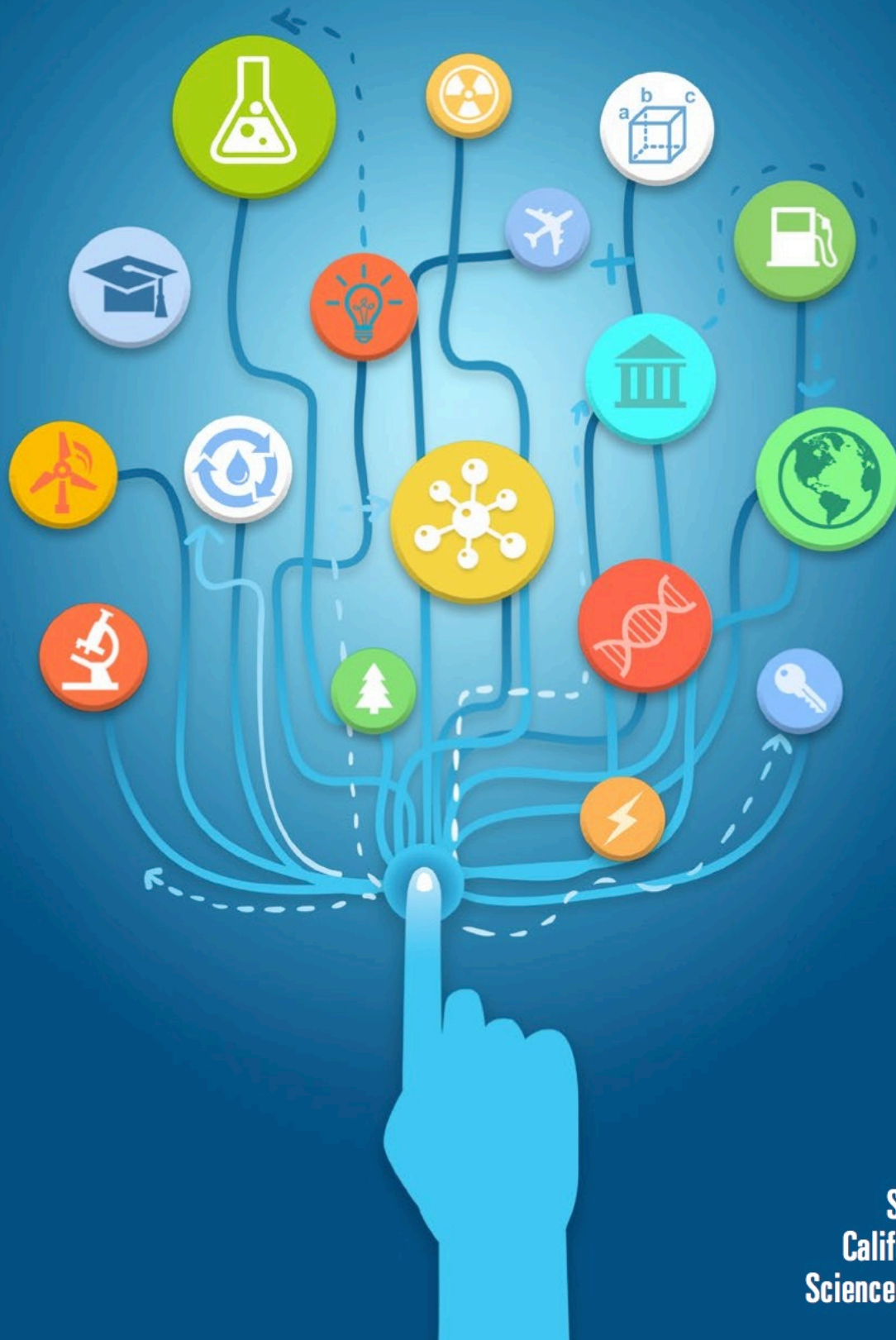


# ASSESSING THE EFFECTS OF DIGITALLY ENHANCED EDUCATION SUMMARY OF SYMPOSIUM DISCUSSIONS



September 2013  
California Council on  
Science and Technology



# Assessing the Effects of Digitally Enhanced Education - Summary of Symposium Discussions

California Council on Science and Technology  
September 2013

## ACKNOWLEDGMENTS

We are deeply grateful to the S.D. Bechtel, Jr. Foundation and the Stuart Foundation for providing support for the Symposium Series. In addition, we want to thank those who sat around the table with us, graciously giving of their time to explore the issue of efficacy in the field of digital teaching and learning. Especially, we would like to recognize their pioneering spirit and their willingness to allow others to learn from the risks they have borne to advance the field of education.

## COPYRIGHT

Copyright 2013 by the California Council on Science and Technology. Library of Congress Cataloging Number in Publications Data Main Entry Under Title:  
Assessing the Effects of Digitally Enhanced Education - Summary of Symposium Discussions  
September 2013  
ISBN 13: 978-1-930117-99-0

Note: The California Council on Science and Technology (CCST) has made every reasonable effort to assure the accuracy of the information in this publication. However, the contents of this publication are subject to changes, omissions, and errors, and CCST does not accept responsibility for any inaccuracies that may occur. CCST is a non-profit organization established in 1988 at the request of the California State Government and sponsored by the major public and private postsecondary institutions of California and affiliate federal laboratories in conjunction with leading private-sector firms. CCST's mission is to improve science and technology policy and application in California by proposing programs, conducting analyses, and recommending public policies and initiatives that will maintain California's technological leadership and a vigorous economy.

For questions or comments on this publication contact:

California Council on Science and Technology  
1130 K Street, Suite 280  
Sacramento, California 95814  
(916) 492-0996  
[ccst@ccst.us](mailto:ccst@ccst.us)

## Table of Contents

Introduction.....	1
A Symposium Series to Examine the Efficacy of Digital Teaching and Learning.....	1
Framing the Discussion .....	2
A Welcome from Linda Katehi, PhD, University of California, Davis Chancellor .....	2
Charles Kerchner, PhD, on Policies to Support a Learning Infrastructure.....	3
Discussion.....	5
Moving from Anecdotes to Evidence: Assessing the Quality of Distance and Blended Learning .....	7
An Ongoing Experiment at San Jose State University: Keynote Remarks by President Mohammad Qayoumi .....	10
The Efficacy of Digital Teaching and Learning from the Perspectives of Providers and Users .....	12
What’s Next? .....	15
Appendix A: Symposium Participants	
Appendix B: Lines of Inquiry for Strengthening Assessments of Digitally Enhanced Education	



## Introduction

For better or for worse, in almost every venue of modern American life — airport, workplace, coffee shop, park, ball game, bus stop, grocery store — people of all ages and demographic segments are tethered to electronic devices and the wide world of content they deliver and exchange. Increasingly and inevitably, these devices and streams of content have found their way into the classroom.

What do we know about the efficacy of digitally enhanced education? What works, and why? What contexts and circumstances either hinder or enhance digital modes of teaching and learning? What education policies need to be in place to make the most of these opportunities and ensure their equitable distribution across schools and systems?

Although researchers, educators, and policy makers recognize that digital instruction is bound to be part of the educational landscape, surprisingly little empirical data has been available to determine how the vast potential of increased access to tools and information can be balanced with rigor, quality, and value for both teachers and learners. Similarly, few coordinated efforts to support teacher and student learning in the digital realm have been conducted at either the state or county levels.

## A Symposium Series to Examine the Efficacy of Digital Teaching and Learning

The California Council on Science and Technology’s (CCST) California Teacher Advisory Council (Cal TAC) has responded to the gap in data and coordination by developing a toolkit for the design of an initial framework for digitally enhanced education (DEE) in California. To address the lack of information about what works, a Symposium Series was launched in 2012, bringing together representatives of the education, technology, policy, research, and philanthropic communities. The Symposium Series is designed as an ongoing conversation and discussion among those with distinct but complementary perspectives on the efficacy of DEE. (For a list of Symposia participants, please see Appendix A.)

This report summarizes discussions from the most recent symposium in the series, which took place at the University of California, Davis on May 24, 2013. In addition to exploring what is currently known about the efficacy of digitally enhanced education and how it can best be measured and monitored in the future, the overall goal of this initial symposium was to identify specific policy and practice issues, with particular attention to the perspectives of classroom teachers represented by Cal TAC.

Cal TAC was created by CCST in 2005 to serve as a conduit for bringing real-world classroom experience — the “wisdom of practice” — to policy makers and others whose decisions affect the quality of science and math education in California. It is modeled on a national Teacher Advisory Council affiliated with the National Academies of Science, tapping the talents and creativity of California’s outstanding science and math teachers. CCST is a nonpartisan, impartial, not-for-profit corporation established 25 years ago to offer expert advice to the state government and to recommend solutions to science- and

technology-related policy issues, modeled in part on the National Research Council that serves the National Academies of Science. CCST's core support comes from California's major post-secondary institutions, which provide important backing, support, and resources to CCST. CCST is governed by a Board of Directors composed of representatives from its sponsoring academic institutions, from the corporate and business community, as well as from the philanthropic community. Together, these members are helping both the public and private sectors find answers to the important science and technology-related issues facing California.

As CCST Executive Director Susan Hackwood explained in her welcoming remarks, “There is no piece of work we get involved in — from energy and climate change to transportation, genetic testing, or big data — that doesn’t end up in education, and specifically with the conclusion that we need smarter people with more science and technology backgrounds.”

## Framing the Discussion

### *A Welcome from Linda Katehi, PhD, University of California, Davis Chancellor*

Dr. Katehi welcomed Symposium participants to the campus with an overview of how online and digital education have changed conversation and practice on her campus. First, she emphasized that from a higher education, public institution perspective, she sees online courses as a powerful *tool* for teaching and learning, but not necessarily a new way of learning. Still, she acknowledged, online learning has raised expectations — among faculty and students, as well as the general public and the legislators who represent them — about what it can offer to education.

In a public institution and land-grant university such as UC Davis, Dr. Katehi observed, educators are committed to providing an excellent education and making it widely accessible and available. Just as true as when land-grant universities were founded 160 years ago, these public institutions are foundations of democratic systems that depend on an educated, engaged citizenry. In this broader sense, educators not only provide content to students to increase their knowledge, but help develop them as productive citizens and contributors.

As we consider different modes of learning, Dr. Katehi said, we must remember that people learn by associating themselves with others — by experiment, observation, and association. Online education can certainly provide some aspects of these ways of learning, but will not replace the fundamental human process of learning by association with others.

At UC Davis, Dr. Katehi explained, she and her colleagues have focused on maintaining flexibility and giving students options for selecting their own ways to use online tools — not only within courses, but for administrative and other services. A particular challenge at UC Davis — as has been the case on other UC campuses — has been managing the credit system across campuses, especially when semester and quarter systems do not align in terms of course credits.



Another challenge has been ensuring a learning environment for students that allows them to take advantage of online learning. While online learning can replace lectures and provide more interactive contents, early evidence suggests that it caters more to students who are already focused.

Instead of prescribing how online learning should unfold on campus, the UC Davis provost has launched an initiative to provide incentives for faculty to create online content and share their ideas. Over 140 faculty participated in day-long meetings, ultimately identifying three categories for online support: education programs and curriculum, student service programs and orientation, and staff/faculty programs and orientation.

Online strategies can save money for students and families by making more gateway courses accessible and reducing long waiting lists. However, online courses currently do not save money for the campuses directly, Dr. Katehi observed. In many cases, they require up-front investments — especially for faculty who need additional support in programming and software development.

An important online success story at UC Davis has been to adapt the traditional guidance/advising role. In one assessment, administrators found that 80% of advising questions could be resolved in an online environment, freeing up resources for more intensive face-to-face interactions.

Dr. Katehi noted that several areas of concern have emerged during this early adoption period that warrant careful study, including how some online courses may promote an inappropriate “one-size-fits-all” approach; how universities maintain control over which courses are approved for credit (especially given the role of for-profit organizations and trends to privatize education); and the importance of being vigilant in ensuring that all tools — digital or otherwise — really benefit students.

### ***Charles Kerchner, PhD, on Policies to Support a Learning Infrastructure***

Symposium participants had received two background documents prior to the in-person gathering: *Connected Minds: Technology and Today's Learners*<sup>1</sup> and a pre-release copy of a PACE policy brief by Charles Taylor Kerchner, *Education Technology Policy for 21<sup>st</sup> Century Learning Systems*.<sup>2</sup> Dr. Kerchner launched the Symposium discussion with an overview of his policy brief.

First, he noted, “technology has always been oversold and underused.” When he visits classrooms, Dr. Kerchner said, he conducts an impromptu technology assessment: he walks to the back of the room where the computers are and runs a finger over the keyboard. “If it’s dusty, I have some idea of where the school is in terms of technology.”

---

<sup>1</sup> Available for download from the OECD iLibrary: [http://www.oecd-ilibrary.org/education/connected-minds\\_9789264111011-en](http://www.oecd-ilibrary.org/education/connected-minds_9789264111011-en).

<sup>2</sup> Available for download from Policy Analysis for California Education (PACE) at the Stanford Graduate School of Education: <http://www.edpolicyinca.org/sites/default/files/PACE%20Policy%20Brief%202013-3.pdf>.

Technology shouldn't be measured by the volume of equipment purchased (and often gathering dust), but rather by how it is used, he said.

Dr. Kerchner's analysis also points to a period of uncertainty in terms of technology and systems. "My plea to you," he said, "is don't engage in premature certainty and create standards for things you don't understand." Instead, he urged, the education arena — not known for taking risks — needs to conduct a great deal of experimentation and to systematically learn from repeated attempts and failures.

Technology is almost always superimposed on an existing system, he continued. Yet in education, "We haven't changed our basic system of teaching and learning for well over 100 years." This not only prevents innovation and experimentation, but turns those who might question traditions and norms into heretics. Nevertheless, Dr. Kerchner is optimistic that system changes are on the horizon. "We're on the cusp of starting to think about a different learning system," Dr. Kerchner said, "different from the storage and acquisition system we have now."

Through his research and visits to classrooms, Dr. Kerchner has come to realize that students are the real workers in the education system. "We can't make schools better by making adults work harder," he said. "We've got to make the kids work harder, and that's best done through engaging them in interesting work."

Digital education offers ways to do so by building academic experiences that are much more individualized to each student's pace, while also "re-joining head and hand" so that learning feels more relevant. For Dr. Kerchner, technology offers the promise of re-balancing the parts of teaching that help a young person grow up and learn about the world — and perhaps a new way of considering his or her place within it.

How do we get there? Dr. Kerchner introduced, as a means of transition into digitally enhanced education, the concept of *Learning 2.0*, "the next full-scale upgrade of learning production. Like well-designed software, it stands on the shoulders of the century-old model courses and classes, Learning 1.0, but does not destroy it." Here, he offers a short list of policy options that will have substantial leverage:

- Invest in technological solutions to real and persistent problems in public schools.
- Create an educational infrastructure for California's students, teachers, and schools.
- Modify regulations to create better incentives and fewer barriers to using technology without losing the safeguards that regulation is intended to provide.

As a way of getting started, Dr. Kerchner noted that there are three areas of "low-hanging fruit" that offer practical entry points into digital education ripe for implementation:

- **Remediation.** A great deal of money, energy, and time is wasted in California (and elsewhere) on "re-teaching," which also has implications for inefficient **high-school-to-college** transitions. Technology could help high school students understand college-level expectations and complete some of that work (for credit) while still in high school, and make remedial courses more effective when they are

needed. “This could make college a 3- or 4-year experience, instead of a 5- or 6-year experience,” Dr. Kerchner said, “and we have the capacity to deal with that right now.”

- **Special Education.** Over 680,000 California students are enrolled in Special Education; about \$9.3 billion is devoted to this labor-intensive educational model, with about 17% of the general education budget covering 10% of students. Technology has a role to play not only in individualized instruction, but also in making virtual communication and meetings possible among the adults in a Special Education student’s life.
- **English Language Learners (ELL).** ELL students, currently nearly a quarter of California’s students, are faltering because they lack the English skills to keep up with language arts and mathematics. What if technology could help these students gain English fluency faster and exit their ELL status? This would not only help students throughout their academic careers, but save millions for the state’s education budgets.

In addition to picking low-hanging fruit, Dr. Kerchner said, continuing with his orchard analogy, some roots — i.e., outdated rules and regulations — are badly in need of pruning. They include:

- A misplaced allegiance to **seat time**, as opposed to mastery of material. Instead, students could achieve at their own pace, similar to how Boy and Girl Scouts achieve **merit badges** for demonstrating knowledge or skill — an approach already adopted by 38 states.
- Altering the **contiguous county rule** that only allows online or virtual education to be provided to students within the county where the course is offered and those immediately surrounding it.

Dr. Kerchner concluded by challenging his audience to ponder these questions: “Why in the world shouldn’t California be the best? Why do we exist as a state deeply in the eddies of an early 20<sup>th</sup> century learning system?”

“I can’t think of a good reason,” he said.

### **Discussion**

Caleb Cheung, Cal TAC member and Science Manager for the Oakland Unified School District, posed several questions to Symposium participants, sparked by the introductory remarks from Chancellor Katehi and Dr. Kerchner:

- What can we do right now, in our schools and districts?
- What are considerations for transforming and building systems in ways that will be robust over time?

- What current research exists?

Response, suggestions, and comments included the following:

- **Provide small technology grants for teachers** that would be easy to apply for and get — with the only requirement in return being a small report on what’s been learned, to advance understanding of what works well, with whom, and under which circumstances.
- **Track natural experiments in DEE that are unfolding in the field. This could include:**
  - **Documenting the results of the ongoing CCST/Cal TAC technology experiment, which has involved giving each Cal TAC member an iPad** and has yielded some remarkable stories — many within weeks and months of first use. Cal TAC members have reported on transformations of individual students who had been struggling, engaging students in seeking and sharing new information and insights, bringing other teachers within their schools on board, parents seeing the transformation in their children and sacrificing to get them their own iPads, school administrators finding funds to provide iPads for teachers and students, and generally giving students much more say in their learning pace and environment.
  - **Tracking broader system experiments, such as LAUSD’s deployment of tablet devices for every student by the end of 2014** — included proposals to have publishers partner with device manufacturers on a K-12 digital curriculum.
- **Address school site and district technology restrictions** — such as what happens when the IT person who gave a teacher Apple TV moves on to another job, and his replacement no longer supports its use because he wants the school to be PC-based, not Apple.
- **Technology glitches**, such as spotty and slow Wi-Fi networks (or lack of Wi-Fi altogether), incompatible hardware or software, firewalls and the like also are frustrating and time-consuming; these, too, need to be addressed.
- **Note that the iPad success stories are really teacher success stories.** While it’s true that many schools and districts lack basic resources, the major problem is not just lack of access to technology, but lack of access to great teachers.
- **Technology should be put to use for professional development** to serve teachers and empower them.
- **Focus on more even distribution of resources** — including technology and professional development resources — to level the playing field and address important equity issues. (“The future is already here — it’s just not very evenly distributed.”)

- **Swap the term “iteration” for “failure.”** Failure has a negative connotation in education, but true innovation depends on it. Keep trying (but provide needed tech support, too!).

## Moving from Anecdotes to Evidence: Assessing the Quality of Distance and Blended Learning

**K**atie Ward, Science and Biotechnology Teacher at Aragon High School in San Mateo, CA, introduced a panel that included Cal TAC member Lewis Chappellear, who teaches engineering at James Monroe High School in North Hills, CA; Catheryn Cheal, PhD, Associate Vice President and Senior Academic Officer at San Jose State University; Mike Lawrence, Executive Director of Computer Using Educators; and Andrew Ng, Co-founder of Coursera.

What’s known about the ways in which distance and blended learning options and strategies are working, for whom, and in what contexts?

The panel members were asked to reflect on the ways in which distance and blended learning options and strategies are working — and especially for whom and in which contexts.

**Andrew Ng** opened the discussion by describing his company, Coursera (<https://www.coursera.org/>), and some of the insights he has gleaned as both a company co-founder and university professor (of computer science at Stanford). Coursera offers a variety of university courses online in a Massive Open Online Course (MOOC) format, serving hundreds of thousands of students who would not otherwise have access to courses from top professors at leading universities. Ng explained that the company also serves another important audience: educators themselves. This is because Coursera can free up teacher time from grading, testing, and reiterating textbook or other material so that a teacher’s time is more available for customized and richer interactions with students.

That being said, Ng noted that assessments and studies of how MOOCs affect teaching and learning are in their infancy, and “the evidence is weaker than we would like.”

**Catheryn Cheal** noted that in her own experience providing an art history course online in the late 1990s, synchronous versions of courses (with teachers and students online simultaneously and real-time feedback) were superior to asynchronous options in terms of retention. She pointed to other benefits of online courses: more active participation from students, and better writing on their assignments — all without a loss of personal interaction between her and her students. “I thought it was a success in 1999 and never looked back,” she said.

More recently, at San Jose State University, flipped classes have been tried in the electrical engineering department, using content provided by edX (<https://www.edx.org/>), a Harvard/MIT MOOC provider. Instead of hearing lectures in the classroom and trying to apply what they learn outside of class, the students learn content through edX videos or other online material, and then work in groups in class with the instructor in a coaching

and problem-solving role. As discussed in the summary of San Jose State University President Mohammad Qayoumi's lunchtime remarks, this initial experiment was encouraging because it increased pass rates for students, compared to the face-to-face version of the course.

**Lewis Chappellear** described his experience with an online engineering course at the high school level. Online options have been appealing to him precisely because of some of the aspects mentioned earlier — the value placed on experimentation, and the ability to try other approaches if an initial one does not work. This is in stark contrast to traditional textbooks, workbooks, and teachers' manuals, Chappellear noted.

The online engineering course was a success for Mr. Chappellear and his students, particularly because he saw his role as their guide and facilitator for the material they were acquiring online. But what really changed his approach in the classroom was Edmodo (<https://www.edmodo.com/>), which is a social networking/connection site exclusively for the use of students and teachers.

Through Edmodo, Chappellear said, he was able to pose questions that were immediately answered by students — answering him, as well as interacting with each other. “It was a great equalizer,” he recalls, “because everybody has a voice and everybody can challenge everyone else.” The first few weeks were rocky as students experimented and made some inappropriate posts, but they soon figured out that their online manners mattered. “They start to spell everything correctly,” he said, “and care about their grammar — because they see that others will react to what they write.”

Edmodo and other online learning options also allow students to match their inquiry and learning to times that better fit their needs. Much of the activity, Chappellear noted (to knowing nods from the other teachers in the room), appears to occur between 10:00 p.m. and 2:00 a.m. His class time becomes a venue for practicing skills they've learned elsewhere — and at other times.

These tools also have increased students' roles in assessing each others work — as well as teachers' trust in their students' reactions. “If students are creating things in class,” Chappellear noted, “it's often for an audience of one — the teacher.” But with Edmodo postings, they can get valuable feedback from many other people. Instead of spending hours grading hundreds of student assignments, teachers can post a rubric on line and students can evaluate themselves and each other — freeing up teacher time.

Chappellear is excited about the potential of Coursera to offer his students material beyond what is available in his classroom, but noted that many school districts block access to YouTube videos featured on the site. Participants noted that these types of restrictions on students — while perhaps well intended and designed to protect them — are in fact a disservice, because students don't have opportunities to learn how to navigate the online world. The focus should be on the behaviors, not the devices; if a student passes an awful note about another student, it's wrong whether it occurs online or on paper.

**Mike Lawrence** posed the idea of certification as a blended learning teacher or digital educator, as a way of agreeing upon some quality standards for what this would look like. Another idea was to get more devices into the hands of students — a “Bring Your Own Device” approach (with foundations supplementing this for those whose families could not afford them). Middle school student tablet accesses doubled between 2011 and 2012; the trend is likely to continue.

What else do we need to know about the efficacy of online and blended learning? Catheryn Cheal recommended against comparing traditional classes to online versions. Instead, she said, “We should be figuring out which blend works best for different subject matter, situations, and teachers.”

Andrew Ng suggested that the group consider best practices in blended learning through the lens of professional development. Coursera already offers 28 courses for teachers on topics such as how to teach character, how to survive the first year as a new teacher, and aspects of the Common Core. Similar professional development courses are in development on topics such as how to use technology to create a MOOC, how to flip or blend course materials, and how to use peer learning to greatest advantage.

Lewis Chappellear pointed to teacher resistance as a challenge. Competing with the allure of technology, responding to student expectations that they will be more entertained and engaged — all of these are threatening and could be addressed more systematically.

Others pointed to opportunities such as the Preparation Advisory Panel, a panel of 29 individuals appointed by the Commission on Teacher Credentialing to review the content, structure and requirements for California teacher preparation and licensure to ensure that these remain responsive to the conditions of teaching and learning in California’s public schools (for more information please visit <http://www.ctc.ca.gov/educator-prep/TAP.html>). The panel has recommended that teacher preparation programs do more to prepare teachers for online and blended teaching. (Lewis Chappellear and Mike Lawrence served on that panel and agreed that this was an opportunity.)

Another opportunity is to consider the culture of assessment and evaluation — and avoid some of the mistakes of the past, which used assessments in a “thumbs up or down,” all-or-nothing mode. How do we get to the nuances of how blended and online learning helps children learn and teachers teach?

One way assessments can help students succeed is by assessing mastery of skills and concepts, in smaller increments and in real time. Online courses provide unprecedented volumes of data, which in turn can yield insights about trends that are not revealed in smaller numbers. For example, Andrew Ng described a situation from his own machine-learning class, offered as a MOOC through Coursera to 100,000 students (instead of the 100 in his Stanford course). Of the 100,000 students in the online version of the course, 2,000 submitted a wrong answer — and, more significantly, had arrived at their wrong answer for the same reason (reversing the order of two steps of a math algorithm). In his face-to-face lecture, 2 identical wrong answers out of 100 would not have alerted Professor Ng that there was a common misconception about the material, but the online course data did

provide this signal. Moreover, responding to the issue for his online students, Ng said, also benefits the students in his face-to-face courses in the future.

Other assessment opportunities offered by the volume of student data and the real-time availability of formative assessments include tracking student engagement and giving teachers instant feedback on common misconceptions or confusion — feedback that they can address immediately, without waiting for the midterm (or worse, the final exam). This same immediacy, though, also has implications for professional development so that teachers can receive these signals and clues and respond appropriately.

The volume of tools and options raised another issue: the need for quality ratings and some type of curation. “When I look for an example, I get 200,000, but I just need three good ones,” said one teacher. Who are trusted sources for evaluate and vet these resources on teachers’ behalf? Some resources are available such as Brokers of Expertise (<http://www.myboe.org/>) and Multimedia Educational Resources for Learning and Online Teaching – Merlot (<http://www.merlot.org/merlot/index.htm>), but it is not clear that most teachers are aware of them or routinely access them.

Summarizing the wide-ranging discussion, Andrew Ng listed three things he hopes will happen as a result of these changes in technology, education, and society:

- Everyone, regardless of his or her socioeconomic status or parents’ income, will have access to a great education.
- Instructors will be freed to do the things only they can do: one-on-one conversations, life-changing interactions, customized guidance and coaching. “The role of the instructor is being transformed by technology . . . It should not be to provide content; the Internet does that just fine.”
- Data will infuse more rigor into education, moving away from anecdotes to more scientific approaches to pedagogy — and thus to improving what we do.

As the discussion on assessing MOOCs and blended learning continues, several areas of inquiry will have to be addressed. For example, under what circumstances does distance learning foster a growing divide between economically disadvantaged students and their more affluent peers, and how can it help close or narrow this gap?

### **An Ongoing Experiment at San Jose State University: Keynote Remarks by President Mohammad Qayoumi**

San Jose State University President Mohammad Qayoumi described his institution’s forays into distance and blended learning. As noted earlier, San Jose State had experimented with a blended version of a gateway engineering course required of engineering majors — one that had become a bottleneck and deterrent to students interested in Science, Technology, Engineering, and Math (STEM) careers. Failure rates for



the course were high, with between 40 and 45% of students repeating it after an initial failed attempt. After a second failed attempt, many just gave up and switched majors.

President Qayoumi sent several skeptical faculty members to MIT to learn about the blended version of the course; they returned as evangelists for online blended learning. They adapted the course by adding more electrical engineering content (because the MIT version was a computer science course), but otherwise found that approximately 85% of the material in the two versions was comparable.

Students in the new version watched material before coming to class and took many more quizzes to assess their ongoing mastery of the material (or lack thereof). After the first set of quizzes, a comparison to the MIT results showed that the students in the blended version were matching the performance of their MIT peers. After the first exam, they pulled away in comparisons of the face-to-face course exam results, exceeding those results by 10%. As promising as that initial result was, the second exam was even more so — in fact, so much so that the faculty thought they might have inadvertently introduced a flawed and overly easy exam. However, that was not the case. After the final exam, the results were in. The blended course students had a 91% pass rate (grades of C or above), compared to 59% for the face-to-face version.

*“If a class is boring face-to-face, it’s 10 times more boring online. Putting it online does not improve it.”*

— Mohammad Qayoumi

Encouraged by these results (with another round of promising data expected soon), President Qayoumi described how San Jose State worked with Udacity (<https://www.udacity.com/collegedcredit>) to provide remedial courses in math, algebra and statistics to high school students for college credit. The pilot program involved 100 students — half at San Jose State and half in high schools and community colleges. The results for the statistics class were comparable to the face-to-face

version; the remedial math class had some issues that need to be resolved. The team learned more about tweaks — such as the lack of access to the Internet or computers for Oakland high school students; a lack of familiarity with deadlines for some students; and the unwillingness to read beyond two lines of text on a reminder e-mail. (In response, the team now texts students on their phones — instructing them to open and read the instructor’s e-mail!)

This summer, San Jose State will offer five courses to 1,000 students. Looking ahead, they hope to be able to offer more lower-division courses so that students can complete a year of college while they are still in high school.

In response to a question about whether students needing remedial courses are well-suited to the discipline of an online course, President Qayoumi observed that “if a class is boring face-to-face, it’s 10 times more boring online. Putting it online does not improve it.” Instead, the courses have been re-designed — with shorter segments, videos, frequent quizzes, and assistance in moving from one step to the next. A typical 50-minute session now has 25-30 exercises for students to complete, during which they work through 30 to

50 different problems. They appear to be more engaged and can track their success for each small increment; they also have access to support from their peers.

If these courses yield the results President Qayoumi expects, he envisions significant savings in terms of reduced failure rates and improved student engagement. As with the recent pilot, he sees these courses as becoming available to high schools and community colleges, to use in whichever ways are appropriate for them and their students — including obtaining college credit. Ultimately, he hopes these changes will reduce drop-out rates, which hover at 50% for 6 years at public universities. “As a higher-education sector,” he said, “we should be embarrassed about that — but there are ways we could improve on all these factors.”

## The Efficacy of Digital Teaching and Learning from the Perspectives of Providers and Users

Building on the morning discussions, Jeff Bradbury, Cal TAC member and Chemistry Professor at Cerritos Community College and Julie Meier Wright, CCST Council Member, co-chaired a panel of digital education providers and users. Their charge was to explore how providers and users of digitally enhanced products and services are assessing the quality of what is offered to students, and what questions they are asking as they do so.

The panelists included Benjamin Alisuag, Content Operations Director for Gooru; Rowland Baker, Executive Director of the Technology Information Center for Administrative Leadership; Diana Herrington, Cal TAC member emeritus and Mathematics Teacher at Clovis High School; and Vibhu Mittal, Vice President of Research at Edmodo.

**Ben Alisuag** was Gooru’s fifth employee and the first teacher to join the staff. He explained how Gooru works as a teaching and learning search engine to categorize the rich but almost overwhelming volume of available content and align it with Common Core and other standards.

Gooru works by helping teachers sift through content in four steps: **discovering** the variety of education resources on the web, **organizing** a variety of resources from different sources into customized collections, **teaching** in ways that match students’ specific needs, and making it possible to **study** in ways that can move at an individual’s pace and allow opportunities for tracking progress.

The content itself comes from two main sources: original content from teachers who share their work (“YouTube celebrities,” as Alisuag described them) and open resources available online from sources such as Wikipedia or other non-proprietary compilations. In addition to compiling resources, Gooru (<http://www.goorulearning.org>) gives teachers options for flagging content in various ways, such as in terms of usefulness for various purposes (e.g., quizzes, assignments, mini lessons).

**Rowland Baker** described the role of his organization, the Technology Information Center for Administrative Leadership (TICAL). With funding from the California Department of

Education, TICAL's mission is to help K-12 administrators provide leadership in the use of technology to improve education. The organization does this by serving as a centralized repository of technology resources and professional development opportunities specifically geared to school administrators and as an interactive learning community through which administrators can pose questions to one another and recommend specific resources.

Once a year, TICAL sponsors a virtual symposium of computer-using educators and administrators from all over the world. Rowland described himself as a “doubting Thomas” about most things touted as the latest and greatest trend, but was amazed by the level of engagement generated by this virtual forum. As each speaker presented during the forum — including a principal in New Jersey and a moderator in New Zealand, talking about something they had witnessed in Japan — resources flooded in from audience members.

For Baker, a target year to envision a transformed educational landscape is 2030 — the year when today's kindergarteners will be entering the workforce. Those are the children we should be thinking about as we consider seat time versus competency, informal versus formal modes of instruction, badges versus degrees, the roles of for-profit versus non-profit vendors, cloud-based computing — all of the themes raised so far at the Symposium.



**Diana Herrington** spoke as the teacher in the group when she said, “The role of the teacher is constant. Our role is to engage the student in learning. We may use different tools to do so, but our role is still the same.”

For Herrington, digital tools have increased student engagement, writing skills, and communication. Over the summer break last year, she gave her students an assignment: go on Gooru and create a dashboard of the five best resources to review calculus before school started again in the fall. The students came to class better prepared than ever before, she reported.

Edmodo also has been a valuable tool in her classroom, particularly in terms of engaging students. To illustrate the connection with her students, Herrington unfurled a beautiful, singularly low-tech item: a quilt hand-sewn by one of her students and the student's mother, featuring turtles that signify serenity, peace, and longevity. The quilt was inscribed, “To Diana Herrington, the best teacher I've ever had. Thank you.” Herrington commented, “This is what engaging a student does for them — they can't give you enough back.”

Herrington also described how valuable Google Docs has been in her classroom, giving students unprecedented opportunities for feedback on each other's homework. Using the same tool, Herrington asks her students to let her know their questions about whatever

they did not understand. With access to these comments before class, she can start class by addressing the issues raised — instead of grading homework. Another plus: interacting with each other online through Edmodo and Google Docs appears to unleash safe risk-taking among students. “They come in with incredible projects and questions I never thought they would ask,” she said proudly.

Her classes are now averaging 5-10% achievement improvements over last year, which she attributes to the higher levels of engagement and responsiveness. “I’m using technology to get a head start on everything they’re doing,” she said.

**Vibhu Mittal** explained Edmodo’s creation of a safe environment in which teachers define and control students’ postings and content. Edmodo’s assessments of these environments have reinforced what Symposium participants described about student engagement. For example, according to Mittal, the most successful Edmodo classrooms have at least 10 students — enough to drive peer interaction and specifically learning from one’s peers.

Edmodo researchers also have explored trends in levels of activity, noting that it takes a few weeks for students and teachers to become comfortable with using Edmodo and interacting through it. Noting Diana Herrington’s observation that her students who completed a Gooru assignment over the summer showed up better prepared in the fall, Mittal said Edmodo research had shown similar patterns. Not surprisingly, Edmodo usage drops significantly during the summer. However, those students who do sign on during the summer, even as occasionally as once a week, appear to do better in the fall than those who never sign on.

Another assessment resource is the feedback that teachers receive; as others had noted, this gives teachers opportunities to both detect and respond to misconceptions almost as they occur.

In closing, Mittal applauded the teachers in the room on their role, stressing how central teachers are to Edmodo’s model. After all, he noted, no matter what tools and technology may be in place, it is teachers who make the biggest difference in helping children see learning as something they love, instead of a chore. “Whether or not they leave knowing  $3 + 2 = 5$ ,” he said, “we do want them to think that’s a fun, challenging task.”

## What's Next?

Symposium participants put forward a number of follow-up actions to pursue ideas and address gaps identified during the meeting.

The most immediate steps for action could be explored at the next Symposium in the series, scheduled for September 2013.

Possible action steps identified during the Symposium include:

- **Funding mini-grants for teachers, schools, and/or school districts** that would create incentives for exploring innovative ways of using digitally enhanced education.
- **Supporting professional development modules for teachers** based on existing and emerging best practices, and addressing both classroom use of technology as well as ways to use much richer and more voluminous student data for ongoing feedback and responsiveness.
- **Cataloguing existing resources for teachers** in a more accessible format (e.g., with short videos of teachers explaining how they have used various resources), so that teachers do not have to invest as much time culling through material.
  - Related to this, cataloguing existing networks and communities that teachers use to inform each other of best practices, and making these more easily or routinely accessible.
- Developing a **toolkit for teachers** that covers a spectrum or continuum of best practices, with an emphasis on how digital education can enhance various aspects of the classroom experience even in very small, incremental applications and how these align with the Common Core State Standards.
  - Related to this, identifying ways to address sources of resistance among teachers, particularly fears that online education and technology might be used to replace teachers, rather than to enhance teaching and learning.
  - Also related, developing a basic assessment tool that would help teachers and administrators gauge where a particular school or classroom falls along a continuum of possible uses of digitally enhanced education, from none (still effective, with an excellent teacher at the helm) to some to more interwoven into the fabric of the classroom and interactions between teachers and students — but all examples of excellence in teaching and learning.
- Adding to the currently sparse **assessment evidence base** by engaging researchers and practitioners in designing questions to assess and measure the effects of digitally enhanced education, and specifically exploring in more rigorous fashion:
  - what constitutes a positive learning experience for students;

- what should be measured to gauge differences in students’ understanding of materials (e.g., comparing digital content to textbooks);
  - the conditions under which digital materials enhance understanding, versus serving as entertainment or distractions;
  - how to quantify student engagement;
  - markers for assessing the quality of various tools;
  - what can be done with digital tools, that could not have been accomplished otherwise;
  - lines of inquiry listed in Appendix B.
- Keeping in mind and assessing the degree to which **many students are not digital natives** and lack access to basic digital tools, as well as exploring ways to close these gaps and monitoring ongoing pilot programs attempting to do so (such as L.A USD’s distributions of tablets to all students).

### **The Continuing Quest for Efficacy**

An important set of observations emerged from this first symposium regarding the efficacy of digitally enhanced education, each framed by the fact that this is a rapidly emerging field likely to impact every aspect of public education, from curriculum, instruction, and assessment to issues of equity and school finance. We hope these observations will help to set the stage for further study and evaluation of digital teaching and learning in order answer the basic question put before us: What works well, why, for whom and in what contexts? Among those observations emerge a sample set of key questions. The answers to these questions will be critical to the successful implementation of Learning 2.0, including:

- How do we get to the nuances of how blended and online learning helps children learn and teachers teach? The implementation of digitalized education offers an opportunity to consider the culture of assessment and evaluation — and avoid some of the mistakes of the past, which used assessments in a “thumbs up or down,” all-or-nothing mode. One way the new assessments can help students succeed is by assessing mastery of skills and concepts, in smaller increments and in real time. Online courses provide unprecedented volumes of data, which in turn can yield insights about trends that are not revealed in smaller numbers.
- Studies of how MOOCs affect teaching and learning are in their infancy and “the evidence is weaker than we would like.” A new and vigorous set of studies on the efficacy of digital teaching and learning is necessary to inform instructional practice as well as to point the way toward reasonable expenditure of public funds for platforms, programs, applications and other resources that serve all students well.
- How can what is learned about the efficacy of digital teaching and learning improve course design, better engage students, and boost their academic achievement? In

terms of blended learning, which blend works best for different subject matter, situations, and teachers?

- Under what circumstances does distance learning foster or ameliorate a growing divide between economically disadvantaged students and their more affluent peers, and how can it help close or narrow this gap?
- Who are trusted sources to evaluate and vet these resources on teachers' behalf? How can teachers confidently select the most appropriate learning tools for students that ensure an appropriate fit within specific contexts? The volume of tools and options raised another issue: the need for quality ratings and some type of curation. "When I look for an example, I get 200,000, but I just need three good ones."
- Some resources are available (such as Brokers of Expertise and Merlot), but it is not clear that most teachers are aware of them or routinely access them.
- In what ways must preparation programs be reconceived or modified in order to prepare teachers for online and blended learning?

These and other questions will be the focus of future symposia in the series, as participants continue to explore the changing parameters of digitally enhanced education and strive to keep the effects on teaching and learning front and center.





## Appendix A: Symposium Participants

### Co-Chairs

**Heidi Haugen**

Science Teacher  
Florin High School and Cal TAC Vice-Chair

**Charles Kerchner**

Research Professor  
Claremont Graduate University

**Brian Shay**

Mathematics Teacher  
Canyon Crest Academy and Cal TAC Chair

### Panelists and Speakers

**Benjamin Ailsuag**

Academic Operations  
Gooru

**Rowland Baker**

Executive Director  
Technology Information Center for Administrative Leadership (TICAL)

**Lewis Chappellear**

Engineering Teacher  
James Monroe High School and Cal TAC Member

**Catheryn Cheal**

Vice President and Chief Technology Officer San Jose State University

**Diana Herrington**

Mathematics Teacher  
Clovis High School

**Linda Katehi**

Chancellor  
University of California, Davis

**Mike Lawrence**  
Executive Director  
Computer Using Educators (CUE)

**Vibhu Mittal**  
Vice President of Research  
Edmodo

## **Cal TAC**

**Jeff Bradbury**  
Chemistry Professor  
Cerritos Community College

**Caleb Cheung**  
Science Manager  
Oakland Unified School District

**Andrew (Andy) Kotko**  
First Grade Teacher  
Mather Heights Elementary

**Oswaldo Soto**  
Mathematics Teacher  
Patrick Henry High School

**Katherine Ward**  
Science and Biotechnology Teacher  
Aragon High School

## **Participants**

**Smita Bakshi**  
Chief Executive Officer  
Zyante

**Joan Bissell**  
Director, Teacher Education and Public Schools Program  
California State University Chancellor's Office

**Kyndall Brown**  
Director  
UCLA's Mathematics Project

**Alex Edgcomb**

Graduate Student  
University of California, Riverside

**Greg Gambetta**

Science and Technology Policy Fellow  
California Council on Science and Technology

**Beth Graybill**

Chief Deputy Director  
Commission on Teacher Credentialing

**Phil La Fontaine**

Director, Professional Learning Support Division  
California Department of Education

**Patrick Lee**

Sr. Vice President, Customer Service, Innovation, Business Strategy and Chief  
Environmental Compliance Officer  
Southern California Gas Company and CCST Council Member

**Harold Levine**

Dean, School of Education  
University of California, Davis

**Gerardo Loera**

Executive Director, Office of Curriculum Instruction and School Support  
Los Angeles Unified School District

**Andrew Ng**

Co-Founder and Co-Chief Executive Officer  
Coursera

**Jose Ortega**

Administrator, Education Technology Office  
California Department of Education

**Mohammad Qayoumi**

President  
San Jose State University

**Karen Shores**

Administrator  
California Department of Education

**Maria Chiara Simani**  
Executive Director  
California Science Project

**Van Ton-Quinlivan**  
Vice Chancellor  
California Community Colleges

**Julie Meier Wright**  
Former President  
San Diego Regional Economic Development Corporation and CCST Council Member

## **CCST**

**Margaret Gaston**  
President  
Gaston Education Policy Associates  
Washington, DC

**Susan Hackwood**  
Executive Director  
California Council on Science and Technology

**Nicole Lezin**  
Writer  
Cole Communications, Inc

**Diane Siri**  
Education Advisor,  
California Council on Science and Technology

**Sandra Vargas**  
Project Coordinator  
California Council on Science and Technology

## Appendix B: Lines of Inquiry for Strengthening Assessments of Digitally Enhanced Education

### **WHAT DO WE KNOW ABOUT THE QUALITY OF DISTANCE AND BLENDED LEARNING?**

*General Focus: What is known about the ways in which distance and blended learning options and strategies are working, for whom and in what contexts?*

#### **Areas of Inquiry**

- What is the status of assessment for MOOCs and other distance courses?
- What is the status of assessment of the quality and effect of blended learning?
- Given what is known so far about distance and blended learning, what works best for whom, and in what ways?
- Does distance learning foster a growing divide between economically disadvantaged students and their more advantaged peers, or does it ameliorate the problem? Something in-between?
- What else do we need to know about the efficacy of distance and blended learning in order to ensure they contribute to and promote students' learning?

### **THE EFFICACY OF DIGITAL TEACHING AND LEARNING FROM THE PERSPECTIVE OF PROVIDERS AND USERS**

*General Focus: What are the ways in which providers and users of digitally enhanced products and services are pursuing the quality of what is offered to students?*

#### **Areas of Inquiry**

- How are providers assessing the quality of their products and services?
- How are providers approaching these assessments?
- What are the key questions they are asking?
- What do they hope to learn from the assessments, and how might this information be used to improve their products and services?
- How do they view their responsibility to users (teachers and students)?
- How do administrators, teachers and others determine the quality of the tools, platforms, applications and resources they use?

### **SUMMARY**

#### **Areas of Inquiry**

- Based on what participants have heard, what do they believe to be the key points raised?
- What do they believe to be the most viable aspects of digital teaching and learning with regard to benefit to students? For which students? In what ways? Under what circumstances?

- From the teacher's perspective, what are the steps that should be taken which would be the most helpful in applying digitally enhanced education to strengthen students' learning?
- What kinds of policy questions does the digitalization of education raise?
- What should we be thinking about in order to transform schools and districts into different learning systems?
- What do they envision this system might to be like? Five years out? Ten years out?
- How is the current research and development work likely to inform this transformation and what else is needed?