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Could Plant Science Courses in Africa Better Respond to the Changing World?

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Ben Belden Mugula, Michael Paul Nampala & Tiiti Kämäri

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Kuuntele - Listen

Plant science has gradually become less attractive to students in Africa. Partly because of the unresponsive curricula not addressing global challenges such as food security, biodiversity management, climate change, and sustainability (Stagg & Dillon, 2022). The growing concerns over unemployment and disciplinary attractiveness, compounded by the current methods of teaching seem not to be sufficient for graduates to choose to study plant sciences in the first place. This situation requires a paradigm shift in teaching critical scientific disciplines at universities in Africa, and this article provides an exposition of the

current mode of teaching in plant sciences in Sub-Saharan Africa, its shortcomings, and the need for new methods in teaching plant sciences, with emphasis on strengthening the integration of Problem-Based Learning (PBL) and Entrepreneurship and innovation teaching methods in plant science courses.

To enhance the model shift in the teaching and learning approaches, the focus should be on the exciting and relevant aspects of how the discipline can transform society (Hubbard, 2024) in addition to theoretical concepts in plant sciences, such as the biochemistry of photosynthesis. An equal emphasis should be accorded to knowledge application and activities that promote problem-solving, creativity and the acquisition of an entrepreneurial mindset. However, achieving this learning goal is practically challenging, especially in an often knowledge-driven curriculum for plant science courses offered at universities in Africa.

Although a competence-based model for plant sciences education and their assessment methods has been presented (Hubbard, 2024), guidelines for the application of the methods in the teaching and learning process of plant science are not well documented, and yet future plant scientists should be adequately prepared to contribute meaningfully to solving major scientific and societal challenges of the future (Hubbard, 2024). Our aim in the AgrGROW project is to plan and implement teaching activities, modules, and curricula with student-centred activities like the PBL so that universities could better promote transformative and mind-set-changing teaching and learning.

What is PBL and entrepreneurship pedagogy?

Problem-based learning and entrepreneurship pedagogy in teaching and learning provide practices and techniques that foster creativity, risk-taking, innovation, problem-solving, increased self-confidence, and other entrepreneurial competencies among students (Movahedzadeh et al., 2012; Milla et al., 2019). The PBL approach uses the “real-life problems” or “challenges” for learners, to acquire, integrate and apply new knowledge. In this case, the problem is a training vehicle for students to obtain knowledge, skills, abilities, and the right attitudes (entrepreneurial mindset) for the world of work (Pérez-Urria et al., 2012).

In PBL, the teacher facilitates the learners to encounter a real-life problem, which in the optimum situation is commissioned by a regional stakeholder. After introducing the problem, the teacher mentors and motivates students by providing strategic questions. Students find additional information and understanding around the problem to evaluate possible ways to solve the problem and present their findings or solutions for feedback. The PBL cycle thus promotes professional skills and competencies that are hardly encountered through traditional teaching methods (Yew & Goh, 2016). Through the PBL cycle, the students could learn how to design and solve complex, real-life, and open-ended problems, such as mitigation to climate change, while acquiring skills to ideate, plan, be creative, and undertake deep learning as opposed to surface learning.

Entrepreneurship pedagogy, on the other hand, focuses on imparting professional competencies, knowledge, skills, and mindset (attitudes) required for entrepreneurial success. It lays more emphasis on the processes that lead to the realization of skills such as risk tolerance, creativity, resilience, and

adaptability (Moallem et al., 2019). Thus, teaching enhances the change of mindset among graduates oriented towards self-employment and being those who provide products and services in the sector.

Integrating Entrepreneurship pedagogy in biology-based curricula for courses such as plant science is aimed at helping students to realize value creation and creativity, collaboration, application and integration of academic disciplines, and enterprising behaviour (Duch et al., 2001; Fassbender et al., 2022). These attributes can be achieved through the acquisition of skills such as; risk-taking, innovation, adaptability, problem-solving, persistence, networking, customer-centeredness, and proactiveness. These skills are beneficial to students, universities, external actors in education, and society in circular economies (Mulonda et al., 2022) being one of the key issue of sustainability

How teaching is done today?

Currently, the traditional teaching method of science courses in most African HEIs largely follows a lecture format, sometimes characterized by structured practicals, assignments, and demonstrations (Gourlay, 2015; Getuno et al., 2022). The teachers usually define the topic(s) under study and explain the meaning, associated elements or characteristics. Classroom notes are provided by the teacher to supplement lectures. Talking is done by the teacher, while students pay attention. The teacher and students pose questions to elicit discussions and clarification of concepts. The students listen to the teacher and complete assignments, quizzes, and tests mainly individually – solely for numeric and summative assessment. As indicated in Figure 1 below, there is very limited opportunity for students to create and apply theory to real-life situations, collaborate, think critically, practice communication, solve problems, and acquire entrepreneurial competencies or receive constructive feedback about their learning process.

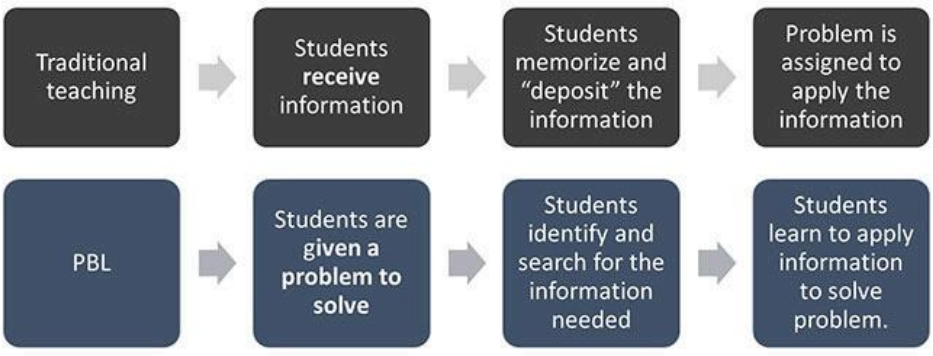

Fig. 1. Process of problem-based learning and how learners can develop and utilize their knowledge with this approach as opposed to the traditional teaching methods.

Most universities in Africa consider traditional teaching methods as cost-effective for large classes, requiring limited staff, resources, and time (Drysdale et al., 2020). However, these traditional methods do not recognize the students' pre-knowledge of a subject, and their interests or individual objectives and aims. This limits students' opportunities for critical thinking, skills acquisition, and reasoning. Through traditional teaching methods, the students' focus is passing examinations which makes them operate under pressure with limited application of theory to real-life problems (Drysdale et al., 2020).

What is still hindering the paradigm shift?

Bringing together the education, research and regional stakeholders could support the creation of PBL-based teaching and improve the regional agricultural sector, since multi-stakeholder involvement efforts have shown successful evidence in the paradigm shift and mindset alignment in Sub-Saharan countries (Schut et. al., 2015), especially among the farmer networks and institutional level (van Ewijk & Ros-Tonen, 2021).

The pedagogical methods described in this article allow students to experience self-directed learning, and develop their confidence while solving topical and relevant problems. As a result, the students become goal-oriented, and develop teamwork and leadership skills, and communication. These approaches will eventually also foster the establishment of university-industry-community collaborations solving societal challenges (Hamaimbo et al., 2022).

So yes, plant science courses in Africa could better respond to the changing world. However, the effective application of PBL approaches in plant science courses should be based on well-designed competence-based curricula and supported by organized teaching plans and adequate resources for teaching. Even when the program and curriculum are fully competence-based, there should be both support but also freedom and the possibility given to the teacher to plan and implement PBL and entrepreneurship-oriented activities in the classroom. In addition, the networking and stakeholder commitment of educational institutions should be strategically aligned with the curricula to create a genuine dialogue aiming to enhance collaboration.

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Authors

Ben Belden Mugula, PhD., Lecturer, Department of Agricultural and Environmental Sciences, Bugema University, Uganda.

Michael Paul Nampala, PhD., Associate Professor, Department of Agricultural and Environmental Sciences, Bugema University, Uganda.

Tiiti Kämäri, Senior Lecturer, School of Biotechnology and Natural Resources, Häme University of Applied Sciences.

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