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**A SHORT NOTE ON THE IMPACTS OF THE CONNECTED LEARNING
FOR TEACHERS CAPACITY BUILDING IN STEM PROJECT (CL4STEM) IN
THE GLOBAL SOUTH**

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ABSTRACT

The CL4STEM project is a South-South collaboration among higher education institutions associated with teacher professional development to adapt and pilot the Connected Learning Initiative (CLIX) (<https://clix.tiss.edu>), which was already developed and scaled in India, to new contexts in Bhutan, Nigeria, and Tanzania. The CL4STEM project is funded by the Global Partnership for Education Knowledge and Innovation Exchange (GPE-KIX) in partnership with the International Development Research Centre (IDRC), Canada. The Ibrahim Badamasi Babangida University, Lapai, Nigeria, is the lead of the CL4STEM Consortium which comprises Samtse College of Education, Bhutan and Open University of Tanzania as the country partners. Tata Institute of Social Sciences, India, is the technical consultant to the project. The Nigerian collaborators are Bayero University Kano and Kaduna State University. Thirteen (13) online modules (three each for physics, chemistry, biology and mathematics and one common pedagogy module) were co-developed and were further localized for each country context. These modules were then curated and shared as open education resources (OER). In each partner country, twenty junior and middle secondary school teachers in physics, chemistry, biology and mathematics (a total of eighty teachers) were invited to participate in the project. The results obtained in the project countries with regards to teachers' instructional practices reveal a shift from the traditional classroom practices to innovative instructional and assessment practices embedded in the CL4STEM modules.

Keywords: OER, CoP, HOTIE, Module curation, Capacity building



INTRODUCTION

Education in the global South is still at the lower level of attainment with millions of children out of school. The poor level of education is partly due to low economic development and incoherent policies. Basic and secondary education normally lays the foundation to build sound education and knowledge dissemination and acquisition. In many of these schools, the teachers are poorly trained in curriculum development and instructional delivery. Worst hit are the STEM subjects' teachers and students. Many teachers teach STEM subjects (in this case: Biology, Chemistry, Physics and Mathematics) with low capacity and poor instructional materials. Furthermore, in many of these schools, the female students are less likely to take STEM subjects in their courses of choice. STEM seems to be a male-dominated environment (Olawuwo, 2015). Many of the students live in remote areas far away from the available schools making regular attendance in school more herculean. The world we live in is changing, and we must keep pace with it. STEM education changes society by offering learners a new mindset and skills valued in any profession (Maduabum, 1990). They allow young people to be flexible, look for patterns, find connections, and evaluate information (Hall, 1974). Besides, STEM education raises social awareness. It communicates global issues to the general public. Therefore, STEM opportunities move us to a knowledge-based economy and enhanced sustainability literacy. The aim of the CL4STEM project supported by the Global Partnership for Education and the International Development Research Centre, Canada, is to use innovative educational resources to enhance the capacities of secondary school teachers, make the teaching of STEM subjects more inclusive to embrace better delivery and accessible. This in turn enhances the knowledge and interest of the students, including the girl child, in STEM subjects and national technological development. Specifically, the project is piloting an innovation and researching its effectiveness and potential scaling for building capacity of teachers in secondary school in science and mathematics to foster higher-order teaching with inclusion and equity (HOTIE) (Obaje et al, 2013). It is a South-South collaboration among higher education institutions to adapt and pilot the Connected Learning Initiative (CLix) (<http://clix.tiss.edu>), which was developed and scaled in India, to new contexts in Bhutan, Nigeria and Tanzania. Data were collected in three phases, baseline, midline, and endline. The Ibrahim Badamasi Babangida University, Lapai, Nigeria, is the lead of the CL4STEM Consortium which comprises Samtse College of Education, Bhutan and Open University of Tanzania as the country partners. Tata Institute of Social Sciences, India, is the technical



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METHODS OF STUDY

In line with the CL4STEM project objectives, the period from 1st April 2021 to 31st March 2022, TISS transferred the knowhow on the CLIX approach to teacher educators in each of the partner countries. Subsequently, 13 online modules (three each for physics, chemistry, biology and mathematics and one common pedagogy module) were co-developed and were further localized for each country context. These modules were then curated and shared as open education resources (OER). In each partner country, twenty junior and middle secondary school teachers in physics, chemistry, biology and mathematics (a total of eighty teachers) were invited to participate in the project. The implementation phase, starting with knowledge transfer, through innovation diffusion, development and curation of subject online modules as OERs and application of Community of Practice for social networking was launched in April 2022 in each country with a launch event and a teacher orientation workshop.

The governance team met in October 2022 at Lapai, Nigeria to take stock of progress made and to plan ahead. This event also served as a platform for stakeholder engagement and publicity in Nigeria. The collaboration among partners over the last two years has vindicated our faith in the value of south-south collaborations to improve educational outcomes. During this time, there were multiple opportunities to travel to each partner country - a design workshop in Tanzania, a governance meeting in Nigeria, a research writing workshop in India. During each of these visits, there were opportunities to visit schools and meet education administrators in these countries. The knowledge transfer process was led by the faculty of TISS in Mumbai, India. Teacher educators of the three collaborating universities participated in virtual workshops and created 13 modules for teacher professional development based on the programme's theory of change (Moore & Benbasat, 1991). Communities of Practice (CoP) was an essential element of CL4STEM TPD model as they offer a social learning space for all the participating teachers, the principals of their schools, and the teacher educators to interact and discuss their experiences with the modules.

RESULTS

The results of the piloted CL4STEM project in project countries from the Global South with regards to teachers' instructional practices reveal a shift from the traditional classroom



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practices to the innovative instructional and assessment practices embedded in the CL4STEM modules. The findings clearly show that the teachers' knowledge, attitudes and perception towards engaging their students in classroom practices were enhanced. The prominent instructional practice employed by teachers was a collaboration or group work in which the students were engaged in exchange of ideas among themselves and between them and the teacher to address equity and inclusion. While the increase in teacher's use of formative and diagnostic assessment strategies promote higher order thinking in their students.

The collaborative classroom environment during the CL4STEM activities encouraged students to construct arguments, ask questions, justify their claims, criticize each other and make decisions; these generally enhanced their higher order thinking skills. The positive impact of the project with regards to instructional and assessment practices, among others; provide a very strong basis for further scaling of the project. On this note, the project team was invited by the Government of Oyo State in Southern Nigeria to scale the project to training of her teachers using the CL4STEM online modules. This is one of the remarkable scaling outcomes of the CL4STEM project. The findings indicate that teachers' understanding of CL4STEM innovation improved from baseline to endline. At the baseline some teachers were still learning how to effectively navigate CL4STEM modules and Telegram group (CoPs) while none was at the endline. There is an increase in the number of teachers exploring ways of improving CL4STEM teaching strategies through further refinement of the modules and CoP participation and/or alternative ways of achieving better results.

CONCLUSIONS

The aim of the CL4STEM project is to use innovative educational resources to enhance the capacities of secondary school teachers, make the teaching of STEM subjects more inclusive to embrace better delivery and accessible. It is expected that this in turn will enhance the knowledge and interest of secondary school students in STEM subjects and national technological development. Communities of Practice (CoP) was an essential element of CL4STEM TPD model. They offer a social learning space for all the participating teachers, the principals of their schools, and the teacher educators to interact and discuss their experiences with the modules. Results obtained clearly show that the teachers' knowledge, attitudes and perception towards engaging their students in classroom practices were enhanced. The prominent instructional practice employed by teachers was a collaboration



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Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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