

Dilemmas of Promoting Expansive Educational Transformation through Information and Communication Technologies (ICTs) in Botswana

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Abstract: The purpose of the present paper is to address challenges and obstacles that educators and researchers face while promoting expansive educational transformation through technology-mediated learning in developing countries. The paper reports challenges and possibilities encountered in Botswana Expansive School transformation (BeST) project by describing preliminary results of creating cross-functional networks, organizing ICT workshops and Change-Laboratory interventions in collaboration between European and African researchers.

Introduction

The Revised National Policy on Education in Botswana is designed to prepare the country for the transition from an agro-based economy to an industrial economy driven by information technology that the country aspires to. In light of the rapid technological changes that are taking place both within the country and in the rest of the world, the policy has called for the introduction of computer use in schools. The purpose of the present investigation is to use methods of the Cultural-Historical Activity Theory (CHAT), such as Change-Laboratory (CL) interventions, to promote educational transformations in the context of ICT-mediated learning in Botswana. Rather than seeing computers as mere technological tools, CHAT guides one to examine technology-mediated learning as an integral part of the contradiction-laden historical development of educational activity calling for profound transformation of social practices prevailing at school and well as renegotiation of relations between schools and the surrounding community. Accordingly, there appears to be an complex interplay between technological and social innovations (Perez, 2002). When a revolutionary combination of technological innovations emerges, it is usually followed by intensive capital investment in technology implementation and creation of the required novel infrastructure. This phase is characterized by a contradictory combination of over-optimistic technology 'hype' and a propensity to apply new technologies within the existing institutional practices. After the economic bubble based on such illusory hopes explodes, a qualitatively different phase emerges that is characterized by broad application of the new technology across society as well as transformation of prevailing institutional practices according to the possibilities of the new technological infrastructure. Venkatraman (1991) argued that the gains achieved when ICTs are used to support local needs for internal integration of activities in business organizations are relatively meager compared to their use for business-processes engineering, for transforming enterprise networks, and for redefining the scope of the business activity. A corresponding potential of facilitating revolutionary development of educational activities has emerged. Initially, ICT were used to elicit traditional learning tasks. Gradually integration of compartmentalized subject domains has become possible in project-based learning activities of students and teachers. A more revolutionary development would involve re-conceptualizing learning processes in terms of technology-mediated investigative learning and knowledge-building projects, transforming and creating a new collaborative network, and redefining the scope and object of the school's educational activity. The first wave of implementing and using this technology in education in developed countries in the 80s and 90s was characterized by the computerization of traditional forms of teaching and school activities. Movement toward the later, transformative phase of educational use of ICTs has been gradually taking place in developed countries since the turn of the millennium. However, an on-going phase involving the re-definition and re-creation of educational functions of the school with the help of ICTs is predominantly lacking in developing countries. The introduction of ICTs has somewhat remained at the level of eliciting traditional learning tasks and teaching styles. Such a historical point of stagnation can only be overcome through the introduction of new ways of perceiving the school activity. Rather than taking the school and its functioning as a given object of

development, the challenge is to radically re-conceptualize what school and learning are all about, redefine the boundaries of school and community, and explore expansive possibilities in practice.

Prevailing social practices in schools channel teachers' and students' activities in a way that is very hard to change without extended deliberate efforts and support from outside intervenors. In order to elicit expansive educational transformation, it appears necessary to involve a heterogeneous network of actors with expanded mandates and perspectives of development. Both vertical dialogue between different levels of authority and horizontal dialogue between various actors involved in transformation are needed. Rather than directly transferring models of using ICTs, it might be advantageous for developing countries to utilize the historical experiences of developed countries as resources for reflecting critically on their own current practices and trajectories of development of school. In order to avoid typical pitfalls of interventions carried out between developed and developing countries sophisticated interventional methodology is needed that allows the participants to make visible, reflect on and deliberately master various aspects of their collective school transformation efforts (Long, 2001), Change Laboratory (CL), based on and the methodology of Developmental Work Research (DRW), Engeström, 1987), is an already well-defined intervention method to support organizational transformations (Engeström et al., 1996). In CL interventions, workplace communities reflect upon their prevailing practices on the basis of data; they analyze the historical development of their current activity system and its inner contradictions, as well as envision and implement, through practical experimentation with a new model of the activity. These collaborative reflections are triggered and guided by the researchers, who collect and prepare ethnographic "mirror" data for assisting participants to reflect on their work. CL comprises a series of workgroup meetings to reflect on current practices and envision future activities. Essential aspects of CLs are; a) using videotaped practices as a "mirror" for assessing current activity; b) generating ideas and tools (e.g., charts) that help to assess past, present and future activity; and c) modeling present practices by using an activity-system analysis. Sharing participants' memories of the past assist the workplace community in analyzing the historical development of its activities. Within a CL process, a facilitator in the initial organizes, provokes and guides participants' learning activity through discourse, and expansive learning actions aimed at questioning, analyzing, modeling and transforming the activity's system. Learning activity is a process, in which the participants ascend from the perspective of their individual work to the joint analysis and development of the system of their actual productive activity in order to radically transform the former into a new and prolific future form which has surpassed its initial contradictions. As a result a new form of productive activity evolves in which the participants increasingly cohere toward a shared object of transformation which is less determined by pre-planned tasks set by the facilitator but rather increasingly by the evolving object. For example, a dialogue between people who examine the school and children's everyday life from varying perspectives is complemented with a dialogue focused on analyzing the historical development of prevailing practices of schooling, examining educational practices in detail, and deliberately experimenting with various new solutions. The participants are themselves engaged in analyzing disturbances that hinder pupils' learning and the development of the school community in its extended social and cultural context. They are provided with conceptual tools for analyzing the data and ways of modeling the dynamic development of the activity system are suggested.

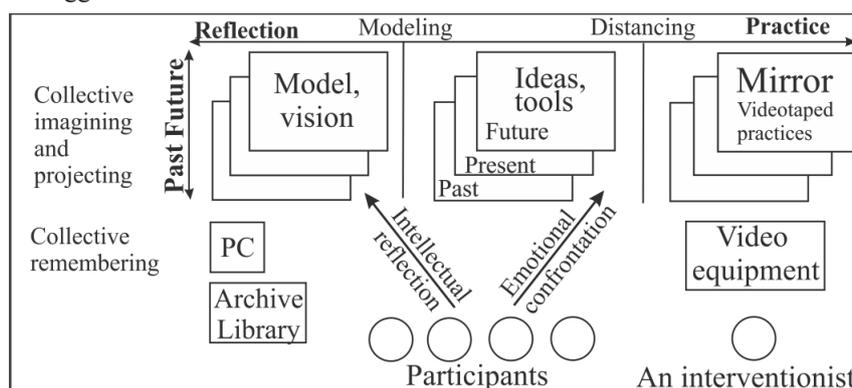


Figure 1. Elements of the setting of the Change Laboratory (Engeström et al., 1996).

The introduction of ICTs into school activities opens up new possibilities for teachers' educational work and teaching as well as children's learning. In Figure 2, four ideal typical conceptions of school have been depicted by crossing two dimensions of expansion of the traditional school discussed in the literature (Engeström et al., 2002). One of these depicts the type of problems school children are working on and identifies the developmental trend from learning by solving given tasks for which the right answer is known to complex real-life problems that can have varying creative solutions. The other dimension describes a school's relationship to the surrounding community and goes from an isolated school to an open school, where teaching

and education is realized in collaboration with the surrounding community. Taking the school texts as objects that have to be remembered in their own right is strengthened in a relatively isolated school that has little contact with the surrounding community. Opening the school up to the community and taking the vital problems of the community, and more broadly of mankind as objects to be solved with the help of culturally developed intellectual tools, can strengthen the pupils' agency in mastering their lives as members of a community. This model introduces the concept of ICTs as a tool for expanding the school ethos. For historical reasons, the western model of school brought to developing countries carries many of the characteristics of the old-time isolated school (Sector 1) in which teachers' work has been defined by subject-by-subject curriculum packages, stage-by-stage teaching models, standardized tests, and corresponding ICTs. The present trend of introducing test-based control systems in schools have strengthened the tendency to highlight memorizing isolated pieces of knowledge and skill on the cost of understanding and creative use knowledge and education (Ravitch, 2010). The increasing emphasis on test scores has broadened the gulf between school knowledge and students' creative interaction with and learning from real life problems and utilizing the new possibilities of digital networks of open innovation (Tapscott & Williams, 2006) and collaborative building of knowledge (Bereiter, 2002). Sector 2 represents various reform-pedagogical ideas of a school that follows ideas of technology-enhanced project- and problem-based learning. Sector 3 represents approaches that highlight the importance of creating students' and teachers' classroom learning communities focused on collaborative building of knowledge with the help of the new ICTs (Scardamalia & Bereiter, 2006); there is a tendency to examine the school community as relatively isolated from the surrounding society. Sector 4 combines the two dimensions of expansion for examining the collective zone of proximal development of school. In such a school, learning is to a great extent carried out by solving real-world problems in contexts of various hybrid forms of activities and networks of learning; these are processes, also, in which representatives of local productive work are involved in and in which the rules are different from those in the classroom (Hakkarainen et al. 2004; Yamazumi, 2006; Roth & Lee, 2007). Various ICTs from word-processing and spreadsheets to collaborative web publishing provide support for such activities. There is, however currently an aggravating contradiction between these new possibilities and the tendency to strengthen the traditional school through increasing testing.

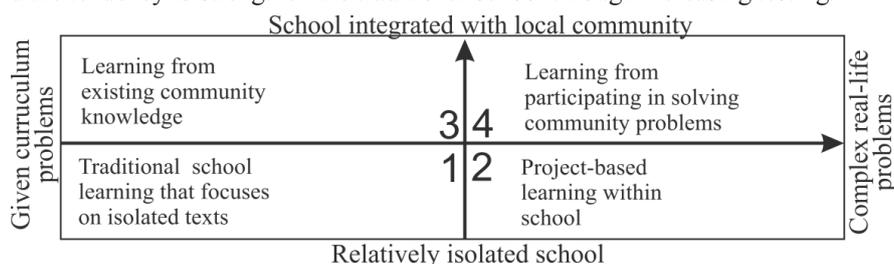


Figure 2. Two dimensions of expansive school transformation.

Research Aims

The purpose of this paper is to describe experiences from the Botswana Expansive School Transformation (BeST) project by addressing the following questions: 1) How is expansive school transformation facilitated through Change-Laboratory (CL) interventions; 2) What kinds of actors and agencies are needed for facilitating ICT-mediated educational interventions in Botswana; and 3) What kinds of challenges and constraints emerge?

Methods, Data Collection, Data Analysis

In order to elicit sustained education transformation of developing countries, based on their needs and developmental potentials, one has to employ sophisticated intervention methodology beyond standard academic research methods. Toward that end, the present developmental intervention relies on multiple methods and associated data sources. Two five-day workshops of 10 pilot schools (2005; 2008) and several smaller meetings have been documented by audio and video recording. Beyond within-school activities, ethnographic data were collected, by interviewing parents and community members and observing local activities, such as Gotla (municipal) gatherings, animal husbandry and vegetable gardening, child care as well as health and social services. These observations gave an insight into how the school activity and the existing way of life of the community related one to the other. Such understanding is paramount, acting as a springboard to unearthing the contradictions existing within the activity. Multiple voices have been recorded by interviewing principals, teachers, students, parents, and other relevant peripheral or distant actors. Change-Laboratory, that allows local communities to deliberately make visible, reflect on, and transform their practices with the help of researchers, has had a central role in the present developmental intervention. Relevant parts of the ethnographic material were used as mirror material in CL interventions. The material collected provides a rich body of data concerning the prevailing practices of learning and instruction at the intervention schools and school-community relations. Qualitative content analysis has been used to assess ethnographic data, such as interviews and videotaped participant observations as well as discourse taking place in Change-Laboratory sessions.

Preliminary Results of the Project

In the following, preliminary results of the present project will be summarized with a focus on the creation of new developmental collaboration. In order to achieve this end, the structure of the project and the first two CL interventions and data illustrating discussions between collective actors shall be presented and discussed.

Actors and Structure of the Project

The present project relies on collaboration between the universities of Botswana and Helsinki for supporting the educational use of ICTs in schools in Botswana and the educational administrators from Botswana. In the initial stages of the project, The University of Mauritius had been part of the project at its initial stage and some staff members attended the first workshops held but they later dropped out. As a result of negotiations and workshops between organizations involved a new unofficial boundary-crossing network of actors was created. The University of Helsinki held a one month Activity Theory Workshop for AS-TIG during 2008. Ten schools, representing five different areas of the country and different types of schools were selected as pilots in the educational use of ICTs and in each school a group of interested teachers, that represented the activity vertically and horizontally, were selected to be responsible for the measures of developing ICT use in the school. The workshops arranged for the ICT-groups of the ten schools provided opportunities for hands on learning of ICTs as well as planning and modeling transformation with the help of the activity system model. In order to have a bigger impact on education, it was essential to involve all ten schools rather than only three CL schools as well as a network of mandated change stakeholders: *“There are drivers, the people who are mandated with providing infrastructure or guidelines so I suppose if they understand our needs and they can re-align our needs towards the vision ..., they will ensure that whatever we are thinking of, they will provide a platform for us to be going in that line”* (a ministry official).

Teachers from the ten pilot schools (two teachers from each) and varying groups of local school officials, their supervisors, representatives of the universities of Botswana and Helsinki, Ministry of Education as well as other organizations took part in various workshops. In these workshops, the basics of activity theory was explained, its application in school development as well as the Change Laboratory method. Later on, an unofficial Activity Theory Special Interest Group (AT-SIG) that involved a heterogeneous group of researchers and educational administrators to discuss how ICT can be used to develop schools, was formed. The idea was that the group would function as a cross-functional and cross-organizational forum for developing a pedagogically grounded concept for ICT use in schools (Figure 3).

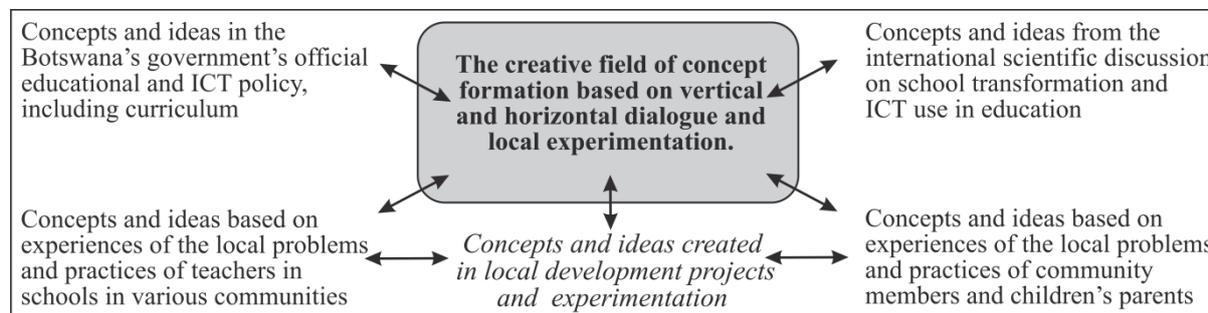


Figure 3. Cross-functional network for developing methods of using ICTs at schools

The research team is currently analyzing results concerning ICT development workshops organized during the project; the workshops were video recorded and there are tens of hours of video data. The local participants’ contributions to joint discussion as well as their narrative descriptions of situations at school have been transcribed. Researcher Lauri Hietajärvi is analyzing those contributions in which the participants addressed challenges of implementing ICTs in the school activity. Preliminary results of the study indicate that at the discourse level, there was some improvement in the integration of ICTs in the pilot schools from 2005 to 2008. Discussions that focused on arising awareness of ICTs transformed toward discourse addressing possibilities of transforming educational practices.

Intervention at School A

The first CL-intervention took place at a senior secondary-level school A (with a population of 1800 students and about 150 teachers) in fall 2008. The school is situated in a village close to a major city. Ethnographic data were collected in school A across ten days by interviewing teachers, principals, community institutions, students, ICT’s community centers, and parents in order to gain insight into the activity and to prepare models and mirror data for the CL. The audio and video recorded data were transcribed and field notes analyzed. The school had a very limited ICT infrastructure –about 20 computers in a computer class – and there was only a minimal ICT-related transformation in educational practices in terms of teaching ICTs as a new school subject. While

government policy required teaching ICT literacy to all students, it was hard to implement such expansion of ICT education due to lack of computers, frequent malfunctioning, constantly occurring viruses, slow or non-existent computer network, and limited teachers' ICT competence. Ethnographic data indicated a strong tradition of categorizing students into different curricular groups on the basis of tests in sciences. Accordingly, computer classes were reserved for high achieving "double" or "triple science" students whereas automatically promoted low achievers ("single" science students) were stigmatized and their consequent tarnished feeling of self-worth aggravated by a lack of access to ICTs and consequently a developing world:

R: "What about access to the computer lab

T: It is a bit of a problem because the computer lab there is only one and there are something like 20 computers and there are 80 students doing ComputerStudies in the mornings they are attending their lessons and in the afternoons they are doing their projects so it is a bit of a problem to have access to a computer

R: How many students do you have in the school?

T: 1800

R: What is the nature of computer literacy across the board, do all of the students have computer awareness and what access do they have?

T: Well like I said, there are only about 80 students, 40 form 4 and 40 form 5, in our committee, one of the responsibilities is that we would like to start computer awareness that is just the basic of ... or introduction to computers. And if we can start computer awareness, then we can get somewhere.

R: So other students who are not doing computer studies are not having...don't have access to computers; T: Ya they do not have..."

An interview with a Computer Science student revealed that the problem was not only due to a limited amount of technology but also instruction as well: *"It is not like I am blaming any one but we have a very big problem. They just give those many textbooks and then they say go and read them but some of us are not conversant with the computer terms which makes it very difficult to understand and we do not get enough end of month tests. I am not going after anybody, I am just trying to remedy the situation"*.

Eight (8) to thirteen (13) teachers, representing multiple subject domains and levels of authority, formed the school's ICT group and, consequently, participated in the CL process. Two members of the local media and teacher training and development centre participated in all the sessions together with the moderating intervenors. The process consisted of eight (8) two-hour sessions at a rate of two, two hourly session per week for 4 weeks. All sessions were video and audio recorded and transcribed. The sessions followed the cycle of expansive learning in terms of analyzing and questioning the prevailing practices, examining the historical development of the activity, planning some concrete changes, implementing the changes, and reflecting on the process. The moderator set tasks in order to stimulate questioning of their activity such as: causes of joys and sorrows for teachers, students and parents; examining the historical development of the school activity in order to track the central contradiction, and envisioned changes that would make educational activity more meaningful for the participants. In order to stimulate the construction of new ideas, each task was supported by a second stimulus such as mirror data or theoretical models of schooling and learning.

In one of the first CL sessions, the researchers projected a video clip, onto the mirror board, of a student testifying how being categorized as a single science student engendered stigmatization by teachers and fellow pupils and that some teachers refused to answer questions and provide added support. This piece of mirror data elicited a lively discussion with tones of self-critique among the participants, the consequence of which was a request for further data on the problem. Later on, the same theme came up in another form when the teachers reflected on methods of Science education that involve asking the students to plan and carry out experimental projects; it was pointed out that the single-science students would not have capability to do it and should, therefore, not be given such tasks. A historical analysis revealed that a former established government policy, requiring automatic promotion of all students to junior and senior secondary schools regardless of their educational achievements, has made the student population more heterogeneous. In order to cope with the prevailing heterogeneity of student learning abilities, categorization was installed. As a consequence, there appeared to be a tension-laden contradiction between the object of teacher's instructional activity for all and prevailing instructional methods and practices that did not tailor and personal instructional efforts according to students' competencies. The tendency to categorize and segregate students according to different levels of accomplishments created some visible contradiction in the school system.

Participants envisioned two solutions for overcoming the double binds together with the intervenors: 1) In order to facilitate students' motivation, the participants designed a new tool (personal study plan) for addressing a student's studying conditions, problems, and study objectives. The design aimed at bringing student weaknesses and strengths to the fore and subsequently to create a peer support network across the categories. 2) the teachers initiated, moreover, experiments with co-teaching so as to provide more time for individual student support. Neither of these solutions was based on the immediate use of ICTs, which is

understandable in view of the limited ICT resources and lack of ICT competencies of the teachers. Yet, the new ideas of a more personalized way of teaching could later be sustained with the use of ICTs as a tool to lead to a more enabling learning environment. Furthermore, the teachers organized collaboration with the local Audiovisual Center for support and teaching in creating ICT based teaching aids. Related to the model in Figure 1, these initiatives would lead to changes on levels 2 and 3. An analysis of transcribed CL data indicates that while ICT-related discourse surfaced frequently, presumably because of limited experience, the participants were not able to sustain concrete ICT-related discussions, their focus tended to gravitate toward other themes. Nevertheless, making the computer into an instrument in teaching other subjects would, however, mean a major qualitative step in the development that could only have been taken with an expanded ICT infrastructure.

The results of the first CL intervention in the AT-SIG surfaced tensions between ICT implementation and school development. Firstly, the teachers, due to new measures, had difficulties in finding time for the further development and experimentation of the new solutions. Secondly, after leaving the country, the foreign intervenors could not adequately continue supporting the educational transformations needed after the 8 CL sessions and the internal change agents were displaced to new geographical areas. Thirdly, as a consequence of the centralized management of Botswana teaching service, which enables teachers to move from one school to another across their careers, (in pursuance for career progression), some key CL teachers participating in developing the new solutions were transferred to other schools before they could elaborate the new tools and practices. Accordingly, the teachers did not have a sufficient support network to expand on the new practices despite adequate analyses of the developmental challenges having occurred through the CL. The envisaged virtual support platform that was planned to be provided by the University of Mauritius as a collaborating partner did not come forth and thus much was lost in this domain.

The CL Intervention at School B.

A recurrent problem in the development of ICT-based learning environments has been the lack of student motivation related to the lack of authenticity of the problems dealt with. The second CL intervention specifically addressed this problem at school B. A school located in a remote and rather deprived rural area in the Kalahari Desert in which the livelihood was mainly based on animal husbandry. School B had 800 students 80% of which are boarders and 42 relatively inexperienced teachers inexperienced in what?sent to the school from elsewhere for a 5-year-period and who maintained a strict separation from the village population of about 1590. The ethnography based on interviews and discussions with teachers, principals, community institutions, students, ICT centers and parents revealed a cleavage between school, parents and the village officials each blaming the other of problems in child rearing in the village. Moreover, teachers are far away from their families which as the following testimony indicates, impacts on their teaching: *“Every time I come back here I have my body here but my heart is with my wife and girls...they need my affection and support...what is a dad that is not at home...we cannot be good teachers with our hearts broken like this”* (field-notes, 2007). Teachers generally blamed parents for a lack of interest in the children’s education which they said was manifested by a lack of school function attendance and alcohol abuse. Because parents felt that they had little control over their children and little to do with their school going activity, they could not find productive solutions. The intervenors hypothesized that the problems lay in the school-community relationships rather than within the school. Instead of inviting only the teachers to develop the educational practices within the school, village officials, teachers from the primary and secondary school and parents were invited to take part in a boundary crossing CL process.

Participants of CL were composed of eight (8) members of the Junior secondary school, five (5) members of the primary school, two (2) members of the vocational school, two (2) members of the non-formal sector, several parents (later this number was around 8), and odd members of the different institutions, a total of twenty-five (25) people. The sessions were organized as two hourly- twice per week sessions for 5 weeks; most of them involving both school and community. Introductory sessions were held separately with each school. All sessions were video-taped and voice recorded and transcribed. The CL experimental space was held at the local ‘*Kgotla*’ (court house), a thatched roofed open- to- the-environment building situated half way between the three educational institutions. The boundary crossing CL began by showing part of the ethnographic data including the interview with a parent welder who testified to the estrangement between the school culture and arts and crafts culture prevalent in this area. The participants then discussed the historical changes that had taken place in child rearing practices between home and school in the village. They came to a collective decision that the children performed better when school lessons were given under the tree and child rearing had been a shared responsibility. They began to question what had led to this transformation:

Head teacher: “It is something like teacher 2 said, mind your own business. It is like parents are not very much supportive to the program for the school, so the parents live their own life there, teachers live their own life, other people in other departments live their own life and people do not come together and support one another it is like there are some barriers in between if the school ask for assistance from the community maybe to say come for a board collection or come to address the issues related to peoples performance and so forth they

come with a different mind to be against what the school is trying to do or to try to be on the side of the kids even when they have done something wrong. So I think that it is a very serious limiting factor because when they come they come to say no even when their kids are wrong they say that they are not wrong. As if we are not good enough to the kids we always say they have done ABCD which is not good and so I think that there is a problem there”.

Children’s voices were as well part of the mirror data and used to maintain focus on the object. A metaphor of a “school under the tree” arose and grew until it became the pivoting point where parents and teachers began to reconstruct models for a learning environment that was both for the wider world and the everyday. In the extract above the school head suggested a new way to understanding the problem of teacher parent collaboration. This insight was strengthened through the introduction of further ethnographic data in which parents discussed a “bad child” and led to discussion in which it was agreed that “parents, teachers and community are all ultimately responsible for outcomes of children under their care; all should work to promote cases of the ‘good child’ and to minimize cases of the ‘the bad child.’

The computer room of the Junior Secondary school contains twenty-five (25) a computers and all children have access at different periods of the week. All teachers are encouraged to plan their lessons and write reports as well as produce exam and test results on the computers. During the first field study period, this laboratory was relatively under exploited but two years later, it was always busy and the level of computer literacy amongst the teaching staff appeared much higher. However, teachers were not using ICTs as a tool to stimulate the learning and development of their students. It appeared clear that creating novel ways of using ICTs as instructional tools and overcoming contradictions embedded within educational the institution and its relation to surrounding society were needed for bringing pedagogical benefits about. Their new designs included the cultivation of vegetables gardens, an arts and crafts center and a bakery projects. These work groups consisted of teachers of the Junior secondary and primary schools as well as the vocational schools, principals of the schools, members of all of the village institutions and parents. These projects planned to make use of all the subjects offered within the curriculum such as Mathematics, Geography, Science and the integration of computers. The concept is that of a school-community type of learning where children are actively involved in the creation of their own knowledge. ICTs are to be used in order to measure, monitor, and design implementation and progress of the projects. Such a leap requires careful planning and nurturing as it is far easier once the contradictions between the old activity and the new design surface to return to the former way of working. Spirits were high in the community after the conclusion of the CL. This was expressed in the words of a member of the Village extension team: “I never thought that I would see the day when parents and teachers came together to work on their children’s future”.

Table 1. A Summary of focuses on the two Change-Laboratory interventions

	School A	School B
School	Senior secondary school	Junior secondary school and Primary school
Location	Relatively urban	Rural
Ethnography	Interviews of students, teachers, principals, parents, educational facilitators	Interviews of students, teachers, parents, principal and community members
Participants	Teachers, an intervenor, media centre, AS-TIG members	Community stakeholders, teachers, AT-SIG members and an intervenor
Process of intervention	Seven sessions.	Nine sessions.(3 with the two schools and 6 with the schools and community)
Developmental experiments	Collaborative study planning to enhance student motivation; learning to create audiovisual teaching aids to enhance teacher motivation; co-teaching, system of controlling the progress in the implementation of new policies.	Joint pursuit of an agricultural project and an arts and crafts project

Discussion

The present investigation focused on examining how CL-intervention is used to elicit expansive school transformation in the context of technology-mediated learning. We considered future possibilities of such usage. The analysis revealed how teachers and educational institutions supported by interventionists explored ways to facilitate educational transformations in difficult conditions. Although there was not an adequate infrastructure, a high shortage of computers, and limited human resources, many critical issues were addressed regarding student motivation, collaborative teaching, or transformed school-community relations. Research on the use of ICTs in schools has shown that the greatest gains from new technology are achieved by redefining the content of the educational activity and using the new artifacts for realizing something that was previously not possible.

Regarding teaching, this means, that the teachers have to rethink the pedagogical principles of their teaching and to use ICTs to realize a new kind of pedagogy. The present experiences of using CL for promoting such educational transformation and experiences are encouraging, in spite of the challenges involved in working through various linguistic, social, and cultural boundaries. It appears, however, that without personal and collaborative experiences of using ICTs, discussion in CL sessions tended to drift to issues other than ICTs (such as how to deal with diversity, overcome prevailing strong categorization practices and cope with common place corporate punishment). As far as CL sessions involve teachers only talking about technology – without appropriating ICTs as a part of their everyday activity – the interventions may not have sustained effect. Thus far, interventions have only hinted as to expansive possibilities provided by ICTs, and there is more talk about technology-mediated learning and instruction than its actual concrete exploration. The slow progress reported in the African context does not, however, appear to be an exception but a rule of technology-mediated learning. Our experiences from ICT in education projects from Finland and Europe (Lehtinen et al., 2001; Sinko & Lehtinen, 1999) indicate that educational transformations take years to consolidate.

The present investigation aimed also at analyzing challenges and constraints of ICT-mediated educational intervention. Much of the research on the use of ICTs in schools has focused on analyzing the use and reasons of lack of use of ICTs, assuming uncritically that these technologies help the schools to carry out their societal task. Fewer studies have been carried out on what inner developmental contradictions in the current school education could be overcome with the introduction of these technologies. The expansive use of ICTs cannot, however, derive sufficient motivation from the new technology as such but must be based on well analyzed developmental challenges of the school that the teachers recognize and are ready to work on. According to the previously quoted theory of Perez (2002) the broad societal utilization of new technologies only started after the implementation of the technology has been carried out by actors representing the new technology. A turn from technology push to need pull takes place as the agency in the development moves incrementally from the providers to the users. In this research we have used the Change Laboratory method to help the practitioners to analyze the central developmental challenges and possibilities of their educational activity. One can argue that this need-based approach came to the pilot schools too early in view of the implementation of the new technologies. On the other hand, the new technologies can never be the only and the whole solution to a major historical challenge of development in an activity. Rather the needs and possibilities of the activities are more aptly recognized by a group of actors involved in an ongoing process of developing their educational activity, rather than by individuals carrying out their traditional work routines.

References

- Bereiter, C. (2002). *Education and mind in the knowledge age*. Mahwah, NJ: Erlbaum.
- Engeström, Y. (1987). *Learning by Expanding*. Helsinki: Orienta-Konsultit Oy
- Engeström, Y., Engeström, R., & Suntuo, A. (2002). Can a school community learn to master its own future? In G. Wells & G. Claxton (Eds.), *Learning for life in the 21st century* (pp.211-224). Cambridge, MA: Blackwell.
- Engeström, Y., Virkkunen, J., Helle, M., Pihlaja, J., & Poikela, R. (1996). The Change Laboratory as a tool for transforming work. *Lifelong Learning in Europe*, 2/1996. Pp. 10-17.
- Hakkarainen, K. Palonen, T. Paavola, S. & Lehtinen, E. (2004). *Communities of networked expertise: Educational and professional perspectives*. Amsterdam: Elsevier
- Lehtinen, E., Sinko, M. & Hakkarainen, K. (2001). ICT in Finnish education: How to scale up best practices. *International Journal of Educational Policy, Research and Practice*, 2 (1), 77-89.
- Long, N. (2001). *Development sociology: Actor perspectives*. London: Routledge.
- Perez, C. (2002) *Technological revolution and financial capital*. Cheltenham, UK: Edward Elgar.
- Ravitch, D.(2010). *The death and life of the great American school system: How testing and choice are undermining education*. New York: Basic Books.
- Roth, W.-M. & Lee, Y. J. (2007) "Vygotsky's neglected legacy". *Review of Educational Research*, 77, 2, 186-232.
- Scardamalia, M. & Bereiter, C. (2006). Knowledge building. In K. Sawyer (Ed.) *The Cambridge handbook of the learning sciences* (pp. 97-115). Cambridge, MA: Cambridge University Press.
- Sinko, M. & Lehtinen, E. (1999). *The challenges of ICT in Finnish education*. Juva: Arena.
- Venkatraman, N. (1994). It-enable business transformation. *Sloan Management Review*, 35, 73-87.
- Yamazumi, K. (2006) Learning for critical and creative agency. In K. Yamazumi (Ed.) *Building activity theory in practice* (pp. 73-97). Osaka: Center for Human Activity Theory. Kansai University.

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