Developing and Delivering
Online Math and Science Teacher Education Programs
With Ten African Countries

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Good morning. I am very happy to be here. Thank you, Dick, for inviting the African Virtual University. The AVU and MIT have shared a very long and important collaboration. I'm very happy to be here today to share our experience in developing and delivering online math and science teacher education programs with ten African countries.

During this presentation I will briefly introduce the AVU, but I will also share with you the reason we are trying to increase access to education, especially higher education, in Africa using ICTs. The reason is that there is a strong link between economic development and higher education, and one of the problems we are facing in Africa is a lack of graduates from higher education institutions, especially in mathematics and science. I will talk in-depth about the collaborative approach to course development and delivery in ten countries.

The AVU, for your information, was a World Bank project. It was created twelve years ago as a World Bank project. Then in 2002, it was transferred in Kenya. Since then, the AVU has become an inter-governmental organization, meaning that its charter has been signed by different African governments. Our vision is to be the leading Pan African Open Distance and e-Learning Network. I have been at the head of AVU for the last three years, since August 2007.

I have found that the biggest asset of this organization is its capacity to work across boundaries, in 27 countries of sub-Saharan Africa. We work in Portuguese, in French and in English. AVU has established more than 50 partners in these 27 countries. This slide will give you an idea of where we are located in Africa, where we have learning centers and partner institutions. In green, at the top of the graphic, is North Africa. We are not yet there. We are trying to move into North Africa. You will see also that we are not in the southern part, in South Africa. We are not very active in that part of the world.

What the AVU has accomplished since its inception is the development of distance and e-learning programs, management of e-learning consortiums, and development of African-based educational content. That is what I would like to talk about today: setting up distance and e-learning centers, higher education resources, quality assurance policy formulation and the digital library.

As I said at the beginning, there is a strong link between higher education and economic development. A country, a continent, has to have a critical mass of university-educated people in order to sustain economic development. This study from 1995 proves this link.

If we look at the next slide, in terms of the number of university graduates around the world, on the extreme right you have high-income countries like the United States, Canada and Europe. As you move left, you can see Latin America, the Middle East, and Eastern Asia. When we reach sub-Saharan Africa, the numbers are extremely low. This is a concern. The first thing you might be thinking of when you think about Africa might be lack of resources and poverty. We are all trying to do something to develop this continent, but with such low numbers of university graduates, what can we do? I do not think that aid will be helpful if we cannot do things ourselves in Africa. That is why the Africa Virtual University is striving to increase access to higher education. We are doing that through the innovative use of information and communication technologies. The AVU is therefore trying to fill a gap in terms of capacity building and also in terms of developing programs. We are striving to be the leading pan-African e-learning network and also to increase access to higher quality education and training through the innovative use of ICTs.

I would now like to talk about what we call the Multinational Project. It is within this project that we have collaborated with some ten countries in sub-Saharan Africa to develop math, science and teacher education programs. This project is funded primarily by the African Development Bank. It has four components. The first component is the establishment of e-learning centers. This is important. One of the major hurdles to delivering e-learning in Africa is actually access to computers and to the Internet. AVU in the past has installed distance e-learning centers in various partner universities in different countries to allow AVU and its partners to deliver courses.

The second component of this project is the AVU Capacity Enhancement Program. This program builds the capacity of faculty members to be able to develop content and put it online, to deliver the content through an e-learning platform and also to manage e-learning projects.

The third component is an ICT-Integrated Teacher Education Program. This is the one I'm going to talk about in greater detail.

Finally, we have gender main-streaming in modern science. I have been very inspired by Dr. Wood who is sitting here. We did our doctorate together at the University of Ottawa. She was working on gender in math and science. We shared the same office, so I was very well aware that this was something we needed to do. It is not just an African problem, but in math and science, I think it is very important to mention gender -- especially in the African context.

The participating countries in this project are Kenya, Uganda, Tanzania, Ethiopia, Mozambique, Zambia, Zimbabwe, Madagascar and Senegal. I am happy to have seen one of our partners here today, Dr. Bakari, from the Open University of Tanzania, one of our partners in Africa You can see from the group that we have actually two Francophone countries - Senegal and Madagascar - and one Portuguese-speaking country - Mozambique.

As I said at the beginning, the main purpose of the distance and e-learning centers of the AVU Capacity Enhancement Program is to serve as a physical hub to complement teacher education in math and science. A center is actually the hub, the place where our partner institutions can set up servers, computers and every piece of equipment they will need to be able to provide these courses online. This is a picture of a computer center. It is in Nairobi, Kenya, at the University of Nairobi. As you can see, there are desks and computers, and there is a piece of equipment that is very important at the bottom right. This is a power generator. I don't know if you are familiar with the African context, but power is not always reliable. If you want to do online education - have your resources available online 24 hours a day, as Bob Hawkins said at the beginning - you must have some kind of power back up. It makes our courses and our programs very expensive because we have to invest more than you would in Canada, in the States or in other developed countries.

Regarding the Capacity Enhancement Program, in each of these 12 universities in ten countries, we have trained six faculty members in content development, in the delivery of e-learning programs and in the management of e-learning programs. Each of these six faculty members is training 30 more. This will help to build the capacity of the university and to have a critical mass. In total, we have 133 trained university staff from 24 institutions and 17 countries. This is one of the workshops we held in Senegal, in Dakar (See slide #19). It was a Francophone workshop, and the Minister of ICTs presided at the opening ceremony. This is another workshop we held in Nairobi for the Anglophone and Portuguese-speaking countries (see slide #19).

Now I would like to spend more time talking about the Teacher Education Program. It is an ICT-Integrated Teacher Education Program for Math and Science. The program itself is labeled “Teacher Education Program,” but what is it exactly? It is a program for developing content in mathematics and science— more specifically, mathematics, biology, chemistry and physics— and then teacher education foundation in professional courses. The purpose is to make these courses available in different formats - on online learning management systems, on CD-ROMs and also in print format. The objective of this program is to improve the quality of teaching and learning in schools through the use of ICTs, and to increase the number of math and science and ICT-based skills. Why math and science? Math and science are very critical to Africa because it is a continent that needs engineers, doctors, -- all these people that you really need to build the continent. It is very important that we have enough math and science teachers in schools to be able to train these young Africans who will be engineers, mathematicians and so on.

We had to develop and promote research in teacher education to inform future curriculum reform and to establish and strengthen relevant partnerships with other initiatives in Africa, in terms of teacher education. How did we do that? As you can imagine, we had 12 universities, in ten countries in Africa -- countries that had their own different education policies. Also, each university has its own policies. We had three different language groups. How did we bring them together so we all could develop a common curriculum? That was a challenge. I was not at AVU then. That was in 2005.

The first thing they did was to organize a policy and curriculum conceptualization workshop. The Ministers of Education were present. They also invited the university leadership, the faculty, the heads of the math and science departments and the heads of the teacher education department. Then they agreed on the policy framework in the ten countries and how they would like to work together.

Once we had done that, there was a curriculum design workshop. In the curriculum design workshop, AVU coordinated with the 12 universities in the ten countries to bring their curriculum in mathematics, chemistry, biology and physics. There was a curriculum mapping process. They determined what they had in common and what their differences were and agreed on the structure of the proposed course modules. We adopted a modular approach like the North American one, where a course - or a module - would be 120 hours, with 40 hours of instruction, worth three credits.

Once that was done, we started developing the content. Those who wrote the content came from the different universities. We had a team of about 200 people participating in this process. This was important because the African Development Bank that funded this project and the AVU, we wanted to make sure that this program actually is adopted as the university program to the senate. So it was very important that we engage with the staff members of each of these universities so they could participate in writing the content. We have now completed this process. We have developed 296 modules -- 73 in each of the language groups.

It was very important also to design and develop a quality assurance framework. Quality assurance is a key to quality higher education. But I have found that most of our partner institutions do not have this culture of having a systematic quality assurance framework.

Now we are enrolling the programs, meaning that we have what they call intakes. Cohorts have been taking the programs. We came up with program teams in each of the universities. In the program team, there is a program called Program Coordinator who is mainly— most of the time—the Dean of the Faculty of Education. We have course leaders in mathematics, in chemistry, in biology, and in physics. We also have a national coordinator based at the Ministry of Education. The program team helps us at AVU. At AVU we are a small number, about 20 people at the headquarters in Nairobi. This team will help us implement this program in each of the countries.

With this project, as with most projects, you are always thinking about what will happen when the funding is over. The universities came together and said, “We don't want this to go.” This has been a fantastic learning process, and we would like now to create what we call a teacher education virtual consortium. We will be carrying on these activities. This project is ending in a few months, in September, but we have plans to carry it on.

Before we unroll the program in the ten countries, we ran pilot studies in three countries. We conducted one study in Senegal because we wanted to see what the courses we have developed looked like there and what lessons we could learn by starting it at a small scale. We ran a pilot at the University of Nairobi in Kenya. One of the countries we are

involved with is Somalia. I don't know if you are familiar with Somalia. It is one of the most challenging countries I have been working with. It is a country that really needs education, because their education system collapsed about 20 years ago. Basically, they have universities and the vice chancellors of the universities want very much to do something. So we are working with them. We decided that we will have two universities in Somalia that will actually test this program.

We also have, at a governance level, what we call a Teacher Education Advisory Committee. The Teacher Education Advisory Committee is a kind of quality assurance mechanism body. We meet once every year. The leadership of the universities, AVU, and the Deans of the Faculty of Education participate in this.

As I said, we have 73 modules in math and science, in three languages. The total is 219. We have structured the content that has been developed into four Bachelor's degree programs— Bachelor of Education in Mathematics, Chemistry, Physics and Biology. The developers from participating universities engage in peer reviewing. It is part of the quality assurance mechanism. We pick up the peer reviewers from the participating universities. For instance, if Biology I was developed by someone from the University of Zimbabwe, then it will be reviewed by, let's say, someone from the University of Zambia. In this way, we actually work with— if we count the peer reviewers— some 300 African academics, all participating in developing and providing quality assurance for this material.

What are we doing now to deliver the program? AVU has— well, we used to have— a commercially licensed learning management system that cost a lot of money. Money is not really something we have, so we tried to change and go to Open Source. Nowadays we are using Moodle. Also, we try to enhance the capacity of what we want to do with Moodle. I don't know if you are familiar with Elluminate. We are also integrating Elluminate into Moodle so we can do more videoconferencing and some other things. That is the new learning management system that we are using. It is already online. We have installed mirror servers for Moodle in the ten countries, so each partner institution actually has the capacity to deliver the courses on their own. Also, the student can access the courses directly through the AVU learning management system. Developing all this was not an easy task. It required a lot of time to do this.

We are still uploading the content into Moodle. We have [challenges to translate the modules?]. This was very, very hard. We realized that if you develop, for instance, a course in mathematics, then to translate it into French you need a scholar who understands mathematics, French and English. We could not just send it to a translator because the content would not make sense. So it made this process very interesting and very hard. Portuguese was where we had a serious problem. Fortunately, we had some colleagues from Brazil and Mozambique who helped us to do this.

Most importantly, I think one of the greatest achievements of this project is that all the courses that have been developed are Open Education resources. They have the Creative Commons license, meaning that anyone in Africa can use it; anyone in the world can use

it. We are currently building an online repository at AVU to host these 219 modules. We will be working with these African academics who will be using the material. They can download it, but also what we wanted them to do is contribute to the repository. The latest figure I have received about the recruitment of students in our partner institutions is that about 3,000 students are currently going through this program, either at the Bachelor level or at the certificate level.

The biggest success came from University Cheikh Anta Diop in Senegal, Dakar. Senegal some 15 or 20 years ago decided to hire teachers that did not have pedagogical knowledge or skills. For instance, to go teach in high school in mathematics, you would just need to have a Bachelor of Mathematics. There is a current political situation in Senegal where these teachers are not recognized as full teachers, or they are not getting the salary of full teachers. There are about 6,000 or 7,000 like this, and with the unions around, it is a political problem. When we started the program, the faculty of education at Cheikh started with a small number to test providing the courses online, because most of the teachers are in-service teachers, meaning that they are spread in the country and they are teaching. It was a success, and now we have about 1,500 students online taking these courses in Senegal. In several countries, also we have over 1,500, and this is just the beginning. Actually, we started enrolling this course only four months ago.

We have what we call a Consortium Program. This is from our website. This Consortium Program is structured in a way that each university, in the 12 universities and the ten countries, is offering this program as its own. AVU is supporting this through the learning management system program. Also, students can access all the resources through our website. Through our website, you will also find the courses online in biology, chemistry, mathematics, physics, and so on.

The lesson learned out of this process: I just wanted to remind you that increasing the numbers of university graduates in Africa is not an easy task. It is not an easy thing to do, but I believe that it must be done. To do that we need to collaborate. Working across three languages is hard. Actually, working within one university with colleagues, academics, is not easy. We do that with 12 universities, in ten countries and with different languages. It is not easy, but I think it has to be done, and it is possible. The sociopolitical environment in Africa does not always help. I remember that in the beginning of 2008, in Kenya, there were political issues. We could not work, so we had to transfer our workshops to Senegal. It cost us a few more thousand dollars. But it is like that. In Madagascar these days— we have launched the program in Madagascar - but the political situation is such that it is not easy to do it right now. So when we implement these kinds of activities I find myself getting involved with social problems, political problems, violence, and war. It is part of the environment, and we should work to deal with that.

We have learned, also, that it is possible to achieve regional integration through projects. What has happened is we have about 200 scholars across Africa, across the language divide, and they are all communicating. We have an online forum where they communicate. It has helped with the mobility of teachers and students because of the fact that they are going through a similar curriculum.

What is the way forward? What we are trying to do now is to duplicate this and have more countries join this teacher education consortium. Also, we hope to expand the usage of the courses to math and science units because AVU has been - and the financial donor has been - targeting mainly teacher education. But after that, as I said, they are math and science courses, and then we can do that, we can involve more math and science faculty.

The OER@AVU online interactive repository, I think should be online in a couple of months. You can find this information on our website. If you go to our website, avu.org, everything I said here is described in a more detailed way. Thank you very much.