

INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHER EDUCATION

Thinking and learning in
computer-supported
social practice

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FACULTY OF ARTS AND SCIENCES

Linköping Studies in Arts and Science No. 471
Linköping studies in Behavioural Science No. 139
Linköping University, Department of Behavioural Sciences and
Learning
Linköping 2009

Linköping Studies in Arts and Science • No. 471

At the Faculty of Arts and Science at Linköping University, research and doctoral studies are carried out within broad problem areas. Research is organized in interdisciplinary research environments and doctoral studies mainly in graduate schools. Jointly, they publish the series Linköping Studies in Arts and Science. This thesis comes from the Department of Behavioural Sciences and Learning at Linköping University.

Distributed by:

The Department of Behavioural Sciences and Learning

Linköping University

581 83 Linköping

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TEACHER EDUCATION

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Edition 1:1

ISBN 978-91-7393-722-1

ISSN 0282-9800

ISSN 1654-2029

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Department of Behavioural Sciences and Learning 2009

Printed by LiU-Tryck

Acknowledgements

This thesis is neither the end nor the beginning of the journey of my research. It is an important step that I have made with the contribution and support of many people. First of all, I would like to express my gratitude to the participants in my studies. With you, newly qualified teachers and student teachers, this dissertation became possible.

I owe a special debt to my supervisor Sven Andersson for his critical reflection, comments and advice. Thank you, Sven, for academic and administrative support and for the meetings and seminars you have organized so that I can meet with different scholars and exchange ideas with them. My special thanks also go to my second supervisors Gunilla Jedeskog and Ingrid Andersson. With you, Gunilla and Ingrid, I acquired a lot of knowledge about academic writing. To all three of my supervisors, I would like to say again, I will try to ensure that you never regret your time.

I would like to thank Staffan Larsson, the discussant at my final seminar for valuable comments that have helped me to improve my thesis. I must also thank Lars Owe Dahlgren and Madeleine Abrandt Dahlgren for integrating me into a community of a scientific discourse. How much do I wish that such a community can be created on the other side of the sea? Hopefully, with my colleagues from Rwanda, this dream will be realized. I owe to my colleagues for their friendship. Thanks to you dear colleagues.

Thanks are also due to you, Elisabeth Ahlstrand, I know how much you care about educational development in Rwanda. Thank you Emile Rwamasirabo, you opened up new academic horizons for me. To my former classroom mate in my primary and secondary education, Alphonse Ndayambaye, I will never forget how much you taught me to be a learner. I am indebted to Susan Barclay Öhman who has taken the time and effort to edit the English language in the biggest part of the manuscripts of this thesis.

I do not know how to express both my apologies and my thanks to you my wife, Marie Chantal, and to you my sons, Bruce and Bruno. During my stay abroad, I know how much you have suffered from my absence. I missed you, too, so much. Nevertheless, your love has been a source of my inspiration, my strength, my success and my hope. I am very proud of you.

To Sida/SAREC and to the National University of Rwanda, the sponsors of my doctoral programme (Sida Ref. No 2004-000746), I owe my deepest gratitude.

Linköping, November 2008
Evode Mukama

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PART II

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PART I

**Overview of the research
field and concluding
remarks**

Introduction

From experiences of learning to inquiry

The purpose of this section is to disclose the research problem pertaining to this thesis in a more experiential way. My own experience has been taken as an example in order to illustrate, to some extent, a situation that some students, from the same context, might have encountered. The first example relates to my experience as a learner in primary and secondary schools in Rwanda. The first day I was in a class at primary school, a teacher asked us to write down something. Later, I realized that this ‘thing’ I had never come across before was indeed the vowel ‘i’. Disappointed, I inferred that I was not good at learning: ‘if learning is like this, I will never succeed’. Throughout the first three years of my primary education, I was one of the weakest learners who could not or hardly achieve 50% on their transcripts (marks). I did not even know how to read. Finally, it was suggested that I repeat Primary 3.

A significant change in my experience of learning happened when I repeated Primary 3. One day, a colleague of mine told me that ‘igipindi’ – a new jargon word to me at that time, meaning literally an amusing joke – was ‘ubugari’ – pasta made from cassava flour. In order to be able to recall the word ‘igipindi’, I had to ask my colleague to remind me of it, again and again, more than four times on different occasions. At the end of the day, I memorized the word ‘igipindi’ once for all. I then realized that with repetition, I could memorize and was able to recall the word. This was my discovery. Based on this conclusion, I changed my learning and became one of the ‘best learners’ in that educational system. My conclusion was reinforced by behaviourist and cognitive theories I learned at a teacher education college (secondary education). Though my inferences worked well with me, I was not satisfied with the outcomes of what could be interpreted as my ‘stocked knowledge’. For example, after my secondary education, I wrote a novel in French. My French reviewer told me that the story was very interesting but she criticized me that I had written in a language specific to books and an old language which was not convenient for everyday life. She advised me politely, ‘maybe, you could write in Kinyarwanda or come to France to become familiarized with the French everyday language’. My conclusion was that I missed the socio-cultural dimension, the context, and the appropriate language in which to write my novel. This was confirmed by my earlier research and my experience as a lecturer in a higher learning

institution in Rwanda (Mukama, 2000, 2007). I found out that some students face difficulties understanding Western literature because they fail to digest the social and cultural reality within which this literature is provided.

Regarding the use of computers, on different occasions, I saw both teachers and learners excited when these tools were deployed in their schools. However, most of them continued to ask what the computers were there for in that they were often kept in labs or in cupboards. I came to Linköping University with the same questions I had developed a long time ago: what is learning? How can learning be supported by a computer?

Two national policies

At the heart of this thesis, and in relation to my inquiry as stated above, there are two national policies: the first on Information and Communication Technology (ICT) and the second on language in the Rwandan educational system. Since 1998, under the auspices of the Africa Information Society, the Government of Rwanda (GoR) has initiated an ICT development programme. A related policy was launched in 2000 in Rwanda and the Vision 2020 is to guide the country to develop into a middle-income society by 2020. ICT as a development policy is expected to be realized through the implementation of four 5-year rolling National Information and Communication Infrastructure (NICI) Plans covering the 20 year life-span of Rwanda Vision 2020 starting from 2001 (GoR, 2001, 2005).

Furthermore, the Rwandan NICI Plans envisage that researchers will develop new knowledge that can support learners and teachers to cope with change in ICT-based learning environments. With respect to the development of ICT in the educational system, higher learning institutions in Rwanda are required to make computer studies and basic computing an integral and a compulsory subject within teacher education programmes. In the review of the implementation of the Rwanda NICI–2005 Plan (2001–2005), Dzidonu (2005) reports that follow-up research activities for evaluating and informing about the plan were lacking. Drawing from an African context, Kozma, McGhee, Quellmalz and Zalles (2004) claim that success in using ICT depends on how teachers can handle the new technique. In this regard, Harley, Barasa, Bertram, Mattson and Pillay (2000) maintain that novice teachers should play a role of leadership. In a European context, Andersson (2006) states that newly qualified teachers can function as a driving force when they work with other teachers in an ICT-supported learning environment. He suggests that emphasis should be placed on investigating how novice teachers may become agents of change for integrating the new technique into learning and teaching culture. In the present dissertation, I assume that student teachers can be regarded as potential novice teachers of

tomorrow. Thus, this discussion shows that research studies with newly qualified teachers and student teachers regarding the implementation of ICT in learning practices are an issue of interest at an international level.

With regard to the national policy on language, Rwanda envisages becoming a regional ICT hub provider, with English and French as the media of communication. In fact, the Rwandan Constitution of 2003 indicates that the national language is Kinyarwanda. Before the genocide of 1994, the language of instruction in primary schools was Kinyarwanda and, in secondary and tertiary education, French. After the genocide, students entered schools from Anglophone and Francophone backgrounds. Therefore, since 1995, the GoR has decided to create a 'trilingual' society, introducing English as an official language and medium of instruction in addition to Kinyarwanda and French. The aims of the language in education policy in Rwanda are, among other things, to promote Rwandan and foreign cultures, and to build an educated knowledge-based and technologically-oriented society (Mineduc, 2007b). However, it is important to mention that the cabinet meeting held on October 8, 2008 has decided that English should become the language of instruction in all public and subsidized private schools (GoR, 2008).

Research has shown that Rwandan students' competence in English and French is very low, especially among rural girls (Williams, 2003; Ntakirutimana, 2005; Mineduc, 2007a). Hence, Hayman (2005, p. 25) states, 'The implication of research findings was that the emphasis should be placed on ensuring children receive a quality education in a language which they understand, namely Kinyarwanda, if EFA [Education for All] goals are to be achieved'. Hayman's discussion is not new. Since the aftermath of the independence in the 1960s, Le Thanh Khoi (1971) wrote that new African leaders should provide education in local languages, arguing that learning is better conveyed in students' native languages. Nevertheless, the GoR believes that communication in English and French depends on geopolitical and international trade assets (GoR, 2005). This debate may indicate how much research needs to be done in order to understand what goes on in classroom settings mediated by ICT as a pedagogical tool and how students' values embedded in their mother language, Kinyarwanda, are handled.

Aim and research questions

In order to understand how learning takes place as a phenomenon under investigation, researchers need a theoretical frame of reference with specific concepts. Among the theoretical perspectives of human learning, I can mention, as an example, behaviourism (Skinner, 1974; Cohen, 1979), cognitivism (Piaget, 1926; 1970, von Glasersfeld, 1989), the theory of

variation (Marton, 1999; Marton, Runesson and Tsui, 2004) and sociocultural theory (Vygotsky, 1978). A broad discussion has been developed within each of these perspectives. Description of all these perspectives on human learning is beyond the scope of this dissertation. Taking into consideration the nature of the research problem, which puts forward learning mediated by a computer and language, I have been inspired by the sociocultural perspective as a standpoint in the present dissertation. According to this perspective, learning takes place in specific contexts or, in other words, learning is situated (Lave and Wenger, 1991). Vygotsky (1978) claims that human beings live in diverse and changing environments, where they gain different experiences. These experiences vary on the basis of their historical, social and cultural contexts. Therefore, with respect to the sociocultural assumptions, multiple sources for data collection have been used to allow me to explore participants' interactions and actions around a computer, namely questionnaires, interviews, focus group discussions, naturally occurring talk and observation. Accordingly, the aim of my dissertation is to investigate how knowledge can be developed in computer-supported social practice. In order to achieve this aim, my studies were guided by the following questions:

- (i) What learning conditions can help or constrain newly qualified teachers or student teachers to learn in ICT-based environments?
- (ii) In computer-supported collaborative learning activities, what kind of discourses do student teachers in small groups engage in?
- (iii) How is meaning reflected in newly qualified teachers' or student teachers' accounts of learning in computer-supported activities?
- (iv) What learning conditions does language bring to the study of web-based literature in small groups?

These research questions have been explored through the four studies which I will present in the second part of this thesis. In the next chapter of the first part of this thesis, I will present the theoretical framework within which my studies are analysed and discussed. In Chapter 3, I will set the scene concerning the methodology and the design used and their implications in terms of credibility, generalization and ethical consideration of case studies in qualitative research tradition. In Chapter 4, I will summarize the results of the four studies in turn and, finally, in Chapter 5, I will discuss them and then reflect on the research process followed in this dissertation.

As referred to above, the second part of this thesis consists of the presentation of these four studies:

- (i) Mukama, E. & Andersson, S.B. (2008). Coping with change in ICT-based learning environments: newly qualified Rwandan teachers' reflections. *Journal of Computer Assisted Learning*, 24, 2, 156–166.
- (ii) Mukama, E. (Accepted for publication). Strategizing computer-supported collaborative learning toward knowledge building.
- (iii) Mukama, E. (2008). Students' interaction with web-based literature: towards dissolution of language boundaries. *International Journal of Knowledge and Learning*, 4, 5, 478–495.
- (iv) Mukama, E. Interplay between learning conditions and participation in ICT-based environments (Submitted for publication).

Theoretical framework

How can the sociocultural analysis help to understand knowledge development in computer-supported social practice? The point of departure is to explain some aspects of the sociocultural perspective relevant to this dissertation and illustrate how some researchers have explored these aspects in learning practices and also in line with ICT-based learning environments. Further on in this chapter, I shall relate the central theoretical concepts to each other and try to outline how they are reflected in this dissertation in relation to earlier research.

The computer as a mediating tool in social practice

Vygotsky (1978) asserts that the introduction of new signs or tools in the course of social practice influences human development through interplay between people's experiences, actions and motives. According to Vygotsky, inclusion of these artefacts (signs and tools) into the flow of human action 'does not lead to a simple lengthening of the operation in time; rather, it creates the conditions for the development of a single system that includes effective elements of the past, present, and the future' (pp. 36–37). Wertsch (1998) comments that signs or tools, in their interplay with human activities, imply some changes beyond a simple quantitative modification in terms of facilitating more efficiently the completion of an activity; but in a qualitative way, human transformation has developed historically and culturally in social practice. In this dissertation the term social practice means 'structured human traditions for interaction around specific tasks and goals' (Hedegaard, Chaiklin and Jensen, 1999, p. 18). It refers more specifically to the use of technology as a tool for learning in educational settings.

Vygotsky (1978) maintains that artefacts are created to satisfy human needs or to achieve certain purposes. Cole (1996, p. 117) explains that an artefact is 'an aspect of the material world that has been modified over the history of its incorporation into goal-directed human action'. The most important aspect of artefacts highlighted in this dissertation is about the qualitative transformation resulting from the introduction of ICT mediation in social practice. In a different work, Vygotsky points out:

by being included in the process of behavior, the psychological tool alters the entire flow and structure of mental functions. It does this by determining the

structure of a new instrumental act, just as a technical tool alters the process of a natural adaptation by determining the form of labor operations (1981, p. 137).

In this connection, Wells (1999) claims that an artefact plays a functional mediating role between human beings (such as students) and the world of objects, and also between these human beings and other people. Thus, according to Wells, appropriating an artefact in a classroom context is a process of a triple transformation: transformation of the learner (new ways of interpreting, perceiving and seeing the world); transformation of the artefact itself (reconstruction of the artefact due to the learner's new knowledge); and, finally, transformation of the situation (learner's contribution in changing social practice). In my view, that is the major aim of learning: building knowledge and change in human practice. Vygotsky (1978, p. 55) explains these modifications more clearly by saying that 'The mastering of nature and the mastering of behavior are mutually linked, just as man's alteration of nature alters man's own nature'.

Wertsch (2003) suggests that Vygotsky's line of thoughts about mediating tools can be applied in different sociocultural contexts such as ICT-based learning environments. This author highlights the relevance of rapid sociocultural change in today's world society with modern ICT: by means of a computer, for example, not only can people have a dialogue in a synchronous way, instantaneously like in a telephone communication, but also in asynchronous ways like in web courses, e.g. sending emails to each other at different times. The point that the inclusion of an artefact can alter human social practice has been explored in ICT-based learning environments. For example, Säljö (2002) argues that ICT can challenge people's traditional hierarchies of knowledge in school settings and other places. In an African context, Jansen (2003) reports that new technologies have changed the way in which teaching and learning take place with regard to new interactions emerging between educational stakeholders and cultural content on the web. Similarly, de Jager and Nassimbeni (1998) in their evaluation of computer literacy for South African students, maintain that ICT has become an attractive tool which has increased students' information and awareness of its implication in various areas. However, in this evaluation, it was revealed that information literacy training has little effect on the students' writing and reading abilities in essays and assignments.

In the present dissertation, ICT is referred to as a mediating tool for thinking and learning. However, the use of ICT in school settings may not necessarily be restricted to its simple technicalities as an artefact that helps to handle some duties like retrieving electronic sources or sending huge amounts of graphic images. ICT is also used as a tool for thinking in social practice (Bliss and Säljö, 1999). Thinking is shaped by language (Vygotsky,

1978; Mercer, 1995). Indeed, Vygotsky contrasts physical artefacts (e.g. a computer) with psychological artefacts (e.g. concepts). Bliss and Säljö assert that psychological tools permit us to codify the world around us into meaningful language and they are used for the purpose of reasoning and communication. Implications of language as a mediating tool is an issue reviewed in the next section.

Language as a mediating tool in social practice

Language as a social mode of thinking

According to Mercer (1995), the study of knowledge construction is done through the analysis of language in use. As mentioned above, language is linked to thought. This point is clearly explored by Vygotsky (1978), who states that language is, at the same time, a psychological and a cultural tool. In a classroom context for example, as a psychological tool, language allows learners to organize their thoughts, represent the external world and make sense of it. They develop some thoughts about it. As a cultural tool on the either side, language is intended for communication. It enables learners to discuss different issues with other people. In this line of reasoning, language allows learners to communicate their thoughts and, in turn, to gain insight from the experience of others. In a different book, Mercer (2002, p. 145) claims that 'We use language to transform individual thought into collective thought and action, and also to make personal interpretations of shared experience'. However, outcomes of language vary according to how interactions of participants in the talk are organized. In the following paragraphs, I will provide some examples of how language in use has been explored by various researchers.

Mercer (1995) identifies three forms of talk that can happen in small task-based groups of social practice: disputational, cumulative and exploratory. According to Mercer, disputational talk is characterized by competition between participants and disagreement with each other. As participants in this kind of talk lack mutual understanding on emerging propositions, decision making is individualized and not jointly achieved. In other words, participants seem to be critical but each one sticks to her or his personal thoughts and does not seek the development of common knowledge. In cumulative talk, participants seem to gather positively but uncritically one assertion after another. This kind of talk is based on accumulation of ideas already uttered by repetitions, confirmations or elaborations. In exploratory talk, each idea is critically analysed and evaluated; knowledge is jointly constructed. The participants ask for clarification while others provide useful

explanations. Hence, justification allows the group to make an informed decision.

The three forms of talk identified by Mercer can show that different discourses take place in classroom social interactions. Mercer (1995) asserts that a discourse consists of language in use and conveys both the social and intellectual life of a community. In a similar vein, Halliday (1978, p. 2) points out that discourse relates to meaning making through social interactions within a particular context. He explains this as follows: 'Language does not consist of sentences; it consists of text, or discourse – the exchange of meanings in interpersonal contexts of one kind or another'. Accordingly, education should aim, among other things, to enable students to shape discourses most effectively and create a community of discourse. The term community of discourse is borrowed from Swales (1990). This terminology is used to mean that a group of people sharing the same interests can engage in language practices and utilize a distinctive terminology and particular networks of communication in order to achieve a certain goal. Most importantly, one of the requirements to gain membership of this group is that people are able to speak the discourse.

As long as discourses can take various forms, education will need to encourage those forms that may enhance students' creativity and problem-solving abilities. Exploratory talk, for instance, is clearly distinct from the other forms of talk (cumulative and disputational) in that it is a learning discourse which creates conditions through which shared meaning can be negotiated (Mercer, 1995). Exploratory talk refers to what Bereiter (1994) has termed progressive discourse. This author maintains that a discourse needs to be progressive so that participants build joint understanding that they 'recognize to be superior to their previous understandings' (p. 6). Bereiter suggests that progressive discourse entails that, first, group members work jointly to generate knowledge satisfactory to all. Second, they provide supportive evidence for emerging ideas. Third, they strive to achieve something new and, fourth, they assess if their achievements are superior to their previous understandings. In my opinion, some students may not be able to assess the progress made through learning practice and this may not be an obstacle to develop new knowledge. However, one of the important aspects to be emphasized is that progressive discourse or exploratory talk implies a 'willingness to sacrifice any belief in the interest of scientific progress' (Bereiter, 1994, p. 7).

Discourse in this dissertation is analysed in relation to a twofold assumption. The first assumption is that, according to the Rwandan education policy on language (Mineduc, 2007b), students are supposed to learn in official foreign languages of instruction, English and French. This means that, in classroom settings, their interactions and actions are (in theory)

conveyed in these languages. By contrast, Wells (1999, p. 35) asserts that 'in learning their mother tongue through [situational] based conversation, children also appropriate the knowledge and practices of their culture'. From this statement, it can be inferred that a language can construe and shape social interactions more effectively if it is a language students are conversant with and if it is grounded in their social and cultural environment. Therefore, the second assumption in this dissertation is that Kinyarwanda, the participants' mother language, can not only convey an everyday discourse, but also frame students' learning. This is to say that in learning settings, Kinyarwanda may be used to voice personal ideas, and to make sense of those of other students. In this way, Kinyarwanda may operate as an unofficial classroom discourse in that it is not officially a language of instruction in higher education according to the language policy in Rwanda. Thus, the actual classroom discourse may result from both the 'official' and 'unofficial' learning discourses.

Language in use with computer-supported learning

Chen, Mashhadi, Ang and Harkrider (1999) maintain that culture and technology are mutually linked. For example, Yang's (2001) study on integrating computer-supported learning and language in schools shows that students with high appreciation of American culture and web-based English learning reported that the web can improve language ability and cultural understanding. However, the same study indicates that some students feel uncomfortable reading on the web, which may create frustration, cognitive disorientation and learning anxiety. Yang explains that the students with high language abilities seem to cope much better with the huge amounts of information available on the web, while some others find the vast amount of data overwhelming, time consuming and too technical. According to Yang's findings, some students complained that web-based literature was written in a language they could not easily understand.

The problems raised by students in Yang's study can reveal that the design of technology-supported learning practices may require taking into consideration language functions, context and culture. Halliday (1978, p. 2) suggests that language should be analysed within its sociocultural context. He puts it in these terms: 'The contexts in which meanings are exchanged are not devoid of social value; a context of speech is itself a semiotic construct, having a form (deriving from the culture)'. Accordingly, Joo (1999) argues that mastering a language does not necessarily ensure that speakers will fully understand a foreign website. Joo concludes that it is equally important to know the cultural context within which information is provided. As Halliday (1978, p. 3) points out, 'The context plays a part in determining what we say; and what we say plays a part in determining the context'. Consequently, Joo

(1999) suggests that it is important to explore the cultural backgrounds of web-based literature.

The interplay between local and foreign languages (mostly English), domestic contexts and technology has attracted the attention of some researchers. In a study of youth language in media settings in a Finnish context, Leppanen (2007) maintains that young people utilize English as an intracultural tool of communication which helps them to negotiate their identity within a worldwide society. For example, drawn from Leppanen's study findings, young people consider English as an expression of belonging to the European community. In a study conducted in Sweden, Sharp (2007) asserts that English serves as an auxiliary language for the sake of discourse. In other words, English can facilitate stylistic variation and expressivity. It can improve the lexical repertoire and mediate interaction and values between speakers. According to Sharp, some students report, among other things, that English is fashionable, sounds interesting, and confers status. Dimova (2007) analysed English loanwords on ten Macedonian business websites and found out that most English borrowing in Internet and computer technology settings concern nouns due to the lack of terminology for hardware, software and Internet packages in domestic contexts. Leppanen (2007) assumes that as most web-based literature is developed in English, it follows that this language is needed to handle it. These studies reflect how expansion of the use of international languages in domestic contexts and in ICT-based environments is of general research interest in terms of globalization and learning.

Learning conditions in ICT-based environments

In this dissertation, the concept learning conditions refers to the context within which interaction and action take place. Mercer (1995, p. 68) explains that context does not represent merely physical objects set up in learning environments, but also 'it is those things beyond the words being spoken which contribute to the meaning of the talk'. In this dissertation, learning conditions include also arrangements made in social practice in order to support students' thinking and learning, such as classroom organization, sociocultural context, access to computers, teachers' assistance or guidance strategies. For example, a UNESCO¹ planning guide on ICT in teacher education suggests four core competences necessary for ICT integration in schools. These core competences can entail some conditions to implement ICT as a tool for learning (UNESCO, 2002). These are described below.

¹ UNESCO stands for United Nations Educational, Scientific and Cultural Organization

Pedagogy – as the most important competence; it implies change in teaching practices, putting emphasis on the learner centeredness approach. In this context, ICT integration aims to support teaching, learning and curriculum development. From a Vygotskian perspective, learners already have a previous experience of learning. In other words, the genesis of behaviour plays a very important role in understanding the development of this same behaviour. Learners' intellectual development is determined by their previous experience, the use of language and other artefacts. What learners can do without help indicates, according to Vygotsky (1978), their actual level of development, whereas their potential to learn something new by the means of adequate support from the teacher or experienced others is called the zone of proximal development. Pedagogy can be reflected on in terms of assisted learning in the zone of proximal development. According to Vygotsky, the zone of proximal development implies that cognitive support from a teacher or another person more experienced can expand students' personal learning or problem-solving abilities. The zone of proximal development has been conceptualized in learning practices as a process of learners' guided participation (Rogoff, 1995) or guided knowledge building (Mercer, 1995), or as a process of scaffolding (Bruner, 1978) with a more skilled partner. Stetsenko (1999, p. 244) explains that the problem of analysing what goes on within the zone of proximal development is that emphasis is often placed on interaction between teachers and learners and that the content to be taught receives little attention. She claims that the focus is mainly 'on the quality of adult-child (or teacher-student) interactions and not on the quality of the cultural tools involved as integral parts in such interactions'. This is one of the issues this dissertation has tried to address, especially in Study 3. Another question that can be raised regarding the zone of proximal development is about the quality of assistance provided. I argue here that it is not enough to be a teacher or a more experienced person in ICT in order to automatically become capable of providing the appropriate kind of cognitive support needed by learners. My point is that an appropriate pedagogy is needed to assist learners in the zone of proximal development with ICT.

Collaboration and networking – this dimension is concerned with the potentiality that ICT has to mediate knowledge construction within groups of learners (see next section), as well as its potential to build a network between local and global communities, taking into consideration diversity, intercultural education and equity. Looking at education in relation to ICT-led collaborative learning, Sorensen, O Murchu and Jedeskog (2006) maintain that schools should produce educated global citizens who can listen to each other, discuss critically each others' propositions, and formulate new suggestions. Similarly, Suarez-Orezco and Sattin (2007) affirm that there is a

need to integrate in school curricula crucial skills related to critical thinking, communication, language, collaboration and technology which suit students' education worldwide. These authors assert that the age of globalization requires 'global citizens'. Yang (2001) argues that the web has indeed become a forum for global exchanges and opportunities for digitalization of data, which is however, according to Joo (1999), dominated by English and Western values. Chen et al (1999, p. 228) state that 'the quality and nature of learning are largely determined by the individual's experience of cultures and technologies'. Thus collaboration and networking pertains cultural dimensions as a learning condition which, of course, puts some participants at a disadvantage.

Technical dimension – this implies the mastering of and ability to update skills and knowledge in relation to ICT resources. Nevertheless, UNESCO (2002) points out that the aim of ICT integration in teacher education programmes is not the acquisition of technical competences per se, but the use of these competences to improve the quality of teaching and learning. In his study with newly qualified teachers in a Swedish context, Andersson (2006) maintains that ICT can be used as a discussion forum between peers for the purpose of developing teaching methods, or negotiating computer-related knowledge. Andersson interprets this situation as an opportunity to generate reflective attitudes where ICT is involved in changing the learning culture in the users' profession. However, this study notes that, on several occasions, teachers use ICT to improve their own competence and only rarely to help their learners to tackle their activities.

Social and health dimension – these aspects entail that professional teachers must be able to promote healthy use of ICT and integrate information literacy, respecting copyright and intellectual property. Accordingly, the search of reliable information is coupled with the ability to use it effectively in different contexts.

Nowadays, one of the difficulties of using web-based literature is that students become overwhelmed by the abundance and complexity of information and find it difficult to discern relevant papers (Lowe, 2004). Another crucial problem identified by researchers is linked to plagiarism. In their studies, Jedeskog and Nissen (2004) and Alexandersson and Limberg (2006) reveal that students lack information literacy skills. These authors report that students understand information seeking as getting facts. Jedeskog and Nissen explain that students seem to face a problem of identifying relevant electronic sources, gathering them and seeing their meaningfulness, or creating something new out of them. Alexandersson and Limberg argue that most students, with the exception of only a few, are content to collect and present information without a deeper critical analysis of it.

In their study, Alexandersson and Limberg (2006) identify two important groups among the users of web-based literature. The first group, including the majority of students, compiles and finds facts on the internet and then formulates research questions to answers already known. The second group starts their academic essays by trying to define the problem or topic at hand and proceed to search related information using keywords. This group critically scrutinizes the content of information retrieved and use it in line with their research questions. Alexandersson and Limberg conclude their study by saying that educational institutions tend to produce 'information illiterates'. Though these authors conclude by taking a pessimistic stance, their study shows that students' attitudes towards the use of web-based literature depends on the nature of the learning material, for example, its complexity and on students' learning experiences in school practices. The studies mentioned above also indicate that investigations on web-based literature constitute an issue of research interest at a global level.

Through an analysis of information literacy education in the world, Moore (2002) considers teachers as the key stakeholders who can support learners to search and utilize web-based literature most effectively. In other words, teachers can help students to analyse information critically, reflect upon it and generate new ideas. Sorensen et al (2006) underpin that teaching with ICT goes beyond the simple transmission of information and facts. They maintain that teaching is about the encounter of students' past experiences, creativity, negotiation of meaning, meta-cognition, collaboration and active participation in social practice. However, according to Moore, the majority of studies in this area focus much more on the obstacles encountered by users and less on the outcomes of their information literacy abilities. This is one of the issues this dissertation has tried to address.

Collaboration and critical reflection

Theoretical considerations

Before going into details pertaining to this heading, I would like to clarify that the concepts collaboration and reflection may be merged to form a single concept, for example collaborative reflection. However, as referred to earlier, all kinds of collaboration are not intended to end up as critical reflection such as in disputational or cumulative talk. My intention here is to relate students' collaborative actions mediated by a computer to critical reflection embedded in exploratory talk (Mercer, 1995). As learning environments are unstable, uncertain, unpredictable, changing and complex, Schön (1983) suggests an epistemology of practice which puts reflective inquiry at the forefront. He explains that this new epistemology should take into consideration reflection-

in- and reflection-on-action within the uniqueness and uncertainty of the context of inquiry. For example, Baker and Lund (1997) reveal that structured interactions in ICT-supported learning environments with task-based activities (such as evaluation, explanation, justification) facilitate reflective and collaborative learning. Deadman (1997) reports that reflective writing within a hypermedia setting can enhance learners' self-perception and ability to reason more objectively. Thus, this dissertation focuses on how the participants construe knowledge through collaboration and critical reflection. In order to understand this process, it is important to analyse the social origins of human mental processes in what Vygotsky termed the 'general genetic law of cultural development':

Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, *between* people (*interpsychological*), and then *inside* the child (*intrapsychological*). This applies equally to voluntary attention, to logical memory, and the formation of concepts. All the higher functions originate as actual relations between human individuals (Vygotsky, 1978, p. 57, author's emphasis).

From this view, Vygotsky points out that knowledge building results first from collaborative endeavour between people working together. In other words, the initial stage of learning is jointly achieved through social interaction. It is within this process that individuals share their experiences and where individual thoughts generate collective thoughts. The central condition for developing knowledge at this stage is that speakers reflect critically on their proposition through an exploratory talk (Mercer, 1995). This means that individual thoughts may be analysed, evaluated, accepted or contrasted through debates. Previous experiences may be sustained, more elaborated or amended and all this with supportive arguments.

The Vygotskian 'general genetic law of cultural development' also indicates that knowledge results from individual efforts, not only because an individual is a member of a group who negotiates knowledge but also because individuals participate actively in the creation of knowledge. Wenger (1998, 56) claims that participation 'is both personal and social'. The point made by Vygotsky (1978) about intrapsychological functions is that knowledge is 'internalized' by learners through the process of its construction.

The concept 'internalization' is often criticized in that it can reflect a transfer of a collection of accumulated possessions from an external to an internal sphere over various time spans. For example, Rogoff prefers to use 'participatory appropriation' or 'appropriation' instead of 'internalization' which may indicate '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). Rogoff argues that participatory appropriation is a process of individual change that can occur through active involvement in social practice. Putting this differently, change refers to a situation where individual learners cope with novel experiences as a result of their abilities developed in the course of participation in previous and related experiences. Rogoff puts it in this way:

Participatory appropriation [or simply 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).

This dissertation draws on Rogoff's definition which shows that appropriation is both future-oriented and also embedded in participation in collective efforts. Similarly, Lave and Wenger (1991) assert that learning develops in a participatory framework. Thus 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'. 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. As Wells claims, when knowledge is appropriated or understanding developed, a new cycle of knowledge building starts. Thus, Wells compares this process of ongoing transformation with a metaphor of a spiral.

Collaboration and critical reflection with ICT

Collaboration and critical reflection have been explored in ICT-based learning environments. For example, Lazonder (2005) affirms that pairs of students express their thoughts in a more articulated way than individual students in a situation of searching web-based literature. In the study of Lazonder, pairs seem to work faster and to use a richer repertoire of search strategies. Romonov and Nevgi (2006) assert that collaboration enhances deeper processes of learning and students achieve better results through social interactions. Neo (2003) explains that social interactions can enable students to develop joint problem-solving and critical thinking skills.

Studying the correlation between epistemological beliefs and preferences toward Internet-based learning environments, Tsai and Chuang (2005) highlight the relevance of critical reflection in learning using the computer. They report that self-regulation implies a higher order of meta-cognitive

activities, which in turn involves inquiry, learning and reflective thinking. Similarly, Leung (2000) suggests that students should receive guidance about how to monitor their learning progress in technology-based environments. According to Reiser (2001), this kind of meta-cognition may be focused on predefined criteria relevant to a programme under study (criterion-referenced evaluation) instead of focusing on comparison between students' aggregated abilities, such as their grades or scores (norm-referenced evaluation). Borrowing the concepts of evaluation, I can argue that, in this dissertation, criterion-referenced reflection indicates that students are involved in performing 'a particular behavior or a set of behaviors, irrespective of how well others perform' (Reiser, 2001, p. 60), whereas norm-referenced reflection means that students' concern 'is to discriminate between individual performance' (Leung, 2000, p. 152).

Sadler-Smith and Smith (2004) suggest that technology programmes should be sufficiently flexible in order to integrate both individual and group learning styles and strategies. This point is also raised by Neo (2003), who argues that some students complain for various reasons that group work does not allow them to perform at their best. In order to address this issue, some researchers explain that students need to receive teacher support. For example, Nevgi, Virtanen and Niemi (2006) state that students who receive teacher support in technology-based learning environments gain much more from a computer than those who work without help. Teacher support is also shown in the 'triadic dialogue': a teacher/computer starts with *Initiation* of a task; students have to provide a *Response* and then the teacher/computer performs a *Follow-up* or evaluates the response (IRF). Wegerif, Littleton and Jones (2003) suggest changing the course of the entire flow of IRF by incorporating a dialogue throughout the students' learning process. Thus, the new learning pattern is shaped as follows: *Initiation* by a teacher/computer – *Dialogue* among students – Students' *Response* – and *Follow-up* by the teacher/computer. Wegerif et al. explain that this new pattern (IDRF) changes substantially students' learning in that they take part actively in collaborative knowledge building. In addition, IDRF seems to fit better with the Vygotskian 'general genetic law of cultural development' referred to above.

Interrelation between the central theoretical concepts

At the beginning of this chapter, I tried to sketch, with examples drawn from ICT-based learning environments at hand, how mediation plays a part in the creation of knowledge. Drawn from Vygotsky (1978) and his tradition, I argue that the incorporation of a tool such as a computer in social practice can generate change in learners' behaviour. In this dissertation, I am interested in qualitative transformations in students' behaviour in terms of

knowledge development. Thus language is an aspect of mediation which needs to be analysed as a cultural tool in social interaction and as a psychological tool which shapes learners' thoughts. Accordingly, understanding different forms of talk is essential in order to determine how thinking and learning take place in technology-based environments and in social practice. This means that mediation with a computer and language is the first key concept in this dissertation.

The second central theoretical concept in this dissertation is about learning conditions. As Halliday (1978) asserts, learning has its foundation in language and language is implicated in a sociocultural context. Learning conditions may vary in space and time, but they seem to be determinant in shaping thinking and learning in computer-supported social practice.

The third central theoretical concept in this dissertation results from the Vygotskian 'general genetic law of cultural development': collaboration. This law stipulates that knowledge is generated through interpersonal mental activities and that it requires personal involvement and appropriation. Drawing from Mercer (1995) and Bereiter (1994), collaboration and personal involvement can contribute to knowledge building on the condition that individual propositions are critically reflected on, evaluated, or explored in a progressive manner. Thus, the fourth central concept in this dissertation is critical reflection. This theoretical concept implies that members of a group are critical in their social interaction and that individual learners are critical in their involvement and in participatory appropriation of knowledge.

The interrelationship between the four central concepts according to how they are reflected in this dissertation can be organized around two axes (Figure 1). However, the concepts on the same axis do not indicate opposite poles. Rather, they show that a strong interrelation exists between them. On *the vertical axis*, represented by collaboration and critical reflection, emphasis is put on social interaction which takes into consideration a progressive and critical analysis and evaluation of individual inputs for the purpose of achieving joint knowledge. Both concepts also relates to participatory appropriation of knowledge, by which means individual learners can handle further situations. On *the horizontal axis*, represented by mediation and learning conditions, the focus is on tools, which may be physical, psychological, social, cultural, or contextual and which may allow thinking and learning to take place in a particular way. Accordingly, as shown by the arrows, each theoretical concept relates to the others and all of them converge to the creation of a situation conducive to thinking and learning specifically with ICT.

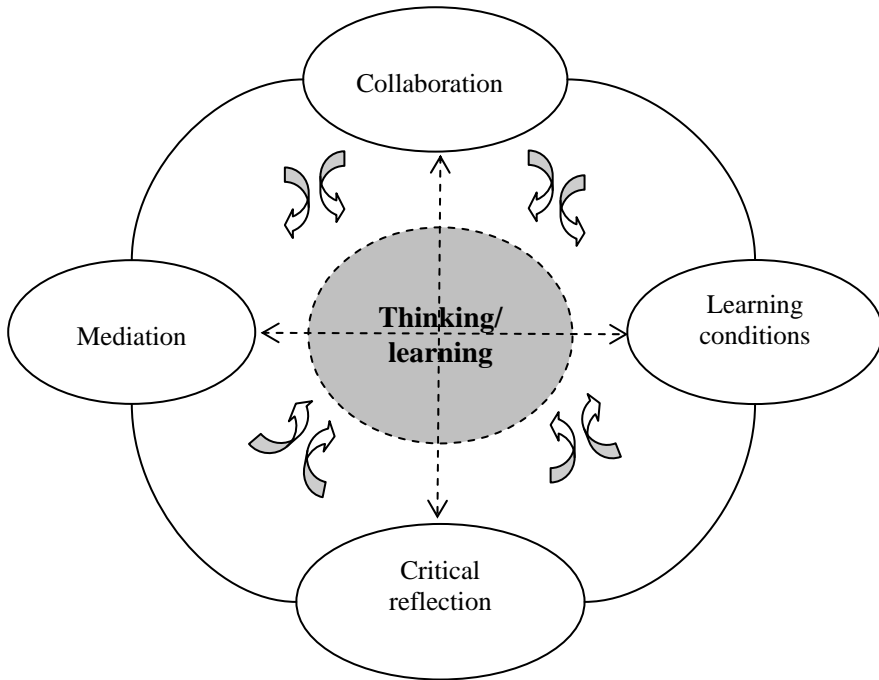


Figure 1: Central concepts for thinking and learning with ICT

A combination of the four theoretical concepts generates a model about thinking and learning with ICT which, in turn, can provide elements of my contribution in relation to earlier research. Although research has tried to investigate how mediation, learning conditions, collaboration and critical reflection play a part, one at a time, in the improvement of learning with ICT, more can be learned about the dynamic relations between them. Moreover, there is a need to examine these dynamic relations where thinking and learning are dealt with as a single unity aiming towards knowledge building in computer-supported social practice. In this connection, I argue that this interrelationship may require understanding of the process of knowledge building in ICT-based environments through various ways of organizing learning in small groups. For example, drawing from earlier research, it can be seen that studies have explored relationships between ICT, contexts and foreign languages (mainly English). Surprisingly, little evidence has been offered regarding change in learning practices, especially when students have to study web-based literature conveyed in foreign languages collaboratively, and, at the same time, have to preserve values embedded in their mother language. Therefore, my dissertation can be seen as a contribution to research attempting to understand how knowledge can be developed in such settings.

Methodology and design

Setting the scene: case study

Exhaustive identification of common features of case studies may not be an easy task. First, Hammersley and Gomm assert that, in one way or another, all research can be regarded as case studies. They explain that ‘there is always some unit, or set of units, in relation to which data are collected and analysed’ (2000, p. 2). Secondly, some research methods, including grounded theory (Strauss and Corbin, 1998), life history (Goodson and Sikes, 2001), or action research (Cohen, Manion and Morrison, 2000) refer to cases in their procedures. Thirdly, Hammersley and Gomm (2000) point out that the concept of case study has been used beyond the research context, especially by some professional practitioners, such as lawyers, medical doctors and social workers. These practitioners often handle cases. These considerations suggest that the meaning of a case study may overlap with other approaches and is not fixed.

Hammersley and Gomm (2000, p. 3) have set some boundaries in terms of dimensions which can frame an acceptable meaning of a case study. They state that this form of inquiry examines a few cases, or just one case (an individual, a group of people, an event, a community or organization, a society) in depth. This requires large amounts of information collected from cases. It implies also listening to the participants’ voice in ‘naturally occurring social situations’. Thus the aim of case studies is ‘to capture cases in their uniqueness, rather than to use them as a basis for wider generalization or for theoretical inference of some kind’. Table 1 summarizes the dimensions of the meaning of case study in contrast with experimental and survey approaches.

The investigatory style, analytical procedures and ways of reporting the findings in this dissertation are inspired by case studies as a form of inquiry implying some assumptions of constructionism. According to the naturalists’ and positivists’ point of view, accounts are considered as a ‘simple representation of the world’. Conversely, constructionists try to explain how accounts ‘are part of the world they describe’ (Hammersley and Atkinson, 1995, p. 126). From this point, it can be said that the aim of observations, interviews and focus group discussions for constructionists is to investigate ways in which participants develop meaning in talk and interaction.

Silverman (2001) highlights that constructionists' concern is to explore how meaning is developed through social interaction.

Table 1: A schematic comparison of case study with experimental and survey approaches

<i>Experiment</i>	<i>Case study</i>	<i>Survey</i>
Investigation of a relatively small number of cases.	Investigation of a relatively small number of cases (sometimes just one).	Investigation of a relatively large number of cases.
Information gathered and analysed about a small number of features of each case.	Information gathered and analysed about a large number of features of each case.	Information gathered and analysed about a small number of each case.
Study of cases created in such a way as to control the important variables.	Study of naturally occurring cases; or, in 'action research' form, study of cases created by the actions of the researcher but where the primary concern is not controlling variables to measure their effects.	Study of a sample of naturally occurring cases; selected in such a way as to maximize the sample's representativeness in relation to some larger population.
Quantification of data is a priority.	Quantification of data is not a priority. Indeed, qualitative data may be treated as superior.	Quantification of data is a priority.
The aim is either theoretical inference – the development of testing of theory – or the practical evaluation of an intervention.	The main concern may be with understanding the case studied in itself, with no interest in theoretical inference or empirical generalization. However, there may also be attempts at one or other, or both, of these. Alternatively, the wider relevance of the findings may be conceptualized in terms of the provision of vicarious experience, as a basis for 'naturalistic generalization' or 'transferability'.	The aim is empirical generalization, from a sample to a finite population, though this is sometimes seen as a platform for theoretical inference.

Source: Hammersley and Gomm (2000, p. 4).

Bryman (2004, p. 412) suggests that, in order to understand ways through which meaning is constructed with qualitative analysis, researchers should move their attention from 'what actually happened' to 'how people make

sense of what happened'. By doing so, researchers may collaborate with participants to disclose the meaning. This can indicate that constructionism also draws on naturally occurring data.

Silverman (2001, p. 111) claims: 'despite the power of naturally occurring data, it does not follow that it is illegitimate to carry out our own research interviews. Everything depends on the status which we accord to the data gathered in such interviews'. This point explains the approach adopted in this dissertation: using flexible interview guides and topics of focus group discussions, rather than giving primacy to survey-led standardized instruments.

Data collection

Methods of data gathering stem from a theory, a methodology adopted and from a research topic under investigation (Silverman, 2001). Accordingly, as the aim of this dissertation is to investigate how knowledge can be developed in computer-mediated social practice, most of the methods used in the four papers overlap and some differences depend on the specificity of each research topic. The focus of each paper is summarized as follows:

- Study 1: Learning conditions in ICT-based environments (newly qualified teachers as participants)
- Study 2: Computer-supported collaborative learning with a focus on hands-on skills (student teachers as participants)
- Study 3: Language in use with web-based literature with a focus on content (student teachers as participants)
- Study 4: Interplay between learning conditions and participation in ICT-based environments (student teachers as participants)

The four studies used interviews for data collection in order to understand how individual learners were involved in ICT-based practice. However, in Studies 1 and 3, interviews helped to deepen understanding of the learning conditions in such environments (Study 1) and different types of language in use in students' interaction and action while studying web-based literature (Study 3). In-depth interviews correspond to purposive sampling with key informants who seem to be relevant to the research questions (Morgan, 1997; Bryman 2004). The same set of data in Study 2 is reused in Study 4. Here, interviews were primarily used as a data collection method and also as a follow-up technique referred to until when the addition of empirical data did not yield any further contribution to the categories (Strauss and Corbin, 1998).

Studies 1, 2 and 4 utilized focus group discussions for eliciting how the participants could interpret their participation in ICT-based learning environments. For the purpose of stimulating participants' critical reflections on their own experiences in computer-supported environments, the topics of the focus group discussions and interview guides reflected mainly 'what' and 'how' and then 'why' questions (Silverman, 2001; Holstein and Gubrium, 2004). Both focus group discussions and interviews were conducted mainly in Kinyarwanda (except for one in-depth interview where the interviewee requested to respond in English, Study 1). They were audio recorded.

While they were completing their tasks, the participants in Studies 2 and 3 were video recorded and this allowed collection of their naturally occurring talk. This material served to track down, step by step, the ways the participants constructed their interactions in ordinary social contexts and how they negotiated learning independently of the researcher's intervention. Here qualitative research is regarded as constructionistic (Silverman, 2001). Accordingly, field notes were made from observations of the participants' activities in small task-based groups. In this regard, I used observation techniques and videoed or audio recorded the participants' interactions and action.

Participants

In Study 1, the target group was drawn from newly qualified teachers while in the other studies the participants were student teachers. It was not only assumed that student teachers' prospective was to become teachers in the future but also that learning conditions with ICT could be better examined in both academic and workplace contexts. As a bridging tactic, in Study 1 I used questionnaires but only in order to capture the general picture about participants' identification and skills in ICT. In order to get an overall picture of newly qualified teachers' needs and skills while learning with ICT, questionnaires were administered. Silverman (2001) supports that this technique can provide some details of data generally lost in qualitative research. A summary of the methods of data collection according to the order they have been used and the participants' group is presented in Table 2.

Except in Study 1, where the participants were drawn from newly qualified teachers, student teachers in Studies 2, 3, and 4 followed a training programme on searching, retrieving and utilizing web-based literature as part of the research process. Students' practices with ICT and the methods of data collection related to this training programme. Men and women participants were equally represented in all interviews and focus group discussions, except when one of them was absent for his or her particular reasons.

Table 2: Summary of data collection strategies and participants

	Instruments	Number of participants	Participants' groups
Study 1	Questionnaires	18 participants	Newly qualified teachers
	Focus group discussions	3 focus groups of 3, 3 and 4 participants	“
	In-depth interviews	3 participants from 3 schools	“
Studies 2 and 4	Individual interviews	12 participants	Student teachers with a training programme on ICT
	Focus group discussions	3 groups of 4, and 1 group of 3 participants	“
	Follow-up interviews	12 participants	“
	Naturally occurring talk (for Study 2 and reused in Study 3)	57 participants who formed 13 groups	“
Study 3	Naturally occurring talk	57 participants who formed 13 groups	Student teachers with a training programme on ICT
	In-depth interviews	12 participants	“
	Observations	57 participants who formed 13 groups	“

Analytical process

The dialectic thinking embedded in the analytical process was influenced by hermeneutics. In the present dissertation, this line of reasoning implies the interplay between the theoretical perspective, empirical data and its interpretation. Larsson (2005) asserts that, in hermeneutics, the parts and the whole influence each other. For example, the meaning conveyed through the interpretation is dependent on the central theoretical concepts underpinned by sociocultural theory namely mediation, learning conditions, collaboration and critical reflection. Thus, the starting point for handling the empirical data was to outline the theoretical framework which allowed me to develop a pre-understanding of the phenomenon under study. For example, during the training sessions, the participants were asked to take seats randomly in a previously set up seating arrangement of four by four. They were also asked to work collaboratively around a computer. This set up seating arrangement reflected the central theoretical concepts. As Larsson explains, a pre-

understanding creates a basis for further interpretation. Of course, my pre-understanding of the phenomenon evolved and developed into a new understanding throughout the analytical process.

Multiple sources were involved in this dissertation; participant observation made it possible to combine different pieces of data into a harmonious whole. The empirical data drawn from interviews, focus group discussions, naturally occurring talk and field notes were analysed qualitatively. Scrutinizing this large corpus of unstructured material was not straightforward. The analysis started after the initial data were collected. The preliminary analysis guided the next steps in the data collection. This process is described as *iterative*, that is, 'there is a repetitive interplay between the collection and analysis of data' (Bryman, 2004, p. 399). The data were broken down into conceptual categories raised to a higher level of abstraction, guided by the process of coding and theoretical sampling referred to above. Bryman suggests that the purpose of qualitative analysis is much more a question of producing categories rather than a theory.

Diagrams and memos supported the process of data analysis in terms of keeping in mind and tracking comparison of patterns and potential relationships between emerging concepts. Strauss and Corbin (1998) claim that diagrams and memos can be used as a conceptual guide. This implies that these instruments are analytical rather than descriptive. They evolve and can be modified. Throughout the analytical process and interpretation, a literature review was conducted. This review enabled me to clarify and supplement emerging concepts and analyse and discuss the findings. In the present dissertation, matrices also served to analyse data from interviews, focus group discussions, naturally occurring talk and observation. In this regard, matrices often indicated codes, themes and categories and some theoretical and analytical notes. Data arising from the questionnaires (Study 1) were recorded on a summary sheet and they were analysed using simple counting techniques.

Credibility in the qualitative research tradition

Silverman maintains that reliability and validity are at the heart of credibility in scientific research. Accordingly, 'Social science is thus scientific to the extent that it uses appropriate methods and is rigorous, critical and objective in its handling of data' (2001, p. 224). In the following paragraphs, I will discuss in turn how this dissertation reflects reliability and validity.

Reliability

According to Hammersley, 'Reliability refers to the degree of consistency with which instances are assigned to the same category by different observers

or by the same observer on different occasions' (1992, p. 67). Following Hammersley's advice, my purpose here is to demonstrate the usefulness of the research strategies employed in this dissertation and to show how systematization of the use of these strategies contributed to the improvement of their reliability. The first strategy consisted of using what is known as low-inference descriptors (Seale, 1999; Silverman, 2001). This means that I tried to include in my studies verbatim accounts of the participants' discussions in certain contexts (naturally occurring talks) while they were completing their tasks. Wherever possible, I also presented long extracts of data drawn from interviews and focus group elicited talk, together with related questions or topics of discussions. These accounts were accompanied by my comments and were supported by a description of the contexts within which the participants were situated.

Second, reliability can be looked at through the standardization of writing field notes and transcribing techniques (Silverman, 2001). Interviews, focus group discussions and naturally occurring talk were transcribed verbatim. Later, relevant extracts of the studies were translated into English. In order to enable readers to gain access to the words uttered by the participants and the context conveyed through the talk, I used the conventions of transcription as depicted in Table 3.

Table 3: Conventions of transcription

Symbol	Meaning
(.)	One period between parentheses marks a perceptible short pause (approximately two second)
(())	Double parentheses indicate interpretations of what was said or how it was pronounced
[]	Square brackets enclose descriptions of other relevant behaviour
[...]	Square brackets with three dots show that a part of an extract has been omitted
...	Three periods mark interruption of the speaker
xxx	One 'x' stands for each word that is assumed to have been spoken but was not clear enough to transcribe

Source: Adapted from Mercer (1995) and Wells (1999)

Third, Silverman points out that 'reliability can be improved by comparing the analysis of the same data by several researchers' (2001, p. 231). Accordingly, I translated two or three interviews or focus group discussions from Kinyarwanda into English and my three supervisors and I analysed the transcripts independently and identified major concepts, themes and categories through coding. Later, our results were compared and discussed until we reached consensus. With respect to the standards established through this process, I analysed other transcripts and therefore enhanced the quality of

my studies. In fact, Hammersley (1992) asserts that reliability provides evidence by means of which the validity of the findings can be assessed.

Validity

The question surrounding validity concerns whether the reporting of findings or ‘a description of particular events (or a set of such descriptions) represents the theoretical category that it is intended to represent and captures the relevant features of these events’ (Hammersley, 1992, p. 67). In other words, the question here is whether a description of the findings portrays the reality it claims and therefore reflects valid knowledge (Silverman, 2001; Larsson, 2005). Taking this line of reasoning, Larsson (2005) suggests some criteria upon which assessment of validity of findings can be based. The *discourse criterion*: the point is to allow a research community to scrutinize and peer-review the findings and compare different statements or arguments. Thus, through discussions, statements or arguments, the issues under study can become visible. Similarly, I have had the privilege of presenting my four articles at different research seminars and at some international conferences. This has allowed me to strengthen the findings and, to some extent, to report and bring them to a broader audience. This interpretation corroborates with my choice to write this dissertation by publication. The four articles have been peer-reviewed on an international level. This process can also ensure the quality of case studies.

This dissertation embraces aspects embedded in the *heuristic value*. As Larsson explains, this criterion of validity entails that the ultimate goal of scientific research is the production of new knowledge. I can argue that the process described above in order to meet the discourse criterion has contributed in one way or another to the heuristic value of this dissertation. Discussions on the findings of my studies were linked to some questions such as: is there something new that the findings can inform in relation to the theoretical perspective as well as to earlier research? What can be learned from the context of the studies? How can the findings be useful to practitioners? These questions are only some examples. Such inquiry has been at the basis of the *pragmatic* aspect of my studies and enabled me to develop interpretation based on *consistency* between their parts and whole (Larsson, 2005).

Furthermore, in order to assess the validity of qualitative research, it is important to take into account what Larsson (2005) calls *empirical anchorage* which can be considered as a criterion involving the relationship between reality and interpretation. Indeed reality in social science can be seen as relative. However, Larsson asserts that relativism does not match well with the use of empirical anchorage. In fact, he argues that relativism seems to be limitative, implying ‘multiple realities’ depending on interpretations by

various people. In this connection, he explains that, with relativism, any interpretation would be judged to be valid, even if it was not sufficiently implicated in the reality it assumes to reflect. Drawing on Hammersley (1992), Silverman (2001, p. 225) asserts that reality in social science 'is always viewed through particular perspectives. Hence our accounts *represent* reality; they do *not* reproduce it' (author's emphasis). For example, in this dissertation, thinking and learning with ICT are viewed through a sociocultural perspective. The fundamental question in empirical anchorage is thus to know whether interpretation is well anchored in the reality it claims to represent (Larsson, 2005). How was this question addressed in my studies? I used different methods of data collection – a strategy known as triangulation – like combining naturally occurring talk, observations and interviews or interviews together with focus group discussions in order to study the same phenomenon. I realized that the methods used converged to explain the same issues under study though in different versions. In a similar vein, I mentioned above how different researchers took part in the analysis of data, which also improved the validity of the findings.

Considerations on generalizability of case studies

To what extent can the results of the present case studies be generalized? The in depth study of cases and their uniqueness have brought some authors to question where findings from a case study can be generalized. For example, Lincoln and Guba (2000, p. 27) wrote about case studies that 'the only generalization is: there is no generalization'. They assume that local conditions are unique and that contexts are different from situation to situation. They point out that a single situation can change over time. Accordingly, they assert that instead of making inferences from case study findings, researchers should formulate 'working hypotheses' (a concept they borrowed from Cronbach, 1975).

Stake (2000, p. 22) in his famous article 'The case study method in social inquiry' claims that case studies lack universal laws of human behaviour regardless of time and space, laws that are 'context-free', such as those involved in the natural sciences. Therefore, Stake suggests that generalization should rather be based on what he calls 'naturalistic generalization'. This author claims that naturalistic generalization allows 'recognizing the similarities of objects and issues in and out of context and by the natural covariations of happenings. Generalizing this way is to be both intuitive and empirical'. In other words, generalization is a matter of similarities between cases and their contexts, and not a question of scientific induction. Of course, people do not learn only from similarities but also from differences which

can provide equally useful information allowing comparisons to be made (Donmoyer, 2000).

Lincoln and Guba (2000, p. 36) criticize Stake's statement, arguing that the naturalistic generalization is not based on rational and law-like scientific discourse, rather on intuition, empirical and individual imagination. Instead they suggest 'transferability' from knowledge gained from one case to a similar case as a function of 'fittingness' (appropriate information) between the two. For this to occur, they explain, comparison needs to be illuminated by 'thick descriptions' of the cases under study. Thus for Lincoln and Guba, instead of talking about generalizability in case studies, the only possibility is 'transferability' of findings from one case to another. I note here that, according to this view, what may be transferable are categories of description.

Naturalistic generalization in Stake's terminology and what Lincoln and Guba call transferability both rely on readers' skills to compare one case with another. The difference is that Lincoln and Guba assume that researchers must provide information which is 'thick' enough and which can enable users or readers to infer transferability. Stake does not produce indicators against which similarities with other cases are to be judged and is content to trust into readers' and users' intuition. Lincoln and Guba state that transferability depends on thick descriptions but do not indicate criteria of what is sufficiently 'thick' to guide the judgement. If the problem of what should be regarded as appropriate information or 'thick' is raised, then the degree of 'fittingness' will also be difficult to assess.

Eisenhardt (1989) argues that the analysis of within case data can enable researchers to cope with emerging patterns of each case as a stand-alone entity. She adds that this process can not only lead researchers to make a cross-case comparison but also, later on, to generalize patterns across cases. 'One tactic is to select categories or dimensions, and then to look for within-group similarities coupled with intergroup differences' (p. 540). Gomm, Hammersley and Foster (2000) concur with Eisenhardt that case studies can draw general conclusions, both within and across cases.

This dissertation draws mainly on a theoretical sampling and rejects statistical approaches as the only basis for researching a scientific generalization. As Silverman (2001) advises, I have selected a purposive sample in relation to the theory I used. Most of the themes and categories emerged from and were grounded in data. Later, the major findings were linked with existing literature, not simply for verifying whether they conflicted or converged but also to strengthen the theoretical scope and validity of case studies and thereby enhance generalizability (Eisenhardt, 1989).

Ethical considerations

In this dissertation, I have referred to ethical guidelines in social research as adopted by the Swedish Council for Research (HSFR) in March 1990. The participants who took part in my studies can be subdivided into two major categories: newly qualified teachers from secondary schools and final year university students. In secondary schools (Study 1), first of all, I negotiated entry and access with the directors of the schools involved. Afterwards, the directors organized a meeting with their newly qualified teachers where I was invited to explain the purpose of my research, its process and its implications in terms of the requirements of informed consent, confidentiality, privacy and restricted use of information (Swedish HSFR, 1990). At the university (Studies 2; 3 and 4), I met the students in their respective classrooms and we discussed similar issues as in the secondary schools. The difference was that at the university, the students were requested to attend voluntarily an extra-curricula training programme on searching, retrieving and utilizing web-based literature as part of the research process.

Both in secondary schools and at the university, the participants did not hesitate to give orally verbal consent, mainly because they were expecting a long term programme for their professional or educational development through the means of ICT, which was indeed a top priority of the government of Rwanda. Sometimes, I felt that the participants' expectations seemed to go beyond the scope of my studies. Thus I was obliged to clarify the limitation of my studies and explained that the information I was seeking was to be used exclusively for research purposes. The university students were also motivated by the fact that they were conducting their research projects as a part of the requirements for being awarded a bachelor's degree in education. This increased their collaboration, since they wanted to learn from my experiences about carrying out research. For example, when an interview or focus group discussion was finished, some of the participants stayed behind in order to ask me how I was to handle data from such instruments. Of course, a problem of access to information as a researcher was raised due to the relationship I had with the university students. I had taught them for some of their academic courses and they seemed to consider me as their lecturer and not mainly as a researcher. In order to address this problem, I tried to limit my interventions and I explained to them why I had to play a role of a participant observer. They were convinced though not easily, since they needed advice about conducting a piece of research.

Whenever a tape recorder and a video camera were to be used, I had to request permission from the participants. In Studies 2 and 3, it was explained to the participants in their groups how to use the tape recorder i.e. how to switch it on and off, how to use the pause button. This allowed them to record their naturally occurring talk at their ease and to switch off, or use the

pause button when their conversation was related to private issues. Tapes recorded were coded and the participants were given fictional names in order to ensure the anonymity and confidentiality of the information. However, confidentiality in group discussions might not be fully guaranteed in that several participants took part in the conversational exchanges. On my part confidentiality was ensured and I requested the participants to be confident about what was to be discussed in focus groups. I explained to them the limitations that this kind of instrument could entail in relation to that issue.

Summary of the results

The four articles of this dissertation converge to investigate how knowledge can be developed in computer-supported social practice, especially when the tool is a new phenomenon in the process of teaching and learning. Given that learning evolves in a context and culture (Lave and Wenger, 1991), the first article was dedicated to exploring conditions that can enable or constrain the implementation of ICT in schools. This study opened up new horizons in the settings where data were collected. Thus, the empirical data of the other three remaining studies were collected during and/or after a training programme on searching, retrieving and exploiting web-based literature, where participants were invited to collaborate in small groups of four members each. During this training programme, it became clear that students adopt different learning strategies depending on whether their attention is directed to acquire hands-on computer skills – the focus of the second article – or whether they handle content embedded in web-based literature – the focus of the third article. Finally, drawn from the first three articles, it became important to gain insight into ICT-use appropriation taking into consideration the interplay between learning conditions and participation in social practice – the focus of the fourth article. This brief description helps explain the order in which the four studies are presented in this dissertation. It can also indicate how the design and conduct of this dissertation were constructed along the journey. This agrees with Fullan's (1993) suggestions according to which visions and strategic plans develop throughout the process of educational change and not prematurely at the very beginning. In the next sections, the summary of the results of each of the studies in turn follow.

Study 1: Coping with change in ICT-based learning environments: newly qualified Rwandan teachers' reflections

This study investigates the necessary conditions through which newly qualified teachers can learn with ICT in Rwandan schools. It tries to gain knowledge about newly qualified teachers' needs, their abilities with regard to ICT and their reflections on in-service teacher training and education with ICT as a tool for learning. The findings show that a computer is a new tool that whole school communities are trying to cope with. Two to five teachers,

depending on schools, go out and attend ICT literacy courses, and come back to train their colleagues as part of extra curricula programmes. From the participants' point of view, schools would not seem to know what should be taught and learned in ICT. First, the content delivered in peer teaching is mainly about word processors and spreadsheets. Second, school-based curricula do not exist in areas like the acquisition of ICT literacy and teacher professional development. Third, teacher trainers do not have enough skills in ICT literacy and related pedagogy.

Implementation of ICT in schools may require coordinated efforts from students, teachers and managers. This study reveals that students and teachers are particularly motivated and committed to acquire and use ICT in the process of learning. However, the style of leadership adopted by school managers may enable or constrain access to ICT facilities. For example, this study indicates that where the management of school computers is centralized and where teachers' access to these facilities is controlled by the director, users seem to be frustrated by a lack of opportunity to engage in creative practice and develop problem-solving skills. Conversely, where the management of computers is decentralized to users, newly qualified teachers express a feeling of self-confidence and ownership of learning with the tools. Thus, this study concludes that teachers' motivation and commitment to use technology may be supplemented by an the unconditional support of the school managers as a necessary condition when integrating and implementing ICT in classroom social practice.

Newly qualified teachers expressed a need to be considered trustworthy and be allowed time to use computers and related skills in order to challenge traditional classroom practice. This point indicates that newly qualified teachers are aware that implementation of ICT in an appropriate way in schools depends to a great extent on whether teachers can handle the new technique. This study reveals that peer teaching would not be enough if the follow-up of what is learned is overlooked. Practice is therefore one of the conditions for effective implementation of ICT in schools.

Drawn from the findings, there are some indications of added educational achievements when appropriate conditions for ICT facilities are present: (i) ICT may serve as a pedagogical tool fostering the principles of problem solving and critical thinking; (ii) access to information from different sources may support critical reflection; (iii) ICT literacy may transcend gender boundaries and allow more opportunities for women's education. The study shows, however, that these preliminary insights deserve further investigation in order to scrutinize how knowledge can be developed more effectively in computer-supported social practice.

Study 2: Strategizing computer-supported collaborative learning toward knowledge building

This study has explored student teachers' interaction and action in the acquisition of hands-on computer skills in small task-based groups. From university students' reflections, the purpose of the study was to understand the process of knowledge building in ICT-based learning environments through various ways of organizing learning in small groups. The study also aimed to investigate whether the different learning patterns are mutually exclusive or whether they can be combined in the acquisition of hands-on computer skills. The findings show the possibility of going beyond a simple relationship between practical action and physical objects or tools (such as a computer) by highlighting the relevance of interactions between learners–learners, learners–teachers and learners–computers. Thus, knowledge was negotiated through discussions and not through a simple transfer of information.

The study suggests two different foci of reflection implied in the regulation of computer-mediated progress or achievements: some student teachers reflected over their tasks by concentrating on expected competence in terms of objectives, outcomes of learning and content embedded in the process of learning (e.g. appropriate use of websites, databases and electronic journals). Their focus was on criterion-reference reflection. Another group of student teachers often referred to a number of norms (gender differences, individual and group abilities) to judge their progress or achievements. Their reflections were therefore norm-referenced, which seems to imply competition between various individuals and groups.

The study indicates that when university students were supported by a teacher, they tended to develop a progressive discourse consisting of constructive exchanges and coordinated interaction necessary for the creation of new knowledge. However, the participants argued that teacher support was limited in the acquisition of hands-on computer skills mediated by small task-based groups. They illustrated this limitation by the means of a metaphor: a key to open a door while the responsibility to open, get in and search what is needed is in the learners' hands. The fact that learners are organized in small task-based groups mediated by a computer does not automatically imply interactions conducive for knowledge building. The findings reveal that learners tend to adopt one of the three learning strategies: individual-led, group-led and individual-group hybrid-led.

The *individual-led learning pattern* is personally directed and basically follows a linear learning process: the teacher/researcher/computer *Initiated* (I) a task and an individual participant tried to *Respond* (R) individually. At the end, this same individual asked the group members, acting as outsiders, to

validate her achievements in terms of *Follow-up* (F). In other words, as long as the members of the group were not involved in individualized response attempts, and as they had to validate individual achievements, this learning process was linear: I→R→F. In this pattern, individual learners seem to be competitive and isolated from the group. Moreover, individual learners tend to develop narrow understandings within the limits of their personal abilities.

According to the findings, the *group-led learning pattern* implies that team members negotiate meaning: they create a core of reflective inquiry (discussion, debate, wondering). After *Initiation* (I) of the task, they *Discussed* (D) how it should be handled. They tried to *Respond* (R) to the task and then together evaluated their response attempts in terms of *Follow-up* (F). As was observed during the training, this IDR pattern was repeated as necessary until the participants were satisfied with their achievements in relation to their objectives or learning outcomes. The participants reported that involvement, both personal and social, are required to achieve success in this learning pattern. They explained that the members of the group extend the abilities of each other in order to achieve ‘worthwhile consensus’, ‘something bigger’, or new knowledge.

The *individual-group hybrid-led learning pattern* is a combination of the two strategies above. The findings show that most of the time, learners start with an individual-led learning pattern in a linear flow (I→R→F) and subsequently switch to a group-led learning pattern (IDRF). This seemed to happen when the participants came across information useful to the group or when they faced a problem involving members of the group.

Study 3: Students’ interaction with web-based literature: towards dissolution of language boundaries

The purpose of the current study is to investigate how language frames student teachers’ interaction and action while coping with web-based literature in small task-based groups. The findings reveal that students coping with web-based literature face a twofold reality of classroom discourse rooted in their sociocultural and educational contexts: the one conveyed through foreign languages of instruction, the other whose vehicle is their native language. The study has identified two major types of discourses conveyed in computer-supported social practice:

In this article, the ‘official’ *classroom discourse* entails the use of English and French as the languages of instruction for the study of web-based literature. In the context of globalization, the GoR views these languages as media that might enable students to cross national boundaries and become internationally competitive (GoR, 2005; Mineduc, 2007b). However, according to the findings of the present study, the implementation of the

'official' classroom discourse faces a number of obstacles. First, because students were not sufficiently proficient in English and French, especially in spoken English and French, they experienced difficulties in using these languages to discuss web-based literature critically, to develop creative thinking and make relevant inferences. In the course of group discussions, students hardly developed their own and full sentences in English or French. One of the participants revealed that constructing ideas in a foreign language was nothing more than an addition of vocabularies. Thus, the use of foreign languages of instruction rather characterized cumulative talk. This kind of talk consisted of reading an extract of a web-based paper in English and translating it into Kinyarwanda. This could indicate that learning was mainly shaped by repetition of the same extracts from a text under study into Kinyarwanda. However, the participants affirmed that translation allowed them to understand and contextualize knowledge.

Secondly, the participants considered the use of English and French an obligation, in contrast to the freedom they claimed to recover when speaking Kinyarwanda. Thirdly, the participants reported that their sociocultural context did not offer them sufficient opportunities to speak and to improve their foreign language proficiency. For example, they explained that speaking foreign languages in their society could be regarded as a sign of arrogance. They affirmed that Kinyarwanda was used in their everyday lives by most of all Rwandan people regardless their socioeconomic background: at home, at the university, at work and at the market. This situation described by the participants could illustrate a gap between classroom and everyday practice regarding language use. Finally, the participants reported that they experienced more difficulties expressing themselves in speech than in writing when they were required to produce their ideas in the official foreign languages. This issue can be addressed in three ways: (i) students will need to improve their spoken proficiency so that they can discuss web-based literature in English and French without being afraid of making mistakes; or (ii) they will need to exchange ideas in writing which, as the participants argued, can enhance their reflections as well as improve their language skills; or (iii) students will need to support their discussions using Kinyarwanda as a language they understand better and which, as the participants suggested, can be elaborated for this purpose.

'Unofficial' classroom discourse reflects the use of the local language, Kinyarwanda. The participants argued that they felt more comfortable and proud discussing web-based literature in Kinyarwanda. They maintained that their mother tongue confers a sense of ease, meaning that they were able to think, communicate ideas, and make sense of others' contributions, and all this spontaneously. In other words, in Kinyarwanda they could save time and energy to study the learning material. Kinyarwanda was used actively to

develop exploratory talk. The participants reported that Kinyarwanda allowed them to formulate, structure and coordinate their thoughts into meaningful propositions. Briefly, beyond shaping the everyday discourse, Kinyarwanda seems to play a central role in students' learning. Hence, it can be inferred that the language conveyed an '*unofficial*' *classroom discourse* in computer-supported social practice. The use of Kinyarwanda seems to be associated with the students' sociocultural context. In the participants' view, Kinyarwanda was the working language, not only their own but also of most Rwandan people as it was used in most sectors of society and spheres of life. Drawing from the findings, Kinyarwanda seems to be a mediating tool that can ensure students' freedom, self-confidence, self-esteem, social integrity and also grant a sense of belonging to their culture. Thus, the study suggests an alternative way of constructing a substantial learning discourse based on dissolution of language boundaries.

Study 4: Interplay between learning conditions and participation in ICT-based learning environments

The focus of this case study is on how ICT utilization can be appropriated among its users, through interplay between those who seem to learn actively with the tool and other students. The purpose is to investigate variations in students' participatory appropriation regarding the use of ICT in their everyday lives. The study shows that students participating in small task-based groups mediated by a computer tend to convey their own experiences to those of their group mates. This situation allowed them to become critically reflective with regard to their understanding of the context or content acquired previously. Their previous thoughts could therefore be modified or more elaborated. On this issue, I argue that the encounter between divergent experiences (sources, techniques, thoughts) in the acquisition of ICT skills can indicate that knowledge can change when students come across disconfirming evidence. Differences in experiences can also be at the forefront of change in students' learning through critical reflection and creativity in ICT-based learning environments.

Three different categories of student learning in computer-supported social practice were discerned from the findings: (i) *Passive ICT users*: a quarter of students belonging to this category tend to demonstrate a capacity to use ICT during training sessions and seem to be aware of the considerable importance of ICT in learning, but its implementation stays at the level of plans and wishes. Sometimes, the passive ICT users tried to utilize the tool but as soon as they faced a problem, they gave up and abandoned the idea. It seems that they were unable to challenge obstacles and ICT-related constraints. (ii) *Reluctant ICT users*: another quarter of participants seemed

to implement ICT in their learning but rarely and claimed to be too busy. Both groups of passive and reluctant ICT users showed a tendency towards technophobia. They reported that they had other priorities putting pressure on ICT implementation. (iii) *Active ICT users*: half of the participants revealed a commitment to participate actively in training sessions and to implement ICT in improving their learning. They also helped their colleagues to learn and utilize ICT in their courses, assignments and research studies. The experience of active ICT users can reflect that appropriation of ICT utilization relies on individuals' motivation and capacity to cope with learning conditions. The study shows that learning conditions are not always favourable, such as getting support from the teacher or colleagues. They can also be challenging in facing the scarcity of ICT infrastructure, having a lot of courses and assignments and other constraints. As the active ICT users argued, most of them tried to venture into uncertainty; they took risk and accepted sacrifice in order to achieve success in their use of ICT. Thus the study concludes that ICT is a necessary condition but an insufficient prerequisite for appropriating its use. Moreover, the study shows that appropriation of ICT use may be enhanced through the interplay between learning conditions and collaboration between active ICT users and their colleagues.

Concluding discussion

As referred to earlier, the aim of this dissertation is to investigate how the participants can develop new knowledge in computer-mediated social practice with emphasis put on the dynamic relations between mediation, learning conditions, collaboration and critical reflection. From the sociocultural perspective, knowledge is negotiated through interaction and action. In other words, knowledge is jointly achieved (Vygotsky, 1978). Similar interpretations have been inferred where ICT is used as a tool for learning such as in Bliss and Säljö (1999), Wegerif et al (2003) and Wertsch (2003). In this line of reasoning, my analysis has gone a bit further in order to understand interrelation between the central theoretical concepts in the process of thinking and learning with ICT: mediation, learning conditions, collaboration and critical reflection. My analysis is also an attempt to understand what these dynamic relations can inform us about in terms of knowledge construction in computer-supported social practice. Thus, as a possible way to cope with change in ICT-based environments, the following discussion will focus on what can imply learners' collaboration and critical reflection, the learners' zone of proximal development and on substantial learning discourse around a computer. Finally, I will reflect critically on the research process followed in this dissertation and throw light on some possible research inquiry for the future. The cross-cutting questions in this discussion are: in computer-supported collaborative learning activities, what kind of discourses do student teachers in small groups engage in? How is meaning reflected in newly qualified teachers' or student teachers' accounts of learning in computer-supported activities?

Supporting collaboration and critical reflection to cope with change

The point of departure in order to understand the dynamic relations between collaboration, critical reflection, mediation and learning conditions is indeed the following question: what learning conditions can help or constrain newly qualified teachers or student teachers to learn in ICT-based environments? The findings of my studies show that the effective use of ICT as a tool for learning involves a change of attitudes and that one possible way of coping with change in computer-supported social practice is to build efforts on positive values existing in teacher education institutions. For example, in

Study 1, newly qualified teachers have shown a capacity to engage in creative practice and develop problem-solving and peer-teaching skills. Study 2 reveals that in the acquisition of hands-on computer skills, the group-led learning pattern (IDRF) seems to create a supportive environment for knowledge building. The findings of this study indicate that this strategy can enhance exploratory talk and progressive discourse. In other words, learners' conversational exchanges may be progressive in such a way that each other's propositions are critically analysed and evaluated; while some learners seek clarification, others provide useful explanations (Bereiter, 1994; Mercer, 1995). Hence, the group-led learning pattern seems to create a supportive environment for negotiating meaning. I argue that ICT contains many hints and represents huge amounts of information that can be handled better collaboratively. I suggest that peer teaching and collaborative learning can enable students to learn from each other and develop continuous critical reflection in social practice.

The Rwandan NICI Plans aim at training teachers who will be able to support student learning with ICT. This dissertation, particularly in Study 4, reveals that although student teachers may be provided with ICT and adequate training programmes, they show variations 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 for improving their learning; (ii) reluctant ICT users: students who acquire and use computer skills successfully but rarely; (iii) active ICT users: motivated students who use the new techniques successfully, creatively and continuously for their personal development. In this dissertation, active ICT users have shown a capacity to help their colleagues to acquire or use the new technique in their learning and research projects. In comparison with Andersson's (2006) study, active ICT users can be related to those he calls experienced and curious users who utilize this tool when they come across challenges. Commenting on the Rwandan NICI Plans aim of training teachers who will be able to support student learning with the new techniques, a question of conceptualization of ICT implementation can be raised here in that all teachers may not 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 technique and, hence, 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 categories of peers with various experiences can change in a positive and supportive way when ICT is utilized for enhancing a new culture of 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.

This dissertation shows that ICT may transcend gender boundaries and allow more opportunities for women's continuous education. The findings reveal that newly qualified teachers, both male and female, have the same ability to and interests in using a computer. This statement is discussed in line with Säljö's (2002) interpretation according to which ICT can challenge people's traditional hierarchies in learning institutions and in other places. From a gender perspective, ICT is one of many strategies identified in order to improve the access and retention of girls in schools in the Middle East and Northern Africa (Rihani and Prather, 1994). Wamala (2005, p 100) reports, in a study about women's accessibility to ICT in Swaziland, that 'social understanding and construction of the feminine is a hindrance on an African Woman's desire to explore her full potential'. However, these views are challenged by a number of women who have embarked on careers that were previously dominated by men. Yet, Wamala concludes that it will take time before women reach general acceptance in ICT workplaces.

These inferences raise new research inquiry in line with understanding why some student teachers do not seem to be interested in the use of ICT in their learning. My dissertation provides some preliminary insights: a tendency to technophobia, lack of appropriate ICT curricula and related pedagogies, scarcity of computer facilities and constraints related to their management. The findings show that, where the management of computer labs is centralized, users seem to be frustrated by a lack of opportunity to engage in creative activities and develop problem-solving skills. In contrast, where the management of computers is decentralized to the users, they express a feeling of self-confidence and ownership of learning with the tools. Additionally, both passive and reluctant ICT users share the same concern: they claim to be too busy and that ICT is not their first priority.

Focus on the learners' zone of proximal development

In concordance with Schön's epistemology of practice which puts reflection-in- and reflection-on-action at the central tenet of inquiry, this dissertation reveals that access to various sources can support learners' critical reflection in ICT-based learning environments. I argue that collaborative efforts and critical reflection may be sustained by external expertise (Study 1-4). Such support may come, for example, from active ICT users or from the teacher in

terms of assistance in the learners' zone of proximal development. However, drawing from Study 2, the request for teacher support by university students working together in small groups mediated by ICT seems to be limited but necessary in the acquisition of hands-on computer skills. These students seemed to make efforts of their own to promote creativity, solve their problems and interact with peers. The teacher is therefore considered a facilitator. My point is that in ICT-based learning environments, learners become more effective where appropriate conditions are created, not only for enabling them to work in a creative environment but also where they are given an opportunity to demonstrate the outcomes of their creativity and their capacity of problem solving. In a similar vein, active ICT users and teachers may take this opportunity to create appropriate conditions enhancing the group-led learning pattern. Nevgi et al (2006) argue that students who receive teacher support in computer-mediated social practice gain more from the tool than those who work independently alone. Neo (2003) maintains that social interactions can allow students to develop joint problem solving and critical thinking skills. Limited assistance may thus be directed toward supporting students to organize their interaction and action. Furthermore, the teacher may assist students in developing an exploratory talk and a progressive discourse as part of their social practice aiming at continuously generating new knowledge relevant to their everyday lives. For example, instead of placing emphasis on norm-referenced criteria (e.g. comparing individual performance in terms of learning pace, gender differences or abilities), the teacher may encourage regulation of learning based on criterion-referenced reflection, which means that individual or group performance is measured against predetermined criteria, such as objectives, outcomes of learning and content. This interpretation is in concurrence with Mercer's (2002) view that students can learn more effectively when they receive appropriate guidance in how to talk and work collaboratively.

From a dilemma to a substantial learning discourse around a computer

Through the discussion above, it can be inferred that at the centre of new knowledge negotiation in social practice, there is language and organization of interaction. I have taken this reflection further with an attempt to examine how students cope with web-based literature in a Rwandan multilingual setting. What learning conditions does language bring into the study of web-based literature in small groups? In Study 3, ICT is primarily used to enable students to search, retrieve and exploit web-based literature. This allowed me to explore in depth how language can shape their interaction and action in small task-based groups, while ICT recedes to the background. This

dissertation shows that in studying web-based literature, most students seemed to be confronted with a twofold reality of learning discourse resulting from the sociocultural and educational contexts of the country: the one conveyed through foreign languages of instruction, the other whose vehicle is their native language. The dilemma is that, on the one hand, it seems relevant to acquire and use international languages in order to become competitive in the region, especially in the East African Community in which Rwanda is a member, and in the world as recommended by the national educational policy on ICT (GoR, 2005; Mineduc, 2007b). International languages, as shown in this dissertation, can facilitate access to different sources. I argue that access to various sources may support students' critical reflection in ICT-based learning environments. Furthermore, Leppanen (2007) asserts that English will be necessary as long as this international language dominates the Internet. On the other hand, it seems relevant to develop some competence in the language students understand better. Study 3 shows that Kinyarwanda can play a central role in students' conversational exchanges and mediate their thinking to build and convey joint knowledge. Helping students to develop the same competence in English and French, i.e. their foreign languages of instruction, would require shaping a learning environment that could stimulate and convey students' social interaction and action in these languages. The sociocultural settings in Rwanda, however, do not seem to offer this opportunity and even tend to be obstructive. Therefore, it would be an illusion to pretend that students will be able to compete worldwide without being competent. Competence comes first and competition follows. As Fullan (1993, p. 46) states, 'students must succeed if society is to succeed'.

Crook (2002, p. 66) claims that successes of computer-supported collaborative learning 'hinge upon the manner in which discourse is actively organized to construct the valued outcome of common knowing'. Similarly, Stahl (2005) argues that collaborative knowledge lies behind the enrichment of the discourse and interaction. Accordingly and drawing from the findings, there is an indication that foreign and native languages can support each other and contribute to the construction of a community of discourse conducive for computer-assisted collaborative learning. For example, with English and French, students may primarily have access to international web-based sources and communicate their own contributions with and to the world. With Kinyarwanda, students would be able to discuss those sources critically and constructively and confront them with their sociocultural and educational contexts by means of exploratory talk. Moreover, the findings show that translation can be an asset in enhancing understanding and contextualizing knowledge. These interpretations concur with previous studies underscoring that knowledge can be jointly achieved when students learn in a language within which they can build mutuality and in which they are more likely to

develop exploratory talk (Mercer, 1995; 2002; Crook, 2002). This may be suitable in a situation where Kinyarwanda is an official language of instruction. In Study 3, exploratory talk was most convenient when students were speaking Kinyarwanda.

Reflections regarding the research process

Different sections in the chapter on methodology and design have already treated to some extent my critical reflections in relation to the research process of this dissertation. These sections include, for example, credibility in qualitative research tradition, generalizability and ethical considerations of case studies. I discussed some limitations and the extent to which my dissertation can be generalized. In the section on ethics, I raised an issue concerning power relations between my former student teachers – who were then the participants in my studies – and myself as a researcher. Although I do not intend to come back to these issues in the present section, I argue that my position both as a researcher and a lecturer could not only affect participants' behaviour in a particular context, but that this could influence how I analysed and interpreted the phenomenon under study because I was part of it. Drawing on Larsson's (2005) description of what he calls *perspective awareness* regarding quality in qualitative research, I will concentrate my attention on how my pre-understanding and my experience as a learner and as a lecturer played a role in the research process of this dissertation.

As referred to earlier, Larsson argues that researchers' interpretations depend mainly on their pre-understanding. He adds, however, that this pre-understanding can be modified or elaborated in the process of interpretation and become a new understanding. These statements are discussed according to a hermeneutic tradition, hence, meaning results from the interplay between the parts and the whole. Larsson suggests making pre-understanding and personal experiences explicit, so that the reader may have relevant information as a starting point to tackle the interpretation with a critical mind. This is what I have tried to do, especially in the introduction of this dissertation where I described my own experience of learning since my basic education up to the university. I have grown up in an educational system within which I was working during the time of writing this dissertation. This made me feel part of that social context. It is within this system that my studies have been carried out. The interpretations of my findings refer not only to the description of my pre-understanding, but also to the theory they are embedded in, i.e. the sociocultural perspective. Thus, the interrelationship between the central theoretical concepts in my dissertation, namely mediation, learning conditions, collaboration and critical reflection can be

seen as a specific standpoint to interpret thinking and learning with ICT as portrayed in the empirical material. This means that this interpretation might not be the same within a different theoretical perspective. Larsson claims that making explicit the theoretical framework is a crucial step which can ensure 'high quality' of the interpretation.

In conclusion, it can be seen from this discussion that my research approach is different from a phenomenological tradition which assumes that pre-understanding is to be bracketed in order to study the essence of a phenomenon, or as Larsson puts it, the pure description of a phenomenon. Moreover, I recognize that thinking and learning with ICT is a long journey and that the introduction of computers in teacher education is a new phenomenon in Rwanda. My dissertation seems to provide some contributions, especially in relation to how knowledge can be constructed in computer-supported social practice in such settings. Insights generated from this dissertation show new ways student teachers and newly qualified teachers as adult learners can cope with change in ICT-based environments. At the level of society, Rwanda has an ambition to ensure EFA to its population before the end of 2015 as part of the Millennium Development Goals (GoR, 2001). Can inferences drawn from this dissertation which reflect adult learners' ways of thinking and learning with ICT inspire regarding how to achieve EFA or reduce gender disparities in learning institutions in Rwanda? This dissertation, as some other earlier research studies, places language at the centre of knowledge building where the computer is used as a pedagogical tool. However, my studies have shown a dilemma between official and unofficial classroom discourse. In computer-supported social practice, what could result from a comparative study between students' learning with official foreign languages of instruction and those learning with Kinyarwanda, their mother language, in the same Rwandan settings? Thus this dissertation has not only generated new understanding and awareness in relation to how thinking and learning with ICT can take place, but also as to how it creates new inquiry that can guide further research with respect to the process of educational change in computer-supported social practice.

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Appendices

Appendix 1a

Questionnaire for newly qualified teachers (Study 1)

A. Personal Information

1. Nationality: _____

2. School: _____

3. Gender: male female

4. Age: at last birthday:

Please encircle the number corresponding to the correct answer:

21-25	26-30	31-35	36-40	41-45	46-50	50-55
1	2	3	4	5	6	7

5 Language profile

Please tick the correct answer(s):

	weak	fair	fluent
Kinyarwanda			
English			
French			

B. Education

6. Level of studies:

Please tick the correct answer and fill in the year of graduation:

Level of studies	Tick	Year of graduation
Secondary school certificate		
Baccalauréat/graduate		
Licence/Bachelor's degree		
Master/DEA		
PhD/Doctorate		

7. What main subject did you study? _____

8. What are your teaching subjects: _____

C. Information Technology

9. I can use the following programmes in my teaching/learning activities:

Please encircle the number corresponding to the correct answer.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Windows	1	2	3	4	5
MS Word	1	2	3	4	5
MS Excel	1	2	3	4	5
MS PowerPoint	1	2	3	4	5
MS Access	1	2	3	4	5
MS Front Page	1	2	3	4	5
Internet	1	2	3	4	5
E-mail	1	2	3	4	5

10. a) List the programme (s) you wish most to learn or improve according to your needs: _____

b) Why? _____

11. How many days do you use the school computer lab a week?
_____ days/week.

12. How many hours do you spend in the school computer lab a day?
_____ hours/day.

13. How many hours do you teach a week? _____ hours/week.

14. Do you have a private computer? Yes No

15. Please list other computer labs that you use in your region: _____

16. a) Have you ever taken a course online? Yes No

b) If yes, please specify which one? _____

c) How was the course organized? _____

17. a) Have you ever taught a course online? Yes No

b) If yes, please specify which one? _____

c) How was the course organized? _____

18. a) I would like to receive the following in-service training through online teaching:

Please encircle the number corresponding to the correct answer.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
How to teach (pedagogy)	1	2	3	4	5
Up-date knowledge in my area of interest	1	2	3	4	5
Credit courses to get a higher degree	1	2	3	4	5
Interaction with other teachers	1	2	3	4	5

b) Other in-service training needed (please specify):

19. I think that I will have enough time to devote to my in-service training:

Please encircle the number corresponding to the correct answer.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	2	3	4	5

20. How would you like to involve your students in the use of ICT?

D. Information about the school

21. Please provide the following information about your school:

Description	Figures
Number of all teachers	
Number of female teachers	
Number of male teachers	
Number of all students	
Number of female students	
Number of computers	
Number of computers connected to Internet	
Number of computers with CD reader (operational)	
Number of computer with floppy disk (operational)	

22. Any other issues you wish to raise?

Thank you for your participation

Appendix 1b

Topics of focus groups for newly qualified teachers (Study 1)

1. What do you think about the use of ICT in secondary schools in Rwanda?
(Mutekerereza iki ku ikoranabuhanga rya ICT mu mashuri yisumbuye yo mu Rwanda)
2. What do you think about your in-service training now and in the future in relation to the use of ICT?
(Muratekereza iki ku myihugurire yanyu muri iki gihe no mu gihe kizaza hakoreshejwe?)
3. **Optional questions emerging from the visits to different schools**
 - What are the advantages and disadvantages of ‘Speak out clubs’ in this school?
(Ni izihe ngaruka nziza mubona muri ‘Tuseme Clubs’ muri iri shuri? Ni izihe ngaruka mbi muyibonamo muri iri shuri?)
 - This school allows all students from S4, even those who are not in the stream of Secretary to acquire computer literacy. What are the advantages and disadvantages of this initiative?
(Iri shuri ryemerera abanyeshuri bose uherye ku biga mu mwaka wa kane gukurikira amasomo y’ikoranabuhanga ndetse n’abatiga ishami ry’ubunyamabanga. Ingaruka nziza n’ingaruka mbi mubibonamo ni izihe?)
 - In this school, the computer lab is managed by four teachers, and the school director is not one of them. What are the advantages and disadvantages of this initiative?
(Muri iki kigo imicungire n’imiyoborere y’icyumba cya ‘ordinateurs’ biri mu maboko y’abarimu bane. Muri abo bane umuyobozi w’ishuri ntarimo. Ingaruka nziza n’ingaruka mbi mubibonamo ni izihe?)

Thank you for your time (Mbashimiye umwanya mwampaye)

Appendix 1c

In-depth interview guide for newly qualified teachers (Study 1)

1. How is ICT implemented in this school in line with the process of teaching and learning? (*ICT ikoresha ite mu myigishirize n'imyigire muri iri shuri?*)
2. How do you use ICT in your activities as a teacher? (*Ukoresha ute ikoranabuhanga rya ICT mu kazi kawe nk'umwarimu?*)
3. What are the main problems that could impede the implementation of ICT in this school? (*Ni izihe nzitizi zishobora gutuma ikoranabuhanga rya ICT ridashyirwa mu bikorwa muri iri shuri?*)
4. What is done in this school that could be taken as exemplary for other schools as far as ICT is concerned? (*Ni iki cyiza kibera kuri iki kigo cyabera andi mashuri urugero mu birebana n'ikoranabuhanga rya ICT?*)
5. For you, what should be changed so that ICT can be effectively developed in this school? (*Ni iki ubona cyari gikwiye gukosorwa cyangwa se guhindurwa kugira ngo ICT rishobore itere imbere muri iri shuri?*)
6. Do you have any question to ask or any thing to add to what we have discussed so far? (*Hari icyo wifuzza kubaza cyangwa kongeraho ku kiganiro tumaze kugirana?*)

Thank you for your time (*Ngushimiye umwanya wampaye*)

Appendix 2a

Interview guide for student teachers (Studies 2 and 4)

I. Conceptual understanding (*Imyumvire y'ikubitiro*)

1. What can you say about this training programme on searching, retrieving and exploiting web-based literature? (*Ni iki wavuga kuri aya mahugurwa yo gushakisha no gukoresha amakuru y'ubumenyi kuri internet?*)
2. What did you learn through this training programme that you did not know before? (*Ni iki wize muri aya amahugurwa utari usanzwe uzi mbere yayo?*)
3. Could you describe the process you have used when learning? (*Wansobanurira uburyo wakoresheje mu kwiga?*)
4. What kind of assistance did you receive from the teacher in line with how to search, retrieve and use web-based literature? (*Ni mu buhe buryo mwarimukazi yagufashije mu kwiga gushaka no gukoresha amakuru y'ubumenyi kuri internet?*)

II. Collaborative learning (*Kwiga mu bufatanye*)

5. What benefit did you gain from your teammates during this training programme? How? (*Ni iki ubona warungukiye kuri bagenzi bawe mwari mu ikipe imwe muri aya mahugurwa?*)
6. Could you give me some examples showing how you have learned from your teammates during this training? (*Wampa se ingero zigaragaza uko washoboye kwigira kuri bagenzi bawe bo mu ikipe imwe muri aya mahugurwa?*)
7. How far do you think you have been helpful to your team-mates in their learning? (*Wowe se utekereza ko wafashije ute bagenzi bawe bo mu ikipe imwe mu myigire yabo?*)
8. Could you give me some examples showing how you helped them to learn? (*Wampa se ingerero zigaragaza uburyo wabafashije mu myigire yabo?*)
9. Do you think that you need to work in small groups and help each other in order to learn better, especially for using the Internet? Why do you think so? (*Utekereza se ko ari ngombwa gukorera mu matsinda yo*

gufashanya kugira ngo murusheho kwiga neza cyane cyane kuri internet? Kuki ubitekereza utyo?)

10. Would you suggest that other teachers organize their classrooms in small groups in order to learn collaboratively? Why do you think so? *(Ese ku bwawe urabona wagira inama abarimu yo guhuriza abanyeshuri mu matsinda mato mato kugira ngo bige bafatanyije? Kuki se ubitekereza utyo?)*

III. Reflections on ICT-supported learning (*Ibitekerezo ku byafashije kwiga ICT*)

11. What did you like most about this training programme? *(Ni iki cyagushimishije kurusha ibindi muri aya mahugurwa?)*
12. What do you think should be changed or improved in this training? *(Ni iki ubona cyari gikwiye guhindurwa cyangwa se gukosorwa muri aya mahugurwa?)*
13. Why do you think that the training programme on searching, retrieving and using web-based literature is important or unimportant for you? What about your project work? *(Kuki utekereza ko amahugurwa yo gushaka no gukoresha amakuri y'ubumenyi kuri internet ari ngombwa cyangwa se ko atari ngombwa? Bizagufasha se iki kuri "mémoire"?)*
14. What challenges or problems did you come across during this training programme? How did you address them? *(Ni izihe ngorane cyangwa ibibazo wahuye na zo muri aya mahugurwa? Wazikemuye ute?)*
15. Would you like to add something or to ask any questions about what we have discussed so far? *(Hari icyo ushaka kongeraho cyangwa se hari ikibazo waba wifuzaga kubaza ku byo twaganiyeho kugeza ubu?)*

Thank you for your time *(Ngushimiye umwanya wampaye)*

Topics of focus groups for student teachers (Studies 2 and 4)

I Introduction (*Iriburiro*)

A. Moderator introduction and purpose of the focus groups (*Iriburiro ry'umuhuzabikorwa n'impamvu y'ibiganiro mu matsinda*) (5 min)

- Welcoming and thanks for agreeing to participate (*Gutanga ikaze no gushimira abitabiriye ibiganiro mu matsinda*)
- Explaining selection process (*Gusabanura uko ihitamo ry'abari mu matsinda ryakozwe*)
- Explaining what the research is for (*Gusobanura impamvu y'ubu bushakashatsi*)
- Explaining confidentiality and privacy (*Gusobanura ibanga rigirirwa abari mu biganiro n'ibanga ry'ibyo bavuze ndetse n'uburenganzira bwo kutavuga ibyo wumva ari ibanga ryawe*)
- Requesting authorization to record the discussion (*Gusaba uburenganziza bwo gufata amajwi*)
- Explaining group rules (*Gusobanura amategeko y'itsinda*):
 1. The group discussion will be based on the video recordings taken during the training sessions whenever possible (*Ibiganiro ku matsinda biribanda ku mashusho ya videwo aho bishoboka hose*)
 2. The video recordings are about social interaction and action in the group during the training (*Amashusho yerekana uko abagize itsinda bakoranaga hagati yabo*)
 3. Discussions will be conducted during or after watching the video (*Ibiganiro biraba hagati cyangwa nyuma yo kwerekana amashusho*)
 4. There is no right answer to the questions (*Nta gisubizo nyacyo ku kibazo birabazwa*)
 5. In general, you don't need to raise your hand to speak (*Muri rusange si ngombwa kuzamura akaboko kugira ngo uvuge*)
 6. Please speak only one at a time (*Ni ngombwa ko havuga umwe umwe*)

7. It is important to respect different opinions, so please do not interrupt (*Ni ngombwa kubaha ibitekerezo bitandukanye, none rero ntihagire uca undi mu ijambo*)
8. If you disagree with something someone is saying, raise your hand instead of interrupting – I will make sure you get the chance to speak (*Niba utemeranya n’ibyo mugenzi wawe ari kuvuga, uzamure agatoki aho kumuca mu ijambo – ndakora ibishoboka byose kugira ngo uze kubona ijambo*)
9. Everyone should speak (*Buri wese akwiriye kugira icyo avuga*)
10. I might need to cut you off so that we can get to everything we need to cover and be sure everyone has the opportunity to talk (*Bibaye ngombwa hari ubwo nahagarika ikiganiri kugira ngo tuze gushobora kuvuga ku ngingo zose ziteganijwe no kugira ngo buri wese ahabwe umwanya wo kuvuga*)
11. Are there any questions? (*Nta kibazo mufite kuri ibyo?*)

B) Playing video (*Kwerekana amashusho*) (15 min)

II Warm up (*Kwitegura kwinjira mu kiganiro*) (5 min)

- What can you say about what you saw in this video? (*Mwavuga iki ku mashusho mumaze kubona?*)
- What were you doing there? (*Ni ibiki se mwakoraga hariya?*)
- Why did you proceed in that way? (*Kuki mwabikoze muri buriya buryo?*)

III Topics (*Ingingo z’ibiganiro*) (45 min)

General Evaluation on the training (*Ijora rusange ry’amahugurwa*)

- What did you learn during the training? (*Mwize iki mu mahugurwa?*)
- How did your team proceed to learn better? (*Ni ubuhe buryo itsinda ryanyu ryakoresheje kugira ngo ryige neza?*)
- Why did you proceed in that way? (*Kugi mwahisemo gukora kuri ubwo buryo?*)

Group interaction (*Imikoranire y’abagize itsinda*)

- What do you see as the strengths of learning in a group? (*Ni iki kiza mubona cyo kwigira hamwe mu itsinda?*)
- What do you see as the weaknesses of learning in a group? (*Ni izihe mbogamizi zo kwigira mu itsinda?*)
- How far do you think your teacher has been helpful for your group to be effective in the search for scientific information online? (*Mubona mwarimukazi yarafashije ate itsinda ryanyu mu kugira ngo rigere ku ntego yo gushaka amakuru y’ubumenyi kuri internet?*)
- Do you have any other comments? (*Hari ikindi mushaka kongeraho?*)

Follow-up interview guide for student teachers (Studies 2 and 4)

1. Five months ago you attended a training programme on searching, retrieving and utilizing web-based literature. What have you done so far with the skills acquired through that training programme? (*Hashize amaze atanu mubonye amahugurwa yo gushaka no gukoresha amakuru muvanye kuri Internet. Ni iki washoboye gukora kugeza ubu wifashishije ubumenyi wungutse muri ayo mahugurwa?*)
2. How often do you use the Internet for searching web-based literature? Why is it so? (*Ngereranyiriza inshuro ukoresha Internet kugira ngo ushakeho amakuru ukeneye Ni kuki ubigenza utyo?*)
3. What kind of assistance did you request or get from your colleagues in line with the use of Internet sources? (*Ni iyihe nkunga wasabye cyangwa wahawe na bagenzi bawe mu bijyanye no gushaka amakuru y'ubumenyi kuri internet?*)
4. How did you help others in the search and use of web-based literature? (*Wansobanurira uburyo wafashije bagenzi bawe mu gushaka no gukoresha amakuru y'ubumenyi kuri internet?*)
5. After the training programme, can you see any differences in your way of searching and using Internet sources compared to what you used to do before? Why do you think so? (*Nyuma y'aya mahugurwa, ese hari itandukanyirizo ubona mu buryo ushaka kandi ukoresha amakuru y'ubumenyi kuri internet muri iki gihe ugereranyije na mbere y'amahugurwa? Ni kuki ubibona utyo?*)
6. What difficulties or challenges did you come across in the use of web-based literature? How did you address them? (*Ni izihe mbogamizi cyangwa se ingorane wahuye na zo mu gushaka amakuru y'ubumenyi kuri internet? Izo mbogamizi cyangwa se ingorane wazikemuye ute?*)
7. Would you like to add something or to ask any questions about what we have discussed so far? (*Hari icyo ushaka kongeraho cyangwa se hari ikibazo waba wifuzza kubaza ku byo twaganiyeho kugeza ubu?*)

Thank you for your time (*Ngushimiye umwanya wampaye*)

In-depth interview guide for student teachers (Study 3)

1. What have you been able to do so far using literature retrieved on the Internet? (*Ni iki washoboye gukora wifashishije amahugurwa yabonye yo gushaka no gukoresha amakuru uvanye kuri Internet?*)
2. In what language is literature you are interested in conveyed on the Internet? (*Ibyo ubana kuri Internet ubishaka mu ruhe rurimi?*)
3. What are the advantages of utilizing that language when you search and exploit Internet resources? (*Ni iki kiza ubona mu gukoresha urwo rurimi mu gushaka no gukoresha amakuru uvanye kuri Internet?*)
4. What are the challenges or problems of searching and exploiting web-based literature as far as the language is concerned? How did you address these problems? (*Ni izihe mbogamizi cyangwa ngorane wahuye na zo mu gushaka no gukoresha amakuru uvanye kuri Internet mu bijyanye n'ururimi? Uzikemura ute?*)
5. When you were working in your groups, I realized that you discussed in Kinyarwanda while the literature discussed was written in English? Why did you proceed in that way? (*Mu gihe mwari mu matsinda nabonaga ko mujya impaka mu kinyarwanda kandi inyandiko mwaganiragaho yanditse mu cyongereza. Ibyo biterwa n'iki?*)
6. What do you think about the use of Kinyarwanda on the Internet? (*Utekereza iki ku mikoreshereze y'ikinyarwanda kuri Internet?*)
7. Would you like to add something or to ask any questions about what we have discussed so far? (*Hari icyo ushaka kongeraho cyangwa se hari ikibazo waba wifuza kubaza ku byo twaganiyeho kugeza ubu?*)

Thank you for your time (*Ngushimiye umwanya wampaye*)