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## COVID-19 drives development of online laboratories



Wagdy Sawahel 16 July 2020

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African universities have recognised the potential of online laboratories in promoting science education. And while online experiments are especially relevant during COVID-19, there are significant challenges.

"The current situation has prompted African universities to switch their training to distance learning," Professor Abdelhalim Benachenhou, director of electromagnetism and guided optics in the faculty of exact and computer science at the University of Abdelhamid Ibn Badis Mostaganem in Algeria, told *University World News*.

"However, it is challenging to carry out practical laboratory experiments from a distance. Remote laboratories are complicated to set up and require equipment that is difficult to find in Africa," he said.

He pointed out that in a remote or conventional face-to-face laboratory, the student interacts with nature in real time. In a virtual laboratory, he or she interacts with a mathematical model which simulates the real world. Benachenhou is also the vice-chair of the **e-Engineering Alliance Special Interest Group**.

He said the objectives of data collection, observation and interpretation can be effectively achieved by virtual laboratories.

Dominik May, assistant professor at the Engineering Education Transformations Institute of the United States-based University of Georgia, told *University World News* that online laboratories can offer experiences under socially distanced learning settings.

"Educational research shows that online experiences can be as beneficial to students as those in hands-on laboratories," added May, who is the vice president of the **International Association of Online Engineering**.

He pointed out that online labs are still at a developmental stage in terms of technical maturity and educational research, not only in Africa but around the globe. "However, COVID-19 has precipitated a pressing demand for the development of online laboratories," he said.

Pablo Orduña, co-founder and CEO at **LabsLand**, told *University World News*: "Virtual laboratories allow students to gain practical knowledge in science, technology, engineering and mathematics (STEM) education without taking unnecessary risks. LabsLand has provided free access to thousands of students in the past four months and ... will continue to support universities and schools."

### Virtual laboratories in Africa lag behind

"Although there is zeal and motivation, not many universities in Africa have rolled out virtual laboratories," **John Agumba**, lecturer at Jaramogi Oginga Odinga University of Science and Technology in Kenya, told *University World News*.

Agumba established test e-labs at Pwani University in Kenya and is currently preparing an online science laboratory workstation for real-time experiments by engineering and science students at his own university. He pointed out that serving students from a central facility would circumvent time and space as well as avoid excessive expense.

Phumezo Kwinana, director of the **Forté School of Science and Technology (FOSST) Discovery Centre** and founder of the Remote and Virtual Education Laboratory (ReVEL) at the University of Fort Hare (UFH), South Africa, told *University World News*: "Virtual laboratories are being developed in African universities. ... Remote laboratories were introduced to UFH's physics department in October 2019."

ReVEL enables students and researchers to interact with peers from over 20 universities around the world on experiments in the STEM field. Learners from local rural schools are able to perform all their syllabus-based experiments online, according to the **ReVEL website**.

Kwinana explained that virtual and remote technology allows for less setup, easier to record data and better results analysis, as well as the feel of a real face-to-face interaction.

He went on to explain that UFH collaborates with **India-based Amrita University** to run their virtual laboratory. For the running of their remote laboratory, they collaborate with LabsLand.

The UFH received funding from the Albert Wessels Trust to convert South African high schools' physical science experiments into digital ones. They are working with LabsLand and Rexlab on the digital conversion of UFH's first-year science syllabus.

Kwinana said a virtual laboratory at the University of Stellenbosch is in the initial stages of development but that according to LabsLand and Amrita University, few other African institutions are running virtual laboratories.

### Real-time remote laboratories in Africa

The development of virtual laboratories might be lagging in Africa but there are several initiatives developing real-time remote laboratories, according to Pablo Orduña of LabsLand.

"These include the European Commission Horizon 2020-sponsored **GO-GA project** which delivers a learning tool called Go-Lab to schools. Go-Lab facilitates the use of online laboratories and enquiry-based learning applications for science education," said Orduña.

He added that African universities in Morocco, Tunisia and Algeria are implementing remote laboratories in collaboration with other universities in Jordan, France, Spain and Belgium as well as with LabsLand. This is driven by the **e-LIVES project**.

He said the Massachusetts Institute of Technology **iLabs project** has had a strong presence in some African countries, for example, Uganda and Nigeria's Obafemi Awolowo University.

Benachenhou highlighted the need for African universities to invest in virtual laboratories in this time of COVID-19. He said an existing IT infrastructure is all that is required for their development. However, he sees a lack of skills as a barrier and proposes that IT developers be called on for assistance. He suggests national or international networking and pooling of resources to make the production of virtual laboratories profitable.

"African universities are technically ready to use virtual, remote and hybrid laboratories for teaching science, engineering, technology, mathematics and art," Hamadou Saliah-Hassane, professor in smart networked educational devices for online laboratories at TÉLUQ University, Canada, told *University World News*. Saliah-Hassane is originally from Niger.

He delivered a **keynote lecture** at the 2018 International Conference on Computer Supported Education entitled "**Standardization of Online Laboratories for Education – Why and How?**", which called for including African experts abroad in the decision-making process.

### Digital laboratories – networking is key

Agumba from Kenya said: "There should be proper funding, skills training for staff, improvement of electrical provision and internet stability as well as inculcation of positive attitudes in students and lecturers."

May, from the University of Georgia, emphasised that collaboration among institutions could address some of the financial challenges. He pointed out that individual institutions could benefit from sharing online laboratories.

Kwinana took this further by suggesting that institutions could share their specialist expertise for the development of experiments to avoid duplication. He said: "African universities can promote the use of virtual laboratories in science education by working together to ... have a network of users. I think the key is to build on what works, drawing on companies like LabsLand, Rexlab, etc, and then work on developments and innovations."

"The UFH is our reference in this approach, as it is actively sharing results, knowledge and opportunities with teams in the US, Brazil, Costa Rica and Spain," Orduña said.

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