

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]

04:22 when I say the word chemical reactions
04:25 what comes to mind is this the chemical
04:28 reaction
04:31 thank you for teaching this lesson to
04:34 your class till next time I'll see you
04:37 out there we hear their rear that's a
04:46 little sampler of some of the BLOSSOMS
04:48 lessons so we go back to the PowerPoint
05:01 there we go do we have two or one rather
05:06 than two good so it's an initiative
05:08 amount MIT as I said we just entered our
05:10 seventh year and basically we're
05:19 connecting Science and Mathematics to
05:21 the real world and you might ask well
05:28 what is BLOSSOMS well BLOSSOMS is a set
05:32 of math and science and engineering
05:34 video lessons interactive to be used in
05:37 classrooms in high schools and sent to
05:39 some extent middle schools so it's free
05:43 it's interactive and it's available to
05:47 all of us worldwide now you might say
05:51 well gee videos is not going to put the
05:54 kids to sleep these are not long videos
05:57 that go on for 40 or 50 minutes and
05:59 would put them to sleep these are videos
06:02 that go in short segments to three
06:04 minutes fade the black then that then
06:06 the classroom is challenged to some
06:09 thing that they haven't seen before out of
06:11 the textbook not in the textbook some
06:13 challenge and the teacher the in class
06:15 teacher is still involved with guiding
06:18 the class through a very active learning
06:19 session to achieve some learning
06:21 objective while the video is off once
06:23 that learning objective is achieved then
06:26 the teacher goes back and presses a
06:28 button and the next video segment is
06:30 shown so we call the pedagogical model a
06:35 teaching duet because half the teaching
06:38 and learning is done by our video
06:40 teacher the other half the teaching and
06:42 learning is done by the in class teacher
06:44 so the in class teacher is very very
06:47 important to this process and in a 55 or
06:51 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 Urdu 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

09:14 recent training exercise we did via
09:17 Webx I to about 90 of individuals in
09:22 Lahore Pakistan Pakistan is one of our
09:24 country partners
09:27 so we'll see if we can go to the next
09:31 video
10:10 hi I'm concealer from superior
10:13 University Pakistan major in computer
10:15 science still and my favorite subject is
10:18 programming especially when it comes to
10:19 building the logic for program or
10:21 relating the real-life stuff with
10:23 programming one and in today's lesson
10:25 they're going to do the same thing we
10:28 are going to learn programming right
10:29 here working in the kitchen we will
10:32 analyze that where are those basic
10:34 programming concepts are applied while
10:36 making a mango milkshake so help me
10:39 making the milkshake and I'll help you
10:40 learn programming deal so let's get
10:43 started while programming there might be
10:46 some situations when a certain task is
10:49 assigned to you well you know how to do
10:51 this by using the marvelous brain you're
10:53 blessed been almost without thinking but
10:55 when it comes to parking the task into
10:57 discrete logic and you get stuck why
11:02 does this happen this is because the
11:04 human thought process is much faster
11:06 than the sense of observation life
11:09 experience has enabled us to lump
11:11 together a set of steps into one
11:13 necklace step driving a car is an
11:15 example as it has become so much
11:17 intuitive we don't need to think when to
11:20 apply the brakes for instance but the
11:22 computer does not have the advantage of
11:24 life knowledge it's an amp machine even
11:26 it can't think anything so being a
11:29 programmer it's your challenge to move
11:31 your smarts all your knowledge into
11:33 discrete sequence steps that would
11:35 direct the computer what to do also
11:37 called a program so if this thinking
11:40 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

13:46 we didn't have any country partners we
13:47 didn't have BLOSSOMS we had a one-on-one
13:49 one hour with her Majesty Queen Rania of
13:52 Jordan because we ran a LINC conference
13:54 there in 2007 and in the room were two
13:58 of us BLOSSOMS people from MIT Queen
14:01 Rania and her ministry of education and
14:03 her ministry of higher education and
14:05 she's she's very articulate and very
14:08 passionate about learning and education
14:10 in her country and she said you know
14:12 what we don't do is we don't really
14:15 develop critical thinking skills we
14:17 focus too much on teaching to a test
14:20 rewarding memorization and having these
14:22 evaluating people on standardized test
14:24 scores and in this country in Jordan
14:27 unlike some other countries in the
14:28 Middle East we don't have oil and
14:29 natural gas buried underground on
14:31 unlike some countries in Africa we don't
14:33 have diamonds and gold and silver buried
14:35 underground so we have things buried
14:38 someplace else which are our core assets
14:41 and basically it's between the ears of
14:44 our citizens so that's where that's
14:50 where the gold and silver and gas
14:53 natural gas and oil are buried in in
14:56 Jordan and she said if you have a
14:57 program that will enhance critical
15:00 thinking skills in Jordan you're welcome
15:02 in this country so Jordan was our first
15:04 country partner as we started BLOSSOMS
15:07 six-plus years ago so you might say well
15:13 what's the framework for BLOSSOMS what
15:15 are some guiding principles well first
15:18 and foremost to improve math and science
15:20 teaching and learning at the secondary
15:22 level we go beyond delivery of content
15:26 too many of us confuse delivery of
15:29 content and parroting back that content
15:32 with true learning and so we want to go
15:35 beyond that we want to introduce
15:38 teachers in a gentle way supportive way
15:40 to the power of technology enabled
15:42 education we've done lots of on the

15:44 ground boots on the ground research in
15:45 Mexico China the US and now our partner
15:48 countries and we find the majority of
15:51 high school teachers and middle school
15:53 teachers oppose technology-enabled
15:56 education when the mental model is
15:58 students sitting in front of the
15:59 computer and the role of the teacher is
16:02 ambiguous at best you get a role
16:05 reversal in terms of the power structure
16:07 of the class and you get a secondary
16:10 role reversal in that invariably
16:12 teenagers know a lot more about
16:13 technology than the teachers do and so
16:16 therefore the teachers are afraid of
16:17 Technology able education when it means
16:20 that this the most learning what is
16:22 supposed to happen with students sitting
16:24 in front of computers so we have a
16:28 gentle way which actually enhances the
16:30 role of the teacher guiding the
16:32 classroom and the teacher
16:33 still in charge by the way the National
16:36 Education Association the largest labor
16:39 union in the United States has brought
16:41 features BLOSSOMS on its website and I
16:44 think it's because we
16:45 enhanced teacher performance and
16:47 evaluations and our role of Technology
16:50 novel education is not viewed as a job
16:52 threat or security threat to their to
16:55 their members we want to encourage
16:58 universities to reach down to help
17:00 improve science and math education in
17:02 high schools if you look at it from a
17:04 systems point of view the input to the
17:07 freshman class in any University
17:08 including University of Iowa is the
17:10 output of high schools and for
17:13 universities to ignore high schools
17:14 particularly of high schools aren't
17:15 delivering the kind of preparation for
17:18 university education that they should be
17:20 I mean if the universities ignore that
17:24 they're ignoring a fundamental systems
17:26 input into their own system so there

17:30 were many colleges and universities that
17:32 work closely with high schools in Boston
17:34 we have Boston University runs its own
17:36 high school Monterey tech in Mexico runs
17:40 a number of high schools themselves and
17:42 MIT has scores of high school outreach
17:46 programs that it runs year-round and
17:48 particularly intensively during the
17:50 summer finally we want to initiate an
17:56 educational resource that involves
17:57 international partners in co-creation as
18:00 well as skill utilization so one of our
18:02 tenants is okay if if let's say let's
18:06 say if Canada where to sign up and
18:08 become a BLOSSOMS partner and we'll talk
18:10 about what that might mean later on that
18:13 means that Canada would sign up to maybe
18:15 create in 10 or 20 BLOSSOMS lessons here
18:19 yourselves with our guidance and we have
18:24 a multi-step process for the guidance so
18:26 we don't believe that all knowledge
18:29 stems from Cambridge Massachusetts and
18:32 should be graciously spilled on planet
18:34 Earth we think that knowledge comes from
18:36 everywhere on planet earth and we should
18:38 all contribute and we call this highly
18:41 vetted crowdsourcing for improving a
18:44 stem education in high schools so that's
18:49 stem education some people call or
18:51 advocating for steam education the a in
18:55 steam making go from stem to steam
18:58 is for arts and so if we're bringing in
19:00 the humanities and there as well and we
19:02 do that with some of our some of our
19:04 lessons and so what are the goals of
19:08 BLOSSOMS well it's to 1 we want to show
19:12 how exciting stem can be it's not some
19:15 routine thing out of a textbook let's
19:17 say a math textbook where you memorize
19:18 the quadratic equation solution formula
19:20 which is complicated square root etc etc
19:22 and turn the crank and get the answer
19:24 it's really quite exciting and to
19:27 increase student interest in careers in
19:30 stem not just engineering and
19:32 mathematics but there's so many careers

19:34 these days that requires knowledge of
19:37 math and science a lot of lawyers
19:41 require this take abstract concepts and
19:47 show to the real world a lot of students
19:49 again teenagers they said why should I
19:51 work hard and study this stuff I don't
19:52 see any relevance in my own life and
19:54 they should and also to engage students
19:57 in observation experimentation and
20:00 discussion for them to act and think
20:01 like scientists and engineers as I said
20:04 before critical thinking skills to
20:06 develop critical thinking skills and
20:07 last but certainly not least to foster
20:11 cross-cultural awareness sensitivity and
20:14 appreciation you know too often young
20:17 people only hear about folks from other
20:20 countries through let's say their
20:22 parents who might have a stereotypical
20:23 view or through news events and in the
20:26 news you know what the headlines are if
20:28 it bleeds it leads so you have a very
20:31 biased exposure to other cultures and
20:35 other countries just by looking at the
20:37 news so one of the things about BLOSSOMS
20:39 is you can learn things in science and
20:41 math and engineering from people who
20:43 don't look like you who people who don't
20:45 dress like you and people who don't
20:46 speak your language
20:51 so we also need all students these days
20:54 to be stem literate it just can't be
20:56 engineers and scientists mathematicians
20:57 all of us just about every job these
21:01 days that's growing up has some element
21:03 of the need to become aware of math and
21:06 science as I said before BLOSSOMS is a
21:11 gentle way of introducing teachers to
21:14 technology naval education and if you
21:15 think about it video has been with us
21:17 for decades so this is our mechanism
21:20 video is not threatening it doesn't
21:23 require exotic programming skills it
21:25 doesn't require the knowledge of is the
21:28 software compatible between PCs and
21:29 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

28:31 presentation but you can because the
28:33 internet is very available and if you go
28:36 to oh we live here know if you go to
28:40 BLOSSOMS.mit.edu you can go to the
28:44 website see our 110 plus different
28:46 lessons you can it they're
28:48 categorized in clusters of the topic
28:51 area or by math and the different
28:53 sciences biology physics chemistry and
28:56 also we have engineering and they're all
28:59 searchable at least in the for the u.s.
29:02 teachers by state standards so we have
29:05 up-to-date up to the most recent changes
29:08 in each of the 50 states for the state
29:10 standards in both math and science and
29:12 also Washington DC and also the two
29:15 growing national standards so you can
29:18 search for them that way and but
29:21 basically I those of you who are
29:23 interested I invite you to explore the
29:24 BLOSSOMS website and see all that we
29:27 have I think one key thing about it is
29:29 that every one of the 110 plus well I
29:33 say plus because I don't know exactly
29:34 what the count is is a little bit of
29:36 noise 109 hundred eleven whatever it is
29:39 every BLOSSOMS lesson has its own
29:41 website so when you click through here
29:44 you'll see a whole page which is just
29:45 that one lesson and so it'll show you
29:48 the languages that that BLOSSOMS lesson
29:49 is available in and for the teacher it
29:52 provides a complete teacher's guide and
29:54 all the entire lesson plan is there for
29:57 the teacher first of all every BLOSSOMS
29:59 video lesson at the end has a private
30:01 conversation between the video teacher
30:03 and in class teacher and that video
30:05 conversation starts with the learning
30:07 objectives of this video lesson
30:10 the prerequisites required and then then
30:13 suggestions on what to do during each of
30:15 the class breaks when it goes to black
30:17 it's black for 10 seconds to allow time
30:19 for the teacher to go and shut off the
30:20 video and then guide the class through a

30:22 very active learning exercise so we
30:24 suggest what the teacher might do in any
30:26 of those breaks any also any handouts
30:29 that are needed for the class are
30:31 available in PDF files on our website
30:34 and those are downloadable and she can
30:36 print them out and he can print them out
30:38 and hand it out to the class also a
30:40 fraction of our of our lessons have
30:43 accompanying online animated simulations
30:47 so for instance or instance we have one
30:49 called flu math games which we created
30:51 in 2009 when we thought that h1n1 was
30:54 going to have a kill ratio of six
30:56 percent we were very scared and we
30:58 thought well maybe we could educate high
31:00 school students through a math exercise
31:04 as a show as they change their behavior
31:07 more hygienic behavior and more social
31:10 distancing their probabilities of
31:11 getting h1n1 flu would drop and they
31:13 would see this in a simulation they
31:15 would do in their classroom with
31:16 different colored hats that they would
31:17 wear well they could then go home and do
31:20 the simulation on a computer-based
31:22 animated basis and get statistically
31:25 significant results and write up the
31:27 reports so we have some animation
31:29 simulations like that for some fraction
31:32 of our lessons I would say maybe ten to
31:34 fifteen percent we hope to we hope to do
31:36 more but the key thing is a complete
31:39 lesson plan is there for the teacher so
31:41 the teacher doesn't have to do a lot of
31:42 research also we have other general
31:44 online freely available resources in
31:47 case the teacher wants to explore it in
31:48 more depth or assign a project to the
31:51 class after they experience this this
31:53 lesson the last thing I'll say is that
31:56 we don't care so much whether the
31:58 teacher shows the entire video lesson to
32:01 the class maybe a year one she or he
32:04 does and maybe in year to the teachers
32:06 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
34:08 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
34:22 today I'm giving a lecture oh it's a
34:25 inconsistent
34:27 it's not a typical lesson from a
34:29 textbook and it's not a passive
34:33 experience for students so hopefully if
34:37 you look at the BLOSSOMS lessons you
34:39 will agree with that now what is a
34:41 BLOSSOMS lesson well we try to make it
34:44 an interactive learning experience we
34:46 try to approach a topic from a new
34:48 direction not a textbook approach or a
34:50 standard scripted lecture approach we
34:53 try to connect math and science to the
34:54 real world and we like to have it as an
34:57 active learning experience for our
34:59 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
36:14 the shortest lessons in introductions we
36:16 try to engage them really early and get
36:20 them totally committed to the problem
36:21 we're going to focus on and so you might
36:23 say ok Oh sum of the integers from 1 to
36:27 100 and these are students in a middle
36:30 school who have not seen a formula and
36:32 who are challenged to figure it out how
36:34 to create that sum and if you think
36:36 from basic principles there are a few
36:40 ways you could do that in two minutes
36:42 but you really have to you know know
36:45 your arithmetic know your math and be
36:47 creative and maybe draw a few pictures
36:49 and be able to come up with that
36:52 solution now it's ok it's ok if the
36:55 students some of the students don't
36:57 figure that out because you have them
36:58 frustrated and you have them totally

37:00 engaged and hopefully now they'll pay
37:02 attention to the entire lesson ok so
37:09 when you're designing a BLOSSOMS lesson
37:11 what are some of the things well the
37:13 first one and perhaps the most difficult
37:15 is to come up with a good concept what
37:18 is it you're trying to do what is it
37:19 you're trying to teach it should be
37:21 something which is important and
37:24 difficult to understand and perhaps
37:27 counterintuitive you know you've got all
37:30 those kinds of things going on there it
37:32 might be a concept that's widely
37:33 misunderstood by
37:35 students and maybe it's a concept that
37:38 has some real-world applications now the
37:43 pedagogical models we have we have
37:46 something we you know we have blended of
37:49 problem-based learning inquiry based
37:51 learning the so-called 5 e's and some
37:55 combinations of these we don't really
37:57 care so much which which pedagogical
38:00 model out of the literature is used
38:01 other than the fact that we don't want
38:04 scripted lectures and we want active
38:05 learning between the bricks and as I
38:10 said before we try to emphasize again
38:12 and again and again the key role the key
38:15 goal the BLOSSOMS lesson is develop
38:17 students critical thinking skills the
38:18 last thing you want to do to evaluate it
38:20 BLOSSOMS lesson afterwards is it give
38:22 them a multiple choice test so we say
38:26 the teachers if you want to evaluate the
38:27 effectiveness of this lesson assign them
38:29 an extended homework problem extended
38:31 homework exercise or project maybe in
38:33 small groups and have that submitted
38:36 maybe a week later and then read that
38:38 evaluate that grade that if you want
38:41 that's fine but don't give them a
38:43 multiple choice test that's not the way
38:44 to evaluate the effectiveness of a
38:46 BLOSSOMS lesson and for teachers and
38:50 this is interesting because this is a
38:52 huge surprise for us as we started

38:55 working with teachers and face-to-face
38:56 we've trained over 1,000 teachers in our
38:58 various countries probably more in Saudi
39:01 Arabia even than in the US and the
39:04 teachers come to us and they say you
39:06 know when we have these sessions and we
39:08 can talk with folks from MIT and we can
39:11 talk with our fellow teachers they said
39:13 you do you know how often we can talk to
39:15 fellow teachers about issues of pedagogy
39:17 about content and about how to deliver
39:20 quality education almost never you know
39:23 we might meet in the faculty lounge over
39:24 a cup of coffee and we talk about you
39:27 know when the next vacation day is or
39:29 the cost of textbooks or things like
39:32 this so they really enjoy getting
39:34 together collaboratively and with us and
39:38 discussing education their profession
39:42 okay
39:44 and so they have told us that the
39:47 BLOSSOMS lessons and this whole process
39:49 of this training process is actually
39:51 more valuable as professional
39:53 development and then the actual teaching
39:56 of it in the classroom to students not
39:59 that that's not important they say
40:00 that's very important but they say the
40:02 key aspect of this is professional
40:03 development for the teachers and so we
40:06 have a project going on right now funded
40:08 by a private foundation in Washington DC
40:10 with eight prize prize-winning
40:12 teachers from the Commonwealth of
40:14 Massachusetts and they are developing
40:16 their lessons primarily to use first for
40:19 professional development in
40:20 Massachusetts and in the USA to show
40:23 other teachers about next generation
40:26 science standards the pedagogical model
40:28 for introducing the pedagogy and the
40:30 idea of next generation science
40:32 standards students thinking and acting
40:34 like scientists going down dead ends
40:35 coming up with hypotheses creating
40:37 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

42:23 space etc so that's the concept then
42:27 there's the architecture and the
42:28 architecture is how many different video
42:30 segments will there be typically it's
42:32 four to six and equally important
42:35 besides what's happened in the video
42:36 what's going to happen in the classroom
42:37 when the video is off so the
42:39 architecture is designing the skeletal
42:41 outline of the whole thing then those
42:44 are the two most important things then
42:45 you develop a so called pseudo script
42:47 it's like a like a Hollywood performance
42:50 but we don't ask anyone to memorize we
42:52 developed a pseudo script so we can we
42:55 do vetting of with content experts about
42:58 exactly the content that's supposed to
43:00 be in the video and we usually go
43:01 through two or three four iterations of
43:03 that then we do the videotaping then we
43:06 write a teacher's guide review and
43:08 approve the transcript and provide
43:10 information to be decided on the web but
43:12 steps one two and three are the most
43:15 important now how long do you think it
43:18 takes us with our video crew to create
43:20 22 minutes of BLOSSOMS video a full
43:25 eight to nine hour day the other thing
43:29 is from step one to step 7 the duration
43:34 ranges from three months to 12 months
43:36 for one BLOSSOMS video so it's not
43:40 something you could just roll out of bed
43:42 one day and do the whole thing here we
43:49 have Alex Deegan who was chief scientist
43:52 and director of the Office of Science
43:54 and Technology at USAID and he says some
43:58 kind things about BLOSSOMS and I'll let
44:02 you look at that I know I'm embarrassed
44:04 to read them to you but so it's nice
44:07 when USAID says some kind things about
44:10 USAID actually supported two of our
44:13 BLOSSOMS for BLOSSOMS lessons that we
44:15 created recently jointly with Pakistan
44:20 here are some BLOSSOMS titles gravity at
44:24 work from Pakistan Lebanon gravity a
44:26 sister stealing at planets angular

44:28 momentum and getting away with it Saudi
44:31 Arabia where we take stem and make it
44:33 steam but put the a in for arts
44:36 arabesque arabesque the where art meets
44:38 mathematics Jordan wind and sand and
44:41 Malaysia is one of my favorites
44:43 fantastic factorials now over time we've
44:49 accumulated some interest and those who
44:52 redistribute OER content and so we
44:55 have a number of redistributeers
44:57 worldwide they include eat granary which
45:00 if you don't haven't heard about it and
45:02 you're interested in distributing OER
45:04 content to developing countries this is
45:06 the best show in town or on planet earth
45:08 check it out MIT tech TV youtube of
45:12 course Canal Futura this is our
45:15 Brazilian connection this is the largest
45:18 educational TV network in Brazil they
45:21 reach 32 million Brazilians and they
45:24 contacted us and they said could you
45:27 send us your videos we will translate
45:29 them into Portuguese put Portuguese
45:32 subtitles on them we will broadcast them
45:34 on our network over and over again and
45:38 we'll send you back the video so you can
45:40 put them on your website so we now have
45:42 I don't know 40 or 50 BLOSSOMS lessons
45:45 with in Portuguese and actually
45:47 actually Brazil now is our number two
45:51 country after the USA a number of hits
45:53 on our BLOSSOMS website and we know it's
45:55 all due to Canal Fortura other
46:01 redistributes CPalms if you don't
46:03 know about CPalms please find out
46:05 about if you're interested in vetted
46:07 crowd-sourced oh we are education for
46:10 high schools this exists in the state of
46:13 Florida it's run by Florida state
46:15 University in Tallahassee
46:19 and it's linked it's funded by the
46:22 Department of primary and secondary
46:24 education of the state of Florida and
46:27 what they do is anyone of you who have
46:30 an OER a lesson doesn't have to be video
46:32 can be text can be whatever it is could

46:34 be a game a digital game if you want to
46:37 submit it to CPalms they will then
46:39 send it out to referees these referees
46:42 are content experts who are high school
46:43 stem teachers throughout the state of
46:45 Florida and these referees can be quite
46:48 vicious and made it because they're
46:49 quite knowledgeable and they'll come
46:52 back and either accept or reject your
46:54 thing we have about an 80% acceptance
46:56 rate of those BLOSSOMS lessons we submit
46:59 their then they put them on the
47:00 CPalms website they also become certified
47:03 on the Florida Department of primary and
47:08 secondary education website and so we
47:10 view this as the Good Housekeeping Seal
47:12 of Approval so whenever one of our
47:14 BLOSSOMS lesson is on the Cpalms
47:16 thing we put a little see problems I
47:18 icon on the web page to show that it has
47:20 this Good Housekeeping Seal of Approval
47:22 a guru share my lesson calm which gets
47:27 millions and millions of hits every
47:29 every month this is something you should
47:31 probably know about this is because we
47:35 have more Arabic language content I
47:38 think that any of the program at MIT
47:40 we're now supported by or redistributed
47:44 by the Qatar foundation international
47:48 okay so getting near the conclusion here
47:52 and maybe this is the the sales part for
47:56 me because I'm embarrassed that we have
48:00 no French language partners with
48:03 BLOSSOMS so I'm out really to get one or
48:06 more French language partners and one or
48:09 more Spanish language partners I'm very
48:11 very close to getting to Spanish
48:13 language partners but not so close in
48:16 the other one so basically what is a
48:19 partnership it means co-creation as well
48:22 as co utilization so it means sign it up
48:25 to designing and creating some of these
48:27 things yourselves
48:30 and typically I mean every agreement we
48:33 have with a partner country is different
48:36 but usually the successful ones involve

48:39 the Ministry of Education one or two
48:42 premier universities a small number of
48:45 high schools willing teachers and a full
48:48 time project local project manager and
48:51 basically then the MIT BLOSSOMS team
48:54 comes to that partner country as we've
48:57 done for every one of them except Brazil
48:58 because that's kind of a unique
49:00 situation and does live teacher training
49:03 and mentors the entire process so we
49:11 have international partners in
49:13 co-creation co-utilization and so
49:15 that's our current set of partners and
49:18 we might say Canada next possible
49:32 France next possible now there are many
49:38 other flags particularly some in Europe
49:41 so I didn't mean to offend anyone for
49:44 French-speaking nation that I just gave
49:47 two examples for instance Belgium but also
49:52 many in Africa and we would love to work
49:56 with those countries so basically that's
49:58 it and I thank you for attention and if
50:01 we have any time I welcome questions and
50:04 comments thank you very much
50:24 do you have hands on in all of the use your
50:28 videos with hands on experiments to with
50:31 for the students the question is do we
50:35 have hands-on experiments with the
50:36 students yes in some of them the issue
50:39 is that and this makes it difficult for
50:42 our chemistry ones because the best ones
50:44 to do with chemistry will be in a
50:45 laboratory but again we're sensitive
50:48 that many of our audience is directed to
50:50 developing countries with where the
50:52 resources available for the teachers and
50:55 in schools are limited so when we do
50:58 have hands-on we usually have equipment
51:01 that's easily obtainable for a low price
51:05 like a yard stick or a meter stick and a
51:07 saw but I would say maybe twenty to
51:11 twenty-five percent of our lessons have
51:15 hands-on in the usual manipulative way
51:18 but others have hands-on in terms of
51:20 experiential and the majority of them
51:22 are that way for instance flew math

51:23 games we asked each student to create
51:25 for themselves three different colored
51:28 hats at home the night before and they
51:30 come in and the hats are green blue and
51:33 red depending on their state of
51:35 infection or non infectiousness in a flu
51:37 epidemic and then they they take random
51:40 numbers out of a hat and they kind of
51:41 infect each other so that's very much
51:43 hands-on but it's not in the usual
51:45 laboratory sense so we have a lot of
51:47 activities like that
51:58 thank you very much for this really
52:01 interesting presentation I think that in
52:05 your network you developed and you use a
52:10 well-known concept about learning with
52:15 television it's what we call
52:18 souplantation souplantation it's a way
52:20 the video can enhance and support
52:24 cognitive process for the use of
52:28 simulation and image so it's a alltel
52:33 we're coming back to 30 years ago but
52:36 you do I think will kneel yes education
52:42 for media and I think it's really
52:44 important I have a question it's really
52:48 not easy for the teachers to use this
52:51 sort of material I've been a long time
52:54 ago teachers trainers for math teachers
52:58 and it was really necessary to train
53:03 them to to teach that in this sort of in
53:10 these types of a situation finding and
53:15 using real problems and discussing with
53:19 the pupils because I am NOT my teachers
53:23 but I remember that it's really
53:27 necessary to know very well mathematics
53:30 to do that and I have a question or how
53:33 could you or do you people math teachers
53:36 and young my teachers pretty impressive
53:39 indeed in prison training or do you do
53:41 that and a second question perhaps do
53:44 you think it's possible to realize such
53:48 an experience at university level it's
53:52 another question ok I think you've
53:56 identified some very very important
53:58 issues and I think one of the key
54:03 impediments to implementation were to

54:07 scaling
54:07 up widespread implementation of
54:09 something like this this is not the
54:11 little brain content this is allowing
54:14 the class when you deliver a lesson like
54:17 this to find its own path at each time
54:21 let's take you you take any one of those
54:23 that we showed or any of the other ones
54:25 and suppose you were to do it six times
54:27 to six different classes each time that
54:30 each class would go a different route
54:31 and it's a little bit scary to the
54:35 teacher because if the teacher doesn't
54:37 have in-depth content knowledge it won't
54:39 be long until the students see that and
54:42 learn that it's much easier to give a
54:44 scripted lecture when you have five
54:47 percent depth of knowledge and don't
54:49 allow questions in interactivity then if
54:52 you allow this kind of interactivity and
54:54 exploration so this is you know what we
54:57 find and it's basically almost every
55:01 country has this issue of in-depth
55:03 knowledge of the teachers and that
55:05 really has to be enhanced and expanded
55:08 this is one of the reasons that whenever
55:10 we have a country partner we go out and
55:12 we train the teachers in this way of
55:14 thinking and try to add in depth
55:16 knowledge in the areas that they're
55:17 going to work on but we do have I mean
55:20 some of these lessons I think the
55:22 teachers would not have any difficulty
55:23 with for instance we have four
55:24 applications of the Pythagorean theorem
55:26 you saw one of the mention here how do
55:28 you estimate distances to nearby stars
55:31 and that's one of them we have three
55:32 others and and I think they're all kind
55:35 of neat and I think any teacher who
55:37 teaches that Pythagorean would be
55:39 very comfortable with these with these
55:41 sorts of things but but that is a key
55:44 issue and the issue is in-depth
55:46 knowledge of teacher training and
55:49 particularly in developing countries I

55:51 think that's the key impediment to
55:53 increasing technology or no technology
55:55 the key impediment to increase in the
55:58 educational quality in those countries
56:00 now your second question is is this
56:03 useful in colleges and universities as
56:05 well I think the obvious answer is yes
56:08 we don't have that right now our focus
56:11 is really on high schools and to some
56:13 extent middle schools although let me
56:15 say this I've been an MIT professor
56:16 longer that I'm going to confess here
56:18 publicly and but from the major
56:21 are any of these lessons I have learned
56:22 a lot myself so so take that for what it
56:28 might be but I think there's a lot of
56:30 content and hear that that college
56:32 freshmen and sophomores and professors
56:34 could learn from I know we're running
56:38 out of time do we have time for one more
56:40 question no hi hi I work at the Faculty
56:49 of Education here at the University of
56:51 Ottawa and I'm particularly intrigued by
56:53 this gentle introduction and I wanted to
56:56 ask you whether in your training
56:58 sessions or observations whether you saw
57:00 teachers taking that gentle introduction
57:04 even further as a result of their
57:05 perceived success or how they their
57:08 experience and also if you saw on the
57:10 student side empowerment to maybe even
57:12 make their own BLOSSOM video I know it's
57:15 technically the way it works is with you
57:17 know experienced knowledgeable teachers
57:19 but I just didn't know if there was any
57:21 effects happening as a result of using
57:23 the resource thank you yeah well the
57:26 students for instance we some of our
57:28 most successful or I think best and
57:30 missed BLOSSOMS lessons are made by
57:33 students we have graduate students at
57:35 MIT we have undergraduates and I was
57:38 going to let was the best to last we
57:41 have one on a brigade rose number done
57:44 by a high school student she was an
57:46 emerging junior at South South Newton

57:50 High School and near Boston and I'll
57:52 just tell you what the opening of it is
57:54 she's there speaking with her homeroom
57:55 teacher who happens to be also a
57:57 chemistry teacher and she starts and she
58:00 shows this quiz paper she says I don't
58:02 understand why I didn't get nearly full
58:03 credit I gave the right number 6 point 0
58:06 to that for the number of a number of
58:09 atoms in twelve grams of carbon and of
58:12 course the answer it's apogodas number
58:13 the answer is six point 0 2 times 10 to
58:15 the 23rd she forgot the 10 to the 23rd
58:18 so the whole thing and so that so the
58:21 teachers as well you know that's good
58:23 you got the six-point 02 right but when
58:25 you forget 10 to the 23rd that's kind of
58:26 a big forgetting you know
58:28 and so but she volunteered and her
58:31 parents were in the back of the room on
58:32 the video was it was being made to make
58:34 sure that everything was okay and that
58:37 she was not damaged by this experience
58:38 so so we have had high school teachers
58:40 high school students volunteer to work
58:43 with adult teachers we haven't had a
58:45 hundred percent high school students by
58:49 making these things yet but we would
58:51 welcome that but they have to work with
58:53 us on our six step production process
58:54 and it takes several months to go
58:55 through all that you just can't take a
58:57 video tape camera out one day and makeup
58:59 BLOSSOMS lesson it's much more
59:01 complicated than that but the teachers
59:03 themselves seem to like it and they
59:06 don't feel threatened by it as I said
59:08 the the NEA National Education
59:11 Association features that the any a
59:14 fellow who's in charge of stem is a
59:16 content contributor to one of our
59:18 monthly newsletters we have two monthly
59:20 newsletters we're also on Facebook and
59:21 Twitter so you can follow us you can
59:23 friend us and you can sign up for
59:24 newsletters see I'm a Salesman to the

59:27 price is right it's free there's one
59:28 more question yes I like very much your
59:31 pedagogical principal and the OAR
59:33 international collaboration I think
59:36 these these are very important things
59:39 one thing that troubles me is about the
59:42 video basically videos are rigid a
59:45 non-interactive material and you want to
59:48 use them to promote active learning so I
59:53 believe the active learning is in the
59:54 lesson plan and if I understand you
59:59 correctly you start with the video and
60:01 then you build a lesson plan around it
60:04 or wouldn't it be a good idea also to
60:08 first build a lesson plan and then find
60:11 out what kind of resources are needed to
60:13 achieve some some goals something like a
60:17 trickle goals so basically my question
60:20 is about instructional engineering what
60:24 kind of methodology that you used to to
60:26 build these lesson plans yeah well the
60:30 whole thing is organic we don't view the
60:32 video as a separate thing we view the
60:34 video part it's a teaching duet and
60:37 both parts of the duet are equally as
60:38 important so the lesson plan is you
60:42 night we have a whole set of templates
60:44 and a whole set of handouts for this
60:47 thing that I didn't have time today to
60:48 go through but they're all in our
60:49 website and I think they're in multiple
60:51 languages but the the idea is you start
60:56 out with a concept as I said whatever
60:58 the concept is which is an important
60:59 concept like angular momentum many
61:02 people don't understand including me
61:03 don't understand angular momentum like a like
61:06 how a gyroscope gyroscope works or when ice
61:09 when an ice skater is she's spinning
61:11 around figure skater she's spinning
61:13 around and then she brings her arms in
61:14 and she spins twice as fast and she
61:16 hasn't put in a torque on our honor
61:17 under ice skates we had one like this so
61:19 we start off with a concept like this
61:21 and then organically the video and the

61:24 live is the same so we don't say oh this
61:27 is going to be video content and let's
61:29 design a lesson plan around it the whole
61:31 thing is is is is together and
61:33 integrated and I'd be happy to talk with
61:35 you offline about more details of that
61:38 thank you very much