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Transformation towards problem-based learning in East and Southern Africa: Perceptions from the field

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ABSTRACT
Student-centered learning methods, such as problem-based learning (PBL) are suggested as a method to provide future graduates with the 21st century skills needed in the rapidly changing world and working life. Transformation from traditional lecture-based teaching towards PBL requires role transformation from all the main university stakeholders: teachers, management staff and students, yet this change is not easy. To understand how to enhance and assist the transformation towards competence-based learning, we examined teachers' perceptions towards learning and teaching, with special focus on PBL. The data were collected through short anonymous surveys with open-ended questions, during problem-based learning program organized for East and Southern African university teachers. The results show that teachers clearly recognize the need for role and responsibility transformation when converting to PBL, and acknowledge that this transformation require wider mind-set and policy changes in the whole academic community. Teachers are able to pinpoint the practical elements needed for, and elements limiting, education paradigm shift towards PBL. To overcome the current challenges and to encourage adoption and implementation of PBL, teachers will require institutional support and capacity development, especially in terms of pedagogical trainings. Themes and concerns raised by teachers themselves should be prioritized and should be at the core of all projects and interventions promoting PBL.

Key words: Higher education, problem-based learning, Sub-Saharan Africa

RÉSUMÉ
Les méthodes d'apprentissage centrées sur l'étudiant, telles que l'apprentissage par résolution de problèmes (PBL), sont des méthode suggérées pour fournir aux futurs diplômés les compétences nécessaires liées au 21e siècle dans un monde et une vie professionnelle en évolution rapide. La transformation de l'enseignement magistral traditionnel vers le PBP nécessite l'implication de tous les principaux parties prenantes des universités: les enseignants, le comité de direction et les étudiants, néamoins ce changement n'est pas facile. Pour comprendre comment améliorer et accompagner la transformation vers un apprentissage basé sur les compétences, nous avons examiné les perceptions des enseignants à l'égard de l'apprentissage et de l'enseignement, en mettant l'accent sur le PBL. Les données étaient recueillies au moyen de courtes enquêtes anonymes en utilisant des questions ouvertes, au cours d'un programme d'apprentissage par résolution de problèmes organisé pour les enseignants universitaires d'Afrique orientale et australe. Les résultats montrent que les enseignants reconnaissent clairement la nécessité d'une transformation des rôles et des responsabilités lors de la conversion au PBL, et reconnaissent que cette transformation nécessite des changements de mentalités et de politiques plus larges dans l'ensemble de la communauté universitaire. Les enseignants sont en mesure d'identifier les éléments pratiques nécessaires et les éléments limitant le changement de paradigme de l'éducation vers le PBL. Pour surmonter les défis actuels et encourager l'adoption et la mise en œuvre de le PBL, les enseignants auront

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besoin d'un soutien institutionnel et d'un renforcement des capacités, notamment en termes de formations pédagogiques. Les thèmes et les préoccupations soulevés par les enseignants eux-mêmes devraient être prioritaires et devraient être au cœur de tous les projets et interventions promouvant le PBL.

Mots clés : Enseignement supérieur, apprentissage par résolution de problèmes, Afrique subsaharienne

INTRODUCTION

The world is facing multiple complex ecological and socio-economic challenges. To solve these challenges and adapt to inevitable changes require competent and innovative experts and workforce. Higher education and higher education institutions (HEIs) play a crucial role in producing these experts: the future problem-solvers and change agents. Indeed HEIs are expected to provide solutions to local and global challenges and prepare graduates to the world of work (Watson *et al*., 2011). While HEIs value in societal development is recognized globally (Watson *et al*., 2011; McCowan, 2018), it can be considered especially crucial withing the Global South, such as in Sub-Saharan Africa (SSA), confronting low income, economic productivity and industrialization, high unemployment rates, harsh environmental conditions and rapid changes in relation to environment and demography. Indeed, many national and inter-African strategies and vision statements emphasize the importance of higher education in enhancing and achieving socio-economically and ecologically sustainable development (e.g. Republic of Kenya, 2006; Republic of Zambia, 2006; The Republic of Uganda, 2012; The African Union Commission, 2016).

However, despite the improved quantity and access to higher education, the educational system in SSA has been unsuccessful in providing its graduates with 21st century skills and preparing them for self- and wage-employment (McCowan, 2018; Monga *et al*., 2019). Higher education in SSA is largely based on lecturing and rote learning (Muganga and Ssenkusu, 2019), that inhibit, or at least hamper, the development of hands-on and generic skills, such as problem-solving, planning and comprehending complexity (McCowan, 2018). Many higher education graduates in SSA face unemployment, as they lack knowledge application skills and other competencies demanded by employers and for self-employment (McCowan, 2018; Monga *et al*., 2019). The African Development Bank (Monga *et al*., 2019) calls for paradigm shift in higher education to equip students with skills enhancing employment opportunities.

Problem-based learning (PBL) and collaboration with external partners are recommended methods for reforming curricula to be more relevant for world of work and keeping up with the rapidly changing demands of business life (Watson *et al*., 2011; Easterly *et al*., 2017). As such, PBL is based on constructivist learning theory that presumes people to construct knowledge, i.e., learn through experiences (Bada, 2015). Thus, it emphasizes practical, authentic and hands-on learning (Jumaat *et al*., 2017). In practice, PBL is an example of student-centered learning methods that put student needs in the core of the learning (Weimer, 2002). In PBL students learn by solving real-life problems, often faced by external partners, within teams. The core idea is for students to integrate theory with practice by acquiring and evaluating information, and ultimately applying knowledge and skills to solve the problem (Major and Palmer, 2001; Ding *et al*., 2014).

Problem-based learning changes the roles of the educational actors compared to traditional lecture-based learning, as students transform from passive information recipients to active knowledge constructors, and teachers transform from information providers to facilitators of learning (Biggs and Tang, 2011). In practice, PBL has been associated with, among others, improved learning outcomes on generic skills, such as

critical thinking, communication and teamwork skills (e.g. Major and Palmer, 2001; Tan *et al*., 2014; Abbey *et al*., 2017). Students have also reported PBL to increase motivation, leading to increased class attendance and reduced course drop-outs (Major and Palmer, 2001; Abbey *et al*., 2017).

In this article we discuss the roles and requisites of the main actors within PBL: the teachers, students and management staff. We focus especially on the transformation of the roles and responsibilities when transitioning from conventional lecture-based teaching to problem-based learning. The article utilizes data collected within AgriSCALE (www.agriscale.net/) and PBL-BioAfrica (www.pbl-bioafrica.net/) projects, coordinated by Häme University of Applied Sciences. The projects have eight partnering universities in sub-Saharan Africa, with focus on improving higher education in the African continent. The project, and thus this article, focuses only on higher education in agriculture, following the African Union (2017) strategy to prioritize agricultural sector in providing employment for the increasing number and share of youths in the African continent.

The roles and role transformation of main actors in problem-based learning. Teachers as facilitators of problem-based learning. In traditional lecture-based teaching, also known as teacher-centered approach, the teacher has the control and authority of the classroom (Weimer, 2002). The teacher's role is only to provide information to students (Major and Palmer, 2001). In PBL teachers transform from information providers to facilitators of learning. Facilitators do not give direct answers nor resources, but instead they guide and monitor students, helping students to learn and teach themselves (Major and Palmer, 2001; Weimer, 2002). Facilitating requires a task shift from lecturing to designing of various student activities and assignments (Weimer, 2002). In PBL, the teacher's main role is to motivate students and create a setting and learning framework conducive to learning. Being a PBL facilitator requires set of skills and resources, such as time, patience, emotional intelligence and tolerance of messiness or chaos (Weimer, 2002; Abbey *et al*., 2017).

Students as active core of problem-based learning. Compared to lecture-based learning, where students are passive recipients of information and dependent on the teacher, in PBL, as in other student-centered approaches, students are active participants of the learning process (Major and Palmer, 2001; Weimer, 2002). Accordingly, PBL switches the control and responsibility of learning from teachers to students. Students learn by doing; by discovering and constructing information themselves (Weimer, 2002). In order for students to take the responsibility and ownership of learning, they need to develop and possess skills such as independence, autonomy, maturity and self-regulation (Weimer, 2002). These skills develop during the PBL-process.

Management as enablers of problem-based learning. By being responsible of the curricula design and resource provision, HEI's management play a crucial role in enabling adoption and implementation of new teaching methods, such as PBL. As such, HEI managements' or faculty's role in PBL is to provide teachers the flexibility and opportunity to implement the method, and create and maintain an environment enabling student activity and autonomy (Weimer, 2002). Management staff should encourage cooperation between peers, both students and teachers, and enable and organize activities and events that guide students and teachers to learn and work with new approaches (Weimer, 2002). Management creates the framework for PBL, and this requires flexibility from the management staff and HEI policies, as there is no one standard method to implement nor evaluate PBL process and outcomes.

MATERIALS AND METHODS

As part of AgriSCALE project activities, an online-based teacher training-program on PBL was organized to teachers of the AgriSCALE and PBL-BioAfrica projects' partner universities between April and November 2021. More information on the training programme can be

found in the article by Määttänen *et al*. (2022). A total of 78 teachers from seven universities from Kenya, Uganda and Zambia participated to the program at least to some extent. However, not all teachers were present in all of the online sessions. During online training sessions within Zoom software, short voluntary and anonymous surveys with open-end questions were administered to the participants, using Mentimeter-software. This article utilizes data collected from five of these surveys. Number of survey responses varied from 12 to 51 responses (see Figure captions for details). The data were analyzed by using thematic coding with inductive approach. A quantitative aspect was added to the data analysis by calculating the number of mentions received by each theme.

RESULTS AND DISCUSSION

University teachers' perceptions on problem-based learning

Enjoyable learning. When teachers were asked to recall enjoyable learning experiences in their previous learning history, and state factors making them enjoyable, most mentioned practical, hands-on, experiences that enabled utilizing theory (Fig. 1). " -- industry visits and practicals (labs, field trips) etc. I saw things practically and the theory became reality!"; "Field/Industrial visits. I could experience first hand what we learnt from books"; "hands on and relevant to an issue at hand". Teachers also enjoyed interactive and collaborative learning, i.e., working with others and sharing experiences and viewpoints. The following quotation synthesizes well the responses "The discussions and collaboration with colleagues. The gaining of different experiences all over the world". Other themes emerging from the responses were: learning of new things: "learning something new that I really was interested in --"; learner-centered methods: tailored to each students' objectives, and delightful: lively and pleasant learning atmosphere with incorporation of humor and drama to teaching. Few respondents also mentioned self-reflection: i.e., gaining self-awareness and understanding of oneself, as most enjoyable experience.

What teachers find most enjoyable and appreciate in learning does not correspond to the dominant teacher-centered and lecture-based approach of most of SSA universities. In fact, the responses include many core elements of PBL: student-centered approach, practicality, real-life relevancy, working in teams and self-reflection of one's skills and their development. Teachers thus seem to appreciate the principles of PBL, even though the approach itself, and the theory behind it, is rather weakly known among them (Laitinen *et al*., 2023). This indicates motivation and potential among teachers to transform to alternative teaching approaches, such as PBL, with adequate capacity building. It is likely that teachers themselves want to be or become the enablers of enjoyable learning experiences. Teachers of the same universities have indeed showed great interest towards PBL in general (Laitinen *et al*., 2023), and on applying it in their teaching – after receiving initial training of the practice within the AgriSCALE and PBL-BioAfrica projects (Määttänen *et al*., 2022).

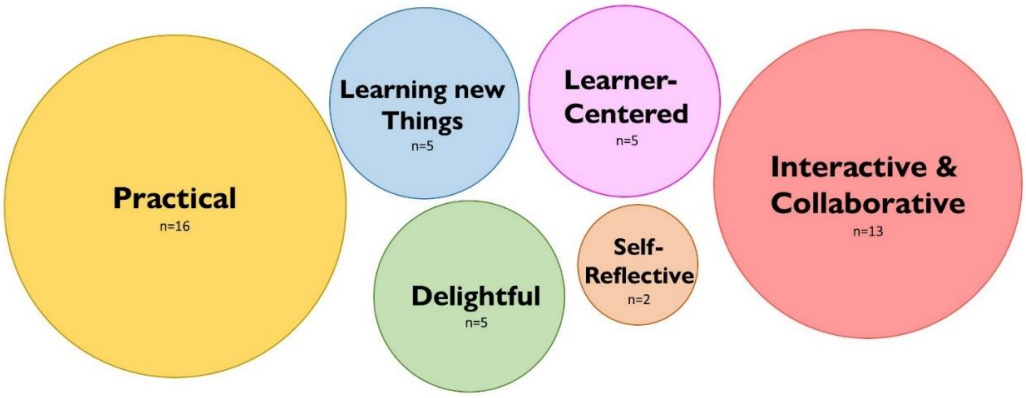

Figure 1. Themes emerging from responses to the question: What is your most enjoyable learning experience? What made it enjoyable? Total number of responses = 44. The size of each bubble represents the number of mentions, i.e., the bigger the bubble, the more mentions within that theme. Note that withing one response there may have arose multiple themes.

Constraints of PBL. Teachers clearly perceive lack of resources and student-related challenges as the main concerns of PBL and its adoption (Fig. 2A). Of the resources, teachers are especially concerned of time, finance, infrastructure, and low teacher/student ratio. Most of the African HEIs indeed struggle with limited resources and bad networks (McCowan, 2018) that constrain the teaching and learning in general. Moreover, PBL has been associated with higher monetary and time costs compared to lecture-based learning (Abbey *et al*., 2017). In research of the Kenyan higher education, McCowan (2018) noticed that teachers do not have enough time to develop their teaching practices. Weimer (2002) blamed "race to cover content" leading to teacher-led teaching and subsequently role learning. Indeed, when the teachers were asked about the support needed to adopt PBL, most of them stated the need for additional resources: more and better infrastructure, more time and either smaller class sizes or more teachers (Fig. 2B).

Teachers recognize that in PBL, they cannot totally control students and their learning, but the success depends also on students, as student-related challenges received many mentions. As stated by Weimer (2002), it is up to students to decide whether and what they want to learn, teachers can only influence students in their decisions, but not control nor force them. Teachers were concerned of "lack of collaboration" among students or "free-riders", student resistance towards new approach and lack of student activity; "lazy students". One respondent was also concerned whether students themselves have enough time, if all teaching is problem-based. Many previous studies have noticed initial student resistance when transforming from conventional learning to PBL (e.g. Weimer, 2002; Abbey *et al*., 2017; McCowan, 2018). However, the same studies found the resistance to decrease with more experience with PBL, as students become more used to and comfortable with the practice.

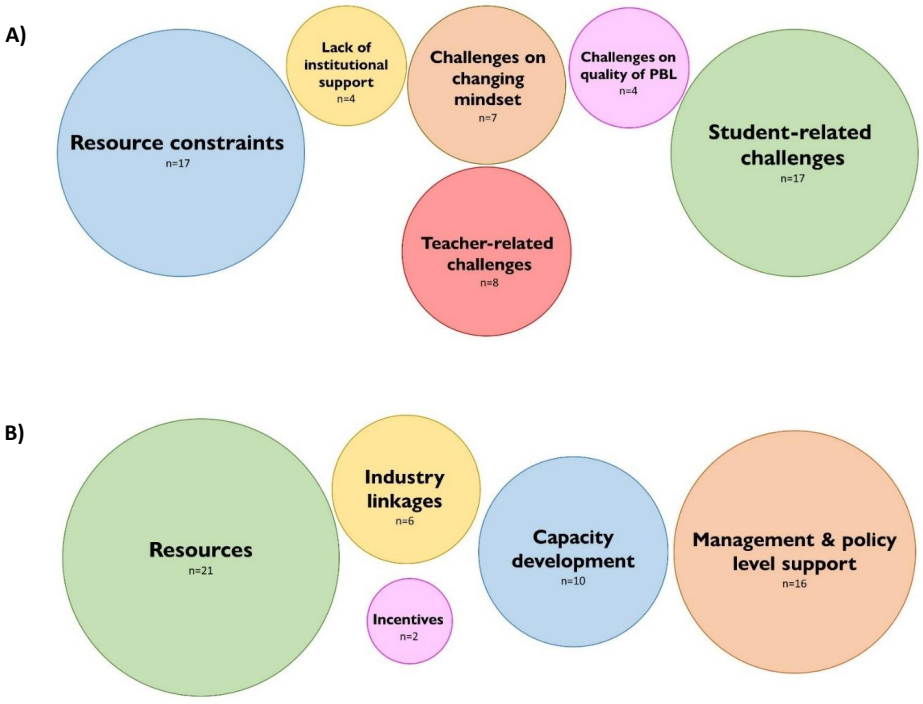

Figure 2. A) Themes emerging from responses to the question: What is your most concern of PBL? What risk do you see in PBL? Total number of responses = 49. B) Themes emerging from responses to the question: What kind of support would you like to have when becoming a PBL tutor? Total number of responses = 51. The size of each bubble represents the number of mentions, i.e., the bigger the bubble, the more mentions within that theme. Note that withing one response there may have arose multiple themes.

Teachers noticed constrains also among themselves. Problem-based learning was perceived to require lots from a teacher, and teachers were feeling incompetent, "not being able to control the class" with "facilitator inadequacies". Evaluation of students in PBL was found challenging. It is thus no wonder that teachers perceived a need for capacity development, especially in the means of training, to become tutors of PBL. The emerging concern of the quality of PBL and the learning outcomes may also partly relate to the perceived incompetency of teachers. As one responded put it: "Poorly designed PBL lessons may lead to ambiguous learning outcomes". Respondents, however, feared that PBL may detach students from theory "-- This can make some learners lose interest in theory and prefer to go practical instead. The risk is to produce half baked students who are not well grounded in theory". Studies on learning outcomes of theoretical knowledge of PBL versus lecture-based learning have mixed results, with some studies showing lecture-based teaching learning to better theoretical knowledge compared to PBL, while other studies showed no significant differences on the theoretical learning outcomes between the approaches (Major and Palmer, 2001). To utilize the benefits of both practices, combination of PBL and lecture-based learning can be adopted (Abbey *et al*., 2017). This may be especially useful for both teachers and students that are first-timers in PBL.

Respondents do not only perceive lack of knowledge and practical skills of teachers and students to constrain PBL, but the challenge of changing one's mindset is perceived to be constraining. Teachers are concerned on "whether majority of lecturers can buy the PBL approach" and "how to help change the mindset of the learners".

Finally, lack of institutional support, e.g. "Inadequate facilitation by institution" and "Limited adoption of the approach by faculty" is perceived as a concern or a risk of PBL. Teachers call for support from the faculty and institutional level, but also from wider societal scale, from communities and government. Institutional support and policy changes are needed to transform the evaluation methods, namely "removing exam focus", and to allow teachers more "free thinking" and "flexibility". These findings are in line with results from a Kenyan study that concluded that faculty resistance and wider structural elements in higher education hinder the transformation of educational practices (McCowan, 2018). Additionally, teachers report a need for incentives and motivation to change, "financial or other --", as well as linkages to industries to be able to present real-life problems to students.

Role of students and teacher requirements. Teachers capture and recognize well the role transformation needed among students and teachers in PBL as compared to traditional teacher centered methods (Fig. 3). When asked how PBL changes the role of students, half of the teachers mentioned PBL transforming students from passive recipients to "active participants" and "doers". Teachers also recognized the responsibility of students within PBL, describing students to become "in charge" and "responsible" of their learning as well as "independent learner(s)". The need for students to become "team player(s)" was mentioned multiple times, as well as students thinking and problem-solving skills usage and development: "Student -- to become a problem solver and solution seeker", "Transforms student into a systems thinker", "-- Students become co-thinkers in class -- free thinking is encouraged--".

Teachers' requirements for PBL were only asked from participants of one partner university. Three themes emerged from these responses. Teachers recognized the need to find suitable problems to present to students, as well as external partners to collaborate with: "I need to be aware of the problems existing on the ground. This would be made possible by working closely with industry/ farmers/consumers etc.". Almost as many times was mentioned the requirement of enhancing one's own skills and practices: "Enhance my practicals and demonstrations", "I would have to revise my practical periods to enhance the quality of practicals being done". Finally, teachers also mentioned PBL to require them to enhance and encourage student activity, "to provide room for more student participation".

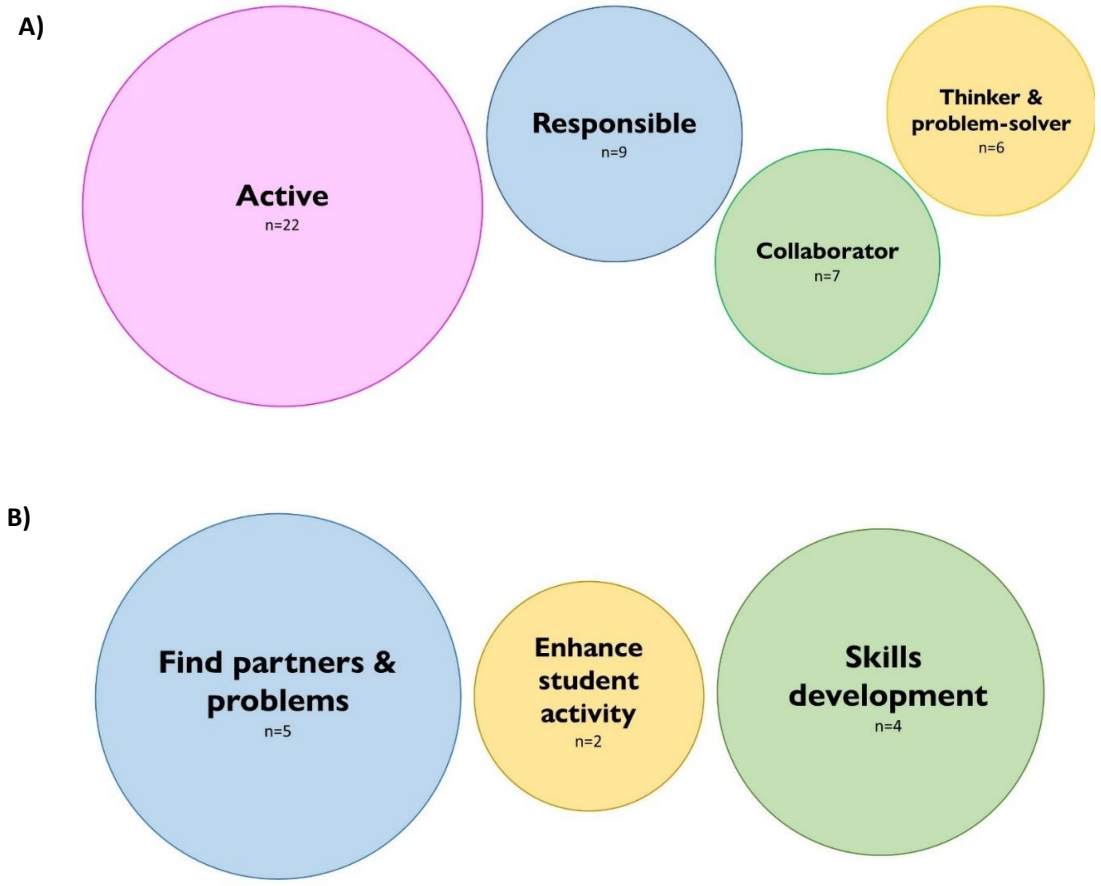

Figure 3. A. Themes emerging from responses to the question: How does PBL change the role of a student? Total number of responses = 41. B. Themes emerging from responses to the question: What would PBL require from me as a teacher? Note, that only teachers from one participant university have responded to this question. Total number of responses = 12. The size of each bubble represents the number of mentions, i.e. the bigger the bubble, the more mentions within that theme. Note that withing one response there may have arose multiple themes.

Teachers seem to understand the importance of the role transformation of students and themselves when switching to and successfully implementing PBL. Firstly, teachers recognize many practical elements that are required from students and teachers in PBL. Secondly, as came up with the response to question regarding potential risks/constraints of PBL (Fig. 2.A), teachers acknowledge that the failure to fulfill or to transform to these roles poses challenges to PBL, i.e., lack of collaboration or activity and resistance towards responsibility among students, as well as teacher incompetency. Indeed, PBL requires a complex set of competencies from teachers to be able to implement the process and guide students through it. In addition to emotional skills, successful PBL implementation requires teachers to understand the principles of PBL and its enhancing an impeding factors (Abbey *et al*., 2017). Teachers recognized their need for capacity building, especially in terms of training, when transforming to PBL tutor (Fig. 2B). The responses of teachers to all the survey questions suggest that training should focus on the a) basic principles of PBL and its implementation to provide teachers feeling of competency, b) how to enhance student activity and responsibility in learning, c) how to find external partners and

come up with real-life problems, d) how to hold practicals and demonstrations, and e) how to evaluate students in PBL.

CONCLUSION

Teachers of Kenyan, Zambian and Ugandan universities acknowledge that switching to PBL requires transformation on the roles of themselves, students and the management staff. They understand that transformation is not easy, but it requires change in mindsets, change in practices and policies, development of competencies and skills and physical and time related resources. Teachers recognize the practical elements needed to enhance the transformation and can point out the limiting factors of the adoption of and their concerns towards PBL. However, to overcome the constraints of and enable PBL adoption and implementation, teachers require support in the means of capacity development, especially training, and institutional support, in the means of policies and adequate resources. In teachers' capacity building, themes and concerns raised by teachers themselves, such as principles of PBL to enhance general competency and PBL's practical elements, including evaluation, should be prioritized. No single stakeholder can alone convert to PBL, but effort from all three stakeholders: teachers, management staff and students is needed. Thus, in projects and initiatives aiming to promote PBL, all these stakeholders should be included in the activities.

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STATEMENT OF NO-CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

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