International Forum of Open and Online Education
2nd and 3rd of October – University of Ottawa FSS4007

Theme

Since the 1970s, technology has been involved in streamlining the entire society and the university's education system. In fact, distance engineering has developed a mass education accessible to all. Moreover, engineering processes have helped reduce costs and standardize quality by streamlining the training process. Computers and networks have democratized learning in universities. Educational resources are always more accessible and open to all communities. However, new issues arose, which are related to the semantic of big data produced during the interactions in these training systems and instructional challenges. This conference will attempt to address these issues, particularly for the francophone context, by presenting an overview of the research and practices in the field to ultimately participate in the development and technological transformation of higher education.

Thursday October 2, 2014

SESSION II : TENDANCE OU MUTATION PÉDAGOGIQUE

Richard LARSON,
Mitsui Professor of Engineering Systems Massachusetts, Institute of Technology, Cambridge, États-Unis, MIT's BLOSSOMS: Vetted Crowd Sourcing for Creating Engaging High School STEM Lessons

Transcript

00:00 good morning welcome back to day two of
00:05 the forum great to see everyone just a
00:08 brief announcement before he introduced
00:09 the first speaker it seems that we're
00:12 not going to have the numbers of people
00:13 we need for a round table today so
00:16 instead we'll extend the question period
00:18 so put on your thinking caps you won't
00:21 have the ability to ask your questions
00:23 or make your statements at the end of
00:25 the day so please do so at the end of
00:27 each speaker and that means we'll be
00:29 finishing a bit earlier than much on
00:30 like the agenda today [French] it's now my pleasure
01:09 to introduce Richard C Larsen he's a
01:14 MITU professor of engineering systems
01:16 at Massachusetts Institute of Technology
01:18 he's applied his operations research
01:20 background to a wide range of service
01:23 sector including healthcare Public
01:25 Safety Homeland Security banking
01:28 transportation and most recently
01:30 education he's a co-founder and director
01:33 of MIT LINC Learning International
01:36 Network Consortium and his co-founder of
01:38 principal investigator of MIT BLOSSOMS
01:41 Blended Learning Open-Source Science for
01:45 Math Studies please join me in welcoming
01:48 Richard to the podium thank you
02:06 good morning everyone happy Friday it's
02:12 an honor and a delight for me to be here
02:14 today before you to talk about my
02:18 favorite MIT program BLOSSOMS which has
02:22 just entered its seventh year so this is
02:27 both an MIT activity and something that
02:33 we have a set of volunteers both in the
02:37 US and a number of partner countries so
02:40 just to show you a little bit about what
02:41 BLOSSOMS is let's see if we can go to a
02:44 sampling of some of the BLOSSOMS video
02:47 lessons
03:07 I can't believe I won
03:14 crazy mind-boggling yes indeed
03:19 [gibberish] let's do
03:23 an experiment here let's think like a
03:25 scientist welcome today we have a Burton
03:28 force a problem for you you can try to
03:32 slap the mosquito and no matter how hard
03:34 you punch or hit it it will survive
03:43 a famous painting is stolen from a
03:45 museum let's discuss the evidence you
03:47 would want to collect in a forensic
03:48 investigation most closely related to
03:52 t-rex the chicken seems more similar
03:54 because its posture is similar how do we
03:58 measure the distance to stars
04:01 this is a perfect example of linear
04:03 momentum and Newton's laws in action so
04:07 do you want to play another game [not English]
when I say the word chemical reactions
what comes to mind is this the chemical reaction
thank you for teaching this lesson to your class till next time I'll see you
out there we hear their rear that's a little sampler of some of the BLOSSOMS lessons so we go back to the PowerPoint there we go do we have two or one rather than two good so it's an initiative amount MIT as I said we just entered our seventh year and basically we're connecting Science and Mathematics to the real world and you might ask well what is BLOSSOMS well BLOSSOMS is a set of math and science and engineering video lessons interactive to be used in classrooms in high schools and sent to some extent middle schools so it's free it's interactive and it's available to all of us worldwide now you might say well gee videos is not going to put the kids to sleep these are not long videos that go on for 40 or 50 minutes and would put them to sleep these are videos that go in short segments to three minutes fade the black then that then the classroom is challenged to some thing that they haven't seen before out of the textbook not in the textbook some challenge and the teacher the in class teacher is still involved with guiding the class through a very active learning session to achieve some learning objective while the video is off once that learning objective is achieved then the teacher goes back and presses a button and the next video segment is shown so we call the pedagogical model a teaching duet because half the teaching and learning is done by our video teacher the other half the teaching and learning is done by the in class teacher so the in class teacher is very very important to this process and in a 55 or 50 minute lesson at least 25 of those
06:54 minutes the video is off and the
06:55 classroom is doing active learning
06:58 guided by the in class teacher and at
07:00 most 25 minutes is these short video
07:03 segments so BLOSSOMS has many faces
07:09 we're very proud that at least half of
07:12 our teachers are females
07:14 and we have country partners from around
07:17 the world and I'll explain a little bit
07:20 about how the whole thing works as we go
07:22 as we go forward basically right now
07:27 these are the languages that BLOSSOMS is
07:30 available in in order of frequency I
07:32 would say about ninety percent are
07:35 available in English either made
07:37 directly in English or voiceover
07:39 translation or subtitles Arabic is
07:42 number two because we've had we have
07:45 country partners Jordan Lebanon although
07:49 they do theirs in English Saudi Arabia
07:52 and so we have more Arabic language
07:56 educational content than any other MIT
07:58 program as of this date we're also in
08:01 Portuguese Erdu Male and Mandarin
08:04 Chinese as of the current time we only
08:06 have six of our hundred and ten lessons
08:08 in Mandarin Chinese now here are some of
08:12 the here are some of the photographs of
08:13 some of our partners this was taken this
08:15 past January some of our partners at
08:17 Varick in high school in Chongqing China
08:22 we've trained 400 BLOSSOMS stem teachers
08:27 my stem teachers from high schools from
08:29 throughout the kingdom of Saudi Arabia
08:31 and here's one of the five-day training
08:34 sessions we've trained 200 males and two
08:36 hundred females in Jordan the minister
08:41 of education and our BLOSSOMS team gives
08:45 certificates of appreciation to the 17
08:48 teachers both high school teachers and
08:50 professors who made BLOSSOMS lessons for
08:54 us in Jordan and there's a one of the
08:56 certificates here are some physics
09:02 doctoral students study in one of the
09:05 BLOSSOMS lessons in Lahore Pakistan here
09:12 is a recent training this past summer a
recent training exercise we did via
Webx I to about 90 of individuals in
Lahore Pakistan Pakistan is one of our
country partners
so we'll see if we can go to the next
video
hi I'm concealer from superior
University Pakistan major in computer
science still and my favorite subject is
programming especially when it comes to
building the logic for program or
relating the real-life stuff with
programming one and in today's lesson
they're going to do the same thing we
are going to learn programming right
here working in the kitchen we will
analyze that where are those basic
programming concepts are applied while
making a mango milkshake so help me
making the milkshake and I'll help you
learn programming deal so let's get
started while programming there might be
some situations when a certain task is
assigned to you well you know how to do
this by using the marvelous brain you're
blessed been almost without thinking but
when it comes to parking the task into
discrete logic and you get stuck why
does this happen this is because the
human thought process is much faster
than the sense of observation life
experience has enabled us to lump
together a set of steps into one
example as it has become so much
intuitive we don't need to think when to
apply the brakes for instance but the
computer does not have the advantage of
life knowledge it's an amp machine even
can't think anything so being a
programmer it's your challenge to move
your smarts all your knowledge into
discrete sequence steps that would
direct the computer what to do also
called a program so if this thinking
process could be slowed down you would
11:42 be able to identify the steps that put
11:44 followed by the your brain and
11:45 eventually you will make a logic for
11:48 computer program moving towards my mango
11:52 milkshake as the first step of recipe I
11:54 have to mix sugar with milk by using
11:56 this thunder but I have put the ice
11:59 already in it now it's not a good
12:01 approach to mix sugar in cold milk so
12:04 what I want is I want this ice to be in
12:06 this bowl and this milk to be in this
12:09 blender but how can I do this think
12:11 about this problem discuss with your
12:13 fellows and teacher and I'll see you in a
12:15 while okay
12:20 this is a student in Pakistan who
12:24 volunteered to work with us in making a
12:27 BLOSSOMS lesson and you can see she's
12:29 very natural she's an excellent teacher
12:31 and goes through this and actually
12:33 creates five different algorithms that
12:36 five of the fundamental algorithms of
12:38 computer science by creating this mango
12:40 milkshake so this is an example of what
12:44 comes from one of our partners in one of
12:47 our partner countries so our focus is
12:51 not on memorization and rote learning we
12:54 are enemies of memorization and rote
12:57 learning not that you don't have to
12:58 memorize some things but that's not the
13:00 end in itself that might be a necessary
13:02 condition to get some core knowledge in
13:04 an area but that's not critical thinking
13:06 so we are focused on developing critical
13:09 and creative thinking and a motivation
13:12 of learning for life as well so you
13:17 might say well why do we need an
13:19 initiative like BLOSSOMS and yeah
13:24 everyone is saying this these days and
13:26 we agree with this particular point of
13:28 view that we're now one global village
13:31 we have expanded economic globalization
13:34 and our children will need to be able to
13:38 compete in this global economy so we're
13:41 all kind of one and we live in a
13:44 knowledge age I know when we started and
we didn't have any country partners we didn't have BLOSSOMS we had a one-on-one one hour with her Majesty Queen Rania of Jordan because we ran a LINC conference there in 2007 and in the room were two of us BLOSSOMS people from MIT Queen Rania and her ministry of education and her ministry of higher education and she's very articulate and very passionate about learning and education in her country and she said you know what we don't do is we don't really develop critical thinking skills we focus too much on teaching to a test rewarding memorization and having these evaluating people on standardized test scores and in this country in Jordan unlike some other countries in the Middle East we don't have oil and natural gas buried underground on unlike some countries in Africa we don't have diamonds and gold and silver buried underground so we have things buried someplace else which are our core assets and basically it's between the ears of our citizens so that's where that's where the gold and silver and gas natural gas and oil are buried in Jordan and she said if you have a program that will enhance critical thinking skills in Jordan you're welcome in this country so Jordan was our first country partner as we started BLOSSOMS six-plus years ago so you might say well what's the framework for BLOSSOMS what are some guiding principles well first and foremost to improve math and science teaching and learning at the secondary level we go beyond delivery of content too many of us confuse delivery of content and parroting back that content with true learning and so we want to go beyond that we want to introduce teachers in a gentle way supportive way to the power of technology enabled education we've done lots of on the
ground boots on the ground research in Mexico China the US and now our partner countries and we find the majority of high school teachers and middle school teachers oppose technology-enabled education when the mental model is students sitting in front of the computer and the role of the teacher is ambiguous at best you get a role reversal in terms of the power structure of the class and you get a secondary role reversal in that invariably teenagers know a lot more about technology than the teachers do and so therefore the teachers are afraid of Technology able education when it means supposed to happen with students sitting in front of computers so we have a gentle way which actually enhances the role of the teacher guiding the classroom and the teacher still in charge by the way the National Education Association the largest labor union in the United States has brought features BLOSSOMS on its website and I think it's because we enhanced teacher performance and evaluations and our role of Technology novel education is not viewed as a job threat or security threat to their to their members we want to encourage universities to reach down to help improve science and math education in high schools if you look at it from a systems point of view the input to the freshman class in any University including University of Iowa is the output of high schools and for universities to ignore high schools particularly of high schools aren't delivering the kind of preparation for university education that they should be I mean if the universities ignore that they're ignoring a fundamental systems input into their own system so there
were many colleges and universities that work closely with high schools in Boston we have Boston University runs its own high school Monterey tech in Mexico runs a number of high schools themselves and MIT has scores of high school outreach programs that it runs year-round and particularly intensively during the summer finally we want to initiate an educational resource that involves international partners in co-creation as well as kill utilization so one of our tenants is okay if if let's say let's become a BLOSSOMS partner and we'll talk about what that might mean later on that means that Canada would sign up to maybe create in 10 or 20 BLOSSOMS lessons here yourselves with our guidance and we have a multi-step process for the guidance so we don't believe that all knowledge stems from Cambridge Massachusetts and should be graciously spilled on planet Earth we think that knowledge comes from everywhere on planet earth and we should all contribute and we call this highly vetted crowdsourcing for improving a stem education in high schools so that's stem education some people call or advocating for steam education the a in steam making go from stem to steam is for arts and so if we're bringing in the humanities and there as well and we do that with some of our some of our lessons and so what are the goals of BLOSSOMS well it's to 1 we want to show how exciting stem can be it's not some routine thing out of a textbook let's say a math textbook where you memorize the quadratic equation solution formula which is complicated square root etc etc and turn the crank and get the answer it's really quite exciting and to increase student interest in careers in stem not just engineering and mathematics but there's so many careers
these days that requires knowledge of math and science a lot of lawyers require this take abstract concepts and show to the real world a lot of students again teenagers they said why should I work hard and study this stuff I don't see any relevance in my own life and they should and also to engage students in observation experimentation and discussion for them to act and think like scientists and engineers as I said before critical thinking skills to develop critical thinking skills and last but certainly not least to foster cross-cultural awareness sensitivity and appreciation you know too often young people only hear about folks from other countries through let's say their parents who might have a stereotypical view or through news events and in the news you know what the headlines are if it bleeds it leads so you have a very biased exposure to other cultures and other countries just by looking at the news so one of the things about BLOSSOMS is you can learn things in science and math and engineering from people who don't look like you who people who don't dress like you and people who don't speak your language so we also need all students these days to be stem literate it just can't be engineers and scientists mathematicians all of us just about every job these days that's growing up has some element of the need to become aware of math and science as I said before BLOSSOMS is a gentle way of introducing teachers to technology naval education and if you think about it video has been with us for decades so this is our mechanism video is not threatening it doesn't require exotic programming skills it doesn't require the knowledge of is the software compatible between PCs and Mac's got a little laugh here at the
21:32 side and we're also since we were
21:37 dealing with developing countries
21:40 primarily actually so far it's we cannot
21:45 assume that they can support streaming
21:47 video off the internet in the classroom
21:49 in fact we can't assume that there's
21:50 internet in the classroom in fact even
21:52 in the USA and probably here in Canada
21:54 many classrooms do not have internet
21:56 connectivity so we wanted to design a
21:59 system where you don't require internet
22:01 in the classroom and BLOSSOMS is it
22:03 because every one of our BLOSSOMS video
22:06 lessons is downloadable onto the hard
22:09 drive of a laptop and so the teacher can
22:12 take that downloaded video on her or his
22:15 laptop into the classroom and just show
22:17 it on a TV set or projector and a screen
22:19 and that's it so in some sense we use
22:23 the internet as a DHL forwarding device
22:27 and but it's not required to be live in
22:30 the classroom
22:40 ok so this the classroom teacher here we
22:43 have a photograph that we took I took in
22:46 a classroom in a very poor part of
22:48 central China in 2004 and I've already
22:52 talked about how teachers often feel
22:54 marginalized by students marched laying
22:56 out into a computer lab and all sitting
22:59 down in front of a computer and they
23:00 wondered what their role is but this is
23:03 the aha moment where we decided to start
23:05 BLOSSOMS we're in Mingxia province in
23:08 China which is one of the poorest on a
23:10 gdp per capita basis 55 most fifty
23:14 percent is a minority population of one
23:16 of their minorities in china and it was
23:18 an unheated classroom with an old TV set
23:21 in and a video tape recorder donated
23:25 by some business businessmen in Hong
23:28 Kong and what the teacher was doing in
23:30 this particular classroom and this was
23:32 wasn't the only one we saw several
23:33 classrooms like this she would show
23:35 segments of a video that was made by a
23:37 superlative teacher in Shanghai a few
23:39 weeks earlier this was downloaded by
23:42 satellite fixed position satellite which
23:44 is focuses just on delivering
23:45 educational content throughout the
23:46 country of China ok which is so even in
23:51 the poorest villages they had a
23:53 satellite connector so they could
23:55 download this stuff and every five
23:57 minutes or so she would stop the video
23:58 and then engage the class about what
24:00 they had just seen and they'd have a
24:02 very active learning session but the
24:05 video itself was a one hour a 60 minute
24:07 lecture so our aha moment was hey what
24:12 if you created the videos to be
24:14 interrupted so don't just have a 60
24:17 minute lecture and maybe you shouldn't
24:18 even have lectures have something else
24:21 and have it go for two or three four
24:23 minutes stop and then engage the class
24:27 from the video so that was our aha
24:29 moment it was 2004 for it it took us
24:31 about three years to find the funding
24:33 for this and to design it exactly right
24:35 but the Hewlett Foundation saw the light
24:40 and helped us get our feet on the ground
24:43 initial funding
24:46 so as I said we encourage universities
24:49 to reach down to help math and science
24:51 education and high schools and we've
24:53 done this with with the majority of our
24:55 of our partner countries now here our
24:58 partner countries some of them Jordan
25:01 has created 17 videos in Pakistan so far
25:06 we have seven videos Lebanon and so far
25:08 we have five the Kingdom of Saudi Arabia
25:10 we have 20 excellent videos all in
25:12 Arabic with English subtitles available
25:14 as a as a translation option and
25:18 University of Technology Malaysia who
25:21 were currently extremely active with
25:23 they're on their way to making 20 videos
25:25 some of them are in English some of them
25:27 are in Male and we're negotiating with
25:30 them a second follow-on major project
25:32 with the Ministry of Education there we
25:37 have other countries that are very
25:39 states of almost readiness Japan will be
25:42 the next one that that joins our our
25:45 consortium so you could I call this
25:49 vetted crowdsourcing international
25:51 co-creation a co utilization and if you
25:55 think about it wikipedia is something
25:59 like this although creating and
26:01 designing these BLOSSOMS lessons is much
26:03 more difficult and more time-consuming
26:04 than writing some text so let's see if
26:11 we can go to the next sample
26:26 every country has its own music
26:47 so you were at the game yeah Wow 40,000
26:52 40,000 in the stadium and the stadium
26:55 holds what 50,000 incredible
26:58 Wow oh hey it's George Hi how you doing
27:04 loud gorgeous day out fantastic great do you
27:07 know Isam Isam hi George I'm George
27:11 good to meet you nice to meet you Isam
27:12 also at the faculty of engineering
27:14 here at AUB ah that's right where do
27:17 you study I some UT Austin at UT when
27:20 was that who is between 2000-2005 hmm
27:24 you know I used to have an automated
27:26 mind from graduate school days who was
27:28 there about that time do you happen to
27:30 know Carl Parts do I know Carl Parts he's
27:33 my advisor wow what a small world
27:36 imagine that in a country the size of
27:39 Lebanon about four million people how
27:41 many people does each person need to
27:43 know to guarantee that any two randomly
27:47 selected people would know one person in
27:50 common think about that question for a
27:53 while and we got to get back to the
27:54 classroom we'll meet you there
28:07 so that's an example of one of our
28:09 lessons it's on really the mathematics
28:11 of social networks but you can see how
28:14 it starts okay so here's another example
28:19 of the faces of BLOSSOMS and you do see
28:21 lots of different faces lots of
28:24 different cultures and we're very proud
28:26 of that we're not going to go live to
28:29 the BLOSSOMS website here in this
presentation but you can because the internet is very available and if you go to BLOSSOMS.mit.edu you can go to the website see our 110 plus different lessons you can it they're categorized in clusters of the topic area or by math and the different sciences biology physics chemistry and also we have engineering and they're all searchable at least in the for the u.s. teachers by state standards so we have up-to-date up to the most recent changes in each of the 50 states for the state standards in both math and science and also Washington DC and also the two growing national standards so you can search for them that way and but basically I those of you who are interested I invite you to explore the BLOSSOMS website and see all that we have I think one key thing about it is that every one of the 110 plus well I say plus because I don't know exactly what the count is is a little bit of noise every BLOSSOMS lesson has its own website so when you click through here you'll see a whole page which is just that one lesson and so it'll show you the languages that that BLOSSOMS lesson is available in and for the teacher it provides a complete teacher's guide and all the entire lesson plan is there for the teacher first of all every BLOSSOMS video lesson at the end has a private conversation between the video teacher and in class teacher and that video conversation starts with the learning objectives of this video lesson the prerequisites required and then then suggestions on what to do during each of the class breaks when it goes to black it's black for 10 seconds to allow time for the teacher to go and shut off the video and then guide the class through a
very active learning exercise so we suggest what the teacher might do in any of those breaks any also any handouts that are needed for the class are available in PDF files on our website and those are downloadable and she can print them out and he can print them out and hand it out to the class also a fraction of our of our lessons have accompanying online animated simulations so for instance or instance we have one called flu math games which we created in 2009 when we thought that h1n1 was going to have a kill ratio of six percent we were very scared and we thought well maybe we could educate high school students through a math exercise as a show as they change their behavior more hygienic behavior and more social distancing their probabilities of getting h1n1 flu would drop and they would see this in a simulation they would do in their classroom with different colored hats that they would wear well they could then go home and do the simulation on a computer-based animated basis and get statistically significant results and write up the reports so we have some animation simulations like that for some fraction of our lessons I would say maybe ten to fifteen percent we hope to do more but the key thing is a complete lesson plan is there for the teacher so the teacher doesn't have to do a lot of research also we have other general online freely available resources in case the teacher wants to explore it in more depth or assign a project to the class after they experience this this lesson the last thing I'll say is that we don't care so much whether the teacher shows the entire video lesson to the class maybe a year one she or he does and maybe in year to the teachers as well gee I know that material I don't
32:08 have to show the BLOSSOMS video now I'll
32:09 just do it all myself or some of the
32:12 teachers who use this stuff just take
32:13 one or two segments and use that in the
32:15 classroom and not the entire lesson so
32:18 we're very flexible also we're very
32:21 bottom up
32:23 we put this stuff out there for the
32:26 teachers to voluntarily use but we
32:27 haven't gone after administration
32:30 bureaucracies to try to mandate the use
32:33 of this in classrooms maybe that's a
32:36 mistake but I tend to think that let's
32:38 let's create something of value and then
32:40 hopefully market demand will will
32:42 increase its use so the BLOSSOMS
32:45 approach basically we want to examine a
32:48 topic from an unusual angle you've seen
32:51 a couple of examples of that we want to
32:53 connect science and math to the real
32:55 world we want to show what real
32:56 scientists real engineers mathematicians
32:58 do and we want to have some sense of
33:02 humor once a while to make math fun
33:05 here's an example is a photograph out of
33:08 one of our lessons one of the early bus
33:10 is created in Lahore Pakistan by the
33:13 virtual University of Pakistan called
33:15 donkey cart physics they might say well
33:19 how can there be physics of donkey carts
33:21 well a significant fraction of the
33:24 mobile traffic on the streets of Lahore
33:26 Pakistan I've been there five times I
33:28 know our donkey carts two wheels one
33:31 axle no brakes and yet they have to obey
33:36 traffic lights stop signs and have to
33:40 stop you know when the traffic in front
33:41 stops and they have to know how to load
33:44 up the cart at five to six a.m. in the
33:46 morning before they go off then there's
33:48 one axle so there's going to be it's
33:49 like a seesaw and if you put too much
33:52 weight on the back of that axle when you
33:53 start loading it up this is what happens
33:55 to the donkey's front legs they all end
33:57 up in the air like this and if you
33:59 believe this is just a show for
34:01 Hollywood I've actually seen this in in
34:04 in Pakistan so it happens so we have to
34:06 teach the owners of the donkeys and
donkey carts a little bit of Newtonian
34:11 physics to understand what the concept
34:13 of center of mass is ok so a BLOSSOMS
34:17 lesson is not a lecture I apologize
today I'm giving a lecture oh it's a
34:25 inconsistent
34:27 it's not a typical lesson from a
textbook and it's not a passive
experience for students so hopefully if
you look at the BLOSSOMS lessons you
will agree with that now what is a
BLOSSOMS lesson well we try to make it
an interactive learning experience we
try to approach a topic from a new
direction not a textbook approach or a
standard scripted lecture approach we
try to connect math and science to the
real world and we like to have it as an
active learning experience for our
students take it away different music
35:17 for every country
35:29 [not English]
36:05 ok ok you see that's one of
the shortest lessons in introductions we
try to engage them really early and get
them totally committed to the problem
we're going to focus on and so you might
say ok Oh sum of the integers from 1 to
100 and these are students in a middle
school who have not seen a formula and
who are challenged to figure it out how
to create that sum and if you think
from basic principles there are a few
ways you could do that in two minutes
but you really have to you know know
your arithmetic know your math and be
creative and maybe draw a few pictures
and be able to to come up with that
solution now it's ok it's ok if the
students some of the students don't
figure that out because you have them
frustrated and you have them totally
engaged and hopefully now they'll pay
attention to the entire lesson ok so
when you're designing a BLOSSOMS lesson
what are some of the things well the
first one and perhaps the most difficult
is to come up with a good concept what
is it you're trying to do what is it
you're trying to teach it should be
something which is important and
difficult to understand and perhaps
counterintuitive you know you've got all
those kinds of things going on there it
might be a concept that's widely
misunderstood by
students and maybe it's a concept that
has some real-world applications now the
pedagogical models we have we have
something we you know we have blended of
problem-based learning inquiry based
learning the so-called 5 e’s and some
combinations of these we don't really
care so much which which pedagogical
model out of the literature is used
other than the fact that we don't want
scripted lectures and we want active
learning between the bricks and as I
said before we try to emphasize again
and again the key role the key
goal the BLOSSOMS lesson is develop
students critical thinking skills the
last thing you want to do to evaluate it
BLOSSOMS lesson afterwards is it give
them a multiple choice test so we say
the teachers if you want to evaluate the
effectiveness of this lesson assign them
an extended homework problem extended
homework exercise or project maybe in
small groups and have that submitted
maybe a week later and then read that
evaluate that grade that if you want
that's fine but don't give them a
multiple choice test that's not the way
to evaluate the effectiveness of a
BLOSSOMS lesson and for teachers and
this is interesting because this is a
huge surprise for us as we started
working with teachers and face-to-face
we've trained over 1,000 teachers in our
various countries probably more in Saudi Arabia even than in the US and the
teachers come to us and they say you
know when we have these sessions and we
can talk with folks from MIT and we can
talk with our fellow teachers they said
you do you know how often we can talk to fellow teachers about issues of pedagogy
about content and about how to deliver
quality education almost never you know
we might meet in the faculty lounge over a cup of coffee and we talk about you
know when the next vacation day is or the cost of textbooks or things like
this so they really enjoy getting together collaboratively and with us and
discussing education their profession
okay and so they have told us that the BLOSSOMS lessons and this whole process of this training process is actually more valuable as professional development and then the actual teaching of it in the classroom to students not that that's not important they say
that's very important but they say the key aspect of this is professional development for the teachers and so we have a project going on right now funded by a private foundation in Washington DC with eight prize-winning teachers from the Commonwealth of Massachusetts and they are developing their lessons primarily to use first for professional development in Massachusetts and in the USA to show other teachers about next generation science standards the pedagogical model for introducing the pedagogy and the idea of next generation science standards students thinking and acting like scientists going down dead ends coming up with hypotheses creating models etc etc etc and that's primarily
40:40 for professional development secondarily
40:42 for use in classroom so creating a
40:47 BLOSSOMS video we're gonna spend a lot
40:50 of time on this but we have we you know
40:52 when we started we didn't really know
40:54 what we were doing and you can probably
40:55 see that if you look at some of our
40:56 original lessons that are six years old
40:59 I made the first one so I was the guinea
41:00 pig it's called the broken stick problem
41:03 it's still up there and I'll tell you
41:05 what the problem is you take a yard so
41:07 let's take a meter stick take a meter
41:08 stick made out of wood cost twenty-five
41:10 cents to buy it Ace Hardware in
41:12 Massachusetts and you get two random
41:15 numbers you got two random numbers and
41:17 there are different ways you can get the
41:18 random numbers they uniformly
41:20 independently distributed over the 100
41:22 centimeters of the yardstick you put
41:24 chalk marks where those two random
41:25 numbers are and I do this live both on
41:29 the video and actually head MIT classes
41:31 and in high school classes around Boston
41:33 and I take out a very dangerous looking
41:34 rusty saw and actually saw the thing
41:37 into three pieces by sawing where those
41:38 two chalk marks are and then I asked the
41:41 students I said if I did this 10,000
41:43 times and I had 10 that I destroyed
41:46 10,000 of these rulers and I had
41:48 different random numbers each time about
41:50 how many times do you think I could form
41:52 a triangle with a three piece of so-op
41:53 tape where each piece of this broken
41:57 would form one full side of a triangle
41:59 and I take estimates from the class
42:02 ninety percent hundred percent fifty
42:04 percent whatever and then then we go
42:06 through that in this BLOSSOMS video and
42:09 we actually do it in practice and show
42:12 the math behind it again it's out of it
42:15 it's not textbook and but it requires
42:17 the fundamental knowledge of graphing of
42:20 inequalities and locating events in a
space etc so that's the concept then
there's the architecture and the
architecture is how many different video
segments will there be typically it's
four to six and equally important
besides what's happened in the video
what's going to happen in the classroom
when the video is off so the
architecture is designing the skeletal
outline of the whole thing then those
are the two most important things then
you develop a so called pseudo script
it's like a like a Hollywood performance
but we don't ask anyone to memorize we
developed a pseudo script so we can we
do vetting of with content experts about
exactly the content that's supposed to
be in the video and we usually go
through two or three four iterations of
that then we do the videotaping then we
write a teacher's guide review and
approve the transcript and provide
information to be decided on the web but
steps one two and three are the most
important now how long do you think it
takes us with our video crew to create
22 minutes of BLOSSOMS video a full
eight to nine hour day the other thing
is from step one to step 7 the duration
ranges from three months to 12 months
for one BLOSSOMS video so it's not
something you could just roll out of bed
take one day and do the whole thing here we
have Alex Deegan who was chief scientist
and director of the Office of Science
and Technology at USAID and he says some
kind things about BLOSSOMS and I'll let
you look at that I know I'm embarrassed
to read them to you but so it's nice
when USAID says some kind things about
USAID actually supported two of our
BLOSSOMS for BLOSSOMS lessons that we
created recently jointly with Pakistan
here are some BLOSSOMS titles gravity at
work from Pakistan Lebanon gravity a
sister stealing at planets angular
momentum and getting away with it Saudi Arabia where we take stem and make it steam but put the a in for arts arabesque the where art meets mathematics Jordan wind and sand and Malaysia is one of my favorites fantastic factorials now over time we've accumulated some interest and those who redistribute OER content and so we have a number of redistributees worldwide they include eat granary which if you don't haven't heard about it and you're interested in distributing OER content to developing countries this is the best show in town or on planet earth check it out MIT tech TV youtube of course Canal Futura this is our Brazilian connection this is the largest educational TV network in Brazil they reach 32 million Brazilians and they contacted us and they said could you send us your videos we will translate them into Portuguese put Portuguese subtitles on them we will broadcast them on our network over and over again and we'll send you back the video so you can put them on your website so we now have I don't know 40 or 50 BLOSSOMS lessons with in Portuguese and actually Brazil now is our number two country after the USA a number of hits on our BLOSSOMS website and we know it's all due to Canal Fortura other redistributes CPalms if you don't know about CPalms please find out about if you're interested in vetted crowd-sourced oh we are education for high schools this exists in the state of Florida it's run by Florida state University in Tallahassee and it's linked it's funded by the Department of primary and secondary education of the state of Florida and what they do is anyone of you who have an OER a lesson doesn't have to be video can be text can be whatever it is could
be a game a digital game if you want to
submit it to CPalms they will then
send it out to referees these referees
are content experts who are high school
stem teachers throughout the state of
Florida and these referees can be quite
vicious and made it because they're
quite knowledgeable and they'll come
back and either accept or reject your
thing we have about an 80% acceptance
rate of those BLOSSOMS lessons we submit
then they put them on the
CPalms website they also become certified
on the Florida Department of primary and
secondary education website and so we
view this as the Good Housekeeping Seal
of Approval so whenever one of our
BLOSSOMS lesson is on the CPalms thing we put a little see problems I
icon on the web page to show that it has
this Good Housekeeping Seal of Approval
a guru share my lesson calm which gets
millions and millions of hits every
every month this is something you should
probably know about this is because we
have more Arabic language content I
think that any of the program at MIT
we're now supported by or redistributed
by the Qatar foundation international
okay so getting near the conclusion here
and maybe this is the the sales part for
me because I'm embarrassed that we have
no French language partners with
BLOSSOMS so I'm out really to get one or
more French language partners and one or
more Spanish language partners I'm very
very close to getting to Spanish
language partners but not so close in
the other one so basically what is a
partnership it means co-creation as well
as co utilization so it means sign it up
to designing and creating some of these
things yourselves
and typically I mean every agreement we
have with a partner country is different
but usually the successful ones involve
the Ministry of Education one or two premier universities a small number of high schools willing teachers and a full time project local project manager and basically then the MIT BLOSSOMS team comes to that partner country as we've done for every one of them except Brazil because that's kind of a unique situation and does live teacher training and mentors the entire process so we have international partners in co-creation co-utilization and so that's our current set of partners and we might say Canada next possible France next possible now there are many other flags particularly some in Europe so I didn't mean to offend anyone for French-speaking nation that I just gave two examples for instance Belgium but also many in Africa and we would love to work with those countries so basically that's it and I thank you for attention and if we have any time I welcome questions and comments thank you very much do you have hands on in all of the use your videos with hands on experiments to with for the students the question is do we have hands on experiments with the students yes in some of them the issue is that and this makes it difficult for our chemistry ones because the best ones to do with chemistry will be in a laboratory but again we're sensitive that many of our audience is directed to developing countries with where the resources available for the teachers and in schools are limited so when we do have hands on we usually have equipment that's easily obtainable for a low price like a yard stick or a meter stick and a saw but I would say maybe twenty to twenty-five percent of our lessons have hands-on in the usual manipulative way but others have hands-on in terms of experiential and the majority of them are that way for instance flew math
games we asked each student to create
for themselves three different colored
hats at home the night before and they
come in and the hats are green blue and
red depending on their state of
infection or non infectousness in a flu
epidemic and then they take random
numbers out of a hat and they kind of
infect each other so that's very much
hands-on but it's not in the usual
laboratory sense so we have a lot of
activities like that
thank you very much for this really
interesting presentation I think that in
your network you developed and you use a
well-known concept about learning with
television it's what we call
souplantation it's a way the video can enhance and support
cognitive process for the use of
simulation and image so it's a alltel
we're coming back to 30 years ago but
you do I think will kneel yes education
for media and I think it's really
important I have a question it's really
not easy for the teachers to use this
sort of material I've been a long time
ago teachers trainers for math teachers
and it was really necessary to train
them to teach that in this sort of in
types of a situation finding and
using real problems and discussing with
the pupils because I am NOT my teachers
but I remember that it's really
necessary to know very well mathematics
to do that and I have a question or how
could you or do you people math teachers
and young my teachers pretty impressive
indeed in prison training or do you do
that and a second question perhaps do
you think it's possible to realize such
an experience at university level it's
another question ok I think you've
identified some very very important
issues and I think one of the key
impediments to implementation were to
scaling
up widespread implementation of
something like this this is not the
little brain content this is allowing
the class when you deliver a lesson like
this to find its own path at each time
let's take you you take any one of those
that we showed or any of the other ones
and suppose you were to do it six times
to six different classes each time that
each class would go a different route
and it's a little bit scary to the
teacher because if the teacher doesn't
have in-depth content knowledge it won't
be long until the students see that and
learn that it's much easier to give a
scripted lecture when you have five
percent depth of knowledge and don't
allow questions in interactivity then if
you allow this kind of interactivity and
exploration so this is you know what we
find and it's basically almost every
country has this issue of in-depth
knowledge of the teachers and that
really has to be enhanced and expanded
this is one of the reasons that whenever
we have a country partner we go out and
train the teachers in this way of
thinking and try to add in depth
knowledge in the areas that they're
going to work on but we do have I mean
some of these lessons I think the
teachers would not have any difficulty
with for instance we have four
applications of the Pythagorean theorem
you saw one of the mention here how do
you estimate distances to nearby stars
and that's one of them we have three
others and and I think they're all kind
of neat and I think any teacher who
teaches that Pythagorean would be
very comfortable with these with these
sorts of things but but that is a key
issue and the issue is in-depth
knowledge of teacher training and
particularly in developing countries
think that's the key impediment to increasing technology or no technology the key impediment to increase in the educational quality in those countries now your second question is is this useful in colleges and universities as well I think the obvious answer is yes we don't have that right now our focus is really on high schools and to some extent middle schools although let me say this I've been an MIT professor longer that I'm going to confess here publicly and but from the major are any of these lessons I have learned a lot myself so so take that for what it might be but I think there's a lot of content and hear that that college freshmen and sophomores and professors could learn from I know we're running out of time do we have time for one more question no hi hi I work at the Faculty of Education here at the University of Ottawa and I'm particularly intrigued by this gentle introduction and I wanted to ask you whether in your training sessions or observations whether you saw teachers taking that gentle introduction even further as a result of their perceived success or how they their experience and also if you saw on the student side empowerment to maybe even make their own BLOSSOM video I know it's technically the way it works is with you knowledgeable teachers but I just didn't know if there was any effects happening as a result of using the resource thank you yeah well the students for instance we some of our most successful or I think best and missed BLOSSOMS lessons are made by students we have graduate students at MIT we have undergraduates and I was going to let was the best to last we have one on a brigade rose number done by a high school student she was an emerging junior at South South Newton.
High School and near Boston and I'll just tell you what the opening of it is she's there speaking with her homeroom teacher who happens to be also a chemistry teacher and she starts and she shows this quiz paper she says I don't understand why I didn't get nearly full credit I gave the right number 6 point 0 to that for the number of a number of atoms in twelve grams of carbon and of course the answer it's a pagodas number the answer is six point 0 2 times 10 to the 23rd she forgot the 10 to the 23rd so the whole thing and so that so the teachers as well you know that's good you got the six-point 02 right but when you forget 10 to the 23rd that's kind of a big forgetting you know and so but she volunteered and her parents were in the back of the room on the video was it was being made to make sure that everything was okay and that she was not damaged by this experience so we have had high school teachers high school students volunteer to work with adult teachers we haven't had a hundred percent high school students by making these things yet but we would welcome that but they have to work with us on our six step production process and it takes several months to go through all that you just can't take a video tape camera out one day and makeup BLOSSOMS lesson it's much more complicated than that but the teachers themselves seem to like it and they don't feel threatened by it as I said the the NEA National Education Association features that any a fellow who's in charge of stem is a content contributor to one of our monthly newsletters we have two monthly newsletters we're also on Facebook and Twitter so you can follow us you can friend us and you can sign up for newsletters see I'm a Salesman to the
price is right it's free there's one
more question yes I like very much your
pedagogical principal and the OAR
international collaboration I think
d these these are very important things
one thing that troubles me is about the
video basically videos are rigid a
non-interactive material and you want to
use them to promote active learning so I
believe the active learning is in the
lesson plan and if I understand you
correctly you start with the video and
then you build a lesson plan around it
or wouldn't it be a good idea also to
first build a lesson plan and then find
out what kind of resources are needed to
achieve some goals something like a
trickle goals so basically my question
is about instructional engineering what
kind of methodology that you used to to
build these lesson plans yeah well the
whole thing is organic we don't view the
video as a separate thing we view the
video part it's a teaching duet and
both parts of the duet are equally as
important so the lesson plan is you
night we have a whole set of templates
and a whole set of handouts for this
thing that I didn't have time today to
go through but they're all in our
website and I think they're in multiple
languages but the the idea is you start
out with a concept as I said whatever
the concept is which is an important
concept like angular momentum many
people don't understand including me
don't understand angular momentum like a like
how a gyroscope works or when ice
when an ice skater is she's spinning
around figure skater she's spinning
around and then she brings her arms in
and she spends twice as fast and she
hasn't put in a torque on our honor
under ice skates we had one like this so
we start off with a concept like this
and then organically the video and the
live is the same so we don't say oh this
is going to be video content and let's
design a lesson plan around it the whole
thing is is is together and
integrated and I'd be happy to talk with
you offline about more details of that
thank you very much