational conference --to justify a new pedagogical idea or an educational product launch.

The fact is, our students have left us. However, I do not see it as a sad reality. Quite the contrary: We are at a cusp of a very exciting moment in the history of education.

The big and positive change is that learners have become active about their own learning. Due to our lack of capacity to react to the high speed of Digital Age changes, learners were drawn to find alternative ways to efficiently adapt to their environment. They found their own solution, given their accessibility to a system that provides plenty of resources that respond to their needs.

We live in exciting times, learners are actively learning through the resources offered in this new and expanding world. It's a world where learners are wisely using opportunities in order to be taken seriously as 21st century citizens. It is not surprising anymore to see yet another youngster developing a ground-breaking solution and producing significant changes around the globe. Collaboration, community as a major learning pillar, intrinsic motivation, self-expression, exploration, are only a few examples of unresolved pedagogical challenges that are now common practice among the young generations.

However, the lack of professional educational response has left the youngsters to find support from their peers, from amateurs and from smart industries looking for new markets. This is a panorama of uncertainty and chaos.

There is plenty on which to reflect. The opportunities and challenges this new world brings are unprecedented. If we want to stay relevant in their education, if we do not want to abandon this generation to build their future by themselves, we need to stay alert, not scared or judgmental, but actually curious in order to explore and understand this new culture. Only then we will be able to develop new pedagogical approaches that fit the needs of the new generations and help them become 21st century citizens. ■

Q&A

with **Dr. David Weinberger**

Writer and Researcher at Berkman Klein Center, Harvard University

» There are many resources in front of learners today; how do you see the learner navigating them?

Learners today not only have unlimited resources, but also the ability to connect between them, to jump between them at a moment's notice. If learners can't immediately find a link, they'll go to a search engine and find it. They'll also find large numbers of video and "paper-based" tutorials. There's never been anything like this richness of material, coupled with its interconnection.

It's becoming more common that if you run into a problem, you go to a site that will fix that single problem without going up levels to theory and abstractions. If you're a developer and you want to learn a new language, you can take one of the many online tutorials. Most of them were written by other developers, not professionals, and some of them are fantastic. You might start with one, to learn the basics. As soon as you hit a problem --"I wonder how I do this" – it's simple to go to a site like Stack Overflow. This is a community of millions of developers answering every conceivable question at an incredible level of specificity. You get your answer, move on. At your next problem, you pop in, get your answer, move on. It's learning by problem solving rather than by learning and applying theoretical frameworks.

» Can you expand on the communities?

We have communities, in the traditional sense, that are online. They comprise a group of people who know each other and do more for each other than they "have" to. They are caring communities, and they show up in all kinds of places, for all sorts of interests.

We also have mass communities, where people don't know each other because there might be millions of people. They are learning from each other, more or less from a sense of mutual obligation regarding a shared interest.

When I was a child, and for thousands of years, learning was done with a teacher. It improved you as a person; you became smarter and a better citizen. By having lots of educated citizens, the culture became better. This obviously still happens, but now learning by yourself just seems selfish. If you figure something out, and you know how to do it, and you don't tell others, well that's just being selfish. To know and not share feels wrong.

Thus, millions of people go online and post answers. They might not do it on an organized site like Stack Overflow or its equivalent in another field, but they post it somewhere. Far more learning happens in public as a public service. The communities might have thousands or millions of people who don't know each other, but feel obligated to the others, whether they're interested in programming, or model ship building, or whatever. There's a fantastic fountain pen community at Reddit.

» You're speaking about real-world examples; how might this translate to a new learning space?

The sense that learning ought to be a public

activity, that holding onto knowledge is selfis, is becoming prevalent. It manifests itself in different tools and different sites. I mentioned Stack Overflow and Reddit. The gaming world is less organized but you can still find a way to post, "How do I do this? I'm stuck." And you'll only be stuck if you want to be stuck.

When computer gaming started, there was no place to turn. Now you'll find walk-throughs, some of them very detailed and well done pedagogic instruments. There are tons of videos and YouTubes of people playing the game. Sure, people like the credit, they like to see their counters going up because they're still human beings. But it's also done, I believe, because people feel, "I know something therefore, we should all know it; why should I be the only one?"

» Is this how you also envision learning?

A lot of attention is focused on machine learning. This is a tremendous advance, because it's one of the first times we're able to advance without having a theory first.

It's not entirely true, but true enough that we can gather data and learn from it without having to start with a theory and hypothesis. We can do it because everything is a sensor now, our phones, everything we carry. We have sensors feeding information to a global network attached to incredibly powerful computers. With all this data, we're able to start understanding and predicting things without having a theory about why they work.

I believe this is changing our Ideas about how the world works. Traditionally we thought the world works based on a theory, on laws. Yeah, the laws still apply, but if our kids are growing up in a world where they succeed without starting with theories, then this suggests they'll learn in the same way. When they have a question, they'll go out and get an answer. When they have a problem, they'll go out and see someone's video about how to fix it. They'll have less of a sense that they can master the world from the top down. They'll be less inclined to approach problems by understanding and applying theories, less of a sense that this is how the world works. The world is a giant, fantastic, beautiful, incredibly complex machine. The idea that we can conceptualize it is going to seem a bit arrogant, because we have these little tiny brains. It suggests that attempting to educate by means of evoking theories may become less important.

The new way is more on-demand and less coherent than the alternative, but in some ways, it's also more realistic.

Learners crown amateurs as professionals

Ido Keinan

The word "amateur" carries a negative association – an amateur is the opposite of a professional, and his output lacks expertise. But there's another way to look at it – professionals work in their field, but amateurs *love* and passion can be a much stronger motive than a salary. Some amateurs gather fans online, by whom they are considered experts in the subject – that is, they become teachers and educators. These teachers and educators were the subject of the Learners Crown Amateurs as Professionals session at the Shaping the Future 4 summit.

"We are losing our students. We can call it lack of motivation, we can call it an attention deficit epidemic," said Dr. Cecilia Waismann, VP of R&D at MindCET, in her opening lecture. "I personally do not see it as a sad reality; on the contrary: I think learners have become active with regard to their own learning… The system is providing them with all the resources they need– students are actively learning through this brave new world which is currently expanding".

Podcasts

One of these amateurs **providing alternatives** is Doron Nir, a high-tech entrepreneur and co-host, alongside Re'em Sherman, of the podcast Geekonomy. He said he'd been listening to podcasts for years and heard programs the like of which he couldn't find on Israeli media – "deep content, people who are having conversations about topics that usually don't get attention in broadcast media, longer sessions, conversations that extend beyond the 3-5-minute item you usually get on talk shows – and we said, why not do it ourselves?" The practical side was easy – there's no regulation, the equipment's on the cheap side, network casting is easy – and their podcast started out as an after-work hobby. Within a year and a half it became meaningful, popular and economically lucrative, and the two started producing additional podcasts.

A podcast can serve as a learning tool for various subjects because, according to Nir, "When you get to podcast, you can explain a topic more deeply, it feels less of a shouting contest, of fake news," and because "conversations are much more diverse in their topics. If you interview me, we will not talk about anything but podcasts, you're not gonna ask me about my life, you're not gonna get a broad context of what I'm doing, of what I'm thinking of, if I'm having a good or bad day, and these things have a tremendous impact on this conversation right now. When we have two hours I'm much more interested in who this person is, what his motivations are, and also to discuss his knowledge; I like people, I like talking to people, and when you talk to a person – not an interviewee, not a professor – you have a normal conversation: How are you doing, what are you doing these days, what are you passionate about? It's not just about what you know and what you came to say." Also, Nir said, "We have a lot of hours when we are not able

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LEARNING ON THE GO

2 WORDS
ipod+broadcast

100,000
RESULTS
IN GOOGLE A YEAR LATER

2004
THE FIRST PODCAST "DAILY SOURCE CODE" WENT ON AIR

2005
THE WORD PODCAST WAS CHOSEN BY THE OXFORD DICTIONARY AS THE WORD OF THE YEAR

①
MILLION
USERS SUBSCRIBED TO APPLE'S PODCAST SERVICE ONLY 2 DAYS AFTER IT WAS

LAUNCHED IN 2005

66 Already millions of people are subscribing to these podcasts and I think this is just gonna send it to orbit 99

Steve Jobs (2005)

to watch Youtube – we're on our way somewhere, we're walking the dog, we're doing exercise – and this is usually a good time for audio listening. People ask us – where can I find podcasts about economics, medicine, stuff like that – and this is really great content, it's deep, it's not compromising in length and depth."

Podcasts are also good for the creators, Nir said. "I have an 8-year-old son who's already starting to create content for Youtube – in his case it's videos on how to build stuff in Minecraft – he sort of walks people through what he's doing. But for podcasting, just start creating something; some people will listen, some people won't, it will start an interesting conversation online about things. It's just a really easy medium, as opposed to video and Youtube, where I think a lot more attention and effort are required; audio is less demanding, you don't need to look good, set up a frame or edit it. In Geekonomy we made a point that our episodes are not edited [...] and that creates a certain authenticity that doesn't exist in a lot of other mediums."

Youtubers

Youtube, said Dr. Waismann, is the world's second largest search engine, and people go there to learn and get answers and its stars are the Youtubers. "A Youtuber is an Internet celebrity who has actually turned the screen around. It is no longer about listening to videos to learn from actors, experts and professionals, but actually Youtube allows, enables and empowers all of us to be able to learn, become experts and share our knowledge – what we know, and what we think we know." A video about Youtube was screened, and at the end of it a young girl said: "If Youtube didn't exist – I would have created it". Waismann said: "That's what we should be doing. We should not be scared, we should enable kids to enjoy learning. It's natural for them."

"You can get an extension of what you teach in school, during school, via Youtube," said Youtuber Ben Ratzon, who said he'd taught in high schools and universities. "You teach something in class, but after that, during lunch or recess, these kids will go into Youtube and they will learn more via Youtube, because it's something they'll look for. School is like TV – you push it down the kids' throat, you tell them 'this is what you must do'; some love it and some don't. But Youtube – the kids choose to come to Youtube, and that's where my responsibility is – because I have a huge following, so I need to do something to educate them, and that's the most important thing I can do. Youtube changed my life."

"Youtube searching allows students to find anything, including conspiracy sites, racism, completely false and inaccurate information," warned Prof. Renee Hobbs, Director of the Harrington School of Communication and Media at Rhode Island University. "So the obligation upon the viewer of Youtube to be a critical thinker about media is more important than ever before. Every time a child comes to Youtube, she will see an ad before the cartoon or the information will roll – so she better learn how to critically analyze advertising, because that's how Youtube makes money. The teenager who goes to PewDiePie because he's so cool better think hard about celebrity culture, and the way in which values get embodied in celebrity and transmitted – good values, sometimes, yes, and also problematic values that are troubling and actually destructive to humanity. And young adults, as they search on Youtube to learn about contemporary society, political controversies, current events – even fashion and makeup – they need to be able to separate marketing and promotion hype from stuff that's presented without a commercial bias; and they need to be able to distinguish the many, many kinds of fake news that are happening now, as disinformation and propaganda and hoaxes and satire and inaccurate journalism are just multiplying in an extraordinary way. So it's more important than ever before to ask – who's gonna teach Israeli children how to critically analyze Youtube?"

"Critical thinking becomes a major aspect for us educators to introduce in the school system," said Waismann, "because it has to become an important skill for the young generations. They have to be able to look at all this immense amount of information they get and be able to choose from, analyze and understand it."

1.3

BILLION PEOPLE USE YOUTUBE ON A REGULAR BASIS

68%
MEN

32%
WOMEN

A NEW SOCIAL MEDIA PHENOMENON: **YOUTUBERS**

83
YEARS

THE TIME IT WOULD TAKE FOR SOMEONE TO WATCH ALL THE VIDEOS UPLOADED IN A DAY

54
MILLIONS VIEWERS

WATCH PEWDiEPIE CHANNEL THE MOST POPULAR YOUTUBER

YOUTUBERS

ARE NOT THEM. THEY ARE US!

YOUTUBE | IS THE SECOND **MOST POPULAR** WEBSITE AFTER GOOGLE SEARCH

500
HOURS OF VIDEO UPLOADED **EVERY MINUTE**

YOUNG VIEWERS LEARN FROM VSAUCE → THE LEADING EDUCATIONAL YOUTUBER ON YOUTUBE

18 SECONDS
FIRST VIDEO EVER UPLOADED TO YOUTUBE IN 2005

Q&A

with Lord Jim Knight

Chief Education Adviser at TES Global, former UK Minister of State for Employment and Welfare Reform

» **You've had a variety of professional experiences; how does it relate to the way you see learning?**

I'm on my fourth career: I was an actor; I sold telephone directory advertising; I'm a recovering politician; I was an MP, and now I'm a Lord and working in education.

Because I change careers, I'm always learning. And that's what the future will look like as people live to a hundred and have working lives of sixty to seventy years. They always will be learning, always changing careers while technology takes their careers away and de-skills them. This is the future we're focused on. We're trying to imagine, trying to create a learning environment that instills a love of learning and liberates the talent of young people.

» **How do you see teachers in this ever-evolving world?**

Learning and teachers are completely interlinked. We know the best outcomes are because of great teachers. But this doesn't mean that what teachers do stands still. We've come from an industrial tradition where we needed the teachers to instruct a lot of content, a lot of knowledge and get students to remember it and recall it in tests.

Now we have these devices in our hands that can give us all the content. But we need a framework of knowledge and understanding so we can tell fake news from real news, so we can use all that technology well. Today, it's more about asking the right questions than having the right answers.

Rather than being on a stage giving instructions, teachers are doing more coaching. They're observing, motivating students to ask questions and work hard. They're drilling down, getting deeper and deeper into their learning and their thinking, which is hard and it's a really tough challenge for teachers. Good teachers will keep students driving forward even when the going gets tough, and keep connecting them back to their original motivation.

» **How do you see the learner, and how should the learner be seen by the teacher?**

In the future, I think the learner is right at the heart. When I went to school, when we all went to school, we were one of thirty in the class. There was a standardized school with standardized curricula and standardized tests. We measured ourselves against the average. Our grade told us whether we were above or below average. That's over. We can now finally wrap education around the learner. We can individualize it because we have the technology tools to give us the data and analytics to understand where learners are.

We have the technology to learn more and more about individual learners -- what they need to keep them motivated, what they need in terms of content and how they're doing. We don't have to test them because the data already tells us that. We can focus on the learning and bringing learners together for collaborative learning. They will be able to present and exhibit their work as a form of assessment rather than test and recall. The notion

of an individualized, learner-centric experience is exciting because it works for every single child, not for the majority with those on either side kind of falling off the edge.

» The main characters of education are the teacher and learner; how do you see community interaction?

I think one of online learning's early mistakes was to be very solitary. It's ironic that telephone technology and social networking are about connecting with lots of people. Meanwhile, learning became something where you went through content on your own and it was boring.

We can get over that: Community is crucial for learning. I really believe in the social aspects of learning so that learning space, whether virtual or real, brings learners together. And the space must be inspirational and empowering. It must be respectful of all those who are working in it whether teacher or learner. It's very important.

» How do you see technology being used to transform the subject matter?

The use of technology is non-negotiable because we already do so much informal learning at home or on the bus or wherever we are; we need to

smooth that journey into formal learning.

As we move to more self-directed, individualized learning it will be a more research-based model -- we'll pursue what we need guided by our coach, our mentor our teacher. Technology is the learner's gateway to content, to other learners, to mentors, coaches and teachers. These are all resources that help us by connecting us online.

» What is the value of a specific learning educational space?

Something I heard today about learning spaces stays with me; the notion that an inspirational learning space is an environment that allows you to do things you couldn't do anywhere else. That feels very powerful to me.

It's important for learners to like the learning they do at home, when they're out working, when they're in their natural environment, when they're in the urban environment. All of that is valid. But, sometimes you need to get into a specifically designed space that has facilities you wouldn't have had elsewhere, technical facilities that provide a window to other people and places that you wouldn't otherwise have. That describes a magical space for you to really get learning up to speed.

Heat up the STEAM
With the experience workshop
Math-Art Movement!

Mathematics and arts learning with hands-on tool and technology in multi and transdisciplinary context

Dr. Kristóf Fenyvesi

Dr. Zsolt Lavicza

Ho Gul Park

Tschool that is built upon the dogmatic segmentation of knowledge and the pedagogy of highly hierarchical and strictly fixed roles is less effective today. By now, multimodal flexibility that integrates several variables of the learning process has become an indispensable precondition for meeting the ever-increasing and wide-ranging demands that education has to face today. Traditional models of accumulating knowledge through direct teaching are being replaced by networked models of learning. The development of collaborative problem-solving skills and enabling students to discover unexpected connections between different aspects of various phenomena are not only effective tools, but also ambitious goals of today's education.

In the Experience Workshop International Math-Art Movement (www.experienceworkshop.org) all these developments prompt us to enlarge the set of pedagogical approaches, tools and materials. In cooperation with global initiatives in the field, such as the world's largest math-art-education community, the Bridges Organization (www.bridgesmathart.org) and the International Symmetry Association (www.symmetry.hu), we would like to complement the STEM (Science, Technology, Engineering and Mathematics) learning with creative, aesthetic and artistic aspects. Our goal is to move from STEM to STE-A-M (by the inclusion of Arts) and make the most of the successful models of cooperation among science and art education.

In mathematics education, there is a growing need to design activities, which focus on the creative process, instead of emphasizing a product, which was created by following a certain plan. Art as a context for mathematical problem solving can be a fruitful starting point, as art is usually thought to include creative thinking and finding one's own way. Creative activities may support the students to recognize that doing "real" mathematics is creative thinking; and creative thinking in mathematics means, that you do your own mathematics. These kind of activities can underline the process aspect of mathematics and if these activities require collaboration, then different students' strengths
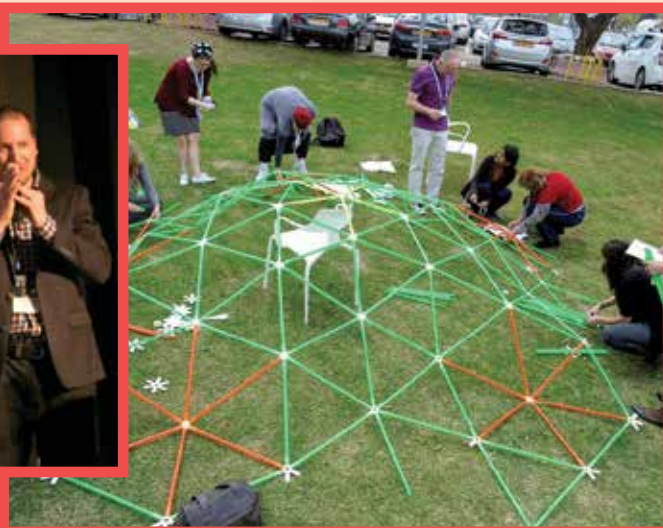
in different areas are adding up on the group level. This supports both teachers and students in appreciating various kinds of creativities and in transforming their whole world – including the school – into a "possibility space" of learning.

The knowledge gained through blurring the boundaries of science, technology, design and art, became our common experience of heterogeneity, and this common experience is also expressed in the transformation of our socio-cultural practices. Phenomenon-based learning opens schools to become multi- and transdisciplinary, experience-oriented and collaborative educational environments offering new opportunities for both mathematics and art learning in parallel. As technology is transforming learning environments and becoming part of learning in the 21st century, it is also important to experiment with connecting hands-on and digital modeling in the learning process.

Recognizing significant new trends in the currently transforming creative practices in globalized societies, we see the children and youth not only as a diverse target group of STEAM awareness raising projects, but also as the most active and as most potential promoter of successful examples of emerging STEAM careers. Experience Workshop would like to bring the learners and their unique creativities into the spotlight by breaking up with the simplifying and hierarchical top-down model of

"adults are trying to convince students on the importance of something".

We approach youth not only as mere end-recipients or "consumers" of STEAM-based knowledge, but as active or potential future participants of STEAM-related Do-It-Yourself (DIY), Open-Source (OS) and Citizen Scientist (CS) communities.

Connected to their special interests, students have unique perspective and own views on the social importance of STEAM awareness, and they are also the main beneficial of the increasing social support and educational development of STEAM collaborations across globalized societies. Accordingly, we would like to facilitate creative processes which help students to (1) discover the importance of STEAM fields in their own life and social environment; (2) help to identify individual and social opportunities that STEAM-based education can provide to them; (3) facilitate students in the process of recognizing themselves as successful members of emerging STEAM communities; and (4) support them to form small multi- and transdisciplinary and intercultural STEAM teams, which are operating like "small-scale models" of real-world DIY, OS and CS communities with the goal of STEAM awareness raising in order to involve their own peers into STEAM activities. We see youth as potential inventors of new forms of intercultural and multi- and transdisciplinary STEAM collaborations, creators of original thoughts and technological inventions and developers of independent, non-traditional ways of using existing technological tools and special transdisciplinary knowledge and future managers and co-workers in successful start-ups rooted in the STEAM integration. ▪

Q&A
with Dr. Zsolt Lavicza

Mathematician at University of Cambridge

» **What motivated you to get involved in educational technology?**

Originally, I was a mathematician; my Ph.D. is in numerical analysis. As I became aware of how mathematics was taught at universities, I tried to see how technology could be used to improve the learning experience. I worked with my friend, Marcus Hohenwarter. We did a lot of research and created GeoGebra. It's now used by forty million students around the world, primary school to university, to learn mathematics and all different kinds of subjects.

Now I usually work with students of different ages, showing them how we can do experiments and make discoveries in mathematics and STEM subjects. My recent work is about connecting art with mathematics and technologies with art. We build different kinds of structures and connect the physical and virtual worlds. We go from physical to virtual and back to physical. We use a lot of building and a lot of technology to make learning in the school much more interesting.

» **What innovations are you bringing to teaching in the digital era?**

In this new era, we don't really need to teach in the traditional sense. Students are very proficient at creating and searching for different kinds of resources. The innovation is to create environments that are interesting for the students and motivate them to create or build something digitally. As they build their projects they realize they need, for example, mathematics, or programming, or geometry. So they learn it. We don't even have to put a name on what they're learning. We create interesting environments that can compete with the video games and the other things. The students learn without knowing that they are learning specific subjects.

» **When you are building this methodology, what elements are essential to provide in this new learning environment?**

The main element is the teacher. We are used to the teacher speaking about a subject and the students learning it. Now we are changing the perspective. The teacher's role is to ask good questions and provide resources for good learning environments. This motivates students to take an interest in doing a project, building something or creating online structures. When the teacher provides a good educational environment -- one that gets their motivation and interest -- the learning starts to happen. This means it's very important to have very good teachers, well prepared teachers, who can ask good questions and provide motivating challenges for the students.

» **How do you create the learning space? What elements do you need?**

The learning spaces can all be different and, when you have good teachers, they can decide when to use digital, when to use physical, when to use a combination, when to give instruction, when to just step back and observe the students.

The sensitivity of the teacher in the environment is very important. We are creating different kinds of resources and training the teachers in how to use them. It's very different from the schooling we have now, where we go step by step through the curriculum. It requires a lot of trust in the teachers, because they're using a lot of creativity and they're given a lot of freedom. The outcome of the learning is different from student to student.

» You're saying the teacher follows the student across different curricula?

Ideally yes, but it's often difficult in practice. Schools have restrictions and guidelines about the subject matter. We made a proposal just last week for transdisciplinary learning, with different kinds of teachers creating environments, resources and new kinds of pedagogies. It would be very good to change the system, but it takes time. Meanwhile, we have to adapt by introducing more of these creative approaches. In the long run, what we need to do -- and probably students will demand it, because they just get really board in the schools -- is to create environments that compete with Minecraft, for example.

» Let's forget about the restrictions and follow your way of thinking; how would you create the ideal learning environment?

It would be very interesting to have a very good teacher go into the classroom and start to talk with the students about what interests them. After a while, the kids would start coming up with ideas. Some of them want to go to Mars, some of them want to play soccer, some of them want to build a robot. This would lead to student teams working together on different subjects. Then the resources could be provided; many are available on the internet. So, for example, in the project "Let's go to the Mars" what would the students need? This is where the teacher or a maybe a team of teachers would work together to provide the resources and guide the students.

Because this is a subject the students came up with, they are motivated, they want to learn. Let's take another example, "Building a Rocket". For this, you would need knowledge from physics, from art, from mathematics. Launching a rocket requires a lot of mathematics, so the students will demand it. They will either ask the teacher or look on the internet. This is how all the subjects fall into place in the learning environment.

The students could create websites, they could present to each other, build teamwork. In the process, the different groups would teach each other. It's a long process to create something that's interesting for the students and have the teacher guide them to the goal. But while they do it, they're learning mathematics or science – the subjects we have now. They're not studying because we just tell them to learn the Pythagorean theorem or the parabola. They need it to launch their rocket! And because they need it, they find it. If not, they won't be able to go to Mars. We're creating a motivating environment. It's been our experience that students want to do it, and they are getting what they need from whenever they can. It's a very nice way to approach education.

A Meeting of the Minds:
Global Perspectives on
EdTech Innovation

Ovi Jacob

What happens when you bring together 30 EdTech leaders from around the world for a 1 day forum on the future of innovation?

On the closing day of Shaping the Future 4, MindCET hosted an invite only session titled "Solving the Biggest EdTech Challenges, Business Models from Around the Globe". The guest list for the event included a virtual who's who of leading education players from around the world. The crowd was equally diverse, as 6 continents were represented, at CET's office in Tel Aviv.

Throughout the morning, participants had a chance to hear about EdTech innovation from a wide range of perspectives. Tony Wan, Managing Editor at EdSurge led off the morning with thoughts on the U.S. education market. That was followed by a striking conversation on the European market, led by Pierre Antoine Ulmo, of PAU Education. As the U.S. and Europe are home to mature education systems, the initial group discussion centered on how early stage companies can break in to those traditional systems.

One important takeaway from these first two presentations came from Harold Levy, former Chancellor of NYC Schools and currently the Executive Director of the Jack Kent Cooke Foundation. He noted that there exists a tension between breakthrough innovation and willingness of school systems, specifically in Higher Education, to adopt new concepts in learning. For a startup company to enter the market, they may be held back by the innovative nature of their offering. The group discussed this challenge and in the afternoon session started to develop a thesis around encouraging innovation in EdTech companies.

The session then shifted toward emerging EdTech ecosystems. We heard from Shantanu Prakash, founder and CEO of Educomp, India's largest education company. He described 8 key trends that in his opinion will define worldwide markets. Prakash described the shift from B2B to B2C delivery models in education.

Stating that India is projected to have eight hundred and ten million smart phones by 2020, he highlighted the impact that the mobile revolution will have on education in emerging geographies.

Jamie Martin, who leads Citi Africa, the first education accelerator based on the African continent, followed this talk with perhaps the most hotly debated statement of the session.

Africa, in Martin's opinion is the most promising education opportunity in the world.

Despite great infrastructure challenges, the education system in Africa is ripe for breakthrough disruption. Indeed, Africa is starting to see some of its innovation come to fruition, highlighted by startup GetSmarter being acquired for one-hundred and three million dollars in the spring of 2017.

The afternoon session of the day was aimed at creating concrete outcomes from the conversations that preceded. The gathering was broken down into small teams, each focused on a different sphere of influence. Groups focused on creating investment vehicles and business development opportunities for emerging markets. They also developed plans for encouraging cross-national piloting programs and for incentivizing innovation. Dr. Martin Dougiamas, founder of Moodle, described his team's output and encouraged more cross-platform integration, especially with companies emanating from his home country of Australia.

Nina Iles, Head of EdTech at the British Educational Suppliers Association summarized her experience with a telling and poignant statement. She said that despite the status and accomplishments of the group, everyone was pushed out of their comfort zone.

Corporate executives, venture capital investors and heads of major organizations were all challenged to work together to define and start to implement concrete solutions for the world's biggest education challenges. The unique perspectives shared and the foundational solutions that emanated from this event will surely help shape the future of education.

Q&A
with Tony Wan
Managing Editor at EdSurge

» **Can you tell us about your focus at EdSurge and a little about your background?**

At EdSurge, we tell stories and share information about educators, entrepreneurs, funders, and others in the ecosystem. We hope to provide people with the resources they need to make smarter decisions about what to build, what to buy, or what to fund when it comes to building new digital technologies for learners.

Before joining EdSurge, I actually did a stint as an entrepreneur. I worked with a few friends to build a math game. It's through that experience that I learned a little about the startup world, and I learned about the educational market as well. Ultimately it was a humbling experience, and a very enlightening experience. It really opened my eyes to the world of entrepreneurship and educators and the intersection of how they mix.

» **Can you give us some insight on what the start-up world brings to education?**

I believe it's bringing a sense of urgency. There are immediate, important problems in education today, and sometimes you just can't wait for a perfect solution. Sometimes you have to just try new ideas,

even though they may not all work. It's through this iterative, rapid user feedback testing that you collaboratively iterate a solution that hopefully will meet the needs of most learners. There's a sense of impatience and urgency in the way startups operate and it can be a good fit with educational innovation. Education is such a global issue; when we think about what the future of education will be, the sense of urgency is a very fresh approach.

» **Do you think learners and educators have different roles in this start-up, entrepreneurial world?**

With the evolution of technologies, from the web to mobile technologies, and the rising spirit of entrepreneurial energy, I think today's learners will have more opportunities if they receive a proper level of guidance in applying their skills and knowledge. Perhaps there is too much available information, and you do not necessarily know what is objective, what is biased, what's the most relevant to your needs.

The role of the educator is shifting as well. In the past, when we thought about a classroom teacher, we thought of someone whose role was to supply answers. Now we live in a world where
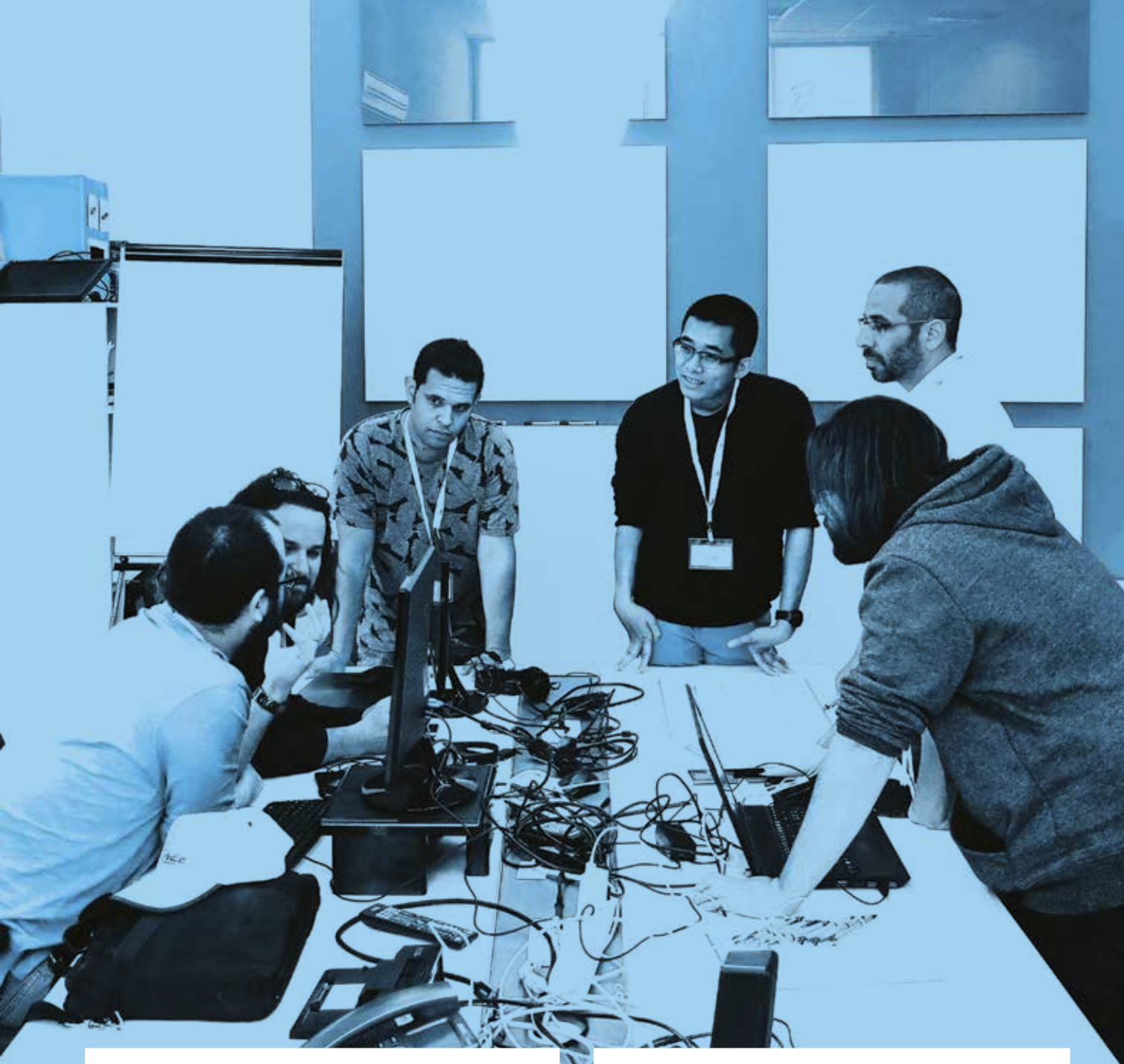
students can have access to all the answers way beyond what a teacher is expected to know. So, what should the role of the educator be? I believe that educators will be responsible for asking good questions rather than providing all the right answers.

» If it were possible for you to create a learning environment for the new generations, what would it be?

If you think about your educational experience versus where you are today, and you consider how well it prepared for you for the work you're doing today, I imagine most people would say their formal schooling accounted for only a portion of their preparation. They might say their formal education accounted for about half of all the skills, opportunities and connections they need to succeed in their current jobs. People learn the other half from doing -- from working, socializing, things they do in informal settings.

In the future, I hope to see the world of school and the world of work come much closer. I'd like to see schools with more opportunities for collaborative workspaces, such as those we see at Mindset and in high-tech communities around the world.

Students as Creators

Guy Levi

Where should we go?

We are experiencing a paradigm shift in the transition to 21st-century education. Although in its early stage, we must start to promote its full realization. This short piece draws on current important reports (Horizon Report-New Media Consortium and Innovating Pedagogy-Open University), to refine the challenges, opportunities and promise of the trend "students as creators." It incorporates many of the elements of what we define as 21st-century education that aims at preparing the current K-12 generation to success in the future. We are looking at the conditions needed to successfully implement creativity with focus on design thinking, a concept and a method that can best bridge the paradigm shift.

We also try to provide here some insights about how to overcome the gap between theory and practice, relating to the role of governments and ministries of education in creating the ecosystem needed for successful implementation of creativity in schooling and learning.

Why is the 21st-century education so different from the 20th?

The French sociologist Pierre Bourdieu once said that the point of his work is "to show that culture and education are not simply hobbies or minor influences." The point is that 21st-century education is not simply a transition from 20th-century education with minor changes; it is a major paradigm shift that we must consider if we wish to prepare the young generation and those who will follow for the challenges they are going to face in the future. In this context, both mentioned reports disrupt the common pedagogical definitions of the last century by introducing new concepts, such as incidental learning, learning from the crowd, productive failure and design thinking - essential for the paradigm shift.

Design thinking helps to disrupt the earlier paradigm as it breaks with the traditional notions of learning and promotes 21st-century skills, particularly those of innovation and creativity and, even more important, it is based on the "network" paradigm of learning in which all actors – teachers and learners – are equal, i.e. can contribute to the group and at the same time learn from it.

Students as creators – the shape of 21st-century learning

Thomas Friedman of the New York Times suggested three years ago that the "digital divide" belongs to the past and we have to anticipate new challenges. "The 'digital divide' will soon disappear. Fairly soon, virtually everyone will have a screen and an Internet connection. In that world, argues futurist Marina Gorbis, the big divide will be 'the motivational divide' – who has the self-motivation, grit and persistence to take advantage of all the free or cheap online tools to create, collaborate and learn." Self and intrinsic motivation are important keys to personal success in today's world and one of the main challenges facing our education systems.

Hence, the trend "students as creators" is essential for moving toward 21st-century pedagogy, working for personalization and choice, focusing on student-centered learning design, and creating new learning spaces to implement these new values. "The trend of empowering learners as creators is also driving a shift in how subject mastery is assessed toward more participatory methods in which students help define the competencies, goals, and skills they are working to achieve." (Horizon). In this context we look at design thinking as processes and products that usually target real-life problems and make learning relevant and meaningful, mostly because they bring creativity to life. Albert Einstein said, "We can't solve problems by using the same kind of thinking we used when we created them," which is, to a certain extent, the foundation of design thinking, whose concepts and methods are not only a means to introduce creativity to the education system, but a process which transforms theory into practice.

Disruptive innovation is needed

"In theory, theory and practice are the same. In practice, they are not." This old saying is quite true as practicality always brings additional variables which normally have nothing to do with the theory, be it political, organizational or conservatism. The term "disruptive innovation" was coined by Clayton Christensen in the 1990s and can be described as an innovation that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market-leading firms, products and alliances. When we look more closely at the educational setting, an example from disruptive innovation in the field of online learning will help. In "Is K-12 Blended Learning Disruptive?" Christensen, Horn and Staker contend that education leaders can foster disruptive innovation in schools in several ways, mainly by focusing on disruptive blended-learning models, initially in areas of nonconsumption, and in the long run, the disruptive models will progress toward becoming good enough to entice mainstream students from the existing system into the disruptive one in secondary schools. The narrative here is clear: depart from traditional schooling and do not compete with it (in the beginning), focus on areas of nonconsumption and develop the new 21st-century pedagogy.

New ecosystem is required

The new educational paradigm needs a fertile ground to evolve; hence there is a necessity for government intervention to develop an ecosystem for innovation and creativity. The case of the New York Innovation Zone (iZone) will help to understand the crucial role of governments. The iZone was established due to the fact that some schools had strikingly better results, often not through strict compliance with central frameworks – not doing what was asked of them or in the ways that were expected of them. Their success appeared to stem from the passion, creativity, entrepreneurship and commitment of the principals and the teachers – people who seemed to function in some ways as "creative deviants." The overall aim of the strategy of the iZone was to transform learning for the 1M students in NYC public schools through replacing the "industrial model" by designing schools around the needs, interests and motivations of individual students, by personalizing rather than standardizing the model of schooling and learning. iZone was the 1st example of an innovative ecosystem in education.

So, what should we do now?

We understand that "students as creators" should become the practice of education systems around the world if countries and governments wish to take an active role in the evolving global digital economy. If that is to happen we must remember that most attempts to integrate creativity and innovation in the core and traditional curriculum failed; thus we have to use the methods of disruptive innovation to introduce creativity to schooling. And last, we should not forget T.S. Eliot's saying that "Only those who will risk going too far can possibly find out how far one can go." ◼