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Teachers' and Students' Experiences of Simultaneous Teaching in an International Distance and On-Campus Master's Programme in Engineering

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Abstract

Swedish universities frequently offer campus-based education as well as online courses, a system commonly referred to as dual mode. This paper analyses some challenging pedagogical aspects of a master's programme in engineering developed and delivered simultaneously online and on campus. Course evaluations, questionnaires, and interviews with the programme teachers were the main instruments used in this study. Activity theory was used as a theoretical framework for data collection and analysis. The study evidences the nature of problems experienced by on-campus and distance students as well as conflicts of interest and expectations existing between these two student groups. Teaching simultaneously in two modes demands extra effort from the course teachers, who are aware of the problems related to pedagogical communication needed by both groups. Though teaching in the dual mode offers economic benefits for the department, the simultaneous mode of teaching is experienced as problematical by both groups of students, with distance students appearing to be more disadvantaged in the programme.

Keywords: Activity theory, distance education; higher education pedagogy, qualitative research

Introduction

There is a strong international trend in higher education to develop distance education using information and communication technology (ICT) in order to provide high-quality education at the least possible cost (Casey, 2008; Högskoleverket, 2008). Science and engineering faculties around the world are also active in the process of introducing online learning, and they seek alternative ways of providing practical, laboratory, and project components of academic studies (Bhattacharya, 2008). Support for ICT-enhanced education is also part of the current political agenda in Europe. The European Commission (2008) emphasizes the importance of supporting educational institutions that promote creativity and innovation through developing specific teaching and learning methods (including the use of new ICT tools). In general, the spread of

electronically customized education around the world seems to be an irreversible process as more courses and programs are delivered online. London and Draper (2008) call this phenomenon "the silent revolution in higher education."

A strong utilitarian argument for online education is that it provides the opportunity to reach new groups of students in new places around the world. For Swedish science and engineering programmes struggling with small enrollments for face-to-face courses, the opportunity to widen the range of potential students through online learning is crucial. In Sweden, the same universities that organise campus-based education also offer e-learning courses and programmes. This system is commonly called *dual mode* (Högskoleverket, 2008). The policy states that the same fundamental quality requirements should apply to e-learning as to campus-based higher education. However, there is also consensus that there are significant differences between e-learning and campus-based education (Högskoleverket, 2008). Switching from the regular on-campus style to a remote one is not an easy process. Researchers express concern (Kuleshov, 2008) that if an aspiration to this web-enhanced online teaching is not supported by adequately prepared faculties, technical support staff, and students, it will lead to the degradation of the teaching process rather than to its improvement.

Exploration of the effectiveness of online education and the quality of educational processes relying on Internet and computerised technology usage has thus been an important part of educational research for many years (for literature review on this topic, see Conole & Oliver, 2007). Currently, new discussions are appearing on the possibilities of mutual enrichment of pedagogies of distance and on-campus teaching when teachers move between face-to-face and online classrooms, transferring ideas, strategies, and practices from one to the other (Lowes, 2008). Researchers are also working actively on analysing the particularities of e-learning in international communities (Hudson, Hudson, & Steel, 2006).

This paper aims to describe and analyse some challenging pedagogical aspects of an international master's programme in engineering developed and delivered in dual mode at a Swedish university. The programme introduced a pedagogical approach of mixing distance and on-campus engineering students on the same course. Though the economic advantages of such an arrangement are obvious as many more students are enrolled on the courses with a marginal increase in the course delivery costs, the design of the pedagogical delivery of the programme is complex and needs deeper analysis, including a focus on the processes involved in simultaneous teaching. With this purpose in mind, the following research questions were formulated:

- What is the student's experience of simultaneous distance and on-campus teaching in the programme?
- How do the teachers experience teaching distance and on-campus students on the same courses simultaneously?

The issue of quality in teaching has not been specifically dealt with in this paper and student performance indicators were used only for illustrative purposes.

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Brief Programme Presentation

The distance master's programme in engineering (DME)[i] analysed in this paper aims to provide state-of-the-art engineering education to places where such education would not be possible otherwise. It has been running for four years and is currently two years in duration (120 ECTS). The first three semesters consist of coursework and the last semester involves a thesis based on research project work. The main part of the course involves lectures, self-studies, and evaluation exercises. Lectures are given in the technically enhanced rooms for on-campus students in the Swedish university but are also aimed at distance students. These lectures can be followed by the distance students synchronously and/or asynchronously via Internet. An important aspect of the programme is that most distance students come from cultures that differ from the national Swedish culture.

The syllabus of the DME programme is identical to the on-campus master's programme in engineering. The courses are provided with the same educational requirements for the distance as for the on-campus students. Examinations are taken by DME students at their place of residence following the procedures and requirements that exist at the Swedish university. Student responses to examination questions are sent to Sweden by express mail for grading by course teachers. The students submit projects and assignments using an interactive web platform. Thus, both groups of students go through all the stages of the programme simultaneously. Student intake to the distance and on-campus sections of the programme are shown in the diagram below.
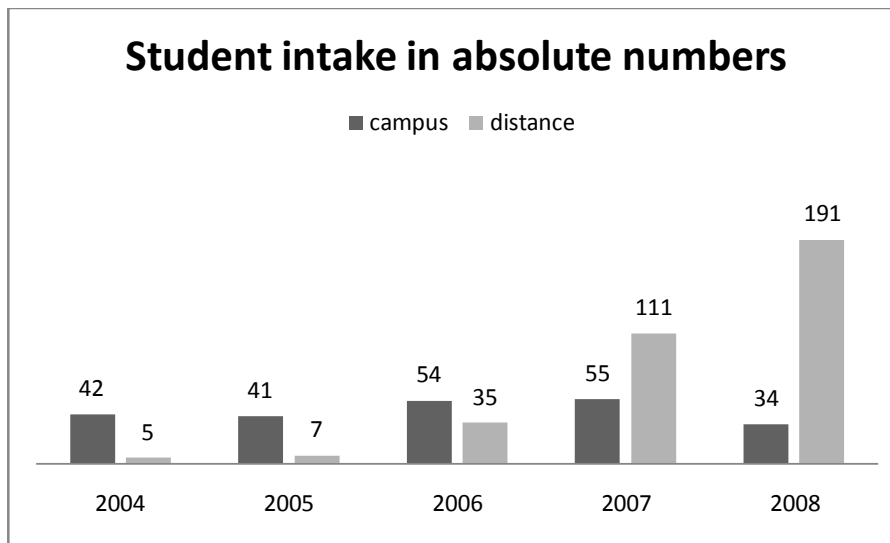

Student intake in absolute numbers

■ campus ■ distance

Year	campus	distance
2004	42	5
2005	41	7
2006	54	35
2007	55	111
2008	34	191

Figure 1. Student intake to the programme.

As shown in the diagram (Figure 1), it is obvious that the distance section of the programme (DME) is gaining in importance in terms of the number of students registered in successive years. Initially, the distance programme was open for applicants from any country in the world. However, two years ago (2007) a decision was taken to restrict the scope of the DME to nine

countries (in Africa and Asia) with the aim of making the students' management process easier to control and compliant with Swedish university rules and regulations (e.g., exam organisation).

The programme completion rate is poor for distance students. For the intakes of 2004 and 2005 only 40% of the students (5 of 12) graduated. Nobody from the intake of 2006 was able to finish the programme on time. Differences in achievement are visible already in the first courses. For example, a short introductory course (on energy technology) in 2007 was passed by 95% of on-campus students (63 of 66; there were also 11 free-movers on the course) but by only 75% of distance programme students (83 of 111). Most of the distance students are chronically delayed in their studies. The average course completion rate for DME students is under 50%. This situation awakened the author's interest to look deeper into pedagogical aspects of the programme and, in particular, into the process of simultaneous dual mode teaching.

Theoretical Framework

Activity theory is used as a theoretical framework for data collection and analysis. Particularly, the socio-cultural part of the theory was found to be useful for the study. This theory is broadly applied by researchers as an approach to the investigation of information technologies in the context of human practice and as a methodological framework for the design and analysis of computer-supported collaborative learning activities (Kaptelinin & Nardi, 2006; Collis & Margaryan, 2004). The main ideas and theoretical constructs of activity theory that helped to frame the research and analysis of the findings are presented below.

Socio-Cultural Context

The importance of the context as an active component of the learning process that interplays with learners' and teachers' activities is suggested by Vygotsky (1978). The conditions of the physical and socio-cultural environment, the resources available to the students, the students' learning traditions, and skills developed in their previous studies (or absence of such) all constitute important contextual factors that should be considered in the educational process.

Practical Collaborative Activity

According to Leont'ev (1981), the first and most fundamental form of human activity is external, practical collaborative activity that is idealised later on human thought. The value of practical activities cannot be underestimated in developing the professional knowledge and skills of future engineers.
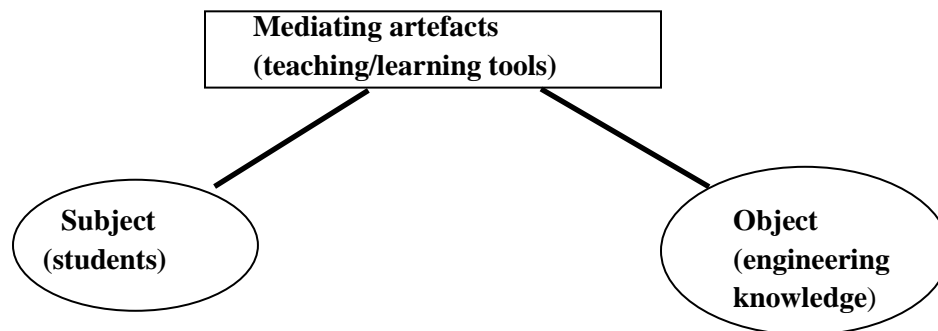
Mediation

The fundamental claim of activity theory is that human activity (on both the interpsychological and intrapsychological planes) can be understood only if we take into consideration the technical and psychological tools that mediate this activity. The programme analysed relies highly on the

functionality of ICT tools. The effectiveness of technological and pedagogical mediation is decisive for the success of distance education.

Object of Activity

The content of human activity is determined first of all by its object, and activity is oriented towards it (Leont'ev, 1981). The object of the programme analysed (and of the students' activities in the programme) is the engineering knowledge and skills used for the transformation of natural or human made objects, with their properties reflected in scientific and technological principles, laws, and theories. In other words, the object of learning activity is that which the programme aims to prepare the students for. The teachers' and students' perceptions of the object of activity influence the teachers' activities and the students' learning motives, actions, and strategies. The process of mediation in DME learning activities can be illustrated by the following diagram (Figure 2).

Figure 2. Mediation of learning activity.

The acquisition of new engineering competencies can be considered as an expected outcome of the activity.

Motives

According to activity theory, goals and motives are considered the basic (key) components of learning activities. Leont'ev (1981) emphasises that motives determine the sense of the activity. The motivation for learning can be more idealistic (such as personal and professional growth) or pragmatic (such as the acquisition of scholarships and diplomas). Activity theory also requires that human interactions with reality be analysed in the context of development. The theoretical constructs presented above were helpful in defining the study.

Research Methods

The main research instruments used in this study were the students' course evaluations, questionnaires, interviews with programme teachers, and analysis of DME programme documentation. Seven course evaluations from years 2007-2008 were analysed. The choice of

courses was incidental as the program administrator sent arbitrarily selected evaluations of different courses to the author. In total, 347 students filled in the web-based course evaluation forms. These forms consisted of Likert-scale questions and a space for free comments. The evaluation forms did not contain a variable concerned with the study form (distance or on-campus) and the questions did not explicitly address the issues related to dual-mode teaching. This information was extracted from the students' free comments. The relevant comments and ideas about the teaching/learning process in the courses were put together through an iterative reading process and summarised in categories that were used for further qualitative analysis (Ritchie, Spencer, & O'Connor, 2008).

Eleven lecturers answered a questionnaire (with 17 open questions) and nine of these teachers attended a three-hour group interview session. Thus, group interviews and additional telephone interviews (with two people) involved most of the staff working in the programme. The interviews took place in the conference room of the department responsible for the DME programme. The questionnaires and interviews with teachers provided some insights into the students' progress in the programme. The anonymity of informants was incorporated into the process of data collection and presentation of results. Documents available on the DME programme website provided background information and gave an overview of the programme structure and design.

Presentation and Analysis of the Results

Using the course evaluations and information provided by the teachers, different problematical aspects of simultaneous dual-mode teaching were identified through an iterative data analysis process. Looking at these problems through the lens of activity theory, various categories could be generated corresponding to the students' and teachers' perceptions of the mediating tools and their reflections about the object and context of the learning activity. They are presented under a number of headings in the text below and illustrated by the informants' quotations. Various tensions and contradictions became visible in the different actors' interpretations of the pedagogical activities of the programme.

Level of Interaction

Many on-campus students commented in the course evaluations on the level of interaction with the lecturers during the classes. They experienced that the lecturers were focusing more on the needs of the distance students thus causing face-to-face teaching to suffer: "no dialog and peer cooperation during the lectures that are otherwise common in on-campus teaching." Distance students often expressed disappointment that they did not have the possibility of interacting with the teachers while they were lecturing and also immediately after a lecture. They also complained about the low teacher response to their emails. This problem caused extensive discussions among the teachers and programme managers. With constantly increasing numbers of distance students, maintaining individual communication became problematic and it was decided to use an Internet-platform as the only form of communication. The students now had to post individual

questions to a common collaborative space to which either the teacher and/or other classmates could respond. However, not all distance students felt that it was easy to post questions to the common e-space instead of addressing them directly to the teacher.

The teachers acknowledged delays in communication as being the main problem in working with distance students and that this factor put them at a disadvantage in comparison with campus students. A teacher explained the reasons for this:

> We teachers receive the tasks (assignments, project, exams) normally much later from distance group. This of course means that we focus our priority on the first tasks that come (tasks that came on time from the campus students) and leave the rest for correction later. Sometimes the delay is months and thus we are already engaged in other activities.

Delay with the teacher's feedback on the assignments was experienced by many students as a very discouraging factor for their studies.

Technical and Pedagogical Mediation

The distance and on-campus students had different needs and requests when working with the course content. Engineering education includes a variety of calculations and problem solving exercises. When hints for calculations were given, on-campus students needed less-detailed guidance than distance students as they had easier access to the teachers, peer students, and reference literature. Some of the on-campus students saw detailed step-by-step recommendations and explanations as rather unnecessary. In the same way, on-campus students experienced lectures based on PowerPoint slides as adjustments to the needs of the distance students and were unhappy about the lecturers' "slide-reading method of teaching." This was particularly the case when slides (PowerPoint presentations) were overloaded with information and were not easy to grasp.

There were many complaints in the course evaluations about the quick pace of the lectures, speed of speech, rate of changing slides, etc. These complaints usually came from the students who attended presentations in the lecture theatre. They expected to be able to follow lecturers' reasoning without the need to go to the material on the Internet and recapitulate the lecture once more at home. On the other hand, distance students studied recorded lectures, so they could pause a presentation whenever they wanted to. They requested that teachers not use the whiteboard (as it is not video-recorded) and when the teachers showed objects in the class or had questions from the audience in the lecture-halls to make sure that this information would also be available to the distance students.

Some campus students considered the use of technical devices, e.g., e-pens for writing on the computer screens, as excessive "when a whiteboard can be used and video filmed." Teachers also felt that the technology might cause some problems for lecture delivery. Commenting on the use of the Internet-based study platform, a teacher wrote, "it is very easy to make a mistake as there

are so many 'buttons to push' to make it work. This sometimes delays the start of lectures, which is also a problem for the campus students." Thus, technical mediation appeared to cause some problems for all actors involved.

Examination and Assessment Practices

Examination traditions and practices form an important part of the socio-cultural context of the DME and these might vary significantly between countries. The DME programme follows Swedish rules of examination, which are stipulated in the curriculum. Some Swedish traditions and rules can be unusual for people coming from other academic cultures. For example, distance students commented in their course evaluation on the extensiveness of examination tasks. Five hour exams (and longer) were seen as too long. After three hours students became too tired and were not able to concentrate. The level of stress was high during the exam and it was difficult to tolerate such stress for as long a period of time as 5-6 hours. According to the students' comments, those who had a good memory could pass, but they asserted that engineering reasoning skills were not tested adequately in the written exams. The use of an Internet-platform to post assignments was very discouraging for the students as there was a low tolerance for errors. Even the correct procedure could give a wrong answer. Assignments could be sent and rejected by the system several times without explanation. The system did not look at the way exercises were solved (method) but only at the results. This approach seemed unfair to many students.

Both teachers and students agreed that the use of regular assignments and quizzes appears to be an important mechanism in course delivery. The distance students coped better when they were required to study the material presented systematically and when they were tested regularly on the content of that material. However, the teachers reported that many distance students lacked a culture of keeping deadlines. A teacher gave an example:

> In my course last year assignments were due in September/October (2007). Few distance students submitted them on time due to problems with accounts, etc. I gave them the chance to submit the task in December and got little response. Then I gave them another chance in March 2008 with not much response...So this created a lot of logistical problems for the teacher responsible for the course and other teachers/assistants involved.

There were comments from teachers and learners that master's students in the on-campus mode of the programme were required to make systematic presentations of their studies for their colleagues. Thus, they were training not only to collect and analyse data but also to present and defend their results publicly, which was a part of the course evaluation. This component was seen as important for students to gain confidence in communicating and evaluating engineering projects, something that the distance students missed.

Practical Activities

The DME programme appeared to provide good general theoretical preparation for the students but provided limited practical engineering skills. Even on-campus students stated in course evaluations that the programme "lacked identity." It struggled between establishing a practical engineering profile and communicating generic knowledge: "We are engineers. We want to understand the nitty-gritty of things." The students pleaded for practical exposure to real situations during the courses.

The situation with practical work was particularly difficult for distance students. The programme attempted to provide alternative solutions for practical activities. One teacher explained it this way:

> What we have tried to do in the courses that I am involved in is to carry out virtual lab exercises on the web, including short videos of the equipment used etc. This should be (almost) as good as attending the lab onsite.

Study visits to industrial sites in Sweden had also been video-recorded and were available on the Internet-based study platform. Teachers also told of attempts to use remotely controlled labs, which required large investments in hardware and labour. They were not aware of research on the effectiveness of such remote labs in comparison with recorded lab sessions and pre-measured data provided for the students to carry out the necessary engineering calculations. Remote controlled labs also demand high-speed Internet connections that not all the distance students have. Only a few DME students came from industry, so most of them could not develop practical skills by being associated with an industry. In general, the practical component of the programme remains a problematical issue.

Study and Self-Monitoring Skills

To be successful in online courses, students need good self-organization and independent learning skills. Their participation in and completion of online courses is entirely up to them. The data collected indicated that many students lacked the study and communication skills that were expected of them. Traditions and methods of learning gained in their previous studies were different and not very helpful in distance and computer-based education. However, the DME curriculum did not include an introductory course aimed to improve students' distance study and communication skills.

The structure of the programme was quite complex. The DME started with five courses in parallel (at the same time) and this put a lot of pressure on the students. The courses were composed of several modules with their own quizzes and assignments (given and corrected by different instructors at different times, which had a certain weight in the final grade) and the exam. Thus, even after passing the exam the students would not have completed the entire course if they had failed some assignments.

Monitoring student progress in the programme was left mainly to the students themselves. Many distance students felt unaware of the progress of their studies, even though data was available on the Internet. The lecturers' feedback on assignments was often delayed and it could take a long time for the students to finally understand if they had passed the course. The teachers recognised the problem, as indicated by this statement:

> It has been very difficult in general to follow the DME students' progress. They are taking parallel courses, many teachers are involved in correcting assignments, and sometimes it takes a long time for the assignments to arrive and to be corrected. There have also been problems with keeping track of who is who as the students do not have the personal ID numbers we use, and their names are long and sometimes used/written in different ways. All this makes it difficult to keep track of their progress and thereby to keep track of who needs help.

In general, the students felt unaware of their progress and had poor distance study and self-monitoring skills.

Content and Context

For the DME teachers it was challenging to adapt the content and methods of teaching to the distance students' different socio-cultural contexts. The study identified two main obstacles. First, when teaching was conducted simultaneously for on-campus and distance students, teachers tended to meet the interests and needs of the students who sat in front of them. Second, teachers had little personal experience and knowledge of the distance students' contexts and did not know much about their needs and conditions.

In the course evaluations, the students commented, for example, on missing content on the use of renewable technology in a non-Western context; solar energy was covered briefly but heating was tackled extensively. The DME programme did not target non-European students in particular or the needs of their local industries. These needs vary greatly between countries and even places within a particular country.

During the interview with the lecturers, the point was made that it would probably be better to have two sets of teaching material, one for on-campus students and one targeted specifically at distance students. However, the lecturers admitted that this would require extra work and time that they did not have.

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Fairness and Equality

The study conditions for distance and campus students were quite different, particularly for the students in economically disadvantaged parts of the world, even though all of them faced the same curriculum requirements. The course teachers were aware of some unfairness in the situation but experienced unease in dealing with it. A DME teacher commented about approaching the problem of disadvantages faced by distance students in the following words:

> They get a positively higher level of study support compared to campus students in terms of preparation for exams, alternative exercises replacing labs that are impossible to perform over the internet, etc. This is often not justifiable as all students should get the same level of support.

Another course teacher gave an alternative view: "We do not make any distinctions between these students and other students, no. But their study situation is probably different from European students and from the situation for on-campus students."

An experienced course leader offered his perspective:

> Generally, I set the tolerance level lower with respect to submitting course deliverables (e.g. assessments) on time due to unreliable internet connections. This is however a major problem as our distance education largely uses the internet as the main tool assuming good performance. If a student contacts me to say that he or she did not have internet access during the last 2-3 weeks I have no reason not to believe him/her as I do not have a reference. Still, it is in my interest to get all students out of the other end of the pipeline. Therefore it is necessary to evaluate such situations individually (= time and energy consuming).

Thus, there were different approaches used on different courses of the programme with regard to what was considered as fair and equal treatment of the students.

Course Material

The analysis of the curriculum indicated that the amount of reference e-material in the program courses was huge. The absence of books and hard copies of lectures (as books were not available in many developing countries and printing costs were very high) compelled the distance student to read material from the computer screen. This was a very tiring exercise when the students needed to study dozens of documents/files presented in different media formats in order to prepare for assignments. The teachers did not see this as a problem. A lecturer stated: "Whether the students have the literature etc. as hardcopies or in digital form should not make a difference." Other teachers agreed: "There are high quality lecture series available in the study platform for my subject. It is screen reading but it is still the right stuff."

The Internet platform used in the DME programme did not allow easy editing of lectures. If a recorded lecture had sound or image problems (which often happened) or if the lecturer made a mistake writing with an e-pen (which was not noticed directly) it was practically impossible to edit the material later. So all of the students needed to live with this. They did not have access to lectures from previous years. All electronic information and course material was made available on the Internet simultaneously for all students. However, on-campus students had access to additional sources of information that distance students did not. The course teachers admitted that the on-campus group had much broader opportunities and a variety of ways to access the necessary information through personal contacts with the teachers, course administrators, and peers.

Discussion

The development of distance education through information and communication technology is an important part of the work at modern universities. This paper analyses a specific model of engineering education where courses are delivered simultaneously to distance and on-campus students following the same curriculum. The general conclusion emerging from the study is that adding a distance component to an on-campus programme and merging them into one is experienced as pedagogically problematical by both students and teachers. Looking at the teaching/learning situation from different perspectives (teachers, distance, and on-campus students) and using conceptual constructs of activity theory, the following reflections can be made.

Concerning the object of the learning activity, from the data collected in this study it becomes clear that the content of the DME programme is not particularly adapted to a non-European context. In course evaluations, the students made comments about the lack of examples using solar and other renewable technologies in hot-climate contexts in low-tech societies; at the same time, they experienced an extensive focus on heating systems and the needs of high-tech societies. Local context knowledge and experience seemed not to be valued in the DME programme.

Concerning the use of mediating tools in teaching, some on-campus students commented in the course evaluations about the need for appropriate graduate level teaching methodology and level of content. They experienced the current teaching of some courses as *spoon-feeding* and related this to the teachers' adjustments to the necessities of the distance students.

The automatic correction of quizzes and assignments used in the programme is reminiscent of traditions of "programmed education." Through this teaching method a massive outcome can be achieved by providing learning tasks using technological tools and also correcting the students' results using the technology. In this respect, even on-campus students missed the "human dimension in training modern engineers who can think creatively and not just get mechanical right or wrong marks from a machine on pure recall-type assignments." Here, an argument can be put forward for ongoing peer and formative assessment through the programme design and the notion of assessment *for* learning in contrast to assessment *of* learning (Hudson, Hudson, & Steel, 2006).

According to the lecturers, some of the above-mentioned pedagogical problems could be related to the large size of classes rather than to the distance form of education. They also experienced that some distance students show low study motivation and engagement in the programme activities. However, many of these problems can also be attributed to poor pedagogical, administrative, and technical mediation of the students' studies in the programme.

In fact, the mediation of learning activities for on-campus students seems to be more efficient than for distance. The elements of the mediation process can be the same for both groups, but their organisation and the students' access to them can be different. Here it is possible to adopt the physics analogy suggested by Kuleshov (2008) and liken mediation in learning activities to the phenomenon of conductivity in an electric circuit with parallel and serial connections of elements. For on-campus students mediation is possible in parallel form where several alternative ways of gaining information, acquiring knowledge, and solving problems are available (different course instructors, laboratory technicians, peer students, administrators, library and technical support staff, study advisors, and director of studies, etc., some of which are not available to distance students). When elements of a circuit are connected in parallel the total conductivity is greater than conductivity of any particular branch of the circuit. The alternative situation of serial connection of elements leads to the total resistance being greater than resistance of any particular element. So, the conductivity falls to zero if at least one component of the chain has a conductivity of zero value (i.e., does not work). The distance students seem to experience more mediation of the latter (serial) type when a step-by-step process of solving pedagogical and administrative issues, transfer of information, submitting assignments, reporting the results, etc. becomes very resistant. Therefore, most of them seldom finish the program on time. The learning outcomes of the programme are much better for on-campus students.

The findings confirm what Bates and Poole (2003) have pointed out: The workload associated with teaching with technology is the most pressing issue from an instructor's perspective. Teaching simultaneously in two modes, both e-learning and face-to-face, demanded extra effort from the course teachers. They needed to concentrate more when working with two categories of students at the same time. More time had to be spent on the preparation and development of courses. Teachers felt overloaded with pedagogical and administrative tasks as no new staff were added to the department with the introduction of the DME. They were tired of working overtime.

After the lectures, the distance students did not have an opportunity to ask teachers any individual questions without exposure on the public e-space. The interactivity of personal electronic communication is experienced as being rather poor. This problem is well recognised for international distance programmes (Hudson, Hudson, & Steel, 2006). Students from different cultural contexts show varying degrees of ease with discussing in public and disturbing teachers with their questions.

Thus, distance education means in many courses that the students experience pedagogical distance to the instructors. Using Moore's words (1997), it could be interpreted as "transactional distance," which refers to the separation of learners and teachers not only in geographical space

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but also in psychological and communications space, leading to potential misunderstandings between the inputs of the instructor and those of the learner. Teachers also agree that students perform better when they work in personal and face-to-face contact with the teacher, but the distance students never have a chance to meet their teachers.

Conclusions

In general, the pedagogy of the DME programme is characterised by a teacher-centric approach with mainly one-way communication, the delivery of materials from teachers to students. The level of interaction among the students enrolled on the program around the world (particularly in African countries) and with the teachers in Sweden remains rather ineffective. Increasing numbers of DME students did not lead to new staff positions at the department. The Swedish government provides the university with 75,000SEK (about 10,000USD) per year for each student (who has enrolled and successfully finished the year, and the department gets one third of this sum directly after a student has registered) in the field of engineering education. Thus, economic resources are available, but money was not converted into "tools for teaching," i.e., pedagogical resources. This makes the mediation process of teaching/learning on the DME rather ineffective.

The practical component of the programme is also weak. It is possible to question what type of knowledge future engineers can gain by watching computer-displayed lectures or video films of laboratory work and study visits. The organisation of hands-on practical activities is a serious challenge in the distance mode of an engineering programme. Practical collaborative activity provides opportunities to acquire the valuable skills of problem solving and cooperative group work, which are very important for modern engineers. Thus, an essential feature of engineering training, i.e., students' engagement in practical collaborative activities, appears to be unsuccessful in the DME. The results of this investigation lead us to believe that the different study contexts should result in different but parallel course syllabi: the campus programme could include the usual laboratory practicum and field visits, while the distance programme could place a stronger emphasis on empirical projects adapted to local needs in addition to virtual laboratory exercises.

It is possible to conclude that skills such as web communication, time keeping, and progress monitoring are not easy to acquire for students who are studying outside Sweden. Greater purposeful action from the programme management is required in this direction, for example a preparatory "zero-course" can be designed particularly with the aim of distance students developing skills in managing technology, studying, and self-monitoring. The DME programme teachers also need an introduction to teaching Internet-based courses for learners with different cultural backgrounds. They should become aware of the differences in social norms and traditions that exist in different cultural contexts, in particular those related to shared study and communication models. These measures can potentially improve the motivation and performance of distance students in the programme.

In conclusion, activity theory suggests that all practice needs to be analysed through the lens of historical development. We have to see for example how the use of tools unfolds over time. From

this perspective, it is possible to conclude that the DME has been in a steady process of developmental change. The teachers acquired the necessary skills of using technology; the study material became available on the Internet platform; and the administrative and organisational tools were placed in action. The programme is in progress! However, teachers need more knowledge about the modern methodology of distance education, more time for self-monitoring and reflection on their pedagogical actions, and additional professional support for the challenging task of teaching distance and on-campus students simultaneously.

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i For anonymity reasons the name and abbreviation of the programme have been changed.