One World School House vs. Old World Statehouse

The Khan Academy and California Red Tape

Lance T. Izumi, J.D. and Elliott Parisi

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Executive Summary

Started by San Francisco Bay Area resident and former hedge fund analyst Salman Khan, the Khan Academy has become a worldwide phenomenon. The Khan Academy combines straightforward instructional videos and interactive software programs to provide both fundamental learning and also higher order education. Khan believes, "that when it comes to education, technology is not to be feared, but embraced; used wisely and sensitively, computer-based lessons actually allow teachers to become a workshop for mutual helping rather than passive sitting."

With his videos and his basic software, Khan proposed using both within the structure of a so-called "flipped classroom." The general idea of the flipped classroom is for students to view lecture-like instructional videos on subject matter at home or at some other non-classroom venue, which then allows class time in schools to be used for students working on problems, teachers working with students one-on-one or in small groups, and students working with each other on problems and projects.

Success of Pilot Programs

The Los Altos school district, located in the Silicon Valley, piloted using Khan Academy videos and interactive software in a "flipped classroom" model in a number of fifth- and seventh-grade classes. Overall, student achievement on state math exams improved in both grades. Khan was especially pleased to see that among the socio-economically diverse seventh graders, "Relative to the year before, their average on the grade level exam improved by 106 percent." This improvement resulted in twice as many students performing at grade level.

"Now, all of a sudden," says Khan, "we were seeing that students who were put in the "slower" math classes could actually leapfrog *ahead* of their "non-slow" peers." Even better, "the experience with both the fifth and seventh graders showed that there really was no reason to track students into separate classrooms to begin with."

Cost Savings and Improved Learning

Widespread use of Khan Academy could also save precious tax dollars. As education technology experts Bryan Hassel and Emily Ayscue Hassel have pointed out, if one class out of four in a school's 4th grade has an excellent teacher, and she spends half her instructional time on whole-group instruction and half on more dynamic/personalized learning, then if Khan takes over the former whole-group instruction, two 4th grade classes could have that teacher just for personalized/ dynamic learning.

"The effect," they note, "is a 100% increase in the number of kids who get the top-tier in-person teacher—without reducing personalized instruction time with the kid." The school would not need as many teachers since the whole-group lectures could be overseen by a less costly learning-lab para-professional.

Barriers to Expansion of Khan-Type Programs

Despite the success of his videos, software and pilot programs, there remain difficult obstacles to expanding the use of Khan Academy in California:

- **Government monopolistic control over education.** Khan Academy has shown itself to be a popular program in the marketplace. However, translating success in one part of the market, e.g. YouTube viewership, to another market such as the school market is hampered by the monopolistic grip of government on the school system and its ability to shut out innovators like Khan. Opening up the education marketplace through universal or large-scale parental choice programs would facilitate the increase in consumer use of Khan Academy because new schools would want to take advantage of Khan's popularity with consumers. Schools would also want to make use of a program that both improves student performance and saves money.

- **Bureaucratic inertia.** According to a representative of an education software company, "One thing I find in working with districts is they think 'okay, it worked there but it won't work in mine,' even if the demographics are very similar, even if they have the same problems." Cato Institute's Andrew Coulson explains: "When efficiency and excellence are rewarded, they thrive. When stagnation and falling productivity are not penalized, they spread. When the risks of innovation and failure are not outweighed by some greater compensation, they are seldom undertaken."

- **Government regulations.** There are various regulations and laws that impede the expansion of Khan Academy. Prime among these are "seat time" rules for regular public schools that require minimum number of classroom-based minutes per school day and rules for charter schools that require minimum percentage of classroom-based instruction. These rules are connected to funding and not to student achievement and mastery of subject matter.

Recommendations

- **Award credit for mastering subject matter rather than mere seat time.** The National Governors Association recommends that states, "Build flexibility into state policy to allow students to earn credit based on demonstrating mastery in the classroom and in expanded learning opportunities." Oklahoma allows students to earn credits in core subjects based on demonstrations of mastery through tests. Michigan grants waivers to seat-time rules and now several thousand students make use of that flexibility, most using blended-learning programs that combine in-person and online learning. California should follow the lead of these states and give schools and students the opportunity to implement mastery/competency-based learning models that are free from state seat-time mandates. Students should be allowed to prove their mastery/competency over subject matter content either through state standards-aligned tests or through a combination of tests and other rigorous achievement-indicating instruments.

- **Change funding formulas.** The California Council on Science and Technology urges state lawmakers: "Create ADA apportionment funding models in California that allow per-pupil funds to follow students for the purposes of instruction received, regardless of that instruction being delivered online from a virtual location or at a brick and mortar school site." Michael Horn, head of the Innosight Institute, proposes a promising specific model. He says that California should "adopt a system whereby fractional funding follows the student to the course level, such that a student could take the best course for his or her needs, be it face-to-face or online." The funding should follow the child to online or blended-learning courses that focus on student outcomes rather than minutes spent in a classroom, and should be contingent, at least in part, on student mastery of subject matter. The National Governors Association recommends, "Modifying school funding formulas to allocate resources based on student mastery," which "can remove the financial barriers that often make moving toward a competency-based system challenging." The governors note that in 2003, the Florida legislature required funding for the Florida Virtual School to be "based on student accumulation of credits tied to the successful mastery of specified content and skills as opposed to enrollment."

- **Implement large-scale school choice reforms.** In Sweden, education funding is attached to a student so that he or she can take it to the public or private independent school of his or her choice. If California adopted a similar portable funding system, it could address issues of funding disparity between regular public schools and distance and online alternatives, save money, and force the regular public schools to compete fully with expanded numbers of private schools and charter schools. It is this competition that would also force all schools—public, private and charter—to meet the demand of consumers who want Khan-type programs integrated into learning models. Indiana and Louisiana have adopted large-scale school-choice voucher programs that will give low- and middle-income students the opportunity to attend private schools if that is their choice. This new widespread competition from the private sector will incentivize public schools to change and adopt programs and policies demanded by consumers in the invigorated education marketplace.

- **Remove the statutory cap on charter school creation.** Khan Academy is being piloted in several charter schools. It should be possible for all students in California to attend a Khan Academy-using charter, or a high performance charter like Grimmway Academy or a Rocketship Mateo Sheedy, but such is not the case. State law limits the number of charter schools that can be established. To promote the creation of schools that may make the best use of Khan Academy and other digital-learning programs, California should repeal the statutory cap on charter schools and encourage the establishment of charters, especially in places where students currently have no access to charter options.

Introduction

California's high-tech leadership has spawned innovative products and programs affecting all aspects of modern living in the 21st century, including education. Indeed, much of today's digital-learning revolution has its origin in Silicon Valley and other parts of California. Emblematic of this revolution is the Khan Academy.

Started by San Francisco Bay Area resident and former hedge fund analyst Salman Khan, the Khan Academy has become a worldwide phenomenon. The Khan Academy combines straightforward instructional videos and interactive software programs to provide both fundamental learning and also higher order education. Although just a few years old, the Khan Academy has garnered powerful supporters such as Microsoft's Bill Gates and Ann Doerr, wife of Silicon Valley high-tech leader John Doerr. Despite such high-powered endorsers, expanding the reach of Khan Academy so that all California students have the option of availing themselves of the entire Khan program will not be easy.

This paper looks at Khan Academy's origin, its documented and potential impact, and the government regulatory and policy barriers in California that prevent all students from accessing innovative online programs. The paper concludes with a series of recommendations to overcome these obstacles.

Background on Khan Academy

After cover stories in publications like *Forbes*, a profile segment on *60 Minutes*, and his own recently authored book *The One World School House*, Sal Khan's story has become the stuff of start-up legend. The son of first-generation immigrants from Bangladesh, Khan grew up in New Orleans, which appealed to his parents because it reminded them of the old country: "it had spicy food, humidity, giant cockroaches, and a corrupt government."[1]

After completing his education at MIT and the Harvard Business School, where he was president of his class, Khan worked in venture capital, engineering and as a hedge fund analyst. He probably would have led a prosperous and conventional life in the financial world, but in 2004 he made the seemingly innocuous decision to tutor his cousin Nadia in math. He then started tutoring her younger brothers. Before long he was tutoring a group of family members and friends. As he later observed, "Though I didn't realize it at the time, the Khan Academy was mysteriously coming into being—was being *pulled* —into being by the curiosity and needs of its students and their families."[2]

The site is used by 6 million unique students each month.

It turned out that Khan had a knack for teaching, and soon all his students were performing beyond their grade level. Because of the growing number of students under his tutelage and the demands of his own schedule, Khan tried different methods of interfacing more easily with his tutees, none of which were totally satisfactory. When a friend suggested he record YouTube videos to better reach his students, he was at first incredulous: "YouTube? YouTube was for cats playing the piano, not serious mathematics."[3] Yet, from that small suggestion a viral sensation was born.

Khan started recording his short instructional how-to videos on math and science topics in the closet of his own house. Believing that seeing faces distracts people, he never appears on camera, but narrates the videos and explains the concepts by writing on a black electronic chalkboard. Once he started posting these videos on YouTube, he was astounded to discover that students, both young and old, from all around the globe, were watching and learning from him.

In 2009, Khan quit his job and started the non-profit Khan Academy. By fall of 2010, the Gates Foundation came through with $1.5 million grant, which would later be augmented with a $4 million grant, and Google put in $2 million to build up the Academy's electronic library and translate the videos into 10 different languages. Currently, Khan has recorded more than 3,400 videos, not only on math and science topics, but also on history, economics and other subjects. The global impact has been stunning. According to *Forbes*:

> Over the past two years Khan Academy videos have been viewed more than 200 million times. The site is used by 6 million unique students each month (about 45 million total over the last 12 months), who have collectively solved more than 750 million problems (about 2 million a day), and the material, which is provided at no cost, is (formally or informally) part of the curriculum in 20,000 classrooms around the world. Volunteers have translated Khan's videos into 24 different languages, including Urdu, Swahili and Chinese.[4]

Although his videos usually get the most attention, they are only half the Khan Academy story. As Khan observes, "The computer-based lessons free up valuable class time that would otherwise be spent on broadcast lectures – a model in which the students generally sit blankly with no effective way for teachers to appraise who's 'getting it' and who's not." If one views Khan's videos as the lecture portion of the learning process, which can be accessed anywhere and in any venue, then the rest of the time available for learning can be much more interactive. Khan points out, "if the students have done the lessons *before* the interaction, then there's actually something to talk about" and there are "opportunities for interchange."[5]

With the videos taking over basic instructional duties, "Teachers can carve out face time with individual students who are struggling; they can move away from rote lecturing and into the higher tasks of mentoring, inspiring, and providing perspective."[6] He believes, "that when it comes to education, technology is not to be feared, but embraced; used wisely and sensitively, computer-based lessons actually allow teachers to become a workshop for mutual helping rather than passive sitting."[7] As a practical matter, Khan uses interactive software and the flipped-classroom model to achieve this ideal.

> As Khan observes, "The computer-based lessons free up valuable class time that would otherwise be spent on broadcast lectures – a model in which the students generally sit blankly with no effective way for teachers to appraise who's 'getting it' and who's not."

Initially, Khan says he wrote some simple software to generate math problems for his tutees, which would "spit out random problems on various topics such as adding and subtracting negative numbers or working with simple exponents." When students had problems, "the software would show steps for coming to the right answers." Khan realized, however, that he needed to know how his students were progressing so he added a database that allowed him to track how many problems each student got right or wrong. Gradually, he found, "by expanding and refining the feedback I could begin to understand not only what my students were learning but *how* they were learning."[8]

He then improved the software so that "the system itself could advise students what to work on next." So, once mastering addition and subtraction of fraction, they could go on to simple linear equations. "Having the software hand out the 'assignments,'" he says, "left me free to do the essentially human parts of the job – the actual mentoring and tutoring."[9] One key question, however, was what should be the definition of "mastering"?

Khan says, "My gut feeling was that in general the expectations of teachers and educators are far too low, and, further, that there is something condescending and contagious in this attitude." He, therefore, devised a high benchmark for students: "I wanted them to work things until they could get ten right answers in a row."[10] He acknowledges that some may see this benchmark as "overidealistic" or "just too difficult," but he sees otherwise:

> I would argue that it was the only simple standard that was truly respectful of both the subject matter and the students (We have refined the scoring details a good bit since then, but the basic philosophy hasn't changed). It's demanding, yes. But it doesn't set students up to fail; it sets them up to succeed—because they can keep trying until they reach this high standard.[11]

Ten correct answers in a row on a given subject, he reasoned, "was a good indication that they truly understood the underlying concept."[12] If students failed to answer ten in a row correctly, they could go back and review concepts and then the software program would create more problems for them to solve.

After input from teachers, Khan refined the software to not only track the progress of students, but also to inform teachers when students became stuck. Like mastery, he defined "stuckness" in simple parameters: "If a student attempted fifty problems and at no point got ten in row right then he or she was 'stuck.'"[13]

He then added on a feedback spreadsheet for teachers, which "fundamentally altered the dynamic of the classroom." Now teachers would have the information they needed to provide the individual attention that could actually improve student learning:

> Once again, *the use of technology made the classroom more human* by facilitating one-on-one interactions; by letting the teacher know who needed her attention most. Even better, a student who had already mastered a particular concept could be paired with one who was struggling. Or two students, stuck in the same place, could work together to get past their common hurdle. In all of these instances, the clear emphasis would be on quality, helping interactions.[14]

> **Khan says, "My gut feeling was that in general the expectations of teachers and educators are far too low, and, further, that there is something condescending and contagious in this attitude."**

With his videos and his basic software, Khan proposed using both within the structure of a so-called "flipped classroom." The general idea of the flipped classroom is to have students view lecture-like instructional videos on subject matter at home or at some other non-classroom venue, which then allows class time in schools to be used for students working on problems, teachers working with students one-on-one or in small groups, and students working with each other on problems and projects.

In an article on the flipped classroom in the journal *Education Next*, Colorado teacher Jonathan Bergmann says that the home-viewed video lessons have improved his interaction with his students: "I now have time to work individually with students. I talk to every student in every classroom every day." He spends more time with struggling students, who are now working through challenging problems in class rather than giving up because they were too hard when assigned as homework. Bergmann, according to the publication, "credits the new arrangement with fostering better relationships, greater student engagement, and higher levels of motivation."[15]

Higher education has experimented with classroom flipping with notable success:

> But the ideas behind flipping are not brand new. For over a decade, led by the National Center for Academic Transformation (NCAT), dozens of colleges have successfully experimented with similar ideas across math, science, English, and many other disciplines. NCAT's increasingly impressive body of practice shows that thoughtful course redesigns lead to improved learning.[16]

For Khan, the flipped classroom, with "lecture at home, 'homework' in class," gave students "the benefit of having the teacher and their peers around when they were problem-solving." "That way," he says, "difficulties or misconceptions were addressed as they were actually occurring." The result:

> The teachers, rather than giving broadcast lectures, worked with individual students who needed help. Students who caught on faster assisted those who were struggling. Teachers also had the benefit of forming personal connections with students and getting real feed-back on student comprehension. The use of technology had, somewhat ironically, made a traditionally passive classroom interactive and human.[17]

Flipping lecture time to the home or other non-classroom venue allowed students to decide "what they wanted to watch, and when." "They could pause and repeat as necessary," observes Khan, giving them the chance to "review basic concepts that they were embarrassed to ask about in front of their peers."[18]

Khan has piloted his flipped-classroom model in a number of schools, both regular public schools and charters, which have students from diverse socio-economic backgrounds.

In fall 2010, the Los Altos school district, located in the Silicon Valley, agreed to experiment with Khan Academy videos and software and the flipped-classroom model in four classrooms, including two fifth-grade classes and two seventh-grade classes. The experiment turned out to be a success.

Teachers track student progress on computer dashboards. They can then assist those students who are having trouble.

Observers who have visited the classrooms have noted the energy and enthusiasm of the students. When they do well on problem-solving, students are awarded "energy points" and badges, which have become important motivational devices. Students move at their own pace so different students can be at different points of learning at any given time, and an online knowledge map helps them move on to the next learning step after they have successfully completed a concept or "module." They also coach each other when the need arises. Teachers have also taken to the new way of doing things.

Teachers track student progress on computer dashboards. They can then assist those students who are having trouble. "I'm getting data in real time about each student instead of assuming the entire class needs intervention," says one Los Altos teacher, which "lets me use my class time more wisely."[19]

Khan himself says with pride that "there was magic going on in those classrooms."[20] Of course, "magic" is a subjective term and must be validated by assessment results. Since Los Altos scores on the state tests are usually high, Khan had a high bar to reach. After the first year of using Khan's program, 96 percent of the fifth graders tested at the proficient or advanced level in math, which was an improvement over the 91 percent who tested at that level the year before.[21] It was the performance of the seventh graders, however, that really cheered Khan.

While the fifth graders came from largely affluent families, the seventh graders were much more mixed, with many coming from low-income backgrounds. No wonder, then, that Khan was overjoyed to see, "Relative to the year before, their average on the grade level exam improved by 106 percent."[22] This

improvement resulted in twice as many students performing at grade level. While acknowledging the small number of students in this data set, Khan still viewed these results as validation of his belief that all students could learn:

> Now, all of a sudden, we were seeing that students who were put in the "slower" math classes could actually leapfrog *ahead* of their "non-slow" peers. Even better, the experience with both the fifth and seventh graders showed that there really was no reason to track students into separate classrooms to begin with. Now every student could work at his or her own pace; it was unpredictable who could eventually advance the most.[23]

Because of the success of Khan's program, the Los Altos school board decided to use the program as part of the math curriculum for all fifth- and sixth-grade math classes. The other schools that piloted Khan's program also saw increases in student achievement. He noted that a group of sixth graders in an inner-city Oakland charter school had risen from a third-grade mastery of math to a fifth- and sixth-grade level just six months later.[24]

When Khan first started making his videos, he thought that he was making them only for motivated students, but then found that giving students "Aha!" moments acted like a motivator for all. Yet, despite the success of his program and the enthusiasm of students, teachers and benefactors, there remain skeptics and critics in the education establishment.

The Debate Over Khan

There is an old saying that no good deed goes unpunished, and so it is with Khan Academy. Sal Khan makes instructional videos that are viewed by tens of millions of people around the world who testify to their effectiveness, and detractors in the education establishment are unmoved and contend that real learning is not taking place. Khan advocates increased student-teacher interaction through the flipped-classroom model, but many critics seem to ignore this fact.

Critics charge that Khan Academy is not a silver-bullet answer, that the program uses the wrong type of teaching pedagogy, and that the program will reinforce student's misconceptions about certain subjects in math and science. In the end, the anti-Khan arguments of skeptics largely fall flat.

Keith Devlin, a mathematician at Stanford University, offers a nuanced critique of the Khan Academy. On one level, Devlin does like the Khan Academy and thinks it is useful, in the sense that anyone from around the world can watch these videos and receive a free education. He further states that Khan Academy is great for a minority of students, and it will also help people who have an ability to learn and love math. He claims, however, that only a minority of students or people actually like math, and a "teacher has the responsibility of teaching all children."[25] Given that the majority of people, in his view, dislike math, Khan Academy will not be a useful resource for them to learn effectively.

The problem with Devlin's view is that he does not go deep enough into why so many people seem to dislike math. Is it because the majority of humans have an inherent aversion to math or is it because they

do not understand certain math concepts, become discouraged, and then come to dislike the subject? Khan believes the latter and says that such discouragement and dislike can be overcome with increased understanding and proficiency.

At Oakland Unity High School, where 95 percent of students are African American or Hispanic and 85 percent are low income, students were disengaged from their coursework and spent little time studying. Devlin would probably list most of these students as part of the majority of people who dislike math. However, once Khan Academy's program was piloted at the school, the situation changed. According to principal David Castillo and math teacher Peter McIntosh:

> We believe that our use of Khan Academy is resulting in a fundamental change in student character – with responsibility replacing apathy and effort replacing laziness. We believe that this character change is the primary reason behind the stunning results we are beginning to experience – at both the class level and in individual students.[26]

Khan himself addresses arguments like Devlin's:

> For me personally, the biggest discovery has been how hungry students are for real understanding. I sometimes get push-back from people saying, "Well, this is all well and good, but it will only work for *motivated* students."   And they say it assuming that maybe 20 percent fall into that category. I probably would have agreed with them seven years ago, based on what I'd see in my own experience with the traditional academic model. When I first started making videos, I thought I was making them only for some subset of students who *cared* – like my cousins or younger versions of myself. What was truly startling was the reception the lessons received from students whom people had given up on, and who were about to give up on themselves. It made me realize that if you give students the opportunity to learn deeply and to see the magic of the universe around them, almost everyone will be motivated.[27]

Devlin believes that a teacher's job is to help develop a student's learning ability and that involves different factors like emotional, social and psychological development. An important factor in student learning is that students and teachers have human contact with each other so students can properly develop these emotional, social and psychological skills. With Khan Academy, he contends, these three areas of development will never fully mature if students are stuck behind a computer screen all day. Devlin states that teaching is a way of changing how a mind works and learns, and that can only be done properly with a teacher in the classroom having human contact with their students.[28]

Yet, the entire flipped-classroom model is designed to increase student-teacher interaction. Khan recognizes that "some people fear that computer-based instruction is all about replacing teachers or lowering the level of skill needed to be a teacher." When Khan Academy is implemented as part of a flipped classroom:

> **We believe that our use of Khan Academy is resulting in a fundamental change in student character – with responsibility replacing apathy and effort replacing laziness.**

Teachers become more important once students have initial exposure to a concept online (either through videos or exercises). Teachers can then carve out face time with individual students who are struggling; they can move away from rote lecturing and into higher tasks of mentoring, inspiring, and providing perspective.[29]

Devlin says, "what bothered me was the program's unspoken implication that the many thousands of American mathematics teachers did not know what they were doing, and that they, or perhaps the kids in our schools, needed 'saving.'" While Khan always tries to be complimentary toward teachers and wants to enhance their roles through his program, the reality is that unlike Devlin's utopian picture of great teachers helping students learn, there are too many teachers in America who are the greatest stumbling blocks to student learning.

Khan relates the story of an African-American young man who overcame the incompetence and low expectations of his teachers by using Khan Academy videos to learn math and to do well in college:

> **Khan always tries to be complimentary toward teachers and wants to enhance their roles through his program, the reality is that unlike Devlin's utopian picture of great teachers helping students learn, there are too many teachers in America who are the greatest stumbling blocks to student learning.**

[The e-mail] was from a student who wanted to tell me that where he'd come from, "blacks [were] not welcomed with open arms into schools." As a kid he'd been "force fed medication to keep me from talking [then] chastised for not speaking out when called on." With sorrow rather than anger, he said that "no teacher has ever done me any good." Determined to give him a chance at a quality education, his family saved enough money to move to a less prejudiced community, but still, he wrote, "without a real mastery of elementary math I was slow to progress."

The young man made it to college, though he was still playing catch-up at the start. He wanted me to know that he'd "spent the entire summer on your YouTube page . . . and I just wanted to thank you for everything you are doing . . . . Last week I tested for a math placement exam and I am now in Honors Math 200 . . . . I can say without any doubt that you have changed my life and the lives of everyone in my family."[30]

Against such real-life testimony, Devlin's case against Khan Academy seems like so much ivory tower pontificating and academic turf protection.

Another line of criticism comes from Tony Bates, a research associate with Contact North, an organization that serves as a resource for online and distance learning. Bates' main complaint is the lack of additional help on the website. If a student has difficulty understanding a concept, all the student can do is watch a video. The website does not offer students the ability to connect with a tutor through the program, so that particular student will not properly learn the concept. Thus, the user, especially if he or she is working with the program outside of the classroom, has no guidance on furthering their understanding of concepts.[31]

The problem with Bates' critique is that he makes the perfect the enemy of the good. Even if Khan Academy makes no live tutor available through its website, the videos and exercises by themselves have helped millions of people. Further, in many poor areas of the world, just having the videos available would be a marked improvement over the resources available to children. For instance, Khan Academy has translated its lessons into Hindi, Urdu and Bengali and has copied these translated video lessons onto DVDs.

While granting that just having students watch DVDs is not the ideal, since they cannot access self-paced exercises or receive much teacher feedback, Khan says, "video lessons on DVD would be a significant improvement over what's available now." With his lineage from the Indian subcontinent, Khan observes that giving children from that poverty-stricken area access to just the videos "would ameliorate the teacher shortage situation; kids would at least be able to pause, repeat, and review the lessons." Further, "it would be a win—wouldn't it?—if we could give kids in the world's poorest areas even a cheap approximation of what the wealthy have."[32]

Further, in many poor areas of the world, just having the videos available would be a marked improvement over the resources available to children.

Another critic, Derek Muller, is considered an expert on using multimedia for teaching physics and other science concepts in the classroom. He acknowledges that the Khan Academy is free, that Sal Khan is an excellent teacher, and that Khan Academy emphasizes mastery over subjects, which is important to truly learning concepts. Still, in his opinion, Khan Academy and other online education videos are not a great resource for teaching students about science.[33]

Muller believes that students do not pay close attention to the videos because they already "know" the information. Before students watch instructional videos on science, they already believe that they know this information and do not pay close attention to instructional videos. In their minds there is nothing new to learn and the misconceptions that they had before watching the video become enhanced after viewing the instructional video.[34]

A program like the Khan Academy, according to Muller, will be useful to people that may be instructors in science or someone who already has a firm understanding of the proper concepts within science, but it is not useful to people who are trying to learn for the first time. The very worst outcome of these instructional videos is that students become more confident in their wrong ideas, so these misconceptions endure throughout the students educational lifetime. In Muller's opinion, students are actually worse off in their science education after watching these videos because misconceptions persist.[35]

While student outcome data on Khan Academy are still scarce because of the newness of the program, the data seem to indicate that exposure to Khan does not result in students becoming less knowledgeable about subject matter. Rather, test scores indicate, as mentioned earlier in this paper, that student achievement rises. In regard to the promising test results in Los Altos, Khan notes, "It did decisively prove to the district that despite the fact that our software was still at a nascent state and that we weren't teaching to the test, the experiment was definitely not doing any harm."[36]

Furthermore, the fact that millions of people are using Khan videos shows that knowledge consumers are finding them helpful. It goes against reason to suppose that all these consumers have been fooled into somehow validating their own prior misconceptions.

Finally, Robert Talbert, a mathematician and educator at Grand Valley State University, admits that Sal Khan is approachable and is good at explaining complex information in a simpler way without making the viewer feel unintelligent. However, Talbert says the Khan Academy can never replace an actual class on mathematics. The program does not offer a live teacher or human interaction. He further argues that the Khan Academy does not have a real curriculum for effectively teaching students.[37]

By advocating a switch to a flipped-classroom model, he wants to enhance teacher interaction with students, not minimize it.

Khan never says that he wants to replace actual classes on mathematics. He simply wants to restructure them so that students are able to advance at their own pace and receive more individualized assistance. By advocating a switch to a flipped-classroom model, he wants to enhance teacher interaction with students, not minimize it. Further, he wants Khan Academy to be integrated into existing school curriculum:

Clearly, I believe that technology-enhanced teaching and learning is our best chance for an affordable and equitable educational future. But the key question is how the technology is used. It's not enough to put a bunch of computers and smartboards into classrooms. The idea is to integrate technology into how we teach and learn; without meaningful and imaginative integration, technology in the classroom could turn out to be just one more very expensive gimmick.[38]

Talbert says, "Khan Academy is great for learning about lots of different subjects. But it's not really adequate for learning those subjects on a level that really makes a difference in the world."[39] He goes on further to state that good videos and engaging lectures are not enough to have a great education. He says that there must be difficult assignments along with traditional teaching to have students think at a higher level, which he claims Khan Academy does not offer. Most important, students and their instructor must have face-to-face interaction to build a relationship and to allow for proper learning.[40]

Khan stresses, however, that he wants students to interact with their teachers so that higher-order learning takes place. "The promise of technology," he says, "is to liberate teachers from those largely mechanical chores so that they have more time for human interactions." Ordinarily, teachers only interact with students 10 to 20 percent of class time in the traditional classroom. Using technology, if that figure went up to 90 to 100 percent of class time, "The student-to-time-with-teacher ratio would improve by a factor of five or ten."[41] With such a switch in student-teacher interaction, the higher-order learning that Talbert favors could more readily take place.

Overall, the arguments of critics remain unconvincing when compared to Khan's documented impact and what Khan truly believes.

Khan-like Programs Could Save Money and Improve Learning

While Khan Academy and Khan-like programs hold much academic potential, perhaps even more intriguing is their ability to improve student performance *and* save scarce tax dollars in the process. Given California's continuing budget crisis, the ability of a new model of education delivery to give greater bang for fewer bucks should grab the attention of state lawmakers.

How could Khan-type programs reduce education costs? The initial answer is simple: lower personnel costs. Professor Jay Greene, head of the department of education reform at the University of Arkansas, has urged state and local governments to "choose to shrink the teacher labor force rather than expand it," partly because their "finances are already buckling under bloated payrolls with overly generous and grossly underfunded pension and health benefits."[42]   Indeed, David Crane, Governor Arnold Scharzenegger's top economic advisor, criticized Gov. Brown's tax-increase measure saying that most, if not all, of the new revenues would go to backfilling teacher pension obligations rather than helping children in the classroom.

Prof. Greene points out that nationally in 2012 there was one teacher for every 15.2 students, which is a much lower ratio than the 1970 ratio of one teacher for every 22.3 students. Despite hiring more and more teachers, he notes, "math and reading scores for 17-year-olds have remained virtually unchanged since 1970, according to the U.S. Department of Education's National Assessment of Educational Progress."[43]

California has reduced class sizes, and thereby hired many more teachers, since the 1990s. Indeed, the state's class-size-reduction program is one of the biggest earmarked education-spending programs in the state budget. Since its enactment in 1996, the state has spent more than $25 billion to reduce class sizes in grades K-3. Local districts have had to pour in dollars as well to cover costs not picked up by the state. Yet, for all the tax dollars funneled into reducing class sizes, California has little to show for this funding generosity. EdSource, the Northern California-based education-research organization, says, "Even though the program has been among the most popular of all education reforms introduced in recent years, there is no definitive research that shows that it has resulted in improved outcomes in California."[44]

> **While Khan Academy and Khan-like programs hold much academic potential, perhaps even more intriguing is their ability to improve student performance and save scarce tax dollars in the process.**

A report by the Brookings Institution also underscored both the expense and uncertain effectiveness of reducing class sizes, and urged that other alternatives be considered:

> Class-size reduction has been shown to work for some students in some grades in some states and countries, but its impact has been found to be mixed or not discernible in other settings and circumstances that seem similar. It is very expensive. The costs and benefits of class-size mandates need to be carefully weighed against all of the alternatives when difficult decisions must be made.[45]

Khan himself is skeptical of class-size reduction. Noting that "one of the most cited metrics in our public debates is class size," he observes, "If a teacher's main job is lecturing, what does it really matter how many students are in the room?" "Whatever the class size," he asks, "how customized can instruction be when kids sit passively, taking notes, and the great majority of the teacher's time and energy is devoted to lesson plans, grading papers, and paperwork?"[46]

He warns, "We can't just focus on things like student/teacher ratio." "In regard to cost as well as standard classroom techniques," he says, "we need to question basic assumptions." For instance, he points out that "student-to-valuable-time-with-the-teacher" is more important than the simple student/teacher ratio. He recalls, "I have sat in eight-person college seminars where I never had a truly meaningful interaction with the professor; I have been in thirty-person classroom where the teacher took a few minutes to work with me and mentor me directly on a regular basis." He therefore recommends:

> Improving the student/teacher *time* ratio doesn't necessarily take money; it takes a willingness to rethink our classroom methods. If we move away from the broadcast lecture, students can have more of the teacher's one-to-one attention; good teachers will get to do more of what led them to teaching in the first place—helping kids learn.[47]

For Khan, the real issue is not class size, but the way in which students are taught. "The point is that whether there are ten or twenty or fifty kids in a class, there will be disparities in their grasp of a topic at any given time," he observes, so even "a one-to-one ratio is not ideal if the teacher feels forced to march the student along at a state-mandated pace, regardless of how well the concepts are understood." Thus, when the end of the chapter comes, the test is administered, the class – of whatever size – has moved on and "there will still likely be some students who haven't quite figured things out."[48]

For instance, he points out that "student-to-valuable-time-with-the-teacher" is more important than the simple student/ teacher ratio.

Technology-based programs like Khan, which adapt to the individual learning needs of the student, are among the alternatives that should be considered when thinking about the future delivery of learning services. These programs could reduce teacher costs and provide the very qualities that class-size-reduction researchers say are needed to improve student achievement.

Jay Greene says that rather than keeping the number of teachers high, we should go in the opposite direction by relying on emergent instructional technology:

> Instead of hiring an army of additional teachers, we could have developed and purchased innovative educational technology. The path to productivity increases in every industry comes through the substitution of capital for labor. We use better and cheaper technology so that we don't need as many expensive people.[49]

He goes on to say:

> In K-12, charter schools such as Rocketship Academy and Carpe Diem in Arizona "flip" the classroom so that computers do much of the teaching and teachers are primarily tutors, problem-solvers, and behavior managers. This model could allow for much more individualized instruction with many fewer teachers.[50]

This individualized instruction is critical. EdSource, quoting a review of class-size-reduction programs done by the education journal *Education Week*, warned that "shrinking the number of students in class does not automatically translate into better learning" and that "teachers may need to alter their teaching practices, dropping lecture-style approaches and providing more frequent feedback and interaction."[51] Khan-type programs can provide the more frequent feedback and interaction recommended by *Education Week*, with fewer teachers as recommended by Prof. Greene.

Bryan and Emily Hassel have been among the leaders in analyzing digital education policies and models. Writing in *Education Next*, they point out that "schools—and nations—that excel in the digital age will be those that use digital tools both to make teaching more manageable for the average teacher, and to give massively more students access to excellent teachers." One way to achieve this goal, they say, is to engage in "boundless instruction":

Instead of hiring an army of additional teachers, we could have developed and purchased innovative educational technology.

> As Sal Khan has made famous, superb conveyers of content can also capture their performances on video and make them available not just to dozens, but to millions of students. Smart software that responds to each child's learning level is another example. Combining these with time-technology swaps could enable far more students to have the best of both worlds – great basic content and motivating, live teachers who take learning to the next level.[52]

What the Hassels contemplate is different than the way Los Altos and other pilot programs have used the Khan Academy videos.

In a place like Los Altos, students watch the Khan videos at home and come back to their regular classrooms, which are overseen by their regular teachers. True, the teacher works with students on a more individual basis, but there is still the traditional element of a teacher-to-student ratio of one teacher for every 25 or so students. More innovative school models, however, can also use Khan-type programs.

The Hassels outline such a model when they make their recommendations to help excellent teachers increase their productivity, within budget and at scale: "swap portions of excellent teachers' time with digital instruction so they can teach more classes with similar or even smaller group sizes; let them delegate nonessential tasks to other adults; use digital tools to save time on instructional monitoring and planning; put them in charge of other teachers; and let the willing have more students to nurture under their strong wings."[53] Specifically, the Hassels come up with this cost-saving scenario:

> Picture this: let's say one class out of four in a school's 4th grade has an excellent math teacher, and she spends half her instructional time on whole-group instruction and half

on more dynamic/personalized learning. If Khan takes over the former whole-group instruction, two 4th grade classes could have that teacher just for personalized/dynamic learning. The effect is a 100% increase in the number of kids who get the top-tier in-person teacher – without reducing personalized instruction time with kids. She'd need a learning lab monitor [person] for Khan time at school and time-saving digital tools to monitor kids' progress (a la Wireless Generation or others; Khan's experimenting with this, too).[54]

The need for one teaching position would be eliminated and the cost of the added lab monitor paraprofessional would be less than the cost of the teacher. Schools could keep their strongest teachers and let their weakest go.

> **Swap portions of excellent teachers' time with digital instruction so they can teach more classes with similar or even smaller group sizes; let them delegate nonessential tasks to other adults; use digital tools to save time on instructional monitoring and planning.**

What the Hassels describe is one version of blended learning, where students spend part of the day in a computer lab using digital-learning tools and another part of the day interacting with their teacher. Unlike the Los Altos flipped-classroom model, the Hassels' model brings Khan into the computer lab and changes the student-to-teacher ratio in the classroom. Although they don't use Khan Academy, high-performing charter schools like the Rocketship elementary schools in San Jose and Grimmway Academy elementary school in Kern County use computer learning labs overseen mainly by non-certificated lab monitors and have fewer, but better, teachers.

Grimmway Academy, which is located in the small rural community of Arvin, uses a type of blended-learning teaching model where students spend 100 minutes per day in the computer lab using a variety of interactive instructional software programs that teach and reinforce key concepts in math and reading. These programs allow Grimmway to staff the lab more flexibly and creatively than traditional classrooms.[55]

One hundred students at a time use the learning lab during designated periods. The learning-lab staff consists of the lab director, who's a certificated teacher, and several paraprofessionals. As noted in a report by Public Impact, an education reform organization, paraprofessionals such as lab monitors are less costly because they "do not need the high levels of combined academic, planning, and classroom management skills that full teachers need."[56]

Not only do paraprofessionals cost less, the mix of paraprofessionals and teachers in a blended-learning model results in cost savings. According to Jose Salas, Grimmway's principal, for every three teachers in the classroom, the lab needs just one paraprofessional plus the lab director. That ratio allows the school to save on personnel costs while at the same time improving student achievement.

Mr. Salas says that the computer programs in the learning lab allow the school to intervene with students performing poorly, push students who are on the margin, and challenge higher-performing students. Test scores prove that Grimmway's learning model is working.

On the 2012 state math exam, an amazing 74 percent of third graders scored at the targeted proficient level and only 8 percent scored below the basic level. Such test results are eye opening given that the school is 96 percent Hispanic, 87 percent low income and 64 percent non-fluent in English.

As the Hassels point out, blended-learning models like the one used at Grimmway allow schools to be choosier about the quality of teachers they hire. In fact, Mr. Salas says that he had 220 applicants for the eight non-union teaching positions at Grimmway. One of the teachers that Mr. Salas chose was a former teacher of the year in one of the local schools districts, but because he didn't have seniority, he was laid off in favor of older, less effective colleagues when the district had to downsize its staff due to funding problems. At Grimmway, however, this high-performing teacher is now the faculty chair.

The need for one teaching position would be eliminated and the cost of the added lab monitor paraprofessional would be less than the cost of the teacher.

As envisioned by the Hassels, Khan-type programs could be part of a re-oriented blended-learning model that uses some variation of the time structure at a place like Grimmway, but changes what is delivered during the different time periods. So, for instance, Khan-type instructional videos could occupy students during the computer lab portion of the day, while teachers could then use their time with students to provide more individualized interaction and learning.

There are other possible models, however, where Khan-type programs could conceivably work.

One such real-life school model can be found at the San Francisco Flex Academy charter high school. Located near Union Square in the historic San Francisco Press Club building, the Flex Academy makes extensive use of online courses. Students are grouped in a common area where each of them has a cubicle and a computer. All students take English, math, science and history through online coursework. In addition, they can choose from a vast array of more than 100 online elective courses ranging from foreign languages to economics to art history. The courses are provided by K12, Inc.

Students do all their initial work using the online programs. Non-certificated academic coaches walk through the aisles of the common area to answer questions or to refer students who are having particular problems to teachers. Rather than stand in front of a traditional class of 20 to 30 students, teachers at the Flex Academy tutor individual students on problems they are having or they teach small groups of students who are having similar problems.

In an interview with KQED, San Francisco's public television and radio station, Megan Jacquot, an English teacher at Flex Academy, says, "It's an intriguing approach." "There is this misconception," she says, "that there is no teaching going on here, but I'm teaching all day." She can track student progress online and target her interventions. Referring to a group of students learning how to write a research paper, she observes: "I know exactly where all of them are in the writing process. Who's drafting, who's finishing up, and who needs help researching. I know all my students really well."[57]

The Flex Academy learning model not only makes better use of teachers' time, the model allows the school to be more cost efficient. Because students are doing their initial work using online resources, there is not the need for traditional student-teacher ratios. Instead, Flex Academy can use fewer teachers and, instead, use less costly non-certificated academic coaches to staff the common area, which saves money that school leaders can direct to other purposes. Further, because fewer teachers are needed, the teachers that are hired can be higher quality, with less need simply to fill positions with a warm body.

So, for instance, Khan-type instructional videos could occupy students during the computer lab portion of the day, while teachers could then use their time with students to provide more individualized interaction and learning.

With regard to Khan-type programs, one can see how the structure of Flex Academy could be used in conjunction with a flipped classroom. As in the flipped model, students can watch Khan-type instructional videos at home and do the interactive exercises during the day, but the latter could be done using the Flex setup of a common area, non-certificated academic coaches and fewer teachers who target their teaching to students who need help based on real-time tracking of student performance on teachers' online dashboards.

In other words, it is not necessarily the case that schools would need one teacher per 20 to 30 students, as is the case in Los Altos, for a flipped-class-room model to work. When asked by the author of this paper if a Khan-type program, assuming it were a full curriculum, could be used in a Flex model structure, a top Flex official said he thought it could. The result could then open up significant potential cost savings.

What occurs at Flex and other blended-learning schools exemplifies the Hassels' observation that in order to help excellent teachers increase their productivity, schools should swap portions of high-performing teachers' time with digital instruction so they can teach more classes with similar or smaller group sizes; let top teachers delegate non-essential tasks to other adults; and use digital tools to save time on instructional monitoring and planning.

Khan himself argues for a future type of classroom that is a variant of the Flex model. "I would group together as many as a hundred students of widely varying ages," he says. Like the Flex students in the common area who can choose to work on an array of different subjects at any particular time, Khan says that in his future classroom students "would seldom if ever all be doing the same thing at the same time." He envisions, "At any given moment, perhaps one-fifth of the students would be doing computer-based lessons and exercises aimed at a deep and durable grasp of core concepts." He believes that only one or two hours would be necessary to cover fundamentals of subject matter using Khan Academy videos and "even that time involves significant peer-to-peer tutoring and one-on-one time with teachers."[58]

Like at Flex, Khan says that those students working at computers will have the benefit of "one of our team teachers circulating among them, answering questions, troubleshooting difficulties *as they occur*." The students not working on computers would be engaged in any number of other creative activities such as "working on art or creative writing projects" or "building robots or designing mobile apps or testing out novel ways for structures to capture sunlight."[59]

Although there are similarities between Khan's ideal future classroom and what is taking place at Flex Academy, there is an important difference. Flex is not afraid to use technology to help it reduce personnel costs, while Khan studiously emphasizes that no teaching positions will be eliminated in his pro-

posed new classroom model: "To be clear, I'm not suggesting either a net loss or a net gain of teaching positions." Khan says that "rather than three or four separate classes of twenty-five kids and one lonesome teacher, I would suggest a class of seventy-five to a hundred students with *three or four* teachers."[60] One may ask, however, why, instead of four teachers, could there not be two teachers and two paraprofessionals, as at Flex? It is curious that Khan is infuriated by the education status quo, but seems loathe to upset powerful stakeholders in that status quo such as teachers and their unions. If Khan videos can teach fundamentals in one or two hours a day and student learning is self-paced and self-motivated, as Khan says it should be, then, one wonders, why would it be necessary to have the same number of teachers as under the status-quo model?

Indeed, the potential of marrying Khan-type programs with less costly blended-learning models has incredible potential, even more than what Khan himself may acknowledge. The Hassels point out, "This dual power of technology—both to extend the reach of super-instructors boundlessly (no more low-value homework and large-group time) AND to allow reorganization of great on-site teacher time—is worth hyping." (emphasis in the original) The Hassels note that Khan is "somewhat onto this" but seems "to be thinking of it more as just enabling in-person teachers of any quality to engage in more interaction with the kids they have—rather than specifically to give dramatically more kids access to the best available in-person teachers."[61]

There is the misconception that digital learning either eliminates the need for teachers entirely or diminishes the importance of teacher quality. Nothing could be further from the truth. "As the technology advances," say the Hassels, "students will still need accountable adults taking responsibility for their learning." Thus, the importance of teacher quality "will have the same enhancing and mitigating effect on digital learning as it has on every other reform tried to date." What is different is that digital learning can help ensure that students will always have access to the best teachers: "Let's focus on how Khan Academy and other less-hyped innovations can give nearly all students access to great teachers, nearly every year."[62]

> **Acknowledging that government wastes public funds in lots of areas, he observes that "the sad truth is that a significant part of what we spend on education is just that – waste."**

Despite his seeming hesitancy to anger teachers, Khan deserves credit for recognizing that more tax dollars is not the answer to the problems of education. He argues that spending more money on education won't necessarily improve the quality of education and the learning of students. Acknowledging that government wastes public funds in lots of areas, he observes that "the sad truth is that a significant part of what we spend on education is just that – waste." "We spend lavishly," he notes, "but not wisely."[63] For Khan, improving the quality of the interaction of between students and teachers, as in the flipped classroom model, is not dependent on more taxpayer dollars.

Indeed, Khan points out that the average American school spends between $250,000 and $300,000 per classroom. He says that half or more of that money is spent on "things like well-paid administrators, security guards, and well-manicured football fields – none of which have a direct role in students' learning."[64]

Unlike the liberal/progressive caricature of his program, Khan does not want teachers to pour knowledge into students' brains, as the oft-derided banking theory of learning supposedly promotes, but, rather, wants to reduce student passivity by increasing their interaction with their teachers and their fellow students to eliminate learning gaps and fulfill their knowledge potential. The boundaries of student learning will not be set by artificial limits of official curricula, but by student ability to master material.

Ultimately, Khan argues that a good education does not have to be expensive. He says, for example, that parents do not have to pay high private-school costs in order to get a good education for their children. Instead, he urges "the enlightened use of technology," which he says, "is our best chance for an affordable and equitable educational future." "The idea is to integrate the technology into how we teach and learn," he emphasizes, because "without meaningful and imaginative integration, technology in the classroom could turn out to be just one more very expensive gimmick."[65]

Places like Grimmway Academy, Rocketship charter schools and Flex Academy have integrated technology in enlightened and imaginative ways and could be the harbingers of a better future for California education. However, it is up to the state's policymakers to make the road to that future free of bumps and barriers.

Barriers to Expansion of Khan-type Programs

While allowing that it was innovative and egalitarian for its time, Sal Khan believes that the old-fashioned Prussian teaching model, with its regimented class schedules broken down by subjects and "students separated by age and moving in lockstep," is one of the key impediments to improving learning for today's students.

According to Khan, "The heavy baggage of the current academic model has become increasingly apparent recently, as economic realities no longer favor a docile and disciplined working class with just the basic proficiencies in reading, math, and the liberal arts." "Today's world," he argues, "needs a workforce of creative, curious, and self-directed lifelong learners who are capable of conceiving and implementing novel ideas." Yet, "this is the type of student that the Prussian model actively suppresses."[66]

To the extent that the Prussian model is outmoded for today's needs, Khan says change is needed. Yes, the Prussian model does teach basic skills to many students, but, he says, "we do ourselves and our kids a disservice if we fail to look past those minimum requirements and recognize the places where the system has become creaky and archaic, and why old customs and standards no longer suffice."[67]

Assuming that some variant of the Prussian model reigns in most schools, what should be done? If parents want to escape the Prussian model in favor of a Khan-type education for their children, what should they do? The answers to these questions lead one inescapably to school choice.

It is possible to *attempt* to change the Prussian model in the public-education system, but the outcome will almost surely be failure. Khan admits that bureaucrats and organizations have a built-in aversion to new ideas and approaches. Thus, despite California's leading role in the online-technology revolution,

the integration of online technology into classrooms has proceeded at fits and starts. Indeed, despite their success, schools like Rocketship charter school and Grimmway Academy are exceptions rather than the rule in California education.

In fact, it is no surprise that Rocketship and Grimmway are charter schools, which are public schools independent of bureaucratic school districts and subject to less state and local rules, regulations and collective-bargaining requirements. Charter schools are often started by parents and teachers and are, therefore, schools that parents choose for their children rather than having their children assigned by school-district policies. Schools of choice give new and promising ideas, such as Khan Academy, a place to prove themselves and be judged by education consumers—parents and their children. For this reason, if Khan Academy is to expand its reach in schools, it is necessary for parents to have the power to choose Khan-type programs. Only with greater choice will regular public schools feel the pressure to respond to consumers and offer Khan-type programs.

Thus, while the Prussian model may be Sal Khan's pedagogical nemesis, his real enemy is the government that perpetuates that model in schools. Only by breaking the government's stranglehold on the school system will innovators and entrepreneurs like Khan be able to change the government's favored method of education delivery on a system-wide scale.

Charter schools are a start, but they are still not numerous enough to give all parents different education options. Not only should barriers to charter-school creation be lowered, but choice options for all parents should be expanded to include schools in the private sector as well. This has been accomplished successfully in progressive countries such as Sweden through the use of universal voucher systems. Indiana and Louisiana have recently enacted large-scale school-choice programs that would give vouchers not only to low-income parents, but middle-income parents as well. California should follow those states' example.

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Khan Academy has shown itself to be a popular program in the marketplace. Its number of YouTube hits proves it. However, translating that success in one part of the market, e.g. YouTube viewership, to another market such as the school market is hampered by the monopolistic grip of government on the school system and its ability to shut out innovators like Khan. Opening up the education marketplace through universal or large-scale parental choice programs would facilitate the increase in consumer use of Khan Academy because new schools would want to take advantage of Khan's popularity with consumers and would also want to make use of a program that both improves student performance and saves money.

Yet, Khan has been largely silent on the issue of empowering education consumers through choice and opening up the school marketplace. Andrew Coulson, director of the Cato Institute's Center for Educational Freedom, notes that Khan "seems to want to change the way the world learns without changing the way the world schools."[68] Khan inveighs against the ossified instructional practices in schools, which are little changed over the last couple centuries, but "does not add, but must be aware, that this methodological stagnation is unparalleled in the rest of the economy."[69]

"The norm in human endeavors over the past two centuries," points out Coulson, "has been innovation and productivity growth." Why has education's progress been so anemic compared to the strides made in other fields? The answer is that government became the monopoly provider of most education: "the government school monopoly became sclerotic and inefficient – that is the normal outcome for monopolies."[70] Khan's innovations have huge potential, but that potential will only be fully realized if the reactionary constraints of government are eliminated:

> Mr. Khan's services are so good and so readily available that they may disrupt the status quo monopoly whether or not he recognizes it as the problem. Without market freedoms and incentives, such a disruption may simply raise the plateau at which the education sector stagnates. The only way for teaching and learning to keep pace with the progress happening all around us is to invite education back into the free-enterprise system that has driven that progress.[71]

Khan's innovations have huge potential, but that potential will only be fully realized if the reactionary constraints of government are eliminated.

Coulson rightly observes that what motivates the rest of the economy to embrace change and innovation is "the combination of competition, consumer choice and the profit-loss system."[72] Until such a combination is injected into the education delivery system, widespread implementation of Khan-type programs will be difficult at best.

Despite the decision of a few schools to use Khan Academy in their teaching process, the difficulty of penetrating the bureaucratic government school monopoly should not be underestimated. Take, for example, the experience of the California-based Mind Research Institute (MRI).

MRI is a nonprofit organization that conducts research on learning and the brain and applies this research to the development of K–12 education programs. These programs teach all children, regardless of socioeconomic or cultural background, how to think, reason, and create mathematically. MRI's math program consists of animated representations of math concepts delivered via computer software games and is designed to enable students to recall basic math facts accurately, quickly and effortlessly. The program does not use text or symbols so that students not fluent in English can easily use the program.

In schools that have implemented the program according to the guidelines issued by MRI, the results have been astonishing. At Madison Elementary School in Santa Ana, 96 percent of the students are Hispanic and virtually the entire student population comes from socio-economically disadvantaged families. Two-thirds are English language learners. The school has used the MRI math program for years and the impact on student test scores has been huge.

In 2003, only a quarter of Madison students scored proficient or above on the state math exam. By 2012, 84 percent of the school's third graders scored at or above the proficient level.

Similar to the cost-potential of Khan-type programs, Ted Smith, the chairman and CEO of MRI, says that with the company's math program, "teachers can manage a large number of students, therefore you can operate within lower budgets and still get higher achievement."[73] He points out that at Madison Elementary, the principal informed him that she could have 35 students in her classes and still get out-

standing student outcomes. Yet, despite this demonstrated success and obvious potential for budgetary savings, the bureaucratic inertia characteristic of government monopolies has proven to be a huge stumbling block to widespread implementation of MRI's program.

"One thing I find in working with districts," says one MRI official, "is they think 'okay, it worked there but it won't work in mine,' even if the demographics are very similar, even if they have the same problems." She notes sadly, "It's just how it works."[74] Smith adds, "We not only don't have [these programs] in our classrooms, we don't even know that we should have it."[75]

Smith describes state and district bureaucracies as a series of walled-off fiefdoms uninterested in software advances:

> You have the old stovepipe thing where every district and the state level have a technology department and they also have a curriculum department. The curriculum people are textbook-centric and the technology people are network-centric and there was no real advocate for instructional software. This is one reason why venture capitalists will not fund companies to do advanced technological education products: because it is so impossible to penetrate the market with new things.[76]

MRI's focus is on regular public schools. "We choose public schools," says Smith, because "the bulk of students go through public schools and if you don't fix that problem you haven't had an impact on the nation." Yet, when asked about the obstacles confronting his organization, he exclaims, "it is practically impossible!"[77]

Where MRI's math program has been adopted and where it has been implemented well, the results have been phenomenal. However, as MRI's experience has also shown, the bureaucratic inertia, the lack of incentive to improve, the inability of teachers to follow program guidelines, the lack of consequences for failure to follow those guidelines, the inability of administrators to get teachers to adhere to those guidelines, and the cynicism of educators and school and district leaders combine to demonstrate how difficult it will be to improve the traditional public-school system, even if a technological silver bullet is available.

The lesson for Khan Academy is therefore clear. Khan faces the same bureaucratic obstacle course erected by the same government monopoly that daunts MRI and other education innovators. Until that monopoly is broken and a true open marketplace for education services is created, it will be difficult for Khan-type programs to expand. As Andrew Coulson emphasizes, "educators are human beings just like the rest of us, and respond in the same way to the constraints and incentives of the system in which they work." Thus:

> When efficiency and excellence are rewarded, they thrive. When stagnation and falling productivity are not penalized, they spread. When the risks of innovation and failure are not outweighed by some greater compensation, they are seldom undertaken.[78]

Yet, despite this demonstrated success and obvious potential for budgetary savings, the bureaucratic inertia characteristic of government monopolies has proven to be a huge stumbling block to widespread implementation of MRI's program.

For Khan-type programs to spread and flourish in California and elsewhere, universal school–choice programs must be enacted to give education consumers easy access to these programs if that is what they demand.

On a pedagogical level, Khan wants to replace the Prussian model with mastery learning. According to Khan, mastery learning posits "students should adequately comprehend a given concept before being expected to understand a more advanced one." The focus is on learning and proficiency rather than on packing subject material into artificial time constraints. As Khan explains:

> [M]astery learning structured its curriculum not in terms of *time*, but in terms of certain target levels of comprehension and achievement. This turned tradition quietly but entirely upside down. In the traditional model, a certain amount of class time is devoted to a particular topic or concept; when the allotted interval is finished, the entire class moves on, in spite of the fact that the individual students will have achieved widely varying degrees of mastery over the material.[79]

In other words, "In a traditional academic model, the time allotted to learn something is fixed while the comprehension of the concept is variable." Instead, "What should be fixed is a high level of comprehension and what should be variable is the amount of time students have to understand a concept."[80]

> **For Khan-type programs to spread and flourish in California and elsewhere, universal school–choice programs must be enacted to give education consumers easy access to these programs if that is what they demand.**

Mastery learning perfectly suits the Khan Academy program and the flipped-classroom model. Students are not bound by the time constraints of a class period, a teacher's lecture, and required in-class or homework assignments. Students can view Khan-type videos as much or as little as needed in order to understand content. They can either whiz through the exercises generated by adaptive software programs or they can review and repeat exercises if they are having trouble and receive individual assistance from teachers.

Although mastery learning has been around since the 1920s, the inertia of America's public education system successfully killed off various attempts to institute this method of learning in schools on a large scale. Now, however, Khan says "technology has radically lowered the expenses formerly associated with mastery learning." There are no more costly printed materials, but, rather, "Everything needed for self-paced learning is right there in the computer; the cost of delivering it to students is miniscule."[81]

Khan believes that moving to a mastery–learning model based in part on new educational technology will motivate students, improve student learning, and promote personal responsibility. The latter outcome, he observes, is of particular importance. "I believe that *personal responsibility* is not only undervalued but actually discouraged by the standard classroom model, with its enforced passivity and rigid boundaries of curriculum and time." Take away the personal responsibility of students for their own learning and the result is predictable: "Denied the opportunity to make even the most basic decisions about how and what they will learn, students stop short of full commitment."[82]

So who or what is responsible for the "rigid boundaries of curriculum and time"? The major culprit is government. Government regulations promote much of the rigidity that prevents students from taking responsibility for their learning. Take, for example, seat-time rules.

According to a report by the National Governors Association, "seat time" refers to "the amount of time required of students to complete a course." "Seat time requirements," says the report, "were designed to ensure that students were present for a set amount of classroom instruction, but they do not take into account the varied pace at which students learned."[83]

The result is that "the number of seat hours required to complete a course is standardized across schools without regard to an individual student's prerequisite knowledge and skills" and "the basic level of proficiency required to earn credit for a course (often the grade of a 'C' or higher) means that students may advance through the grades without learning critical content and skills and may later require remediation."[84] In other words, government requires students to sit in classrooms for a certain number of minutes or hours and once that time requirement is met, the government is satisfied even if students have not learned the subject material and fail to attain grade-level proficiency as measured by state tests.

California has seat-time requirements that affect schools that may use Khan-type programs. In regular public schools, students must sit in classrooms for a minimum amount of time in order for the schools to receive funding. The California Department of Education's School Fiscal Services Division says that "if the student is scheduled for at least the minimum day (in most instances, 240 minutes) of classroom-based study, then the attendance accounting for apportionment purposes can be determined solely from that predominant instructional setting."[85]

> **Khan believes that moving to a mastery–learning model based in part on new educational technology will motivate students, improve student learning, and promote personal responsibility.**

California Education Code section 46112 says that in grades 1, 2 and 3, the minimum school day is 230 minutes, with minor exceptions. Section 46113 states that the minimum day for grades 4 through 8 is 240 minutes. The minimum day for middle school and high school is also 240 minutes, but less for high-school juniors and seniors who take courses at a community college or state university.

A 2012 report by the California Council on Science and Technology notes, "In traditional schools (as opposed to charters), teachers assess the time value of non-classroom-based independent study work to determine the completion of at least the 'minimum day' defined in law."[86] Overall, however, the emphasis in state law is to constrain the ability of regular public schools to break up their school day into more flexible classroom-versus-non-classroom ratios that more effectively address student learning needs and improve student achievement.

The rigidity of regulations regarding minimum minutes of seat time clashes with Khan's view of how Khan Academy videos could increase scheduling flexibility and open up the school day. "Using self-paced video lessons, in combination with the computer-based feedback and team teaching," he says, "fundamental coursework can be handled in one or two hours a day." With the basics covered in such a short span of time, new possibilities for the rest of the day are opened up:

> **Overall the emphasis in state law is to constrain the ability of regular public schools to break up their school day into more flexible classroom-versus-non-classroom ratios that more effectively address student learning needs and improve student achievement.**

That frees up five or six or seven hours for creative pursuits, both individual and collaborative. That might mean writing poems or computer code, making films or building robots, working with paint or in some weird little corner of physics or math – it being remembered that original math or science or engineering is neither more nor less than art by another name.[87]

The venue for these "five or six or seven hours for creative pursuits" need not be the conventional classroom. They could take place any-where -- in schools, the home or some other location. Khan himself recalls that he regularly skipped going to his large lecture courses while at MIT. He and his fellow class skippers reasoned:

To us, honestly, it seemed like a more productive and respon-sible use of our time. Would we learn more sitting passively in a lecture for an hour and a half, or engaging actively with a textbook – or with online videos and interactive assessments, if only they'd been available at the time? Would we be more enriched by watching a professor's presentation, or by deriving equations and writing software ourselves? Even as freshmen, we concluded that our class-skipping approach was working; we didn't need to cram at the end of a semester and we didn't stress about solving problems on a test, because that's what we'd been doing all along.[88]

Yet, it is not possible for students to do what Khan did while at MIT because seat-time regulations re-quire that they be in classrooms engaged, all too often, in the passive learning activities that Khan finds so inadequate. Khan understands that the artificiality of the mandated school day is a huge barrier to student learning:

If the sheer grinding length of the conventional school day is a brake on creativity, so is the artificial chopping up of time into lessons. Time, after all, is a continuum; like thought itself, it flows. The end of a series of lessons blocks the flow, puts a brick wall in the way. It tells students where they need to stop. This is bad enough in cases where a student, say, might like to look a bit more deeply into the causes of the French Revolution; where it's really deadly, however, is in cases where a student is off on a daring and creative tangent, wrestling with a major project or an idea that is truly novel. That kind of creative work simply can't be put on a deadline; genius doesn't punch a time clock![89]

It infuriates Khan that the artificial constraints of the mandated school day may prevent the next great discovery or creation. "Can you imagine if someone told Einstein, *Okay, wrap up this relativity thing, we're moving on to European history?*," he exclaims, or "said to Michelangelo, *Time's up for the ceiling, now go paint the walls.*" His response to the absurdity of such a prospect is to call for the elimination of time restrictions:

Because I would stress the connections and the continuity among concepts, there would be no brick walls between one "subject" and the next. Since learning would be self-paced and self-motivated, there would be no ticking clock telling students when they had to drop a particular line of inquiry.[90]

One might think that charter schools, since they are less hamstrung by state regulations, would not be as constrained by the conventional "ticking clock" and be better able to create more flexible instructional schedules. It turns out, however, that the state has constrained charter schools through a separate set of regulations.

As mentioned previously, charter schools seem to be an ideal school model to use Khan-type programs in innovative ways that not only allow students to focus on mastering subject matter at their own pace, but also to allow them to master that material in settings outside the classroom. So, for instance, in a flipped-classroom charter school, why not allow Khan-type programs to be used by students at home and have variable time schedules that students have to be in classrooms. These variable time schedules could be dependent on students proving mastery of the subject material for which they are responsible. Why should a student necessarily have to be in a classroom for a set amount of time if he or she can show that they are learning outside the school walls?

> **New Hampshire, for example, requires all public high schools to award credit based on student mastery of subject material rather than on seat time.**

New Hampshire, for example, requires all public high schools to award credit based on student mastery of subject material rather than on seat time. *Education Week* says that the state's off-campus "anytime, anywhere" learning includes "out-of-school and virtual programs; personalized education, which strives to tailor studies to students' needs and interests; and competency-based learning." Thus, New Hampshire students are able to demonstrate mastery of subject matter on their own timetables. *Education Week* notes, "Online learning can play a part in competency-based approaches, in part because of its potential to let students pace their coursework as they like."[91]

Yet, unlike New Hampshire and an increasing number of other states, California's Education Code restricts the ability of classroom-based charter schools to use Khan-type programs and other online programs to take full advantage of the mastery-learning approach. Section 47612.5(a) of the Code states:

> Notwithstanding any other provision of law and as a condition of apportionment, a charter school shall do all of the following:
> (1) For each fiscal year, offer, at a minimum, the following minutes of instruction:
> (A) To pupils in kindergarten, 36,000 minutes.
> (B) To pupils in grades 1 to 3, inclusive, 50,400 minutes.
> (C) To pupils in grades 4 to 8, inclusive, 54,000 minutes.
> (D) To pupils in grades 9 to 12, inclusive, 64,800 minutes.

The Code section makes no connection between these minutes and any level of student achievement -- nothing about student grade-level proficiency flowing out of these seat-time rules. No, this Code section is all about money. In part (c) of that same section, the Code says:

For purposes of paragraph (1) of subdivision (a), for each charter school that fails to offer pupils the minimum number of instruction specified in that paragraph, the Superintendent shall withhold from the charter school's apportionment for average daily attendance of the affected pupils, by grade level, the sum of that apportionment multiplied by the percentage of the minimum number of minutes of instruction at each grade level that the charter school failed to offer.

In other words, charter schools will be penalized monetarily for not meeting the requirement for minimum instructional minutes even if students have become grade-level proficient in subject matter using fewer minutes. Thus, basing funding on instructional-time requirements make no sense because they are disconnected to the ultimate purpose of education, which is student learning.

The state also sets a rigid maximum proportion between classroom-based instruction and non-classroom-based instruction (e.g., using Khan videos in a flipped-classroom model). Part (e)(1) of Code section 47612.5 says:

> **Thus, basing funding on instructional-time requirements make no sense because they are disconnected to the ultimate purpose of education, which is student learning.**

Notwithstanding any other provision of law, and as a condition of apportionment, "classroom-based instruction" in a charter school, for the purposes of this part, occurs only when charter school pupils are engaged in educational activities required of those pupils and are under the immediate supervision and control of an employee of the charter school who possesses a valid teaching certificate in accordance with subdivision (1) of Section 47605. For purposes of calculating average daily attendance for classroom-based instruction apportionments, at least 80 percent of the instructional time offered by the charter school shall be at the schoolsite, and the charter school shall require the attendance of all pupils for whom a classroom-based apportionment is claimed at the schoolsite for at least 80 percent of the minimum instructional time required to be offered pursuant to paragraph (1) of subdivision 47612.5.

Thus, students must be at school for four-fifths of their day regardless of whether they may learn better with a more flexible schedule (e.g., a 50-50 split between schoolsite and non-schoolsite learning). A "schoolsite" is defined as "a facility that is used principally for classroom instruction" and does not include "a personal residence (i.e., a dwelling), even if space in the residence is set aside and dedicated to instructional purposes."

As opposed to a classroom-based charter school, which must have 80 percent or more of instruction conducted at the schoolsite, non-classroom-based charter schools, such as virtual charter schools, are governed by the state's independent study regulations. According to the State Board of Education, a virtual charter school is defined as a charter school where 80 percent or more of teaching and student interaction takes place over the Internet. To receive funding, a virtual charter school must spend 80 percent or more of its total revenue on instruction, and it must spend 40 percent or more of public revenues on certificated staff salaries and benefits.

Thus, both classroom-based and non-classroom-based charters have rigid definitions that limit their ability to implement flexible scheduling for students that meet their needs and promote better learning. These definitions are linked to funding, not to student achievement, and are certainly arbitrary given the advances in educational technology, such as Khan Academy and other programs. Why should there be a minimum day or an annual requirement of minimum seat-time minutes if student learning does not conform to such boxes?

In sum, Khan and his fellow innovators face major obstacles, which include the government school monopoly that creates disincentives for school officials to adopt new approaches and prevents competition that would force schools to meet consumer demand; seat-time regulations that are the basis of school funding and which impede flexible scheduling; and the absence of any logical linkage between process requirements and student mastery of subject matter. If Khan-type programs are to become more than boutique success stories, these barriers must be dismantled.

> **The NGA, therefore, recommends that states, "Build flexibility into state policy to allow students to earn credit based on demonstrating mastery in the classroom and in expanded learning opportunities." Individual states are starting to push for such reforms.**

Recommendations

It is one thing to identify the barriers to a better learning world for students and it is another to tear them down and build that better world. So what needs to be done to make it easier for Khan Academy and other innovative digital-learning programs to reach more students? Here are some suggestions:

Award Credit for Mastering Subject Matter Rather than Mere Seat Time

Sal Khan urges that we focus on students mastering subject matter content rather than on imperatives of the "old system," which "is failing us." One of the foundations of the "old system" is the requirement of minimum seat time in schools. As California's Education Code makes clear, seat time is all about money and funding, not about learning and achievement. It is time to change all of that.

The National Governors Association says, "States may not be able to realize the full potential of education reform until the system's focus shifts from time-based inputs to student learning outputs tied to the mastery of content and skills." The NGA, therefore, recommends that states, "Build flexibility into state policy to allow students to earn credit based on demonstrating mastery in the classroom and in expanded learning opportunities."[92] Individual states are starting to push for such reforms.

Education Week reports that Oklahoma "requires schools to allow students, upon request, to earn credits toward graduation in core academic subjects based on demonstrations of mastery through tests."[93] Students must achieve test scores of 90 percent or higher to receive credit. The publication also highlights Michigan's seat-time flexibility:

Michigan in 2007 created a policy to grant waivers from seat-time requirements to districts on a case-by-case basis. More than 200 schools have requested some sort of waiver over the past year, and about 5,500 students are making use of that flexibility, most of them through a blended learning approach, combining in-person and on-line instruction.[94]

In Iowa, Governor Terry Branstad has called for a major shift toward recognizing mastery/competency learning. According to his proposal, "Our system for awarding credit for coursework is primarily driven by time-based factors," which means that students "are awarded credit for sitting in a chair for a number of hours performing at a minimally acceptable level (such as 61 percent or a D-)." Branstad's plan points out that students often are not helped by seat-time rules and that some students can demonstrate mastery very quickly. Therefore, "Moving away from the industrial model requires making high levels of learning the constant and time the variable, rather than the current system, which is just the reverse."[95]

To make the transition away from Iowa's traditional seat-time model, Branstad proposed removing barriers to schools that choose to adopt competency based systems. Unlike the Michigan program, which requires state waivers from seat-time rules, Branstad's plan would create "a pathway to competency-based education for districts that are willing to engage in the work of adopting such a system without having to request permission from the (Iowa) Department of Education."[96]

In the national Digital Learning Report Card issued by the Foundation for Excellence in Education, California achieves only 14 out of 72 indicators of effective digital-learning policy. As opposed to the ideal of not having a seat-time requirement for matriculation, the Report Card notes, "California requires students to complete a minimum day each day, and the yearly number of instructional days."[97] Further, California does not have a state law that gives students the ability to demonstrate competency on a standardized end-of-course exam to earn credit for an online course.

California should follow the lead of Oklahoma and other states and give schools and students the opportunity to implement mastery/competency-based learning models that are free from state Education Code seat-time mandates. Students should be allowed to prove their mastery/competency over subject matter content either through state standards-aligned tests or through a combination of tests and other rigorous achievement-indicating instruments.

Change School Funding Formulas

In 2012, Governor Jerry Brown sought to change the way schools in California are funded. He called for a weighted-student-formula (WSF) plan where simplified funding formulas would tie certain amounts of funding to each child. WSF could be a good basis for assisting online education, including Khan-type programs. However, the governor's plan does not go far enough to provide that basis.

WSF theorizes that a base-funding amount should be attached to each student, with additional amounts added for factors like low-income family background or English-language-learner status. This sum of funding follows the student to the school that he or she decides to attend. This portability of funding allows individual local schools to receive funding directly, bypassing inefficient district bureaucracies and creating competition between schools for students and the funds attached to them. Brown's WSF plan, however, is a pale version of this theoretical utopia.

True, Brown's WSF plan would attach funding to students, but the funds would be collected by school districts, not by individual schools, which undermines WSF's big selling point of bypassing bloated politics-driven bureaucracies. Further, the teacher-union contracts that sabotage efforts to improve teacher quality and student learning remain undisturbed by Brown's WSF plan. California's Democrat-dominated legislature, however, couldn't even stomach Brown's watered-down WSF proposal and failed to include it in 2012-13 budget. That may have been just as well since experts say that bolder WSF plans are needed to address the potential and realities of online-learning programs.

Michael Horn, executive director of the Innosight Institute, a California-based non-profit think tank, says that California is missing an opportunity to leverage online learning to save money and to get better student outcomes. He argues that Gov. Brown "should seize the opportunity to create a funding system that allows students to take the best courses for their needs and lets the state capture real savings."[98]

> **He argues that Gov. Brown "should seize the opportunity to create a funding system that allows students to take the best courses for their needs and lets the state capture real savings."**

Specifically, Horn suggests that California "adopt a system whereby fractional funding follows the student to the course level, such that a student could take the best course for his or her needs, be it face-to-face or online."   So, as opposed to Brown's anemic WSF proposal, which allowed funding to follow the child only to the bureaucracy-dominated school-district level, Horn advocates allowing the funding to be attached to the child to be used at the level where the child actually gains his or her learning, which is at the course level. Further, the funding should follow the child to online or blended-learning courses that focus on student outcomes rather than minutes spent in a classroom:

> Results are far more important than the number of student enrollments, so fractional funding should be performance-based. Receiving a portion of funds should be contingent upon individual student mastery, similar to how Florida funds the Florida Virtual School, with bonuses for achieving the biggest individual learning gains and for students achieving at an advanced level. In exchange for this move to competency-based learning, online learning and blended-learning providers must be freed from policies that dictate inputs such as those around seat time and the traditional academic calendar, student-teacher ratios, staffing arrangements, and antiquated certification rules.[99]

"Digital learning offers the opportunity for better results at lower cost," observes Horn, "but only if the right policies are in place."[100] Changing California's antiquated funding formulas would be a good place to start putting the right policies in place. Others agree with Horn.

The California Council on Science and Technology urges that in the near term, lawmakers, "Create ADA apportionment funding models in California that allow per-pupil funds to follow students for the purposes of instruction received, regardless of that instruction being delivered online from a virtual location or at a brick and mortar school site."[101]

In a recent report, the National Governors Association (NGA) found, "In nearly all states, rigid funding formulas work against school districts and schools that want to implement flexible policies for awarding credit."[102] As this paper has pointed out, California is as guilty as any other state in preventing flexibility and innovation.

> **He argues that Gov. Brown "should seize the opportunity to create a funding system that allows students to take the best courses for their needs and lets the state capture real savings."**

The NGA warns against using "enrollment count," which refers to the number of students in a classroom for the entire school day on a particular date, as the basis for funding schools. Enrollment-focused funding does not take into account students "participating in learning experiences outside the classroom such as work-force certificate programs, virtual courses, and blended courses," which results "in a lower count and less funding per pupil."[103]

In response to the historical use of enrollment to determine state funding for schools, the NGA recommends, "Modifying school funding formulas to allocate resources based on student mastery," which "can remove the financial barriers that often make moving toward a competency-based system challenging." The NGA notes that in 2003, the Florida legislature required funding for the Florida Virtual School to be "based on student accumulation of credits tied to the successful mastery of specified content and skills as opposed to enrollment."[104]

"By linking funding to student mastery," the NGA report says that the Florida Virtual School "has an incentive to focus on and support student learning."[105] California policymakers should look to establish that same linkage in the Golden State.

Implement Large-Scale School Choice Reforms

If funding is backpacked to students so that they can take it down to the course level, as Michael Horn recommends, the question remains as to where that course could be located. Could that course be located in a regular public school, a public charter school or a private school? The answer should be that students should be able to take that funding to whichever type of school satisfies their needs, including public or private schools that make use of Khan-type programs.

In Sweden, education funding is attached to a student so that he or she can take it to the public or private independent school of his or her choice. The portable funding amount is equal to the per-pupil spending amount designated for the government-run municipal schools. A similar portable funding system, based on current operational spending per pupil in California, could address issues of funding disparity between regular public schools and distance and online alternatives, still save money on capital and other costs, and force the regular public schools to compete fully with expanded numbers of private schools

and charter schools. It is this competition that would also force all schools – public, private and charter – to meet the demand of consumers who want Khan-type programs integrated into learning models. In addition, this heightened competition would give school districts incentive to overcome the bureaucratic inertia from which they suffer and would eliminate the earmark problem where public schools resist any innovation that does not have a funding stream specifically attached to it. Giving parents and their children full choice would also get around the opposition of teacher unions and restrictive collective bargaining contracts and force the unions to adapt to the demands of their customers.

As mentioned earlier, Indiana and Louisiana have adopted large-scale school-choice voucher programs that will give low and middle-income students the opportunity to attend private schools if that is their choice. This new widespread competition from the private sector will incentivize public schools to change and adopt programs and policies demanded by consumers in the invigorated education marketplace.

Consumer demand for new and better education options is strong and growing. Indeed, hundreds of thousands of parents and their children attend thousands of grassroots events across the country during National School Choice Week, which is observed during the last week of January.[106]

Per Unckel, the late former Swedish education minister who pioneered his country's universal voucher system, said that when faced with competition from private schools the headmasters of public schools responded by saying, "If they can do it, so can we."[107] That type of attitude opens up schools to the tidal wave of innovation in education and technology, of which the Khan Academy is just one example.

Building a better mousetrap will not do anyone any good if the market is closed off to the new mousetrap. Sal Khan has built a better education mousetrap, but the government's school monopoly is an obstacle to its wider use. Choice will open up the market and promote, as Cato's Andrew Coulson would likely say, "changing the way the world schools."

Remove the Statutory Cap on Charter School Creation

As described earlier in this paper, charter schools have often been the most creative and innovative users of educational technology. Khan Academy is being piloted in several charter schools. It should be possible for all students in California to attend Khan Academy-using charter, a Grimmway Academy or a Rocketship Mateo Sheedy, but such is not the case. State law, however, limits the number of charter schools that can be established.

According to California Education Code section 47602(a), only "an additional 100 charter schools are authorized to operate in this state each successive school year." This cap plus the stubborn opposition of local school boards and special-interest groups like the teacher unions have prevented many children in the state from accessing effective technology-friendly charter schools. In a state with around 10,000 schools, there are only roughly 1,000 charters, and it took 20 years from the enactment of California's charter school law in 1992 to even get up to that modest number. This is far cry from a place like New Orleans, where a widespread network of charter schools has virtually replaced the old failing regular public school system.

To promote the creation of schools that may make the best use of Khan Academy and other digital-learning programs, California should repeal the statutory cap on charter schools and encourage the establishment of charters, especially in places where students currently have no access to charter options.

Conclusion

In its short time of existence, the Khan Academy has helped millions of people all around the world overcome their difficulties in understanding math, science and other subjects. Individual testimonials and initial data on pilot projects strongly indicate that Sal Khan's innovation is not a fad but the real deal. Yet, even the optimistic Khan recognizes, "the conventional educational establishment seems oddly blind (or tragically resistant) to readily available technology-based solutions for making education not only better but more affordable, accessible to far more people in far more places."[108]

> **Khan Academy is part of that tidal wave and as Sal Khan warns, "The one thing we cannot afford to do is to leave things as they are."**

Indeed, the potential use of Khan Academy and other digital-learning programs could revolutionize not only the delivery of education services, but also finally equalize access by all students to high quality teaching and learning. In order to make this potential a reality, the government's monopolistic control over education must be broken and its regulatory straightjacket must be pried open.

"The current system," says Khan, "is rife with inefficiencies and inequalities, with tragic mismatches between how students are taught and what they need to know; and the situation grows more urgent with every day that the educational status quo survives while the world is changing all around it."[109] He is absolutely right.

The 2011 Pacific Research Institute book *Short-Circuited: The Challenges Facing the Online Learning Revolution in California* concludes with this call to action:

> Online learning is not just the wave of the future; it is the tidal wave of the future. It is therefore past time for policymakers in California to tear down the government-made breakwaters that have diminished the full impact of this tidal surge. In other words, it is time for government and its special-interest obstructionists to get out of the way and let the future in so that parents and their children can exercise their fundamental right to choose the type of education that best meets their individual needs.[110]

Khan Academy is part of that tidal wave and as Sal Khan warns, "The one thing we cannot afford to do is to leave things as they are."[111]

Endnotes

1   Salman Khan, *The One World School House* (New York, NY: Twelve/Hachete Book Group, 2012), p. 16.

2   Salman Khan, *The One World School House*, p. 24.

3   Salman Khan, *The One World School House*, p. 25.

4   Michael Noer, "One Man, One Computer, 10 Million Students: How Khan Academy is Reinventing Education," *Forbes,* November 2, 2011, available at http://www.forbes.com/sites/michaelnoer/2012/11/02/one-man-one-computer-10-million-students-how-khan-academy-is-reinventing-education/

5   Salman Khan, *The One World School House*, p. 35.

6   Salman Khan, *The One World School House*, pp. 35-36.

7   Salman Khan, *The One World School House*, p. 36.

8   Salman Khan, *The One World School House*, p. 135.

9   Salman Khan, *The One World School House*, p. 136.

10   Salman Khan, *The One World School House*, p. 137.

11   Salman Khan, *The One World School House*, pp. 137-138.

12   Salman Khan, *The One World School House*, p. 138.

13   Salman Khan, *The One World School House*, p. 144.

14   Salman Khan, *The One World School House*, p. 145.

15   Bill Tucker, "The Flipped Classroom," *Education Next*, Winder 2012, available at http://educationnext.org/the-flipped-classroom/.

16   Bill Tucker, "The Flipped Classroom."

17   Salman Khan, *The One World School House*, p. 116.

18   Salman Khan, *The One World School House*, p. 117.

19   June Kronholz, "Can Khan Move the Bell Curve to the Right?," *Education Next*, Spring 2012, available at http://educationnext.org/can-khan-move-the-bell-curve-to-the-right/.

20   Salman Khan, *The One World School House*, p. 165.

21   Salman Khan, *The One World School House*, p. 167.

22   Salman Khan, *The One World School House*, p. 168.

23   Salman Khan, *The One World School House*, p. 168.

24   Salman Khan, *The One World School House*, p. 170.

25   Keith Devlin, "Khan Academy: Good, Bad or Ugly," *Huffington Post*, March 20, 2012, available at http://www.huffingtonpost.com/dr-keith-devlin/khan-academy-good-bad-or-_b_1345925.html.

26   Salman Khan, *The One World School House*, pp. 169-170.

27   Salman Khan, *The One World School House*, p. 253.

28   Keith Devlin, "Khan Academy: Good, Bad or Ugly."

29   Salman Khan, *The One World School House*, pp. 35-36.

30   Salman Khan, *The One World School House*, p. 155.

31   Tony Bates, "A Short Critique of the Khan Academy," available at http://www.tonybates.ca/2012/03/14/a-short-critique-of-the-khan-academy/.

32   Salman Khan, *The One World School House*, p. 224.

33   Derek Muller, available at http://www.youtube.com/watch?v+eVtCO84MDj8.

34   Derek Muller, available at http://www.youtube.com/watch?v+eVtCO84MDj8.

35   Derek Muller, available at http://www.youtube.com/watch?v+eVtCO84MDj8.

36   Salman Khan, *The One World School House*, p. 167.

37   Robert Talbert, "The Trouble with Khan Academy," *The Chronicle of Higher Education*, July 3, 2012, available at http://chronicle.com/blognetwork/castingoutnines/2012/07/03/the-trouble-with-khan-academy/.

38   Salman Khan, *The One World School House*, p. 122.

39   Robert Talbert, "The Trouble with Khan Academy."

40   Robert Talbert, "The Trouble with Khan Academy."

41   Salman Khan, *The One World School House*, p. 123.

42   Jay Greene, "The Imaginary Teacher Shortage," *The Wall Street Journal*, October 8, 2012.

43   Jay Greene, "The Imaginary Teacher Shortage."

44   Louis Freedberg and Susan Frey, "Class Size Reduction Program Continues to Unravel," May 31, 2012, available at http://www.edsource.org/today/2012/class-size-reduction-program-continues-to-unravel/8730#.UJGmEaYiBU.

45   Matthew Chingos and Grover Whitehurst, "Class Size: What the Research Says and What It Means for State Policy," The Brookings Institution, May 11. 2011, available at http://www.brookings.edu/research/papers/2011/05/11-class-size-whitehurst-chingos.

46   Salman Khan, *The One World School House*, p. 123.

47   Salman Khan, *The One World School House*, p. 121.

48   Salman Khan, *The One World School House*, p. 20.

49   Jay Greene, "The Imaginary Teacher Shortage."

50   Jay Greene, "The Imaginary Teacher Shortage."

51   Louis Freedberg and Susan Frey, "Class Size Reduction Program Continues to Unravel."

52   Bryan Hassel and Emily Ayscue Hassel, "How Digital Learning Can (and Must) Help Excellent Teachers Reach More Children," *Education Next*, September 13, 2011, available at http://educationnext.org/how-digital-learning-can-and-must-help-excellent-teachers-reach-more-children/.

53   Bryan Hassel and Emily Ayscue Hassel, "Reformers: We Must Be Much Bolder to Reach Every Child with Excellent Teachers," *Education Next*, October 14, 2011, available at http://educationnext.org/reformers-we-must-be-much-bolder-to-reach-every-child-with-excellent-teachers/.

54   Bryan Hassel and Emily Ayscue Hassel, "Khan Academy: Not Overhyped, Just Missing a Key Ingredient – Excellent Live Teachers," *Education Next*, June 13, 2011, available at http://educationnext.org/khan-academy-not-overhyped-just-missing-a-key-ingredient-–-excellent-live-teachers/.

55   For an overview of Grimmway Academy, see Lance Izumi, "Even if Prop. 30 had failed, our schools don't have to," *The Orange County Register*, November 7, 2012, available at http://www.ocregister.com/articles/grimmway-376960-school-lab.html.

56   "Redesigning Schools To Reach Every Student With Excellent Teachers," *Public Impact*, 2012, p. 4, available at http://opportunityculture.org/reach/.

57   "At Flex Academy, High School Mimics the Workplace," *blogs.kqed.org*, available at http://blogs.kqed.org/mindshift/2012/03/at-flex-academy-high-school-mimics-the-workplace/.

58   Salman Khan, *The One World School House*, pp. 203-204.

59   Salman Khan, *The One World School House*, p. 204.

60   Salman Khan, *The One World School House*, pp. 197-198.

61   Bryan Hassel and Emily Ayscue Hassel, "Khan Academy: Not Overhyped, Just Missing a Key Ingredient – Excellent Live Teachers."

62   Bryan Hassel and Emily Ayscue Hassel, "Khan Academy: Not Overhyped, Just Missing a Key Ingredient – Excellent Live Teachers,"

63   Salman Khan, *The One World School House*, p. 120.

64   Salman Khan, *The One World School House*, p. 120.

65   Salman Khan, *The One World School House*, p. 122.

66   Salman Khan, *The One World School House*, p. 80.

67   Salman Khan, *The One World School House*, p. 82.

68   Andrew Coulson, "Book Review: 'The One Room Schoolhouse,'" *The Washington Times*, December 11, 2012, available at http://www.washingtontimes.com/news/2012/dec/11/book-review-the-one-world-schoolhouse/?page=all.

69   Andrew Coulson, "Book Review: 'The One Room Schoolhouse.'"

70   Andrew Coulson, "Book Review: 'The One Room Schoolhouse.'"

71   Andrew Coulson, "Book Review: 'The One Room Schoolhouse.'"

72   Andrew Coulson, "Book Review: 'The One Room Schoolhouse.'"

73   Lance T. Izumi, Vicki Murray, Evelyn Stacey, Rachel Chaney and Ian Randolph, *Short-Circuited: The Challenges Facing the Online Learning Revolution in California* (San Francisco, CA: Pacific Research Institute, 2011), p. 104.

74   Lance T. Izumi, Vicki Murray, Evelyn Stacey, Rachel Chaney and Ian Randolph, *Short-Circuited: The Challenges Facing the Online Learning Revolution in California*, p. 106.

75   Lance T. Izumi, Vicki Murray, Evelyn Stacey, Rachel Chaney and Ian Randolph, *Short-Circuited: The Challenges Facing the Online Learning Revolution in California*, p. 106.

76   Lance T. Izumi, Vicki Murray, Evelyn Stacey, Rachel Chaney and Ian Randolph, *Short-Circuited: The Challenges Facing the Online Learning Revolution in California*, p. 107.

77   Lance T. Izumi, Vicki Murray, Evelyn Stacey, Rachel Chaney and Ian Randolph, *Short-Circuited: The Challenges Facing the Online Learning Revolution in California*, p. 109.

78   Andrew Coulson, "Book Review: 'The One Room Schoolhouse.'"

79   Salman Khan, *The One World School House*, p. 38.

80   Salman Khan, *The One World School House*, p. 39.

81   Salman Khan, *The One World School House*, p. 42.

82   Salman Khan, *The One World School House*, p. 43.

83   "State Strategies for Awarding Credit to Support Student Learning," *National Governors Association Issue Brief*, February 1, 2012, p. 2, available at http://www.nga.org/cms/home/nga-center-for-best-practices/center-publications/page-edu-publications/col2-content/main-content-list/state-strategies-for-awarding-cr.html.

84   "State Strategies for Awarding Credit to Support Student Learning."

85   "Digitally Enhanced Education in California: Education Codes and Administrative Codes of Governing Regulations, Volume 2," *California Council on Science and Technology*, May 2012, p. 10, available at http://www.ccst.us/publications/2011/2011digital.php.

86   "Digitally Enhanced Education in California: Education Codes and Administrative Codes of Governing Regulations, Volume 2."

87   Salman Khan, *The One World School House*, p. 248.

88   Salman Khan, *The One World School House*, p. 187.

89   Salman Khan, *The One World School House*, p. 249.

90   Salman Khan, *The One World School House*, p. 249.

91   Catherine Gewertz. "N.H. Schools Embrace Competency-Based Learning," *Education Week*, February 8, 2012, available at http://www.edweek.org/ew/articles/2012/02/08/20proficiency_ep.h31.html.

92   "State Strategies for awarding Credit to Support Student Learning," p. 1.

93   Sean Cavanagh, "States Loosening 'Seat Time' Requirements," *Education Week*, March 7, 2012, available at http://www.edweek.org/ew/articles/2012/03/07/23biz-state.h31.html.

94   Sean Cavanagh, "States Loosening 'Seat Time' Requirements."

95   "Brief on Branstad-Reynolds Administration Recommendations for World-Class Schools," Iowa Department of Education, 2012, p. 14, available at https://governor.iowa.gov/wp-content/uploads/2012/01/World-Class-Schools-final1.pdf.

96   " Brief on Branstad-Reynolds Administration Recommendations for World-Class Schools," p. 14.

97   "Digital Learning Report Card," The Foundation for Excellence in Education, available at http://www.digitallearningnow.com/nations-report-card/.

98   Michael Horn, "Digital Learning Can Deliver More for Less – If Allowed To," *Thoughts on Public Education*, Silicon Valley Education Foundation, available at http://toped.svefoudnation.org/2011/01/09/digital-learning-can-deliver-more-for-less-if-allowed-to/.

99   Michael Horn, "Digital Learning Can Deliver More for Less – If Allowed To."

100   Michael Horn, "Digital Learning Can Deliver More for Less – If Allowed To."

101 "Digitally Enhanced Education in California: Education Codes and Administrative Codes of Governing Regulations, Volume 2," p. 3.

102 "State Strategies for Awarding Credit to Support Student Learning," p. 1.

103 "State Strategies for Awarding Credit to Support Student Learning," p. 3.

104 "State Strategies for Awarding Credit to Support Student Learning," p. 3.

105 "State Strategies for Awarding Credit to Support Student Learning," p. 3.

106 For more information on National School Choice Week, see http://www.schoolchoiceweek.com.

107 Lance T. Izumi, Rachel Chaney and Evelyn Stacey, "Still Not as Good as You Think: Why the Middle Class Needs School Choice," Pacific Research Institute, December 10, 2009, available at http://www.pacificresearch.org/docLib/20091209_Still_Not_As_Good_As_You_Think.pdf.

108 Salman Khan, *The One World School House*, p. 181.

109 Salman Khan, *The One World School House*, p. 253.

110 Lance T. Izumi, Vicki Murray, Evelyn Stacey, Rachel Chaney and Ian Randolph, *Short-Circuited: The Challenges Facing the Online Learning Revolution in California*, p. 163.

111 Salman Khan, *The One World School House*, p. 254.

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