# Technology Supported Collaborative Learning for Higher Education: Comparative Case Studies in Tanzania

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# ABSTRACT

To learn, a person has to be able to communicate effectively with others about the knowledge to be learned. Communication processes in classrooms can be supported by Group Support Systems (GSS), that enable students to communicate anonymously and in parallel. Group Support Systems experiences suggest that the technology increases observed learning, self-reported learning, on-task participation, and satisfaction with the learning experience. The authors discuss case studies from higher education in Tanzania. The particular benefit of GSS in this environment was threefold: First, it encouraged meaningful interaction among students and between students and teachers. Local culture normally hinders this. Second, it allowed all participants to discuss sensitive topics freely. Finally, it exposed students to collaborative technologies that are expected to play a pivotal role in (global) collaborative development activities. Clearly, the use of collaborative technologies enables the participation of a broader range of students. © 2006 Wiley Periodicals, Inc.

Keywords: Group Support Systems; e-learning; collaborative learning; field study; Tanzania

# **1. INTRODUCTION**

Teaching at universities and higher vocational education institutions is currently facing a number of challenging developments (Jarvenpaa, Ives, & Davis, 1991; Rodrigo, 2003; Rodrigues & Govinda, 2003; Scheepers & de Villiers, 2000). Students have to adhere to tight study programs to graduate within fixed time limits. Organizations employing graduates have for years been calling for educational programs to be more closely coordinated with the skills they require. Finally, the budgets of universities and higher vocational education institutions are under almost constant pressure.

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In response to these developments, educators and educational institutions are in search of teaching methods, techniques, and technologies that make teaching more efficient and effective. As a result, various forms of Information Technology (IT) are often deployed. The potential uses of IT in education range from providing analytical tools and eliminating distance barriers to replacement of repetitive tasks (Leidner & Jarvenpaa, 1993). IT-supported education will involve lower costs for travel and classrooms, provide greater convenience, security, and flexibility, and will bestow the ability to ignore time and geographic differences. Learning overall is expected to become faster, more interesting, and qualitatively better, allowing the student/teacher ratio to increase. An additional benefit of IT-supported learning is the development of ICT skills by students. This is especially important as the development of ICT skills is seen to be key bringing about development (Rodrigues & Govinda, 2003). Some studies focus on the computerization of schools to bring about computer literacy and programming (Rodrigo, 2003). Others recognize that the establishment of computer-supported cooperative learning centers brings about greater computer literacy training and collaborative development of training materials in various rural communities (Scheepers & de Villiers, 2000).

Various types of IT support for learning are especially emerging with respect to *collaborative learning methods* (see e.g., Briggs & Brown, 1997, or the proceedings of the Hawaii International Conference on System Science from the last decennium). In contrast to traditional forms of education where the primary interaction between teacher and students is that the teacher speaks and the students listen, collaborative learning emphasizes group or cooperative efforts among students and faculty, and often focuses on the interaction between students themselves. Students actively discuss and debate on a whole range of subjects and problems to come up with explanations, suggestions, and solutions for them. This process helps students to conceptualize, construct, and internalize procedures and knowledge (Vreede, Briggs, & Santanen, 1999). In addition, sharing information helps students to deepen understanding. Collaborative learning has been shown to be a highly effective learning strategy in both face-to-face and distributed settings (Alavi, Yoo, & Vogel, 1997).

In general, bringing electronic support into the classroom aims to facilitate the information flows between students and instructors, and among students (Leidner & Jarvenpaa, 1995). In this article, we focus on one particular collaborative application that can be used within various forms of education to provide effective support for learning processes: group support systems (GSS). Group support systems enable teachers and students to share and capture information and knowledge efficiently and effectively. We applied GSS in a number of case situations in Tanzanian higher education to explore how this technology can support collaborative learning processes. In the next two sections, the case experiences in Tanzania will be presented and discussed. We conclude the article with a summary of our findings, the limitations of our study, and directions for future research. An earlier version of this article was published in Vreede and Mgaya, (2001).

### 2. BACKGROUND

In this section, we first discuss education in Tanzania in general and the state of university education in particular. Next, we elaborate on the collaborative technology that we introduced to a number of Tanzanian university classrooms.

#### 2.1 Education in Tanzania

Education in Tanzania has gone through many changes over time. The history of education in Tanzania can be separated into three periods:

- Before colonialism: Education was passed on through local traditional methods.
- After imposition of colonialism (end of the 19th century): Traditional education was replaced by a formal system based on Western education.
- Past independence adjustments 1961–1967: This was marked by the elimination of racial distinctions, the modification of the curriculum, and the expansion of schools. It was not until 1971, however, that the first national secondary school exams were written, marked, and analyzed entirely in Tanzania.

Today, educating children and students in Tanzania is a big challenge (Boonstra & Lockefeer, 2000). Although close to 70% of children obtain at least some primary education (50% of children complete primary school), only about 5% enroll at the secondary level (less than 3% of children complete secondary school). This is caused by the following three factors:

- The relatively high school-tuition rate for secondary level, while primary schools are free, is a problem for many rural families.
- Language poses additional barriers because primary school instruction is in Kiswahili and secondary level instruction is in English.
- During the early days of Nyerere's presidency he set aside 14% of the national budget for education. Now, government spending on education has declined to less than 4% of the total budget. Educational facilities are lacking, morale is low, and there is a shortage of qualified, committed teachers. Private schools, which had been nationalized in the wake of the Arusha Declaration in 1967, have started operating again and help to bridge the enormous gap between the country's educational need and scarce resources, but their geographical distribution is uneven.

Overall, the Tanzanian educational system consists of the following levels:

- 1. Primary school.
- 2. High school: Based on a final examination at the end of their primary education, a number of pupils are selected for secondary education. Secondary education is divided in two levels, O-level (form 1 to 4) and A-level (form 5 and 6, compulsory before attending university).
- 3. University: To enroll at the University, A-levels have to be completed successfully.

The University of Dar es Salaam was born out of the decision taken on March 24th, 1970 by the East African governments to split the then University of East Africa into three independent universities for Kenya, Uganda, and Tanzania. The University of Dar es Salaam consists of several faculties, institutes, and two colleges. It offers BSc and MSc programs. It is currently not possible to obtain a PhD degree from the University of Dar es Salaam. Few Tanzanians pursue a PhD abroad because of financial restrictions.

The University has developed the institutional "UDSM-2000" Transformation Program. Under this program, the University aims at the expansion of programs and student enrollment from some 3500 students in 1995 to 8000 student in the year 2000. By the year 2008, the targeted undergraduate enrollment will be approximately 13,000 students. The overall targeted enrollment for postgraduates is 2,000 students by the year 2008, with an interim level of approximately 1300 students by the year 2000. One of the key items of the transformation program is the use of computer technology to support educational processes.

Computer literacy in Tanzanian society is very low (Mgaya, 1999) and unfortunately little is known about computer education in Tanzania. Concerning a neighboring East African country, we found an interesting study by Makau (1990) who intensively observed secondary school classes at six Kenyan schools. The observations revealed a number of features of the teaching–learning process, summarized below. Although these observations refer to secondary education in Kenya, based on discussions with various university teachers and our own observations we believe that they largely also apply to higher education in Tanzania:

- 1. In most lessons the approach was teacher-centered.
- 2. Most lessons were focused on providing facts, and very little on "learning how to learn."
- 3. In the majority of lessons, there was little peer learning. Sometimes peer learning was actively discouraged with exhortations such as "do your own work"!
- 4. Virtually no teaching aids, except from the blackboard or textbook, were ever used. For example, in none of the history or geography lessons observed was a map ever used or drawn on the blackboard.
- 5. The most common teaching strategies were lectures accompanied by note taking, question and answer sessions, demonstrations and explanations by the teacher. In many lessons, key and vital steps in the explanation or demonstration were left out.
- 6. Many teachers did not set a high premium on evaluating the learning taking place during their lessons. There were few instances of homework being given, and even fewer cases of homework previously given being corrected.
- 7. In most subjects, the content was approached in a manner that isolated the skills and knowledge from real life. There was little drawing on the experience and environment of the students.
- 8. In the majority of lessons, students sat very passively receiving the "words of wisdom" from the teacher.
- 9. There were very few instances of teachers using a sequenced problem-solving approach to the learning of new concepts or attributes. Students were rarely asked to give their views or to challenge a problem.
- 10. The efficient use of time available to the teacher was rare.
- 11. Although the preceding findings paint a grim picture of teaching learning in the schools, it must be pointed out that there were some shining examples of teachers who really brought their classes alive and who made learning an exciting experience.

Makau (1990) further describes the introduction of computers for various subjects, e.g., geography, math (calculating games), biology (dissecting a "virtual frog"), to bring a change to the teacher–student interaction and make the learning process more vivid. Interesting observations were:

- Teachers were critical of pedagogically poor software.
- Computer-assisted instruction seemed to make learning more interesting for most pupils. For instance, students attended lessons punctually partly with the hope of operating the computer. They also observed that solving problems with the computer can be "exciting, interesting and fun, very easy and helpful."
- Teachers would like to see computer-assisted lessons "where teachers and students don't just gaze at the screen and simply punch keys to move on, but where

students listen, talk, discuss, write something down, ask and answer questions, and get assignments."

These observations provide some first insights into the challenges that East African education is facing now, and the role that IT applications such as GSS may play in making educational processes more effective.

#### 2.2 Group Support Systems

Collaborative learning processes can be supported by various groupware technologies, ranging from electronic mail, to video conferencing, to discussion boards, and shared information spaces (Ellis, Gibbs, & Rein, 1991). Group support systems (GSS) are a particular type of groupware; it is a suite of collaborative software tools that can be used to focus and structure a team's deliberation, while reducing cognitive costs of communication and information access and minimizing distraction among teams who may consist of various stakeholders working collaboratively towards a goal (Davison & Briggs, 2000). A GSS can be defined as a system consisting of computer software, computer hardware, meeting procedures, and facilitation that support groups engaged in intellectual collaborative work (Eden, 1995; Jessup & Valacich, 1993). Group support systems are designed to improve the efficiency and effectiveness of meetings by offering a variety of tools to assist the group in the structuring of activities, generating ideas, and improving group communications (Briggs, Vreede, & Reinig, 2003; Nunamaker et al., 1997). Although many commercial GSS support distributed, any-time any-place collaboration, most groups use the technology to support face-to-face workshops guided by a facilitator.

Groups can reap many potential benefits from using GSS (Table 1). These benefits are often attributed to specific GSS functionalities: anonymity, parallel input, and group memory (Fjermestad & Hiltz, 1998, 2000):

- Parallel communication: By using their own keyboard, participants can enter ideas in parallel. In other words, every participant can talk at the same time.
- Anonymous communication: A GSS does not indicate which participant submitted which ideas or votes. In other words, participants communicate anonymously.
- Group memory:During the meeting, the GSS stores all contributions electronically.

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TABLE 1. Global Support System (GSS) Characteristics and Their Potential Benefits

There is a large body of research that shows that when used under the right conditions, groups can translate the potential benefits of a GSS into real value (for overviews of this research, see Fjermestad & Hiltz, 1998, 2000; Nunamaker et al., 1997). Previous studies on GSS in general have reported labor cost reductions averaging 50% and reductions of project calendar days averaging 90% (Grohowski et al., 1990; Post, 1993; Vreede, Vogel, Kolfschoten, & Wien, 2003). Group support systems can be applied in many different areas, for example, in the development and evaluation of policies, the identification of organizational problem areas, the execution of SWOT (strengths, weaknesses, opportunities, and threats) analyses, the development of new product concepts, expert consultations, software engineering, and the development of company strategies (Briggs et al., 2003). One particular application area, education, will be discussed in more detail below.

## 2.3 Group Support Systems and Education

Group support systems remain one of the few examples of IT applications that were originally developed within universities and subsequently became a commercial success. Considering its background, it is not surprising that students came into contact with GSS at an early stage. Initially, students were introduced to GSS as subjects in numerous experiments directed towards examining different aspects of electronic conferencing in more detail (Fjermestad & Hiltz, 1998). However, the systems rapidly came to be used to support teaching. The most common form of this was the support of "traditional" discussions about questions and opinions in response to a particular case study that the students had to read in preparation for or during the lecture. Group support systems were also set up in a number of university laboratories to support project work. Examples of these are the Learning Theater at the University of Maryland and the electronic meeting rooms at the University of Arizona.

The first experiences with using GSS in educational situations were thus gained fairly rapidly. From a student perspective, these experiences were mainly positive. Group support systems were found (a) to be more interesting, enjoyable, satisfying, efficient, and motivating (e.g., Leidner & Jarvenpaa, 1995; Reinig et al., 1997; Walsh et al., 1996); (b) to lead to more participation among participants (Leidner & Jarvenpaa, 1993); and (c) to help students to generate higher levels of critical thinking abilities (Alavi, Yoo & Vogel, 1997) when compared with non-GSS learning experiences.

There are a variety of successful examples of using GSS to support learning processes. A number of areas in which studies have shown that there is an added value in the application of GSS to educational processes are (Alavi et al., 1997; Bostrom & Anson, 1992; Vreede et al., 1999; Walsh et al., 1996):

- Education in group planning and decision making: During courses on collaborative technology, a GSS was used to familiarize students with the system's characteristics, issues surrounding the application of such systems, and research opportunities.
- Supporting case studies in an executive program: Group support systems allow executives to interact electronically and speed up the process of case discussion. In addition, the executives become familiar with the use of GSS to help address their own organizational decision-making problems.
- Supporting a nursing management course: During a year, a GSS was used to support the in-class discussions of issues with respect to the topic of the course. For example,

for "case management" the following activities were executed collaboratively through a GSS.

- A definition case management
- An identification critical components of a case management system
- A discussion differences between contemporary case management models
- A discussion benefits and problems associated with the case management role
- Survey and questionnaire administration: Group support systems' software has been used to administer questionnaires and summarize results as well as give students an opportunity to provide anonymous feedback on courses.
- A virtual continuous learning space: Group support systems were used during a joint course, in which two sites were linked up, using video, audio, and data. The environment supported both *in-class* learning activities (lectures by instructors, discussions and question/answer activities between instructors and students, and electronic sessions for issue analysis and discussion among students) and *out-class* learning (project work by dispersed student groups).
- Gaming support for participative design: A GSS game was played by groups of six students, representing a governmental branch going through a reengineering process. Each group member played one department employee working in a specific department. By sharing information through the GSS, the group had to work through problem understanding, alternative generation, and alternative elaboration phases.

Overall, GSS experiences in learning environments are very encouraging. In a variety of settings and applications, positive aspects of using GSS are reported. For example, Leidner and Jarvenpaa (1993) observed that computer-supported learning invited students to do exploratory analyses of the course subjects, and stimulated the acquisition of computer skills. In another study, Briggs, Ramesh, Romano, and Latimer (1994/1995) reported that compared to "traditional" students, GSS-supported students participated more in lecture sessions, generated a significantly higher quality and quantity of answers, and were more interested in the lectures. With respect to the dispersed classroom setting described in Alavi et al. (1997), it was found that for the in-class activities, the students perceived that they had learned more, and they found the ability to cooperate with remote instructors and students very enriching and satisfying. In general, there are strong indications from a substantial number of studies that suggest that in educational settings, GSS increase (Reinig, Briggs, Brandt, & Nunamaker, 1997; Walsh et al., 1996):

- 1. Observed learning
- 2. Self-reported learning
- 3. On-task participation
- 4. Satisfaction with classroom experience

It should be noted that these results are mainly based on studies in Euro-American developed countries, the environment where GSS were developed. Group support systems, researchers argue that national culture may influence differences in GSS usage by groups (Eden, 1995; Nunamaker et al., 1997; Vreede et al., 1998; Vreede et al., 2000; Watson, Ho, & Raman, 1994). Little is known about the use of GSS (in education) in African developing

countries (Mgaya, 1999; Vreede, Jones, & Mgaya, 1998; Vreede et al., 2000). Yet, studies (Mgaya, 1999) clearly show that the sociocultural environment indeed influences the way in which GSS are employed in Tanzania. Hence, the question remains: To what extent can GSS have added value in higher education in Tanzania through bringing about collaborative learning styles? In the remainder of this article, we will illustrate some early experiences through a series of case studies.

# 3. CASE STUDIES IN TANZANIA

A qualitative approach for this study was considered to be most appropriate because "qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live" (Myers, 2005). We employed a GSS in a number of classroom situations in Tanzania. In each situation, we collected data from multiple sources, both quantitatively and qualitatively, to enable a rich understanding of the way in which GSS were used and perceived by the students. We handed out questionnaires after each class. In addition, we carried out semistructured interviews with a number of students immediately after class or up to one week later. During the classes the researchers made observations and kept notes that were compared and elaborated after each class (Lacity & Janson, 1994).

Below, we describe three case situations. For each case, we highlight the setting in terms of course context, objective of the GSS session, and the way the session process took place. We also elaborate our observations and findings in each case.

## 3.1 Case 1: University of Dar es Salaam

**3.1.1 Setting.** For 3 hours, 14 students majoring in computer science participated in a GSS classroom exercise at the University of Dar es Salaam. The meeting objective was to discuss problems that hinder a quick and widespread use of computers in Tanzania, and to suggest possible solutions for these problems.

The session started with a 15-minute warm-up exercise to get the students acquainted with the GSS application, *GroupSystems*. Next, the students were asked to identify and select the most critical problems regarding computer adoption in Tanzania. The students were subsequently asked to identify and select the best strategies to handle these problems. In each activity, GroupSystems' Categorizer and Vote modules were used for identification and selection activities, respectively. The problem identification and strategy selection activities each took about 45 minutes, during which 22 distinct problems with supporting comments and 42 solutions were suggested. An example of solution strategies with some supporting comments is depicted in Table 2 (the number within the brackets signifies a unique identification for each contribution, which can be used to refer to earlier contributions).

1. Impose basic computer knowledge at elementary schools	
How can this improve the financial situation of the people? {#48}	
This should be for the development of the country in future. {#74}	
Provide education about computers from primary schools {#30}	
Teach the use of computers from low level, e.g., from primary level {#36}	

After the identification of problems, the students' contributions were first grouped into a number of categories including Financial, Human Resource, Illiteracy, New Technological Development, Government Policies, and Promotion. These categories were moved into the Vote module where students used a multiple selection technique to identify what they felt were the greatest problems. Similarly, generated solutions were first categorized and then ranked in the Vote module. The class was concluded with an oral discussion of the results of the electronic discussion.

**3.1.2 Findings.** During the electronic discussion, all participants appeared to be contributing equally. However, during the oral discussion very few students participated. In fact, only one student dominated the group by expressing his views. This student appeared to misrepresent the group's overall sentiments because the other students were very shy to air their views in public.

The group as a whole was very focused on the goal of the session. Oral communication between different participants was minimal, except at the beginning of the session when students helped each other to operate the system. The students were very serious during the entire class. At no point was the possibility for anonymous communication with the meeting technology used to make off-topic remarks or even "flaming." Compared to our experiences with other student groups, the contributions were serious, well thought out, and of high quality. Feedback suggested that the students used each other's comments as a source of inspiration, as a stimulus for their own thinking.

The computer literacy in the group was high, which could be expected from computer science students. Nevertheless, a lot of technical and facilitation issues were asked before, during, and after the meeting, as the students appeared eager to learn more about electronic meeting technologies. In contrast, the students' typing skills were limited, which negatively affected the productivity of idea generation.

From questionnaires and postsession interviews with some of the participants the following issues were noted:

- Participants were very enthusiastic about the use of GSS to support their discussion.
- The discussion was very open, which is not surprising given the nature of the discussion topic. It was not a topic that raises conflict easily.
- The group was very focused on the subject but also on the meeting technology. They wanted to learn more about the system as it was part of their optional course on groupware.

The scores from a satisfaction questionnaire (scale 1–5 with a score of 5 being most positive—based on Briggs, Vreede, & Nunamaker, 2003) confirm the positive attitude from the students towards the classroom experience. Table 3 shows that in general the students were very satisfied with the GSS process and session outcomes.

#### 3.2 Case 2: The National Social Welfare Training Institute

**3.2.1 Setting.** This case concerned a class at the National Social Welfare Training Institute (NSWTI). Ten students majoring in social welfare subjects participated. The objective of the session was to explore the causes for the substantial increase in sexual offences in Tanzania and to suggest ways to handle this social problem. The session was planned to take 2 hours.

Question	М	SD
Interest accommodation		
Today, my interests were (not accommodated—accommodated).	4.1	0.6
Thinking about what I needed from this meeting (I did not get it—I got it).	4.1	0.6
The outcome of today's activities (does not meet-meets) my personal	4.1	0.9
needs.		
Product value		
The work we accomplished today was (not worth—worth) the effort.	3.9	1.1
The results of this meeting are worth the resources it cost to produce them (disagree—agree).	3.8	1.2
The value of the meeting's outcomes justifies our efforts	4.1	1.1
(disagree—agree).		
Process satisfaction		
The meeting methods we used today (did not meet—met) my expectations.	4.2	1.2
Today's meeting process was (inadequate—adequate) to meet our goals.	3.8	0.8
How satisfied were you with the work process we used today?	4.4	0.8
(dissatisfied—satisfied).		
Product satisfaction		
The outcome of today's activities (does not meet-meets)	4.3	0.6
the meeting's objectives.		
The outcome of today's meeting is (unsatisfactory—satisfactory).	3.9	0.9
The results of today's meeting are (inadequate-adequate).	4.1	0.8

TABLE 3. Satisfaction Scores in the University of Dar es Salaam C
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#### TABLE 4. Example of Students' Contributions

1. The laws should be implemented strictly so that men may fear to break them.

2. Educate the society on the impact of sexual offenses such as rape, defilement, sodomy, and others as a means to arrest such behaviors.

3. Institutions such as churches, schools, etc, should train members in the society about the effect of sexual offenses.

4. Sex education should be formalized; be introduced in school syllabi from the nursery through primary and secondary education up to higher learning institution.

The session started with a 25-minute introduction and warm-up exercise to get the students acquainted with the electronic nature of the meeting. Next, the students performed a problem analysis of the situation. This was divided into two topics: causes and motivation. Students identified causes for the increase in sexual offences in Tanzania. They also contributed possible explanations for the increasing rate of rape of women by men. For this activity, the Categorizer module was used with two buckets, one for each topic. After 20 minutes into this activity, 32 causes and 39 motivations had been generated. Mostly, the contributions were short and focused with only minor English-language problems or typographical errors. The second part of the session addressed problem-solving strategies. For this activity, the Categorizer and Vote (Agree/Disagree) modules were used. In 30 minutes, the students generated 43 problem-solving strategies. Some of the generated strategies are depicted in Table 4.

As in the first case, the group organized generated ideas before voting on them. For example, the problems were categorized under (a) socioeconomic issues, such as increased poverty, leniency in law enforcement, low level of illiteracy, changes in cultural values through new mass media such as televisions, movies, and the Internet, and (b) sociocultural

norms such as alcoholism, drug abuse, and women's dressing styles, and men's chauvinism. The solutions that were generated comprised a variety of policy and educational issues, which is reflected in the example in Table 4. The results of the session were subsequently used in the training program and lectures at NWSTI as input for further discussions.

**3.2.2 Findings.** It appeared that the students' computer and typing skills were very limited. During the session, most students received some support from us and each other. Nevertheless, the way they were eager to learn how to operate the system suggested that they did not feel threatened by the use of computers in their class session. The limited computer and typing skills were illustrated by the relatively low productivity. For example, during the warm-up exercise the students generated an average of only two ideas per student. However, postsession feedback from the students suggested another reason for the seemingly low productivity: The students expressed that they needed some time to think because they wanted to be focused and careful in answering the brainstorming questions.

Another interesting observation during the session concerned gender-dependent behavior. During the first part of the meeting, there were two distinct groups of participants: males and females. This difference manifested itself in the way participants entered the meeting room and by the sitting arrangement. The males entered the room first and all of them sat close to each other. The male group approached the questions at the beginning with giggling and without generating very serious contributions. However, this behavior changed during the course of the session when the students became more focused and started approaching the topic as a single group. At this point, participation appeared to be evenly spread over all participants. Feedback suggested that this was related to the anonymous nature of the communication. The students could generate ideas without calling names, pointing fingers. It became clear they did not need to be shy to discuss this topic and its related sensitive issues.

During the session there was very little oral discussion besides some short discussions between adjacent students. Public comments were rare. This appeared not to be caused by a reluctance to cooperate. Rather this seemed to be caused by (a) differences in the way in which the male and female students participated, and (b) by the sensitivity of the session topic. Nevertheless, the students expressed after class that this had been a very interesting and thought-provoking exchange of ideas. They were especially pleased with the fact that they could build their own arguments and get inspiration from each other's contributions. The teacher was pleasantly surprised by the amount and quality of contributions and discussions. Many students indicated that it would have been difficult if not impossible to have a similar discussion without the GSS facilities.

After the session, the same satisfaction questionnaires were distributed as in the UDSM case. The scores from the questionnaire are depicted in Table 5. The overall results, with a mean score of more than 4.0 for all questions, show that students were very satisfied with class experiences.

## 3.3 Case 3: College of Business Education

**3.3.1 Setting.** The third case is different in nature from the previous two. The previous two cases concerned the use of GSS to support a classroom activity. In the third case, GSS was used to support a discussion among both students and teachers with respect to the organizational development of the College of Business Education (CBE) at UDSM. Two

Question	М	SD
Interest accommodation		
Today, my interests were (not accommodated—accommodated).	4.6	0.9
Thinking about what I needed from this meeting (I did not get it—I got it).	4.4	0.8
The outcome of today's activities (does not meet-meets) my personal	4.5	0.9
needs.		
Product value		
The work we accomplished today was (not worth—worth) the effort.	4.3	1.3
The results of this meeting are worth the resources it cost to produce them	4.2	0.8
(disagree—agree).		
The value of the meeting's outcomes justifies our efforts (disagree-agree).	4.5	0.6
Process satisfaction		
The meeting methods we used today (did not meet-met) my expectations.	4.7	0.6
Today's meeting process was (inadequate—adequate) to meet our goals.	4.1	0.7
How satisfied were you with the work process we used today?	4.6	0.5
(dissatisfied—satisfied).		
Product satisfaction		
The outcome of today's activities (does not meet-meets) the meeting's	4.6	0.7
objectives.		
The outcome of today's meeting is (unsatisfactory—satisfactory).	4.4	0.7
The results of today's meeting are (inadequate—adequate).	4.6	0.6

TABLE 5. Satisfaction Scores in the National Social Welfare Training Institute Case

sessions were organized to enable participants to make suggestions and recommendations that would yield a more efficient and effective College.

The composition of the participant groups differed per session. The first session was dominated by teachers (10 teachers and 2 students). The Director of Studies, representing the Principal, also attended the first session. The second session included only (20) students. The sessions were especially popular with the students. In the second session, students appeared to "invade" the meeting room. This was caused by the fact that at CBE almost all computer courses are taught theoretically. Thus, the session would give a lot of students their first hands-on computer experience.

Both sessions proceeded in the same manner. First, the participants were introduced to GSS; this was followed by a warm-up exercise. Next, the activities of the main agenda were carried out. In both sessions, the Categorizer and Vote module were used for problem discussion and selection of best strategies, respectively. Issues that were contributed and discussed were grouped under Marketing, Training Programs, Resources, and Qualifications of Human Resources and Trainees. A combined selection of the Voting results regarding the selection of the most promising courses of action is depicted in Table 6. The scores represent the average on a scale of 1 to 5, 5 being the most positive.

**3.3.2 Findings.** In the first session, the participants had some experience with computers. Still most had to be trained on the basic functions of the keyboard. In addition, the typing speed was low. This group averaged about 20 contributions in 30 minutes. In the second session, the participants were more experienced. Hardly any assistance was needed to use computers. The second group also achieved a higher productivity—about 30 ideas in 30 minutes (although the number of available computers was the same during both sessions). The participants in the second group appeared more focused on the meeting than their colleagues were in the first session. The second group's ideas were more objective and

Contribution	Score
CBE should now concentrate on both long- and short-term courses. It should be emphasized however, that computerization will have to be taken more seriously than has been hitherto the case.	4.45
The college should make efforts on registering its courses to concerned bodies such as NBAA and NBMM in order to give quality of its diplomas.	4.42
CBE should strengthen her unique courses like the Office Management, Metrology, etc.	4.40
CBE should improve the computer teaching system.	4.36
CBE should concentrate in marketing programs and should try to convince other organizations to sponsor students	4.17
Trainers' qualification: Trainers should be based on professionalism.	4.00

TABLE 6. Example of Voting Results at the College of Business Education (CBE)

more on-task. The students in both groups were very inquisitive about issues such as the operation of the laptops, the meeting technology, and the costs of the various technologies.

It was easy to see that the participants in both sessions felt comfortable offering their views electronically. In the first session, the presence of the Director went unnoticed. In addition, the students in this session were very relaxed. All participants agreed that the anonymity feature in the GSS made them feel more comfortable to express themselves. In the first session, it was stated that because of the anonymity, there was less domination. This feeling appeared to result in very limited oral communication between the participants in both sessions. The only oral communication that took place concerned some assistance by neighboring participants.

The most striking observation which was confirmed by feedback from the participants after the sessions took place, was that they experienced an equal opportunity to participate in the meeting. This was the main reason that the students seemed to enjoy the use of GSS. They found the topic a burning issue and were very motivated to contribute their ideas. In a normal situation, it would have been very difficult for them to enter into such an open dialogue with their teachers and administrators.

At the end of both sessions, we collected satisfaction scores using the same questionnaire as in the previous two cases. Although only about 60% of the questionnaires were returned, the feedback from participants during the interview suggests that the scores are representative for the feelings of the group as a whole. The combined results are shown in Table 7. In general, the participants appeared to very satisfied, especially regarding the accommodation of their own interests and the meeting process.

#### 4. DISCUSSION

The results reported in this study are valuable in shedding light on how collaborative educational processes can be used to stimulate development. According to Schumpeter (2002), innovations in education increase the ability to contribute to the factors of production. This research suggests that changes in the nature of the education process through collaboration technologies can bring about better (perceived) learning processes and outcomes. The experiences suggest that from a student learning perspective participative learning processes were preferable over traditional "sage on the stage" instruction. If learning in collaborative settings is more effective than in traditional individual settings, then this study offers

Question	М	SD
Interest accommodation		
Today, my interests were (not accommodated—accommodated).	4.4	0.7
Thinking about what I needed from this meeting (I did not get it—I got it).	4.3	0.7
The outcome of today's activities (does not meet-meets) my personal	4.2	0.7
needs.		
Product value		
The work we accomplished today was (not worth—worth) the effort.	4.3	1.0
The results of this meeting are worth the resources it cost to produce them	3.9	1.0
(disagree—agree).		
The value of the meeting's outcomes justifies our efforts	4.4	0.6
(disagree—agree).		
Process satisfaction		
The meeting methods we used today (did not meet—met) my expectations.	4.7	0.6
Today's meeting process was (inadequate—adequate) to meet our goals.	3.9	0.8
How satisfied were you with the work process we used today? (dissatisfied—satisfied).	4.4	0.5
Product satisfaction		
The outcome of today's activities (does not meet—meets) the meeting's objectives.	4.2	0.7
The outcome of today's meeting is (unsatisfactory—satisfactory).	4.5	0.6
The results of today's meeting are (inadequate—adequate).	4.1	0.6

TABLE 7. Satisfaction Scores in the College of Business Education Case

evidence to suggest that collaborative processes supported by GSS bring about greater satisfaction and better learning. Below we present some detailed insights that emerged after analyzing the three case situations. We have organized these insights into two categories: *process*, concerning the way in which the sessions were carried out, and *results*, concerning the tangible and perceptional outcomes of the sessions.

## 4.1 Process

There are three main insights regarding the process of the classroom experience. First, it was apparent that the electronic meeting technology allowed students to express freely their thoughts. They could contribute whatever they wanted in any wording they wanted. In all cases, the feedback from the students indicated that they very much appreciated this. The anonymity feature of the meeting software was the key component to their enthusiastic participation in the discussions. Especially when sensitive issues were addressed or when teachers or directors were participating in the discussion as well, the anonymity feature was perceived as a sine qua non for open discussions.

Second, it appeared and was also perceived as such by the students that the participation in the discussion was more equally distributed than in traditional classes. In normal classroom processes, few students participate in class discussions, which was illustrated in the UDSM case. In all cases, the participation in the electronic discussions appeared to be spread evenly over the students. The teachers especially perceived this as a great advantage of using GSS in classroom exercises.

Finally, the nature of the educational process changed during the electronic classroom sessions. In a traditional Tanzanian classroom, the teacher is presenting information to

the students. He or she offers personal knowledge and views on an issue for the students to digest. Discussions between teacher and student are often limited compared to, for example, American standards. The introduction of meeting technology appeared to change this: Instead of the teacher taking central stage in the discussion of a topic, the students themselves were in the spotlight. The students determined the course and content of the discussion. They were triggered to actively participate and express their own thoughts, learn their fellow-students' thoughts, and subsequently use this to further sharpen and formulate their own thoughts. The teacher could steer the course of the discussion a bit, but could not dictate beforehand what would be discussed and what would not. This resulted in a classroom process that was perceived as fascinating by both students and teachers.

# 4.2 Results

With respect to the results of the sessions in the three case studies, we identified three main insights as well. First, it was apparent that the productivity (in terms of contributions per person) in the sessions was somewhat low compared to Western environments that we have experience with. This appeared to be mainly caused by limited computer and keyboard skills. Students' behavior during the sessions and postsession feedback indicated that few had experience operating a computer. Even fewer students had typing proficiency. Nevertheless, lack of skills did not seem to prevent the students embracing the technology. In each case, the students understood the technology within half an hour. Although the pace in the sessions may have been comparatively slow at times, at no point was the technology abandoned and replaced by oral communication.

Second, as was evident from the results of the satisfaction questionnaires, the students liked the classroom experiences very much. Each of the satisfaction indicators received high scores. In addition, the teachers involved appeared to be very satisfied with the way in which the classroom exercises were supported. They found it a stimulating experience for their students. However, one has to be cautious interpreting the positive scores from the questionnaires. During prior research in Tanzania, we found that participants were often reluctant to provide negative feedback (Vreede et al., 1998). Giving positive feedback is normally perceived to be polite. Therefore, we stressed and explained each time before handing out questionnaires or doing interviews, that we were interested in their real experiences and opinions. In addition, we extended our satisfaction data by looking at an additional measure for satisfaction, which is "repeated use" (Nunamaker et al., 1989). From this perspective, we found support for the high satisfaction scores as in all case situations invitations were extended and followed up for more classroom support. Still, the tendency for politeness has to be taken into consideration when interpreting the questionnaire findings.

Finally, the third case situation clearly showed that the applicability of the meeting technology goes beyond just classroom discussions. Group support systems may also be employed to support discussions about the organizational design of the educational institute itself. In fact, it may be argued that a GSS within an educational institute may offer support in four different areas (Mgaya & Vreede, 1999). First, it may be used to support educational processes, as we demonstrated in this study. Second, it may be used to support research activities, for example the formulation of hypotheses, the analysis of qualitative research data, or the writing of a research report. Finally, it may be employed as a service to society where the institute provides (financially funded) GSS services to other organizations.

#### CONCLUSIONS

To be able to learn, a person has to be able to communicate sufficiently and effectively with another person about the knowledge to be learned. In this study, we have investigated the application of GSS in an electronic classroom situation to support such communication and enable collaborative learning. The case studies illustrate the potential of this technology. It appears that GSS may enable a more interactive environment in which all students actively participate in discussions with each other and with their teacher. The results of the study further suggest that students are highly satisfied with this type of learning environment and are highly motivated to perform in class. An additional advantage is that through the use of GSS, students automatically learn how to handle and become acquainted with computers in general and this type of groupware in particular.

An important issue regarding the further applicability of GSS in educational environments in Tanzania concerns the costs involved in setting up a meeting facility. In this research, we used the facilities from the University of Dar es Salaam, which were provided to the teachers at no cost. The costs of hardware and software, however, can be an insurmountable obstacle for educational institutes in developing countries. Outside funding would probably be required. Moreover, the use of technology alone is no solution. To apply GSS in learning environments effectively, teachers need to be trained in its possibilities and applications. Among other things, this means that new, repeatable teaching formats will have to be introduced to make optimal use of the potential of GSS (Briggs et al., 2003). The case studies illustrated that the nature of the classroom process is changing considerably, as is the role of the teacher. It cannot be expected that all teachers are willing to embrace this change.

The limitations of this study are twofold. First, the case situations only concerned single classroom experiences. It was not possible to support all classes in a certain subject with GSS. It may be argued that supporting a whole course would have resulted in different findings. The perceptions of groups that repeatedly use electronic meeting technology change over time (Chidambaram, 1996). Second, within the timeframe of our research it was not possible to assess whether the application of a GSS had a (positive) effect on the students' level of learning. To this end, comparative measures have to be collected from classes that cover similar topics but did not use a GSS. In response to these limitations, our future research efforts extend along two dimensions: We are looking for possibilities to support complete courses using GSS technology; and we are developing procedures and measurements to assess the effect of GSS applications on long-term learning.

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