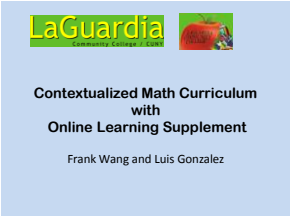
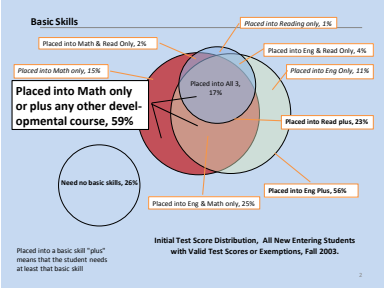
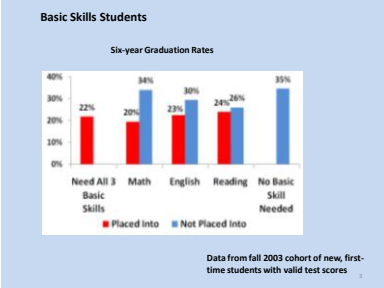
Contextualized Math Curriculum with Online Learning Supplement



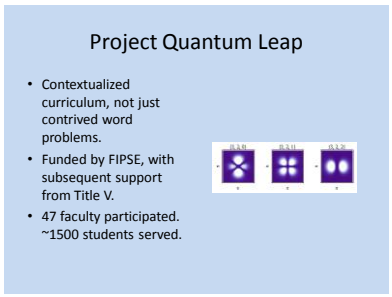
Good morning. We want to thank the organizers for inviting us to this conference.



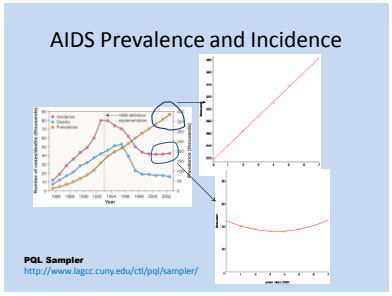
As Executive Vice Chancellor Logue emphasized, improving graduation rate is a top CUNY priority. Let me share some data with you. We all know that many college students need remedial education. At LaGuardia, nearly 60% of incoming students are placed into non-credit math basic skills courses. This Venn diagram shows that many students who lack math basic skills also lack reading and writing basic skills.



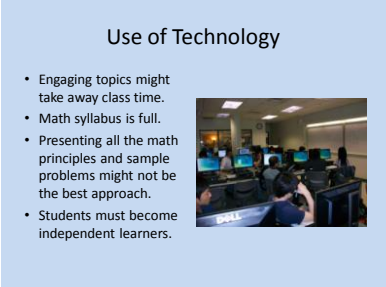
If we compare students who need math basic skills with those who don't, the gap of graduation rate is tremendous. This situation is common not only within CUNY, but also across the nation. Apparently, we need to deeply think about how to improve math basic skills instruction.



Based on data, we recognized that students in math courses have often had unsuccessful experiences with math, viewing the subject as uninteresting, scary, and irrelevant. Although most text books have application problems, they tend to be unfocused. Students end up jumping across widely different contexts. Project Quantum Leap is an approach that aims to deepen the settings and contexts to engage students more fully, to interest them in more complex problems that they will not dismiss as superficial. This Project is supported by a FIPSE grant of the U.S. Department of Education. We named it Quantum Leap because we were not sure it would work, and if that's the case we could claim that quantum leap really means tiny, microscopic change. I think we are doing ok; we received another Title V grant to continue to support our approach. Over the past 3 years, we had 47 faculty members involved, and about 1500 students served. Our efforts have moved beyond innovation at the level of individual faculty working with a handful of students. We have made a large scale institutional change that will benefit a great number of students.



To contextualize the curriculum, we focus on one theme for the entire semester so that the learning is deeper. For example, public health is the theme for our Math 096 Elementary Algebra. Here is an example that we use real AIDS data from Centers for Disease Control and Prevention to illustrate linear and quadratic functions. A collection of this type of thematic lessons are available in our college's website, and I will not spend too much time giving more examples, but come to the central issue of today's conference.



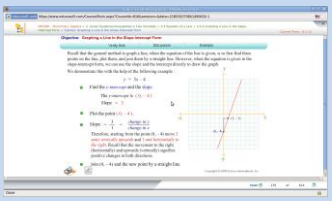
Most of you agree that using technology in education is important. LaGuardia has been using EDUCO Learning System in our math instruction since early 1990's, when MS DOS was the dominant operating system. For younger audience who do not know what I'm talking about, don't worry. We use Windows now. Let me describe our philosophy towards technology. In our Project Quantum Leap, we use interesting topics to engage students. But once students got intrigued, they might not want to let the topic go. For example, a colleague of mine used the human papillomavirus and cervical cancer to motivate students. Students were so engaged, and some male students demand an example that concerns men's health. I suspect that your math syllabus is as full as ours, and engaging discussion inevitably take away conventional instruction time. One the other hand, we believe that using the entire class time to go over all the mathematical principles and sample problems might not be the best approach. Students simply cannot absorb that much in 2 hours. Instead of cramming and rushing, we make students understand that one purpose of college is for them to learn how to learn by themselves. To train students to become independent learners, the use of technology is critical.

MAT096 Online Materials: EDUCO

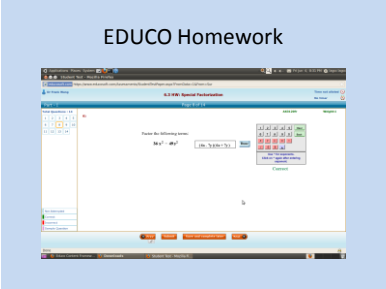
- Tutorials (timed, possible extra credit)
- Homework (5%)
- Online Quizzes (15%, 3 attempts)
- Online Departmental Midterm Exam (20%)
- Online Departmental Final Exam (25%)

EDUCO, like most computer-assisted learning software, has 3 major components. They are tutorial, homework, and quiz. Here is how we structure MATH 096 Elementary Algebra. The tutorial guides students to understand the concept and solve problems step by step. Once you go through the tutorial, you do homework. Under the homework mode, you solve a problem by yourself, and the computer tells you whether you are correct or incorrect. If you get it wrong, you can retry, until you get it right. Some selected prototypical problems have step by step solution, and students can detect their misconceptions this way. After homework, students take a quiz. Under the quiz mode, you do, say 5 or 10 problems straight in an hour. Then the system gives you a score, and tells you what you got wrong. Typically, we give students 3 attempts. If a student is unsatisfied with the first score, he or she can retest to get a better score. We use baby learning how to walk as an analogy. At the beginning, you hold the baby's hand; that's tutorial. Then you release your hand but remain close to the baby; that's homework mode. Finally, you let the baby go for a distance; that's quiz mode. Babies might fall, but you want to encourage them to stand up again. That's our retest policy.

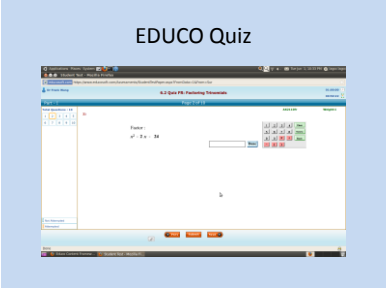
EDUCO Tutorial



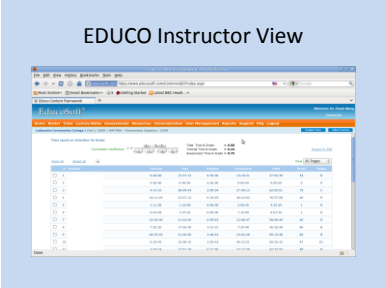
In the interest of time, I will only show you the screen capture of EDUCO. You can go to the vendor for a live demonstration. This is a tutorial. On the upper right corner, you can see that it's timed.



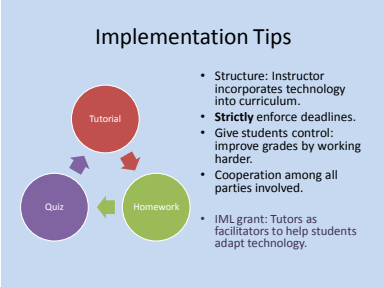
This is EDUCO homework. You know if you are correct or not right after you answer the question.



Finally, this is EDUCO quiz. You go through a set of questions before you know the result. As I said earlier, a student usually has 3 attempts for improving grade.



For the instructor, you can generate many types of reports, so that you can monitor students' progress closely. The most valuable information is perhaps the time that students spend on tutorial, homework and quiz. This is a real screen capture of my class last semester. It might be hard for you to see. On the top, it shows the correlation coefficient between time spent and grade. In my case, r equals 0.75. This is very impressive in educational research. But the inference of this statistic shouldn't surprise us at all. The more time students spend on practicing math, the better grades they might receive.



No one in this room doubts the idea of using technology in math education. (Otherwise you will not be here today.) But we all know that implementation of a good idea is the difficult part. Here I share some of our experience with you.

- First, we must provide a sound structure to guide students. When a student log into the system, he or she might not even know where to start. An instructor must make efforts to integrate technology into the curriculum. (We used to instructors who came to Luis the day before the final exam, and asked how to log in EDUCO. That is obviously not the best way to use technology.) Roughly speaking, I use class time to focus on conceptual knowledge, and ask students to use computer to enhance procedural knowledge. We give reasonable amount of homework, so that students do not feel overwhelmed. Typically, we have weekly assignments, and my second point is that we must strictly enforce deadlines.

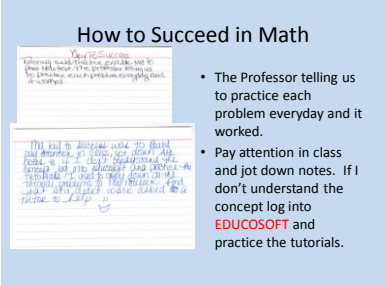
- Many community college students have external factors, such as work and family responsibilities, which can distract their learning. Although we are sympathetic to their situation, we found that extending deadlines often end up hurting them more. The rigidity is what most students need to be successful.

- The third point is to empower students. We want to reward students for their efforts. For online homework, they can retry a problem as many times as they want to, until they get the correct answer. Similarly, students have multiple attempts for a quiz to improve their grade. However, we also need to ensure that students actually understand math. As you know, some students are good at "playing the system" to get the correct answer. But eventually they have to take the COMPASS exam, and students must realize that high score will be useless if they don't actually acquire math knowledge to pass the COMPASS.

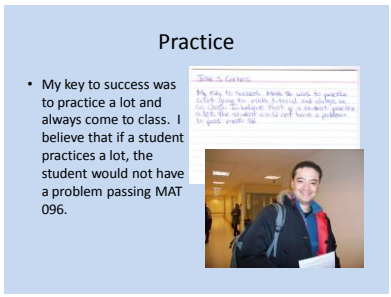
- Finally, students, faculty, and staff need to work together to achieve the common goal, that is student success. I can guarantee you that after you assign the first online homework, some students will come to you and say that computers don't work. In today's society, some people have the mentality that as long as they can find someone or something to blame, they are no longer responsible. We make students understand that ultimately they will face the consequence of their success or failure. They should get used to technology, so that they can benefit from it. My co-presenter Luis Gonzalez has been instrumental in helping faculty and students resolve technical difficulties. He is a true unsung hero in our college.

- It is understandable that some students are indeed intimidated by technology. We received the Improving Undergraduate Math Learning Grant. Our plan is to train tutors to guide students to use technology efficiently. Tutors' role is not to explain to make students FEEL that they understand---you all know that does not translate into learning. We want tutors to guide students to DO math using the software.

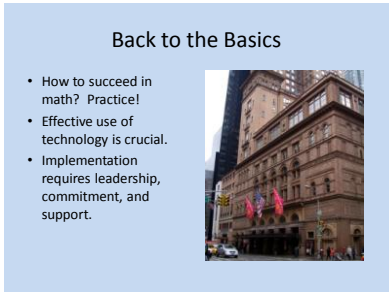
Here I share some students' reflection with you. I took pictures after my students passed the COMPASS exam. You can see how excited they were. Many students have never been challenged, and they've got easy A's without much effort. One student said that this is the hardest D- ever, but she will frame that printout of COMPASS score and remember the experience forever.



I asked them what are the elements contributing to their success, so that I can relay to future students. One student said "The professor told us to practice each problem everyday, and it worked!" (It had better work, otherwise many of us math professors may be sued for malpractice.) Another student said "Pay attention in class and jot down notes. If I don't understand the concept log into EDUCOSOFT and practice the tutorials." Over and over, I got the similar message.



This student said "My key to success was to practice a lot and always come to class. I believe that if a student practices a lot, the student would not have a problem passing MAT 096."



So how to succeed in math? It is similar to the way to get to Carnegie Hall: Practice. I am sorry that I didn't tell you what you don't already know. (One speaker had the same point earlier.) But as we learn from students' reflection, this simple message is also the most powerful message. To facilitate extensive practice, we believe that effective use of technology is crucial. For technology to work, constituents need to work together. We are lucky to have strong leaders, Dr. Kamal Hajallie, our math chair, and Prabha Betne, our basic skills coordinator. We have dedicated technical support, Luis Gonzalez, who is passionate about student success. And we have a responsive vendor, EDUCO. We are here and will be happy to discuss with you on implementation subtleties in further details. Thank you for your attention.