

The interplay between learning and the use of ICT in Rwandan student teachers' everyday practice

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Abstract

The paper describes a study conducted in Rwanda involving 12 participants selected from a larger cohort of 24 final-year university students who were part of a group based training programme. The programme was about how to search, retrieve and use web-based literature. Empirical data were collected through interviews and focus group discussions. The purpose was to explore ways of using Information and Communication Technology (ICT) in student teachers' everyday learning practice. The study draws from a sociocultural perspective and emphasis is put on a literature review involving ICT in teacher education. The findings reveal that utilisation of ICT pertains to three major types of variation among student teachers: passive, reluctant and active ICT users. The active ICT users demonstrated a capacity to cross group boundaries and play a central role as agents of change in learning practice. The point is that more experienced student teachers can assist their colleagues in the zone of proximal development (zpd) and, therefore, enhance the integration of the new technology in teacher education. This implies that having access to ICT together with some instruction is not sufficient to prompt students to start using this technology as a pedagogical tool. Moreover, confrontation of different experiences regarding the use of ICT can spearhead change in student teachers' learning practice through critical reflection.

Keywords: agent of change, information and communication technology, motivation, Rwanda, teacher education, zone of proximal development

Introduction

The implementation of ICT in Rwanda as a development policy is expected to be realized in the course of four five-year rolling National Information and Communication Infrastructure (NICI) Plans extended over the 20-year span of Rwanda's *Vision 2020*, which started in 2001. According to the Government of Rwanda (GoR), this vision aims to develop the country into a middle-income society by 2020 (GoR, 2005). NICI 2010 (2006–2010) envisages strengthening the programme to train a critical mass of computer-literacy teachers in school, with the target that each primary and secondary school should have a computer-literacy teacher by 2010 (GoR, 2005). Thus, higher education institutions in Rwanda were asked to integrate computer studies and basic computing into teacher education curricula (Mukama and Andersson, 2008).

In a study conducted in Rwanda on learning in ICT-based environments, Mukama and Andersson (2008) state that awareness and motivation to use ICT in teaching and learning depend to a great extent on whether teachers can handle the technology. The authors explain that ICT is a new phenomenon in Rwanda and argue that higher education institutions and schools need to integrate it in their curricula. They add that having sufficient time to practice and working together to solve problems can enhance

students' active involvement in learning with ICT. Mukama and Andersson suggest a number of conditions that may be necessary to create an environment conducive to learning with ICT, such as access to computers, teacher motivation, and development of appropriate ICT-based curricula and related pedagogies. Kozma, McGhee, Quellmalz and Zalles (2004) explain that such conditions are often not present, particularly in developing countries. This paper will try to understand different ways student teachers cope with the implementation of acquired ICT-skills in such a context.

Theoretical framework

Technology integration in teacher education

Since computers have entered schools and universities, teachers have been requested to integrate them into their teaching and learning. In their article on the use of ICT in teacher education in an African context, Yidana and Asiedu-Addo (2001) assert that ICT literate teachers should play a key role by motivating, inspiring and exciting learners to cope with these new pedagogical tools. In fact, Fullan (1993) argues that teachers cannot provide what they do not have. Thus, he suggests that teachers must be skilled enough if students have to possess the same characteristics.

UNESCO (2002), in its planning guide on ICT in teacher education, identifies four core competences necessary for ICT integration in schools namely pedagogy, collaboration and networking, technical dimension and social and health dimension. With regard to pedagogy, emphasis is put on learner centeredness in the interplay between teaching, learning and curriculum. In a Vygotskian perspective, learners already have some previous experience of learning. According to Vygotsky (1978), on the one hand, the learners' actual level of development indicates what they can do on their own without assistance. On the other hand, the zone of proximal development (zpd) reflects the learners' potential to acquire something new with the means of an adequate pedagogy or cognitive support from the teacher or experienced others. Thus, pedagogy can be conceptualized in terms of assisted learning in the zpd. One of the problems that can be raised with respect to the zpd is to wonder whether to be a teacher or someone more experienced in ICT is a sufficient condition in order to become capable of providing the appropriate kind of cognitive support needed by learners. My argument is that specific learning conditions need to be created in a specific context so that learners can be supported effectively in the zpd with ICT as pedagogical tool. For example, Roschelle's (1992) study has shown that collaboration may help students scaffold each other's thinking. Rogoff (1994) affirms that students interact much more with each other than they do with their teacher. The extent to which student teachers can support each other in the integration of ICT in their learning is of a particular interest in this paper.

The concerns about teacher education in ICT-based learning environments have been documented. The focus here is put particularly on research literature from an African context. In a study conducted in Rwanda with newly qualified teachers, Mukama and Andersson (2008) report that much effort has been placed on computer literacy in schools (mainly about word processing and spreadsheet programs) and less has been done to support newly qualified teachers to learn and teach with ICT. Moreover, newly qualified teachers complain that they lack ICT-related curricula and adequate pedagogical skills, and that they experience a problem of access to ICT facilities. The problem of access is coupled with the scarcity of computers in schools and repeated interruption of electricity

and/or the Internet. Mukama and Andersson reveal that access to ICT is also influenced by the style of leadership implemented in different schools. It was shown that school directors who centralize to some extent the management of computer labs tend to limit the access to these tools. In this context, newly qualified teachers were frustrated and could not get any opportunity to use their motivation and commitment in order to integrate ICT in their teaching and learning. However, Mukama and Andersson explain that where the management of ICT facilities was decentralized to fellow teachers, the latter were consequently granted easy access and developed a sense of self-confidence and ownership to exploit them.

Though ICT can be a powerful vehicle for change in school practice, its incorporation in teacher education may require involvement of the whole teaching culture as a profession. From a Nigerian context, Emeh and Agbor (2003) identify teachers' problems that can be found in many developing countries: low quality of life, low professional esteem and acceptance, poor and irregular salary payments compared to the business world. Emeh and Agbor suggest that 'As we prepare to produce teachers who are valid and relevant for information age, we must also endeavour to re-build teacher self-image, and to stress the cultural framework within which the information age operates' (Emeh and Agbor, 2003, p. 10). Accordingly, Vygotsky (1978) and Wells (1999) recommend that activities that constitute the object of learning should be meaningful and relevant to the learners' everyday lives. In other words, they maintain that both teaching and learning should converge to satisfy learners' intrinsic needs.

UNESCO (2002) maintains that the purpose of ICT integration in teacher education programmes is not the acquisition of technical skills per se, but the use of these skills in order to enhance the quality of teaching and learning. Reddy's (2006) findings on the impact of ICT on continuous changing teaching-learning programmes in Ethiopia, reveal that technology students do not have awareness of information technology on their learning practice. In a study conducted in Kenya, Keraro, Okere and Mondoh (2004) affirm that teachers do not support enough their students to develop meaningful interactions that can allow them to acquire actively science according to the constructivist framework. In their studies in Rwanda, Mukama and Andersson (2008) point out that some newly qualified teachers who had demonstrated ability of creativity with ICT in their everyday activities were not encouraged to integrate the new technology in changing their traditional classroom practice. However, in his study with newly qualified teachers in a Swedish context, Andersson (2006) argues that ICT can be used as a discussion forum between fellow teachers for the purpose of developing teaching methods or negotiating ICT-related knowledge. Andersson explains that this situation can provide an opportunity of sociocultural change in the ICT users' profession. Nevertheless, Andersson regrets that, most of the time, teachers utilize ICT to improve their practice and only rarely to help their learners to acquire the same competence.

ICT as a vehicle of change in teacher education

The impact of ICT in changing teaching and learning culture can be looked at a cognitive level. For example, Vandeleur, Ankievicz, De Swardt and Gross (2001) claim that education should prepare learners to become creative and state that technology education can offer an ideal opportunity. In their findings on a study on challenges and prospects resulting from the integration of ICT in the Nigerian teacher education programme,

Omatseye and Ireyefoju (2007) report that the quality of education lies in the expertise of teaching and that the teachers' role should be to enable learners to generate new knowledge. Thus, Omatseye and Ireyefoju comment that pre-service teachers expect not to be exposed to the technology, but to be taught how to use it in creative ways in order to tackle problems they encounter in their everyday lives. Putting this differently, ICT can be a tool to bring about change when it is used most effectively. Bush and Middlewood (1997, p. viii) explains the relationship between technology and ways it can be used in these terms: 'Even in an era increasingly dominated by technology, what differentiates effective and ineffective organizations are the quality and commitment of the people who work there'. Therefore, it can be inferred that although ICT can be a useful tool in teacher education, it deserves appropriate learning conditions and competent and innovative people to use it.

Creativity, innovation, knowledge, problem solving ability, appropriation, seeing the world in different ways or transformation, these are some concepts utilized to emphasize cognitive change in learners' practice. This change refers to a situation where individual learners cope with the novel experiences due to their abilities developed in the course of participation in previous and related experiences. Rogoff puts it in this way:

Participatory appropriation is the personal process by which, through engagement in an activity, individuals change and handle a later situation in ways prepared by their own participation in the previous situation. This is a process of becoming, rather than acquisition (Rogoff, 1995, p. 142).

According to this quotation, appropriation is both future-oriented and embedded in participation in collective efforts. This means that participation can be regarded as a process through which appropriation takes place. Rogoff uses the concept of participation appropriation or appropriation rather than 'internalization' which, in her view, implicates 'a separation between the person and the social context, as well as assumptions of static entities involved in the "acquisition" of concepts, memories, knowledge, skills and so on' (1995, p. 151). The point in participatory appropriation is that cognition is a dynamic process of change which, as Lave and Wenger (1991, p. 15) explain, results from 'differences of perspective among the participants'. Hence interaction among learners is a precondition for cognitive change. Moreover, knowledge appropriation implies that individual learners gain new understanding which 'is oriented to action of personal and social significance and to the continual enriching of the framework within which future experience will be interpreted' (Wells, 1999, p. 85). Thus, knowledge building is a continuous process embedded in action and involving individual and social, active participation.

Different studies have identified some variations regarding how ICT is used in classroom settings. For example, some teachers find ICT threatening because it contains vast amount of information and that it requires a lot of hints to use it (Emeh and Agbor, 2003; Omatseye and Ireyefoju, 2007). Some ICT users, especially old ones, tend to resist change and have difficulties to challenge routine in school practice while some young people seem to be more or less enthusiastic to use actively technology (Galanouli and McNair, 2001; Sime and Priestley, 2005; Andersson, 2006). Drawing from Andersson's (2006) study in a Swedish context, variation in the use of ICT can also include 'resistant ICT users', those who are not interested in using computers, 'experienced ICT users' who refer to ICT as an irreplaceable tool to solve their problems, and 'curious ICT users' who

may use ICT actively but who still request some computer-based knowledge and skills in order to become more effective. Further, Andersson suggests that computers can play a role for boundary crossing changes in terms of communication and teaching culture between experienced ICT users and their colleagues. In fact, some teachers may be more interested in using ICT in their everyday activities than the others and that is one of the issues to be explored in this article.

Purpose and research questions

While previous studies have examined various issues related to the integration of ICT in teacher education namely challenges and prospects, access and accessibility, little evidence has been provided in terms of the relationship between learning and exploitation of ICT skills in the users' everyday practice. Therefore the purpose of the present study is to investigate ways of using ICT in student teachers' everyday learning practice in relation to the skills they have acquired. As referred to earlier, Mukama and Andersson (2008) assert that success in using ICT depends to large extent on how teachers can utilise the new technology as a pedagogical tool. In a similar vein, Harley, Barasa, Bertram, Mattson and Pillay (2000) state that novice teachers should play a role of leadership. Andersson (2006) claims that newly qualified teachers can be driving force when they work with more experienced teachers in an ICT-supported learning environment. Andersson argues that emphasis should be put on investigating how novice teachers may become agents of change for integrating ICT into learning and teaching culture. In the present paper, I assume that student teachers can be considered as potential novice teachers for tomorrow. This study addresses the following research questions:

- (i) How do student teachers use ICT to solve problems in their everyday lives?
- (ii) What conditions do constrain or enable utilization of ICT in student teachers' learning?
- (iii) How do student teachers collaborate to address ICT-based constraints encountered in their everyday learning practice?

Method

Participants and settings

Data were collected in 2006 in Rwanda (see also Mukama, 2008a). The target group consisted of 24 final-year university students who had participated in a training programme on how to search, retrieve and use web-based literature. During this training, the participants were invited to work together in small task-based groups mediated by a computer. Each group comprised four members, and this was the first time the participants had attended such a training programme. Group interactions were videoed for at least 15 minutes while searching and retrieving web-based literature. After the training, 12 participants (6 women and 6 men) were selected and agreed voluntarily to take part in this study.

Procedures

The data collection combined initial interviews and focus group discussions and, later, follow-up interviews (see also Mukama, 2008a). First, the initial interviews were used to capture individual reflections on and experiences of learning collaboratively in small

task-based groups mediated by a computer. The duration of each initial interview was approximately 45 minutes. Second, the interviews were followed by three focus group discussions. Two groups comprised four participants each and one group three participants. The focus group discussions began with a 15-minute video presentation depicting the participants' involvement, this is, action and interaction while searching and retrieving web-based literature. The purpose of the discussions was to enable the researcher to understand how the participants reflect on their own practice. Thirdly, the preliminary analysis of the initial interviews and focus group discussions revealed that it would be interesting to investigate how the participants use their acquired ICT skills in different situations in their everyday lives. Thus, five months later, a 5- to 15-minute follow-up interview was conducted with each of the 12 trainee-participants. Data collection was conducted in Kinyarwanda. It was audio-recorded and then transcribed verbatim. Relevant extracts for this study were later translated into English and analysed qualitatively.

The data were broken down into conceptual categories stemming from the process of coding and theoretical sampling. Coding consisted of labelling and conceptualizing the central analytical idea brought out in the participants' extracts. In other words, I analysed paragraph by paragraph and wrote down in the margins the concepts representing the salient issues, problems, event, concerns, action or interaction that were regarded as significant to the phenomenon under study. Then these concepts or abstract representations were closely examined in terms of their similarities and differences and this allowed the grouping of those with similar object under common headings known as categories or themes. These themes were progressively refined and finally became the three major headings of the next section on findings. Other concepts under each theme were further developed into explanatory descriptors of the phenomenon under study according to its properties and dimensions. Diagrams and memos were also used to help keep in mind and track comparison of patterns and potential relationships between emerging concepts. Thus, I followed Strauss and Corbin's (1998) advice according to which diagrams and memos should be analytical rather than descriptive. This means that these analytical instruments evolved and could change. Moreover, during the analytical process, literature review on ICT and teacher education was conducted. This review helped me to supplement theoretical concepts, analyse and discuss the findings.

Findings

Changing ways of seeing with ICT

In the interviews and focus group discussions, the participants often compared different experiences in their computer skills training. The following extract from the initial interview with Simoni can serve as an example:

I used to go to the (.) computer labs just to send or check e-mail or to search for some information. But the way I was used to, it was (.) I thought it was the best. However, with what I learned, now I realize that the information I used to retrieve was not appropriate for research; I mean information that is suitable for scientific purposes and for my personal development. I made another step – of using another way of searching for reliable information, which was better than the way I was used to.

In this statement, Simoni confronts two different experiences. He not only compares different techniques, but also the quality of the information retrieved. New experiences helped the participants to be critically reflective. With a difference in perspective, for example, what Simoni had previously thought best, he now considered inappropriate information for research purposes. The participants created boundaries between what happened before and what occurred after the training. Referring to what Simoni said above, before the training, he reported that he had used a different method of collecting electronic sources: 'I thought it was the best'. After the training, he came to another conclusion rooted in a different situation: 'I made another step – of using another way of searching for reliable information, which was better than the way I was used to'. Therefore, confrontation of different experiences can spearhead change in students' learning through critical reflection.

The training permitted the participants not only to situate their experience in a particular time span but also to save time and be more efficient in terms of the quantity of the work produced. Mariya gave an example:

Sometimes, I asked someone to come along with me so that she could assist me. Sometimes one hour went by without getting any data. For example, you asked us to find articles; before, I couldn't (hmmm). If I used to spend one hour before, I think that [now] I can retrieve the information I need in thirty minutes or so.

Mariya's point reveals how the training changed her behaviour to become more efficient. She stated that finding an article became easier. She could save time. Comparison of her experiences on different occasions can thus be seen as evidence of her ability to search for information on the web and to work independently. In other words, this can show that the participants' knowledge about the quality of online information was relative: it could change when they experienced a contradictory situation.

In the focus group discussions in particular, the participants stressed repeatedly that small groups led them to encounter different experiences of different people. It was through interaction that these differences were handled. Commenting on their interactions as portrayed in the video, for example, Anjelika argued that dialogue was at the heart of their learning in a small group:

We were on two different machines but at the same time in the same group. On time, we ended up with different results. We asked each other questions. Sometimes, we tried again and again but the problem persisted. In this case, we asked for the teacher's assistance.

Alisa put it differently: 'When we converged, we were content. Sometimes, however – maybe because the machines were different – we diverged. That created discussions. We started to wonder why'. Far from being a weakness, divergence in the participants' perspectives generated new ideas, new discussions, and a variety of different possibilities to explore. Interaction between peers, teacher and computers were part of a continuous and participatory activity in dealing with web-based research data. During the focus group discussions, Luwiza illustrated this with an example:

I asked one of my colleagues, ‘Why are you doing this? Why aren’t you doing that?’ She replied: ‘Read this, here it says one thing but there it says something else. Look! The teacher said that when you put this here, you have to click on search’. [...] We tried different ways.

Luwiza and her group reflected on their practice together. They sought to understand what was going on by asking each another questions and, in particular, by attempting to solve their problems by continuous inquiry. Therefore, I can infer that interactions between the participants contributed to building a culture of continuous inquiry in their learning practice with the new technology.

Student teachers’ motivation to use ICT

In the initial interviews, Kizito explained the motives that prompted him to attend the training programme as follows:

As a final year student, I had a problem. I wanted to search for information on the Internet but didn’t know how to or where to find it (hmmm). This training helped me to know (.) where to search for this information, how to find it in a more user-friendly way (hmmm); and I can get a lot of information which (.) fits exactly the topic under investigation.

As a final year student, as part of the academic requirements for a bachelor’s degree in education, Kizito, like all other participants, conducted a small-scale research project. For Kizito, the training in how to search, retrieve and utilize web-based literature helped him, at least in part, to manage his research project. He learned to use *the tools* (where to find information), *the procedure* (how to find it) and *the content* (information fitting the topic under study). Thus, from Kizito’s point of view, his motivation to use ICT was goal-directed. His goal was to conduct successfully his small scale research project. He was therefore motivated by the fact that he was achieving his goal: he was able to retrieve information fitting the topic of his study.

One of the salient points made by the participants in most interviews was that when they were in the computer lab, they became aware of relevant research data available on the Internet. Requests for the teacher’s intervention, thanks to her experience, seemed to help them develop an awareness of useful information that they did not know about previously. The same point was repeated in the group discussions, as shown by Kizito’s utterance: ‘It was the first time we came across those websites. We didn’t even know they existed’. This shows that the student teachers’ motivation to use ICT implied awareness about the importance of this new pedagogical tool in their learning practice.

On different occasions in the follow-up interviews and focus group discussions, the participants related their motivation to their future careers. For example, Alisa explained the kind of professional she wanted to become: ‘We know that a professional is someone who is up-to-date all the time (hmmm). In one year from now we will have graduated. That is to say, we will go to our places of work and practise our profession’. She added ‘I need to be an independent researcher in my teaching profession, of course. I need to be able to search for relevant information’. Tito expressed it in this way: ‘As a teacher I

would like to be able to teach a course through a distance learning programme'. Alisa and Tito, like a number of other participants, identified themselves as teachers. This finding serves to reinforce that student teachers' involvement in the acquisition and utilization of ICT seems to be goal-directed in terms of their motivation.

Challenging ICT-related constraints

Drawing on the initial and follow-up interviews and focus group discussions, the constraints faced by the participants during and after the training can be divided into two: institutional and individual.

Institutional constraints

At the institutional level, most participants reported that many students on campus wanted to use the computers but that the number of machines was small. They said that the Internet connection was often disrupted by electricity cuts. They complained that some lecturers did not allow them to use web-based literature because those lecturers themselves did not know how to retrieve and refer to them in a scientific paper, hence, a few ICT literate users. Another aspect of institutional constraints refers to the nature of web-based literature. The majority of the participants reported that the Internet contains huge amounts of information whose quality was consequently very difficult to assess. They also maintained that vast information on the Internet did not facilitate the selection of relevant articles. Further, they said that some of them were denied access to some electronic articles due to the lack of their institutional subscription.

Individual constraints

These constraints were primarily linked to the participants' personal capacity as novice users of the new technology for working in the complex environment of the Internet. The institutional constraints mentioned above had also impact on ways individual student teachers used ICT in their everyday learning practice. Based on the participants' discussions and responses uttered during the follow-up interviews, three types of variation of ICT users were identified with respect to their passive, reluctant or active involvement vis-à-vis the integration of acquired ICT skills in their learning practice within the five months following the training programme.

1. Passive ICT users

Some participants complained that they were overwhelmed by other courses and exams and did not have sufficient time to devote to their web-based research projects. Mariko reported that during the five months following the training programme, he never accessed the Internet. Asked why, he responded that he did not get enough time. Nevertheless, he affirmed that he had enjoyed the training programme on searching, retrieving and using web-based literature. He added that he was planning to request for assistance from his colleagues in order to use ICT in his research project. Mariya said that during the same period she tried to access the Internet a little, but as it did not work, she abandoned the idea and never tried again. These two participants, whom I have labelled *passive ICT users*, stated that they were aware that the Internet was useful for their research projects. However, they maintained that they could not overcome the difficulties encountered or try any other alternative in order to put what they had learned into practice. They said that

they had other priorities which put considerable pressure on them, such as preparing courses and exams, and using the traditional library rather than web-based literature.

2. *Reluctant ICT users*

The second group is based on utterances expressed by three participants who used electronic sources successfully but rarely, though they showed a strong desire to use the Internet. Asked what she needed in order to become more active, Anjelika, one of the three participants, said that she wanted first and foremost to become confident using a computer and overcome her technophobia: 'When you don't know something, you are somewhat afraid of it', she argued. Computer-based learning while still not computer proficient appeared to be a significant challenge, as explained by Simoni: 'When you don't have sufficient skills to use the computer, it is not easy to learn with it especially in the beginning. It seems as if you are learning a lot of things at once'. Asked if she was not worried about forgetting what she had acquired due the lack of practice, Luwiza explained:

Forgetting? That is obvious ((laughing)). After the training programme, I went in the computer lab only once. When I found what I wanted, I didn't return there. Even there, I was assisted by another person, I was not alone. If you asked me how to search an article right now, I think that you would realise that there are things I can do and others I cannot.

This group, which I will label *reluctant ICT users*, was aware of the risk to forget was they had acquired. It shared the same concern as the passive ICT users: they all claimed to be too busy and argued that the Internet was not their first priority.

3. *Active ICT users*

The final group is the seven *active ICT users* who trusted and tried, sometimes with difficulty, to appropriate the use of web-based research data. Some asked for assistance from each other; others helped their colleagues who did not attend the training or taught them how to retrieve and use online literature. Though Kizito affirmed that he experienced a financial problem, he managed to use ICT successfully:

My little time has been useful. I used various websites and found out some methods of data collection and analysis to be used in my research project. I learned how I will interpret my findings. I continue to discover the importance of the Internet progressively. Now I feel that I should get an advanced programme on ICT literacy.

Kizito and most active ICT users were proud to mention that they had used ICT to tackle different activities such as courses, assignments, exams and research projects. Thus, ability to use ICT to achieve different purposes can be regarded as an indicator of change in student teachers' practice. In addition to his personal achievements, Kizito reported that he offered some support to his colleagues. He gave an example of a student from the department of biology: 'Well, I taught her and she succeeded to retrieve some articles. As she was so excited, she asked me to come again. She still has some difficulties to use correctly usernames and keywords'. Alisa explained how she taught a large group of

students: 'Some students did not attend the training in question. After the training, some of them came to me and asked me to teach them what we had acquired. I explained everything'. Asked how they managed to search for information with so few computers on campus, most active ICT users asserted that it was a 'sacrifice'. Tomasi explained: 'When I am on the Internet, I only search for information; I leave aside other things such as correspondence and so on'. Some participants affirmed that they spent a lot of money in cybercafés searching and retrieving web-based literature. Others reported that they negotiated arrangements with colleagues from other departments in order to gain access to the Internet. Technophobia was also mentioned by active ICT users but in terms of the challenges they had to attend to. For instance, Alisa argued: 'Even if I use ICT, I don't master all the techniques it implies very well. I feel that I am afraid of it. I need the computer to become user-friendly'. These examples show not only how coping with constraints does not involve one solution only but also that active ICT users can play a central role in the integration of ICT in teacher education by supporting and teaching their colleagues to use the new technology.

Concluding discussion

Supporting continuous inquiry among students with different experiences

As referred to earlier, the purpose of this study is to investigate ways of using ICT in student teachers' everyday learning practice in relation to the skills they have acquired. Accordingly, the following research questions were asked: how do student teachers use ICT to solve problems in their everyday lives? What conditions do constrain or enable utilization of ICT in student teachers' learning? How do student teachers collaborate to address ICT-based constraints encountered in their everyday learning practice? The responses to these questions as drawn from the findings can be summed up as follows:

- Confrontation of different experiences regarding the use of ICT can spearhead change in student teachers' learning practice through critical reflection. In other words, interaction on divergent experiences can generate new ideas, new discussions and a variety of different possibilities to explore in the acquisition and integration of ICT skills in teacher education.
- Ability to achieve different purposes by the means of ICT can be regarded as an indicator of change in student teachers' learning practice. Thus, student teachers' involvement in the acquisition and utilization of ICT seems to be goal-directed in terms of their motivation.
- Some student teachers seem to be more interested in using ICT in their everyday learning practice than the others. Moreover, the utilisation of ICT may be linked to institutional constraints (e.g. scarcity of computer facilities; repeated Internet disruption and/or electricity cuts; a few ICT literate users; vast amount of information on the Internet) or primarily to individual constraints (e.g. technophobia; lack of awareness regarding the availability and the importance of ICT; passivity or reluctance to use the new technology).
- Active ICT users seem to challenge the constraints mentioned above by the means of their determination and their capacity to assist or teach their colleagues to use successfully ICT in their everyday learning practice (see next section).

These inferences are in concordance with earlier research findings (Lave and Wenger, 1991; Kozma *et al.* 2004; Andersson, 2006; and Mukama, 2008b). For example, in my earlier study on students' interaction with web-based literature, it was demonstrated that student teachers can elaborate on ideas provided in electronic articles, explain, enrich or contrast them particularly when they discuss in a language they understand better. The present study shows that interaction can contribute to the building of a culture of continuous inquiry and knowledge construction among student teachers.

The present study shows that a computer is a necessary pedagogical tool, but insufficient prerequisite, for developing knowledge. Accordingly, it seems that other learning conditions need to be present to allow successful integration of ICT in teacher education – these include teachers' and students' motivation, their active participation and continuous inquiry. For example, Mukama and Andersson (2008) state that implementation of change with ICT requires, among other things, good leadership and decentralization of computer management in schools, and empowerment of ICT users in pedagogy and development of related curricula. Similarly, Bush and Middlewood (1997) affirm that what counts most in ICT-based environments is the quality of the people who use the new technology and not the technology per se.

Active ICT users as agents of change

The Rwandan NICI Plans aim to train teachers who will be able to support student learning with ICT. This study reveals that although student teachers may be provided with ICT and adequate training programmes, they vary in how this tool is handled in their everyday lives. These variations include (i) passive ICT users: students who acquire computer skills but who seem to show no interest in using them to improve their learning; (ii) reluctant ICT users: students who acquire and use computer skills successfully but rarely; and (iii) active ICT users: motivated students who use the new tools successfully, creatively and continuously for their personal development. In this study and reference to the zpd, active ICT users have shown a capacity to help their colleagues to acquire or use the new technology in their learning and research projects. Active ICT users can be related to the experienced and curious users in Andersson's (2006) study, who utilize the tool when they come across challenges. Commenting on the goal of the Rwandan NICI Plans to train teachers who will be able to support student learning with the new technologies, a question of conceptualization of ICT implementation can be raised here in that not all teachers may necessarily be active ICT users. For example, as shown in the findings, some of them may be passive or reluctant to use this tool. Therefore, drawing on Roschelle (1992) who claims that collaboration may help students scaffold each other's thinking and on Rogoff (1994) who states that students interact much more with each other than they do with their teacher, I argue that active ICT users can be the cornerstone in implementing the new technology and, thus, become agents of change. This interpretation is consistent with earlier research (Andersson, 2006) where boundary crossing changes have been observed between newly qualified teachers and their experienced colleagues when ICT is used as a pedagogical tool. My argument is that interaction between different groups of peers with various experiences can change in a positive and supportive way when ICT is utilized for enhancing creativity and problem solving. For example, this information can be used by teachers, researchers and

policymakers in their endeavour to integrate ICT in learning practices or to raise computer literacy among the population.

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