A Case Study on Teacher Educators' Technology Professional Development based on Student Teachers' Perspectives in Malawi

FOSTER GONDWE (iD)

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ABSTRACT

Student teachers' perspectives on how their teacher educators act as exemplars of using technology appropriately (or fail to do so) could create a basis for teacher educators' technology professional development (TPD). However, there is a dearth of research on student teachers' input into teacher educators' TPD, as research is dependent on self-reports of teacher educators' own competencies. This study explored teacher educators' TPD based on perspectives of student teachers. The study involved policy analysis, a survey, and interviews with student teachers in a university-based teacher education programme in Malawi. Findings indicate that student teachers have a stake in what it means to be a professional teacher educator in Malawi. The case study has also shown the contribution of student teachers' perspectives in strengthening teacher educators' TPD. The contribution includes clarifying the image of a technologically competent teacher educator and student teachers' co-learning with teacher educators. The paper discusses scholarly and practical implications of these findings. For instance, it is suggested that teacher educators should make the co-learning process more explicit to the student teachers.

CORRESPONDING AUTHOR:
Foster Gondwe

Hiroshima University, JP;
University of Malawi, MW

fostergondwe@gmail.com

INTRODUCTION

Teacher educators still face challenges to model effective technology integration into their work, partly because they lack the necessary technology competencies (Foulger et al. 2017). As such, teacher education systems in many countries have paid attention to faculty development in using technology with the goal of preparing teacher candidates in their future use of technology. While previous research provides insights into what constitutes effective professional development models and what the teacher educators learn from them, little is known about how the professional development models support the development of technology competencies relating to specific professional roles such as being a second-order teacher (Uerz, Volman & Kral 2018). In view of this, the need to equip teacher educators with technology competencies continues to be a central area of interest in teacher education research.

Recently, researchers have focused on proposing specific teacher educator technology competencies that can guide technology professional development (TPD) for teacher educators. Definitions of teacher educators' technology competencies vary from "being able to use certain technologies, to feeling comfortable in using technology, to being proficient in a wide variety of technologies, to swiftly adopting emerging technologies and being knowledgeable about (the impact of) technology in general" (Uerz, Volman & Kral 2018: 18). In this article technology competence is defined as the ability to use technology in one's professional role as a teacher educator.

In addition to validating technology competencies with teacher educators from North America, Europe, and the Asia/Pacific Regions (Knezek, Christensen & Furuta 2019), recent research has also shown increasing understanding of activities that might effectively build these competencies (Parrish & Sadera 2019). However, one limitation of research on TPD for teacher educators is the absence of students' voices (Archambault et al. 2010; Uerz, Volman & Kral 2018). Although there are incidences of student teachers serving as technology mentors (Pierson and Cozart 2004), teacher educators' technology learning with and from student teachers seems to be under researched. This is odd because, as Loughran (2014) clarifies, when professionally developing as a teacher educator,

> "the development of one's knowledge, skills, and abilities will be better informed through examining the complex world of learning to teach—most notably from the perspective of the learner" (64).

This paper reflects the above stance by positioning student teachers as important contributors to teacher educators' TPD. Effective TPD activities for teacher educators are characterized by teacher educators' collaborative learning (hereinafter, co-learning) with others such as colleagues, school teachers, or student teachers (Parrish & Sadera 2019; Uerz, Volman & Kral 2018; Lidolf & Pasco 2020). Thus, understanding the student teachers' perspectives as a basis for teacher educators' professional development should be of interest to researchers. Student teachers' perceptions of how their teacher educators exemplify technology use offer the potential to understand teacher educators' technology competencies in their role as teachers of teachers, which is currently lacking in the literature (Uerz, Volman & Kral 2018; Pierson & Cozart 2004).

The paper is part of a doctoral study aimed at understanding why, how, and what teacher educators learn about technology in Malawi. The purpose of the current case study is to explore teacher educators' TPD based on student teachers' perspectives. Although teacher educators are a heterogenous group and broadly defined as all those who actively facilitate the learning of student teachers and teachers (European Commission 2013), in this paper 'teacher educators' refers to faculty members who were working in the teacher education programme offered by the faculty of education at the university under study.

The next section outlines a theoretical framework for understanding teacher educators' professional development from the perspectives of student teachers. This is followed by a description of the study context, research methodology and findings. The last section is a discussion of the findings and their implications for practice and further research.

A COMBINED THEORETICAL FRAMEWORK

This study is based on the concept of co-learning, which starts from and gives centre stage to teacher educators' professional learning through interaction with student teachers. To articulate teacher educators' TPD based on student teachers' perspectives, the theoretical framework of the study combines insights from Social Learning Theory, the role of policy context in shaping teacher educators' professionalism, and the concept of Personal Practical Knowledge (PPK), as illustrated in *Figure 1*.
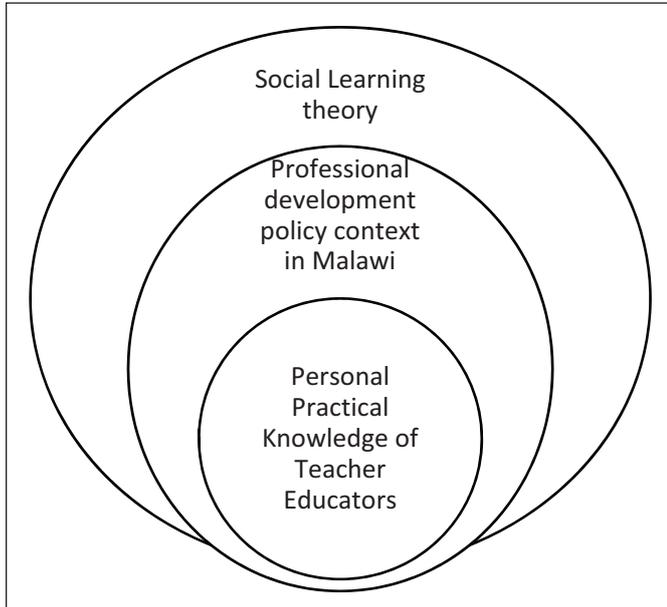

Figure 1 The combined theoretical framework of the study.

Below is a brief explanation of each of the three theoretical aspects illustrated in *Figure 1*.

SOCIAL LEARNING THEORY

The study draws upon insights from Social Learning Theory to justify the use of students' perceptions as a basis for understanding teacher educators' TPD. Social Learning Theory posits that learning results from experience of observing others' behaviour and the consequences of those actions (Bandura 1977). This paper specifically utilizes Bandura's view that not all learning gained by interacting with others can be observed. Observation has been used in evaluating the effectiveness of professional development programmes, but as Veldman and Peck (1963) noted, direct observations are limited in terms of sample. On the one hand, while appreciating that students may not have the relevant training to judge their teachers' competence, Veldman and Peck (1963) argue that students' perspectives can be insightful:

> "students see the teacher perform on many different occasions, as she encounters a wide variety of problems, as she attempts quite varied tasks, and as she deals with individuals known personally to the observer. Not only does each pupil have the advantage of many separate observations upon which to base his judgement, the use of pupils as observers also affords the increased reliability and reduction of bias that multiple judges afford." (347).

The theory is helpful for understanding teacher educators' professional development. Pamuk and Thompson (2009) conceptualized benefits for mentors from a mentoring relationship, stressing that in such relationships some learning gains are not immediately observed. Alternatively, understanding students' perceptions might be another way of observing teacher educators' technology practices. For example, students' feedback concerning faculty teaching effectiveness is recognized as a teacher educators' professional development opportunity (Smith 2003; Kosnik et al. 2015). Some studies have also demonstrated that when faculty members are given the "opportunity to live an authentic and direct experience from a learner perspective", they "personally experience as learners both the affordances and limitations of new technologies" (Lidolf & Pasco 2020: 4). The only disadvantage is that "When the results of student feedback are used as the only source of information on which crucial decisions are

based, there is a danger that teacher educators try to become popular with their students, which can lead to lenient requirements and less serious academic work" (Smith 2003: 207).

THE ROLE OF POLICY IN SHAPING TEACHER EDUCATORS' PROFESSIONALISM

Teacher education policy contexts shape how teacher educators' view their roles and the knowledge required to perform those roles (Vanassche & Kelchtermans 2014; Murray, 2014). Policies set the expectation of what it means to be a professional teacher educator, and teacher education programmes and institutions in turn use these expectations to guide their practice such as recruitment and designing professional development activities. In this way, teacher educators' professionalism is influenced by the complex interrelationships among individual biography, institutional setting, and national imperatives for teacher education (Murray 2014). Thus, it can be argued that professionalism can be best understood in the policy context. Therefore, this paper explored the policy context for teacher educators' professional development in Malawi, especially in terms of how policy positions the contribution of student teachers to the professional development of teacher educators. This was necessary for a discussion of students' perspectives that is sensitive to context. More importantly, results of policy analysis are useful for raising teacher educators' awareness of policy, which is one of the core technology competencies for teacher educators (Foulger et al. 2017).

PERSONAL PRACTICAL KNOWLEDGE OF TEACHER EDUCATORS

The study also engaged student teachers through the lens of Personal Practical Knowledge (PPK). The core of PPK as an epistemological stance is that "knowledge grows out of experience and that teachers construct knowledge through their interactions with students, teacher colleagues, parents and others within and beyond their classroom and school contexts" (Connelly & Clandinin as cited in Ross & Chan 2016: 4). Ross and Chan (2016) represent PPK from multiple perspectives, such as PPK of students, PPK of teacher educators and PPK of teachers. However, the authors note that studies on PPK have tended to overlook students' voices despite the possible usefulness of knowledge gained about students' experience (PPK of students) for teachers' PPK (Ross & Chan 2016). This paper connects PPK of teacher educators to PPK of student teachers. Teacher educators' co-learning with student teachers can be understood through the PPK of student teachers on the assumption that "perception of student teachers regarding teaching competencies bears the influence of teaching styles and methods adopted by their teachers" (Bhargava & Pathy 2011: 79). Within student teachers' perceptions certainly lie the core of what it means to integrate technology well and, by reflecting on such perceptions, teacher educators can begin reimagining their technology competencies.

This paper focuses on student teachers' perspectives of teacher educators' technology competencies and their (student teachers) technology experiences in a teacher education programme. Such experiences of technology are particularly useful for understanding how "the congruence between student teachers' and teacher educators' positioning supports or impedes student teachers' learning" (Vanassche & Kelchtermans 2014: 126). One of the roles of teacher educators is *teacher of teachers*, and their modelling through this role improves student teachers' technology knowledge (Tondeur et al. 2012). This study posits that student teachers' perspectives can contribute to the design and development of professional development activities.

RESEARCH PURPOSE AND QUESTIONS

Overall, the three theoretical aspects are interrelated by positioning teacher educators as learners of educational technology within a particular learning context (Lidolf & Pasco, 2020). While policy represents the context within which teacher educators learn about technology, Social Learning Theory and Personal Practical Knowledge represent what Lidolf and Pasco (2020:3) called "the socio-cultural interactions-based approach" to investigating TPD. According to Lidolf and Pasco (2020, this approach is rooted in the idea of learning that occurs by interacting or collaborating with others, including student teachers. Based on these theoretical insights,

in this study it was assumed that student teachers and teacher educators are contributors to each other's learning of technology. Also, the student teachers' perspectives were conceived of as manifesting important insights for teacher educators' TPD. Thus, the aim of the study was to explore teacher educators' TPD based on student teachers' perspectives.

The research questions were: (1) How does teacher education policy position student teachers as contributors to the professional development of teacher educators in Malawi? (2) Building on the results of question one, How do student teachers contribute to the professional development of teacher educators in Malawi? (3) Based on insights from question two, how do student teachers' technology experiences influence how they rate teacher educators' technology competencies?

CONTEXT OF THE STUDY

Despite realizing increased access to education, Malawi still faces a massive task to deliver quality education to all citizens. Some of the persistent challenges include high repetition, low transition from primary to secondary school, and inadequate teaching and learning materials. In primary education, for example, repetition rates for both boys and girls have been perpetually high, exceeding the target of 10% by 2018 (Ministry of Education, Science and Technology, MoEST 2018b). School-related factors such as ineffective teaching and insufficient numbers of qualified teachers contribute to high dropout and repetition rates. The Malawi government has been addressing some of these challenges by supporting technology projects such as interactive radio instruction and the use of iPads. To illustrate, a technology programme involving the use of tablets was introduced in 50 primary schools in 2007 (Hollow & Masperi 2009). Teachers who participated in the programme reported benefits such as reduced learner absences and dropout rates, and an increase in student motivation to learn. Pitchford (2015) also piloted the use of iPads with mathematics apps in early grades at one primary school using a pupil-level Randomized Control Trial. Children using the iPads showed significantly higher levels of maths attainment than control children who had received normal classroom practice (Pitchford 2015). Meanwhile, the Ministry of Education has endorsed scaling up of these technology interventions as they promise improved learning outcomes throughout Malawi.

However, the potential, success and institutionalization of educational technology in the education system in Malawi is very much dependent on engaging with challenges such as the need for teacher training (Hollow & Masperi 2009; Hubber et al. 2016). This is because teachers have often reported being underprepared for the use of technology (e.g. Kazima & Winter 2013). Although teacher educators are critical to the preparation of teachers and student teachers in the use of technology, available research consistently shows that lack of training is one of the major factors that hinder teacher educators' use of technology in Malawi (Kadzera 2006; Kazima &Winter 2013). This underscores the importance of TPD opportunities for teacher educators. The present study offers insights that might be useful for designing TPD for teacher educators in Malawi and similar contexts.

METHODOLOGY
RESEARCH SETTING AND PARTICIPANTS

Case studies can be selected if they are deemed to have characteristics that can provide insights about the phenomenon under study (Bryman 2012). The case reported in this paper was purposively selected because it is from the oldest university in the country. Faculty development is expected and promoted at the institution but, as with most university-based teacher education programmes in which teacher educators work with faculty from other programmes, professional development tends to be general and not specific to teacher educators (Parrish & Sadera 2019). The university's policy on teaching and learning quality assurance suggests that students evaluate faculty teaching effectiveness to generate insights that might guide further staff development initiatives (personal contact, quality assurance). The four-year degree programme offered at the university prepares future teachers in the use of technology via a separate technology course called Instructional Media and Technology.

Study participants were all final year student teachers at the institution. The researcher assumed that this group of students had reached an exit point in their programme and

could provide useful insights by thinking back to their experiences in the teacher education programme. At the time of data collection from September to December 2019, the participants were on teaching practice.

DATA COLLECTION

This case study utilized multiple data collection methods, including a questionnaire, document analysis and interviews. The study employed a transformative sequential design, where qualitative data is prioritized over quantitative data while keeping lived experiences at the centre of the inquiry (Hanson et al. 2005). The initial data collection involved analysis of the National Standards for Teacher Education (NSTE) and the Continuing Professional Development (CPD) Framework for teachers and teacher educators (MoEST 2018a; 2016) which helped to clarify questions and parameters that needed further inquiry through interviews and questionnaire (Bowen 2009). It also confirmed the significance of studying teacher educators' professional development through students' perspectives.

A researcher designed questionnaire was administered to understand the student teachers' technology experiences. The questionnaire had four parts but only three parts had items related to the research questions addressed in this article. The first part focused on demographic information. The other parts sought to identify how the participants learnt about technology, their perception of teacher educators' technology competencies, the technology competencies they needed, and their perception of coherence in the teacher education programme. The questionnaire items were generated from the literature on strategies of integrating technology into teacher training programmes (Tondeur et al. 2012) and technology competencies (Foulger et al. 2017; Uerz, Volman, & Kral 2018).

The questionnaire was a Google Form administered via WhatsApp to student teachers (N136) who were in the class WhatsApp group. The whole class had 182 students, representing 72.5% reach. Answers to the questionnaire were expected within three weeks. In the first week, students complained about challenges in responding to the questionnaire using a Google link due to the cost of internet connections. Following a recommendation by the students themselves, the researcher converted the Google Form into a Microsoft Word format that could be answered offline and returned via WhatsApp. The researcher also offered to support each respondent with an internet bundle of 100mbs. Thirty-three student teachers responded to the questionnaire, representing a 24.3 % response rate. The distribution by gender was 42.4% (Females) and 57.6 % (Males), while that of subject specialization was as follows: Languages (57.6%); Maths and Sciences, including Geography, Biology, Physics etc. (39.4%); and Social Studies, including History, Religious studies etc. (3%).

Results from the questionnaire were recast to subsequent semi-structured interviews with seven student teachers (Hanson et al. 2005). Three students (one female and two males) were interviewed in a group, while four male students were interviewed individually. The sampling was purposeful, as the students were selected based on their availability and agreement to share more experiences through interviews after responding to the questionnaire. Before participating in the interview, student teachers were asked to read and confirm a consent form. Interview questions included students' perception of technology competencies, what they learnt from the educators concerning technology use, and their perception of teacher education strategies. The interviews used the WhatsApp messaging service. This synchronous online interview had the advantage of allowing real-time interactions, reflection through typing delays before answering, and real time creation of transcripts (Sharpe & Benfield 2017). Moreover, unlike the Google forms, using WhatsApp was convenient for student teachers as it allowed multiple forms of responses to be shared, including audios and texts.

DATA ANALYSIS

Questionnaire data was analysed using descriptive statistics such as frequencies and percentages through charts, tables, and graphs. To show all the useful information, the paper reports the Google forms' automatically generated responses in tables. Policy document analysis involved coding of data that combined deductive and inductive approaches (Bowen 2009). A similar approach was utilized to analyse the interview transcripts. Then, to understand the implications of student teachers' perspectives on teacher educators' professional development, results from

all analyses were integrated. To better understand the integration, findings have been reported using research questions as headings.

FINDINGS

POLICY VIEW OF TEACHER EDUCATORS' PROFESSIONAL DEVELOPMENT BASED ON STUDENT TEACHERS

This section presents results of the first research question: how does teacher education policy position student teachers as contributors to the professional development of teacher educators in Malawi? Generally, the findings support the assumptions of Social Learning Theory and Personal Practical Knowledge, especially as they position teacher educators as learners who can learn from student teachers (Lidolf & Pasco 2020). It is also observed that feedback on teaching is an important professional development for teacher educators (Smith 2003; Kosnik et al. 2015).

Student teachers' co-learning with teacher educators

The policies suggest teaching strategies that teacher educators can use, and the student teachers' contribution to the teacher educators' professional development is especially clear in the strategy of co-learning. For example, teacher educators are expected to develop learning communities in which they (teacher educators) "do not need to pretend that they know everything. Instead, they share with students the view that everyone is a learner and that they too are learners" (MoEST 2016). In collaborative learning activities "…staff and students discuss what is meant by 'learning' and in particular 'effective learning', with the aim of developing a shared understanding" (37). Likewise, "teacher educators should learn by talking with the significant others… and classroom observation" (MoEST 2018a: 19). Results also indicate commonality in some professional competencies between teacher educators and student teachers, which underpins the significance of co-learning between teacher educators and student teachers. It is suggested that "staff provide positive models to students through conduct, attitudes and behaviour, and commitment to the teaching profession" (40). Examples of common core competencies expected from student teachers and teacher educators include the ability to "demonstrate understanding and application of education policies and practices", "demonstrate mastery of content area and approved curriculum", and "effectively utilize student assessment techniques and procedures" (MoEST 2018a: 16).

Student teachers' feedback as basis for teacher educators' professional development

The student teachers' contribution is also evident when evaluating teacher educators' professional development activities. Among others, evaluation involves "analysis of achievement data; structured interviews with teachers, students and parents" (MoEST 2018a: 20) to show "high quality and appropriate continuing professional development, which impacts upon classroom practice to ensure improved student learning and achievement" (9). Student teachers' feedback is also useful for teacher educators to show "progress reports on improvement plans indicating how they have applied their learning from CPD and made practical improvements to their teaching" (38). Similarly, the NSTE recommends that evaluation of teacher educators' CPDs should involve "…interviews with students about the range of courses, subjects, themes, and topics which they experience, how effectively these are delivered and what they have learnt" (23). Overall, the policies suggest that student teachers' feedback ought to be the basis for evaluating and mounting new professional development activities for teacher educators.

STUDENT TEACHERS' TECHNOLOGY EXPERIENCES IN THE TEACHER EDUCATION PROGRAMME

The above-highlighted policy context helps in understanding the student teachers' technology experiences. Student teachers' personal practical knowledge seen through their perceptions can provide insights into teacher educators' co-learning with student teachers as suggested in the policies analysed in the previous section (Bhargava & Pathy 2011; Ross & Chan 2016). The student teachers' experiences were explored through questionnaire and interviews.

Student teachers' co-learning with teacher educators

The first part of the questionnaire sought to appreciate how student teachers learn about technology in their programme, including the instructional technology course, content courses, and methods. *Table 1* summarizes the items and frequency of responses to the question: in what way have you learnt about technology?

ITEM	FREQ	%
I haven't	0	0
By developing teaching and learning materials	21	63.6
By observing my lecturers	14	42.4
By discussing with fellow students	15	45.5
By working in primary/secondary school	6	18.2
By reading about it	14	42.4
By attending academic conferences, short courses, seminars	2	6.1
Other	0	0

Table 1 Student teachers' ways of learning about technology.

Table 1 shows that student teachers had (or were aware of) multiple learning opportunities. The data suggests that students co-learn with fellow student teachers, but it was not clear whether they co-learned with their teacher educators as proposed in the policies analysed in this study. From the interview data, it appears co-learning with teacher educators was inexplicit to the student teachers. For example, when asked about incidences where teacher educators demonstrated an interest in learning from and with student teachers, ST2 remarked that, "I don't remember in time when lecturers wanted to learn from us". Likewise, the student teachers who participated in a group interview (G1) could not recall such instances. Inexplicit co-learning was evident even in cases where the interview data suggested some incidences of teacher educators' learning from and with student teachers:

> "Perhaps a bit of interest can be traced towards one of our assignment in instructional media where we were asked to come up with new technological media which can be used for teaching and learning and afterwards, we were supposed to make a presentation to the lecturer so on that I can say there was an interest to learn from us" (ST4).

However, the data showed insights into co-learning in other subject areas. ST1 commented that, "I don't remember in time when lecturers wanted to learn from us…in the course instructional media…maybe I am mistaken but in other courses yes, there were cases where lecturers wanted to learn from us". Additionally, according to ST2 who had majored in English literature, when analysing a literary piece such as a poem, the lecturers and student teachers would have different opinions. ST2 asserted that by seeking the opinions of student teachers, the lecturer was learning from student teachers.

The inexplicit co-learning reported by student teachers gives insights into the teacher educators' role of teacher of teacher. Swennen, Jones and Volman (2010) maintain that the role of teacher of teacher is operationalized in the concept of modelling, where teacher educators model teaching and their values about teaching. Especially, explicit modelling entails "the ability to articulate the purposes underpinning the practice for oneself and others" (Loughran & Berry 2005: 193). Based on the above findings, it can be said that the student teachers did not experience explicit modelling of technology use by their teacher educators.

Student teachers' perception of technology integration strategies

Student teachers were asked to agree or disagree with an extent to which there was coherence between various components of the teacher education programme. This was necessary because programme coherence influences student teachers' learning and how teacher educators incorporate technology in ways that exemplify its use (Canrinus, Klette, & Hammerness 2017). *Table 2* presents responses to the questionnaire items on coherence.

ITEM	STRONGLY AGREE		AGREE		DISAGREE		STRONGLY DISAGREE	
	FREQ	%	FREQ	%	FREQ	%	FREQ	%
All my courses have been articulating a clear vision of instructional technology integration (N: 32)	0	0	16	50	15	46.9	1	3.1
All lecturers have been articulating a clear vision of instructional technology in education (N: 31)	1	3.2	17	54.8	12	38.7	1	.2
I have been hearing similar views about instructional technology integration across all courses (N: 31)	2	6.5	13	41.9	15	48.4	1	3.2
I have had practical/hands-on experience and try out the theories, strategies, and techniques about technology (N: 32)	10	31.3	16	50	4	12.5	2	6.3
My lecturers are knowledgeable about instructional technology integration as a whole (N: 32)	2	6.3	18	56.3	11	34.4	1	3.1
I have been observing my lecturers using the same theories, strategies, and techniques they promote about instructional technology (N: 32)	2	6.3	17	53.1	10	31.3	3	9.4

Table 2 Student teachers' perspectives of coherence in teacher education programme. *Note:* Items adapted from Canrinus, Klette, & Hammerness (2017).

From **Table 2**, more than 50% of respondents to all but one of the items agreed with the statements. This finding suggests that student teachers experienced a unified approach to introducing technology in the programme, including strategies such as clear vision of technology integration, modelling by teacher educators and hands-on experience (Tondeur et al. 2012). The significance of these and other strategies were confirmed during interviews when student teachers were asked about strategies that would best prepare future teachers in technology use.

The student teachers cited hands-on experience, practice-oriented teaching, and implementing technology across the programme and faculty development as effective strategies. ST1 remarked that "here I will use the phrase seeing is believing…if student teachers see or touch, it will sink in them…the best way is to make sure that all the resources are available". Likewise, ST3 supported the need for authentic technology experiences: "There should be much practice in courses like instructional technology than simply learning the theoretical part of it". Furthermore, faculty development as a strategy was noted during a group interview in which student teachers commented that, "lecturers should be trained so that they can teach others…it appears only one lecturer understands technology, but I think all lecturers should know this". The group interview also suggested the significance of teaching technology in all courses: "That technology course should not only just come once in 4 years…what we learn in instructional technology should appear in all courses in education…like we have language teaching methods…for example English…there are many technologies that we can use to teach a language…but when we are learning how to teach language, they don't use instructional technology…" (G1).

The above-highlighted teacher education strategies offered the potential to understand technology competencies from the student teachers' viewpoint. This connection was implied in the student teachers' description of an image of a competent teacher educator. The following section presents results of student teachers' perspectives of teacher educators' technology competencies.

STUDENT TEACHERS' PERCEPTIONS OF TECHNOLOGY COMPETENCIES
Student teachers' image of a 'technologically competent' teacher educator

Through interviews the student teachers described the image of a technology competent teacher educator. For example, ST4 commented, "the first competence is that a lecturer should have a good knowledge of media itself…and then he should also use it and help learners to acquire knowledge in using that technology". For ST1, a competent teacher educator is one who "clarifies what technologies are out there and how we can incorporate…should explain those technologies to students, and ask them to try to make such technologies, so that when they go out they should be competent". ST3 added that a competent teacher educator is "one who doesn't stick to the use of chalkboard and hardcopy books entirely… It is a lecturer who uses available technological equipment to the advantage of students." Notably, these competencies

as perceived by student teachers seem to cut across all the four domains reported in the literature (Uerz, Volman & Kral 2018), except the socio-ecological dimensions such as policy and ethical consideration. Results of the questionnaire survey also corroborated this finding.

Teacher educators' technology competencies from the viewpoint of student teachers

Through the questionnaire, student teachers identified technology competencies they saw in their lecturers, as presented in *Table 3* below.

ITEM	FREQ	%
They design instruction that utilizes content-specific technologies to enhance teaching and learning.	19	57.6
They align content with methods and appropriate technology.	18	54.5
They use online tools to enhance teaching and learning.	18	54.5
They use technology to differentiate instruction to meet diverse learning needs.	11	33.3
They use appropriate technology tools for assessment.	15	45.5
They use technology to connect globally with a variety of regions and cultures.	3	9.1
They address the legal, ethical, and socially responsible use of technology in education.	3	9.1
They engage in ongoing professional development and networking activities to improve the integration of technology in teaching.	5	15.2
Other: Lecturers' level of competence is high…	1	NA

Table 3 Teacher educators' technology competencies based on students' perspectives.
Note: Extracted from teacher educator technology competencies by Foulger et al. 2017.

The students also reflected on the technology competencies they needed most. As already noted, the policies analysed in this study showed commonality between teacher educators and student teachers' core competencies. *Table 4* shows responses to the questionnaire item: Which of the following instructional technology competencies do you need most?

ITEM	FREQ	%
Designing instruction that utilizes content-specific technologies to enhance teaching and learning.	22	66.7
Aligning content with methods and appropriate technology.	19	57.6
Using online tools to enhance teaching and learning.	17	51.5
Using technology to differentiate instruction to meet diverse learning needs.	18	54.5
Using appropriate technology tools for assessment.	15	45.5
Using technology to connect globally with a variety of regions and cultures.	5	15.2
Addressing the legal, ethical, and socially responsible use of technology in education.	11	33.3
Engaging in ongoing professional development and networking activities to improve the integration of technology in teaching.	11	33.3
Other: coming up with models that involve learners in teaching.	1	NA

Table 4 Student teachers' most needed technology competencies.
Note: Items extracted from Foulger et al. 2017.

Comparing *Table 3* with *Table 4*, a significant pattern emerges that student teachers needed competencies that they had reported to be observable in their lecturers. The researcher did not run a statistical test to explain these differences as the responses were analysed qualitatively. Although this contradiction deserves further research attention, the student teachers' reports on teacher educators' actual technology use shed light on technology competencies. For example, ST1 recalled that "research methods course employed some instances of technology…this is where technology was an instrument to collect data and manipulate it", while ST3 reported incidences, "use of flip charts (don't know if that's technology as well) … use of those modern radios with flash ports in literature classes". For ST3, they "were having WhatsApp, google classroom where course materials and assignments were given…those are examples I can give in the use of instructional technology".

DISCUSSION

The findings support assumptions of the combined theoretical framework employed in this study. As already discussed, the three theoretical aspects are interrelated by positioning

teacher educators as learners of educational technology within a particular learning context, and that the learning in question occurs by interacting or collaborating with others (Lidolf & Pasco 2020). This section discusses two points that can illustrate the role of student teachers' perspectives as a basis for teacher educators' TPD.

TEACHER EDUCATORS' CO-LEARNING WITH STUDENT TEACHERS

Social Learning Theory and Personal Practical Knowledge help us understand that teacher educators' knowledge of using technology can grow out of experience and that teacher educators construct knowledge through their interactions with student teachers (Ross & Chan 2016). The results of policy analysis show that student teachers are important contributors to teacher educators' TPD in Malawi. Specifically, student teachers contribute to the teacher educators' professional development through recommended teacher education strategies such as co-learning, and at the point of evaluating teacher educators' professional development activities. For example, the policies propose co-learning by expecting teacher educators to develop learning communities in which both teacher educators and student teachers are learners. These findings support current thinking in the field of teacher education where there is a growing interest in understanding TPD activities that can support teacher educators to make routine use of technology (Tondeur et al. 2012). Parrish and Sadera (2019) reviewed professional development models that can support teacher educators in acquiring technology competencies. The authors reported that mentoring, communities of practice, and mutually beneficial partnerships are the most promising TPD activities. What is noteworthy is that these models are characterized by collaboration between teacher educators and significant others, including student teachers.

TEACHER EDUCATORS' TECHNOLOGY COMPETENCIES BASED ON STUDENTS' PERSPECTIVES

According to Uerz, Volman & Kral (2018), the literature on technology competencies for teacher educators is "dependent on self-reports of teacher educators' own competencies, and is therefore at risk of representing a distorted view of the reality with teacher educators over- or underestimating their own competencies" (21). Alternatively, the authors suggest triangulating with student teachers for example. In accordance with the view that not all learning gained by interacting with others can be observed (Bandura 1977), the students' perceptions provide insights into the teacher educators' TPD at the institution under study. Findings indicate that the student teachers experienced inexplicit co-learning with their teacher educators. These findings can be considered as feedback on teacher educators' ability to use technology, and therefore they suggest the extent to which teacher educators act as role models for technology use at the institution under study. In this way, Social Learning Theory has the potential to help understand teacher educators' competencies in relation to their role of teacher of teacher, which is manifested through the concept of modelling (Swennen, Jones & Volman 2010). Since research into the teacher educators' role of teacher of teacher is lacking (Uerz, Volman & Kral 2018), future studies can also attempt to utilize Social Learning Theory for an in-depth understanding of teacher educators' TPD in their role as second-order teachers.

Related to the above, the student teachers needed competencies that they had reported to be observable in their lecturers. The student teachers also suggested an image of a technologically competent teacher educator, as well as strategies that teacher educators could use to enhance student teachers' learning about technology use. They viewed a technologically competent teacher educator as one with knowledge of available technologies and how to use them; the ability to practise what they (teacher educators) expect student teachers to know and do; and the ability to help student teachers understand and use technology appropriately. This description reflects technology competencies reported in the literature, especially 1) the ability to use technology in general (not specifically related to teaching and learning), and 2) competencies in using technology for teaching and learning (Uerz, Volman & Kral 2018: 17). Through the lens of Social Learning Theory, the student teachers' description suggests current technology competencies (especially modelling) of teacher educators at the institution under study. This contributes to our understanding of technology competencies of teacher educators and their relationship with the competencies of student teachers that is lacking in the literature (Uerz, Volman & Kral 2018). More importantly, the similarity between the Malawian student

teachers' description of technology competencies and the technology competencies in the literature is also essential for a better understanding of how technology competencies might be relevant and useful in other contexts, especially Africa. This is because current efforts to develop and validate teacher educators' technology competencies have been confined to expert knowledge through Delphi studies (Foulger et al. 2017) and specific regions (Knezek, Christensen & Furuta 2019; Lidolf & Pasco, 2020). The present study departs from this expert-oriented approach and engages student teachers' voices as important contributors to the development of technology competencies.

CONCLUSIONS AND IMPLICATIONS

While teacher educators' professional development in technology is often explored from the teacher educator perspective, knowledge gained about student teachers' technology experience in a teacher education programme provides the potential to better understand the professional development of teacher educators. This case study based on policy analysis, interviews and a questionnaire survey has demonstrated how teacher educators' TPD might be articulated from student teachers' perspectives. The policy highlights show that student teachers have a stake in what it means to be a professional teacher educator in Malawi. The case study has also shown the contribution of student teachers' perspectives in strengthening teacher educators' TPD. The contribution includes clarifying the image of a technologically competent teacher educator and student teachers' co-learning with teacher educators as a TPD activity. These conclusions are scaffolded by the assumptions of Social Learning Theory and Personal Practical Knowledge, which position teacher educators as learners of educational technology within a particular learning context, and propose that the learning in question occurs by interacting or collaborating with others.

The importance of embedding TPD within a context of pedagogy of teacher education is emphasized in the literature (Parrish & Sadera 2019; Uerz, Volman & Kral 2018). This study has discussed teacher educators' TPD within the broader policy that frames the pedagogy of teacher education in Malawi. With limited research on policies targeting teacher educators, the study demonstrates how policy studies would be helpful to generate insights for strengthening teacher educators' technology professionalism. Moreover, the students' perceptions contribute to research on the pedagogy of teacher education because, although understanding learning about teaching is an essential component of teacher educators' professionalism, the process of learning to teach tends to be inexplicit (Loughran 2014). Focusing on students' perception is an attempt to make the field of learning to teach with technology more explicit. The study is also insightful for designers of teacher educators' TPD. It could inform content and approaches of work-based teacher educators' professional development activities that incorporate students' views. In practice, the findings indicate that teacher educators should make co-learning and modelling of technology use more explicit to student teachers. Teacher educators can show that they value student teachers' input into their (teacher educators') technology learning by performing their role in a way that acknowledges that they are also learners.

However, there were some limitations to this study. Although the student teachers had a background of a module on instructional technology, they were not provided with any systematic background about the teacher educators' professional development and competencies in technology. This could have led to a lack of clear understanding of what was being asked with each survey item on the part of some student teachers. Further research may investigate the student teachers' perspectives as a basis for teacher educators' TPD over time. More importantly this study prioritised qualitative data, which means that the findings cannot be generalized. Future research can replicate the mixed method model that involves larger samples and in multiple institutional contexts.

COMPETING INTERESTS

The author has no competing interests to declare.

AUTHOR AFFILIATIONS

Foster Gondwe ⓘD *orcid.org/0000-0001-5716-3538*
Hiroshima University, JP;
University of Malawi, MW

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