MEDICAL EDUCATION THROUGH THE USE OF DIGITAL TECHNOLOGIES: THE IMPLEMENTATION OF A SWEDISH REGIONALIZED MEDICAL PROGRAM

UFV Graduate Student Paper Prize Winner

Fanny Pettersson, Anders D. Olofsson, Tor Söderström, and Christina Ljungberg
Umeå University
Sweden

Abstract

In 2011, the first regionalized medical program (RMP) started in Sweden. The Swedish RMP means that students are distributed in groups while doing their five clinical clerkship semesters. To enable the medical students' theoretical studies when being regionalized, digital technologies are used for educational and administrational purposes. This paper explores medical teachers' and administrators' understanding of faculty preparations, their own preparedness and expectations related to the implementation of the RMP supported by digital technologies. A survey was distributed to teachers and administrators before the first regionalized semester was conducted. Findings indicate that the use of digital technologies began at a small scale, but that there is potential for increased development. It is concluded that although teachers and administrators have limited experience of distance education, the faculty has been able to create a feeling of being prepared.

Introduction

In contemporary society, universities have transformed to encompass dual modes where both online and on-campus learning options are available (Power, 2008). New digital technologies allow more flexible and innovative educational technology and course design solutions (Olofsson & Lindberg, 2012; Schneckenberg, 2009). This is also the case in medical education, where the use of digital technologies to enhance students' learning accordingly has grown rapidly (Maley, Harvey, De Boer, Scott, & Arena, 2008). Digital technologies in medical education are said to offer a wide range of options to meet changing demands, in terms of availability and flexibility of education, from both society and students (De George-Walker & Keeffe, 2010). The educational practice focused on in this paper — educating medical students in a so-called regionalized mode supported by significant numbers of digital technologies — is a relatively new phenomenon in medical education (Eley & Baker, 2009).

Regionalized medical programs (RMP) are primarily applied in Australia, Canada, the UK and Asia (Eley & Baker, 2009; Lau & Bates, 2004) and are considered as an opportunity to overcome the lack of medical doctors in rural hospitals (Lau & Bates,

2004). RMPs are said to contribute to building a genuine awareness of both clinical and rural clinical clerkship, while rural hospitals are afforded the opportunity to recruit medical doctors (Eley & Baker, 2009). The rural clinical clerkship seems to provide good learning opportunities due to smaller student groups and more diverse patient cases (Worley, Silagy, Prideaux, Newble, & Jones, 2000). Instead of collected or dispersed localization, the medical students are distributed in groups at different geographical locations. To enable medical students' theoretical studies during their rural clinical clerkship, digital technologies are used (Janes, Arroll, Buetow, Coster, McCormick, & Hauge, 2005). Nevertheless, RMPs are not entirely dependent on digital technologies, although they feature a significant number of teaching and learning activities using such digital technologies (Lau & Bates, 2004). According to Janes et al. (2005), the use of digital technologies in RMPs is now, and in the future, expected to be an absolute precondition for overcoming isolation and improving knowledge flow.

In January 2011, Umeå University in Sweden was facing its first attempt to transform the existing medical program into an RMP supported by digital technologies. In this paper, a contextual description of the first RMP in Sweden will be presented. More specifically, the aim is to explore the medical teachers' and the administrative staffs' understanding of the faculty preparations (in this paper, faculty embrace the concept of a division within one or a number of subject areas, in this case related to the RMP), their own preparedness and expectations when implementing an RMP in Sweden supported by the of use digital technologies.

Implementation and Preparedness

The implementation of digital technologies and conditions for technology enhanced learning (TEL) has grown rapidly within higher education (Laurillard, 2008). Schneckenberg (2009) puts forth that the academic staff involved in the implementation phase of digital technologies and TEL face great challenges, both technical and pedagogical. Teachers, as designers of courses, and in constant and direct contact with students, seem to have a major impact on how digital technologies and TEL are integrated into the teaching practice. However, when implementing digital technologies and TEL the question of "what the technology makes possible, rather than what learners need" (Laurillard, 2008, p. 526) is often posed.

Beliefs and e-competence

Schneckenberg (2009) describes teachers' so-called e-competence as a related component to successful implementation of digital technologies. At the same time he points out this is not always an easy task to accomplish as "a critical mass of academic teachers still lacks the competence that enables them to know and to judge why, when and how to use digital technologies in education" (p. 413). This also includes knowledge of what digital technologies can contribute to teaching and students' enhanced learning (Laurillard, 2008). In relation to RMP, Janes et al. (2005) claim a lack of application of e-learning among regionalized medical teachers related to inadequate computer skills. A similar line of thinking is expressed by Kitsantas and Dabbagh (2010), who argue that teachers must

learn how to use digital technologies in their teaching. This also includes meeting the students' demands for flexibility and modern use of the technologies for learning purposes. Kirkwood and Price (2005) report that teachers' underlying conceptions of teaching and learning affect the way digital technologies are used. The two main ways are a) technologies to transmit the knowledge, and b) technologies to facilitate student learning. To transmit knowledge, streamed/live-sent lectures and PowerPoint® are frequently used. The transmitting use of digital technologies often enables students to learn and be taught regardless of time and space, but does not provide any changes in the fundamental educational practice. When teachers and faculties challenge their existing cultural conceptions and practices of teaching, digital technologies can be understood and used in ways that further facilitate student learning.

Choosing the Right Digital Technologies First

In medical programs, so-called traditional lectures have always been highly valued (Koller, Frankenfield, & Sarley, 2000). Lately, such lectures have often been carried out in streamed and video-linked modes (Callas, Bertsch, Caputo, Flynn, Doheny-Farina, & Ricci, 2004; Cardall, Krupat, & Ulrich, 2008; Mattick, Crocker, & Bligh, 2007). This transformation is seen as an advancement in medical education (Wang, Mattick, & Dunne, 2010) and perceived as a good start for teachers with limited experience of digital technologies and TEL in educational settings (Ellaway & Masters, 2008). Despite this, in relation to the rapid development of digital technologies and TEL for learning purposes, researchers have raised the following question: "Given the advent of the e-revolution, why is lecturing in any form still necessary?" (Brown & Manogue, 2001, p. 231).

In medical education, given factors like users' previous experience, preparedness and time available, Koller et al. (2000) argue that less complicated digital technology projects and solutions should be implemented first. Adding new and more advanced solutions while working on development and implementation often requires a higher level of experience and preparedness among staff. Previous research also indicates that teachers must be comfortable with the digital technology solutions in order to permit a change in the teaching practice (Olofsson & Lindberg, 2012). Brakels et al. (2002) also support a gradual implementation of digital technology in education. When implementing digital technologies in an academic organization, they suggest a three-line implementation where access to technical equipment needs to come first. The second line refers to staff usage of the digital technology equipment to learn how to use them in a pedagogical way. In the third line, deeper usage is supposed to achieve "new innovative educational formats" (p. 75). Ellaway and Masters (2008) divide the implementation and usage of digital technology in medical education in two parts: content and process. While content implies accessing educational materials such as course material, books, streamed lectures, etc., the process implies the structuring of human activities such as online communication, seminars, cases, e-assessment, etc. Even though Ellaway and Masters argue that both dimensions are part of successful usage of digital technologies, they claim that medical faculties often apply content to a higher extent when implementing and using digital technologies. This is because of cultural conceptions of the use of digital technologies. The authors say that "some people see e-learning as being about 'accessing stuff' and

some see it as about 'doing stuff'" (p. 458). The former are common in medical programs.

Preparations through Formal and Informal Courses

If successful implementation of digital technologies and TEL in education requires gradual implementation and experience among users, formal and informal teacher development courses seem to be of importance. In addition to factors relating to expenses and time, Schneckenberg (2009) claims that established digital technology courses are not "linked to the real teaching and learning contexts of academic staff" (p. 413). Granger, Morbey, Lotherington, Owston, and Wideman (2002) advocate informal digital technology training as more rewarding; this includes good relationships and collaboration among the teachers and other staff.

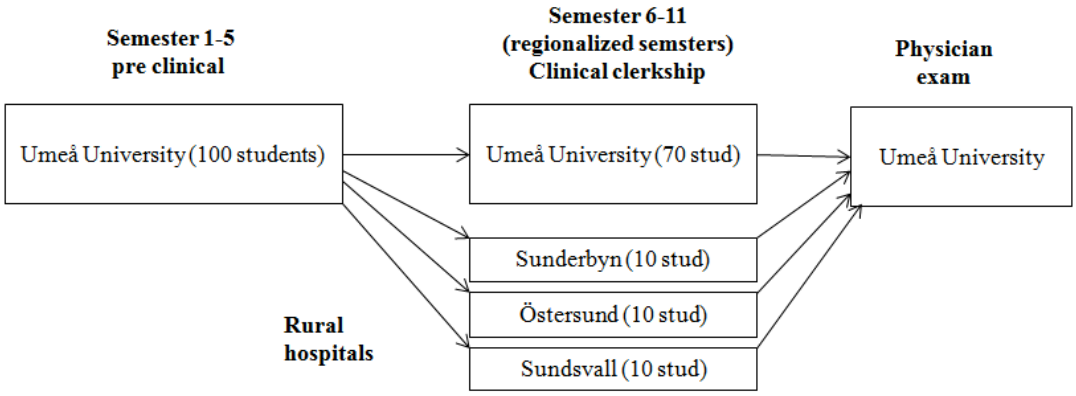
Conclusions

This short review of previous research shows that human factors such as experience, preparedness and activity can be considered to be of importance for the implementation process of digital technologies and TEL in higher education. Teachers and other staff must feel comfortable with the digital technologies implemented and used. The message seems to be to start at a small scale and avoid large and overly demanding implementation processes. Video-linked and streamed lectures are, according to previous research, a good starting point, while the use of advanced digital technologies should come later. The implementation and usage of digital technologies can be understood as both containing content and process aspects. As medical education has a strong tradition of lectures, content is often implemented first. Finally, both pedagogical and technical aspects are said to be important in the implementation process.

The First RMP in Sweden

Based on a government decision — *Expansion of the Medical Program* (The Swedish Government Office, 2007) — the RMP at the Umeå University in Sweden became reality. The result was a national expansion of student positions in which 17 positions were distributed to the medical program in Umeå. A regionalization model was therefore necessary to reduce crowding of students at the Umeå University academic hospital. At the same time, and equally important, the regionalization was an opportunity to expose medical students to clinical clerkship in rural hospitals. From the sixth semester (1-5: pre-clinical; 6-11: clinical) the medical students are located at four study locations (Umeå, Östersund, Sundsvall, and Sunderbyn) in northern Sweden, as they perform their clinical semesters. Of these, 10 students are located in the three different rural hospitals and 70 at the Umeå University academic hospital as shown in Figure 1.

Figure 1: Structure of One Regionalized Semester of the Swedish RMP, Umeå University



(The figure is inspired by Worley, Silagy, Prideaux, Newble, & Jones, 2000.)

One administrator is located in each location for administration and to support teachers and students. Linked to each semester and location are two teachers responsible for the location-specific learning; this includes local learning case, examinations, tutorials, but also stimulating clinical research on the study locations. In the future, all teachers are supposed to teach all students regardless of location. The two-way teaching (lectures are both received and sent from each location) contributes to seeing that teaching responsibility is distributed across all locations.

Digital Technologies in the Swedish RMP

To enable medical students' theoretical studies during their rural clinical clerkship, digital technologies are used. In the RMP educational guidelines, the vision of the digital technology usage is highlighted as follows: "The Medical program will to a high extent use digital technologies. Digital learning resources such as simulations, wikis, digital video and podcasts will be a natural part of educating medical teachers." Each location is equipped with two study rooms which can send and receive lectures. Students have free access to Internet and a video-conference system. A Moodle course platform was developed to facilitate the students' new educational situation.

Preparations for the Use of Digital Technologies in the RMP

In order to help the medical program build and organize the Moodle course platform two educational technologists with long experience were hired (each of them on a half-time basis) from the Department of Education, Umeå University. In cooperation with the subject-responsible teachers and administrators, the technologists constructed and adapted the structure of the platform. As a part of the first step of the development, subject-responsible teachers had both to review their current educational related content (lecture material, cases, examinations, etc.) and to identify what content was suitable for short, streamed lectures. The platform was also supposed to give the students a better and more flexible opportunity to review their own studies: grades, lectures, course content, etc. The educational technologists introduced all teachers and administrators to the course platform through optional two-hour seminars. This included recording streamed lectures

and instructions on how to navigate the platform. Since there were technical worries among teachers, technical support was the primary focus in the implementation phase. Further, policy documents concerning both technical and pedagogical aspects were made available to the teachers. Regular meetings at different levels of the program organization were held; digital technologies were always a topic to be discussed. Student volunteers received a one-hour introduction to the technology equipment to support inexperienced teachers when live-sending lectures.

Method

The data in the study was collected using an online survey distributed to 16 medical teachers and 4 administrators before the first regionalized semester in 2011. Respondents (working on the first regionalized semester of the Swedish RMP and highly involved in the regionalization) were selected in consultation with a key figure in the RMP. The survey was responded to by 12 teachers (11 men, 1 woman) and 4 administrators (4 women) in the sixth semester of the RMP. The respondents were physically located as 2 teachers and 1 administrator in each rural hospital (located in Östersund, Sundsvall and Sunderbyn) and 6 teachers and 1 administrator at the Umeå University academic hospital.

The online survey, based on a 5-point Likert scale and open questions, included 50 questions for teachers and 46 questions for administrators within the following four themes:

- *Previous experience of digital technologies*: questions regarding their experiences of what was understood as core factors for the new educational mode, for instance experience of using digital technologies or teaching in a distance or online mode.

- *Their understanding of preparedness*: questions about the preparations they had been offered and their understanding of their own preparedness for teaching via digital technologies.

- *Expectations of the use of digital technologies*: questions regarding how they expected to use digital technologies when teaching and communicating with the medical students.

- *Expected changes when implementing the RMP and digital technologies*: questions regarding the new educational mode, students' learning and changes when implementing the Swedish RMP.

Findings

In this section, findings from the online survey will be presented. Both quantitative and qualitative data are included. Teachers' responses are coded 1–12 and administrators' 13–16.

The average time spent teaching in the medical education program by respondents is 10 years among teachers in Umeå and 1 year (or less) among teachers in Östersund, Sundsvall, and Sunderbyn respectively. The administrators had worked one year (or less) as administrators for the medical program. The extent of teacher and administrator previous experience of digital technologies is shown in Table 1. The results show a high level of computer skills, while the level of previous experience with the web-based Moodle course platform and with distance education is low.

Table 1: Teachers' and Administrators' Previous Experience of Digital Technologies

Teachers	Low extent	Neither high nor low	High extent
Self-rated computer skills	0	3	9
Previous experience of lecturing via Moodle	9	0	3
Previous experience of distance education	10	1	1
Administrators			
Self-rated computer skills	0	0	4
Previous experience of administrate via Moodle	4	0	0
Previous experience of distance education	2	2	0

Teachers' and Administrators' Preparedness and Understanding of Preparedness

As can be seen in Table 2, both teachers and administrators agreed that they had participated in preparations for the RMP and related use of digital technologies. Nine teachers said that the program organization had prepared them enough for lecturing via Moodle; meanwhile, three felt they were neither prepared nor unprepared, but expected to be fully prepared before spring of 2011 (before the RMP started). Among the administrators, one reported having been prepared; another reported not having been prepared; and the other two reported they were neither prepared nor unprepared, but expected to be fully prepared before spring 2011.

Table 2: Teachers' and Administrators' Understanding of Preparations

Teachers	Low extent	Neither high nor low	High extent
Has the program prepared you enough to lecture via Moodle?	0	3	9
Do you feel prepared to work with an increased use of ICT?	0	4	8
Do you feel involved in the implementation of the regionalization?	0	4	8

Administrators			
Has the program prepared you enough to administrate via Moodle?	1	2	1
Do you feel prepared to work with an increased use of ICT?	0	1	3
Do you feel involved in the implementation of the regionalization?	1	2	1

Expectations of the Usage of Digital Technologies when Implementing the RMP

Teachers and administrators were asked about their expectations when implementing digital technologies in the RMP. Desired and anticipated uses of digital technology-assisted teaching elements in the RMP are shown in Table 3.

Table 3: Digital Technology-assisted Teaching Elements Teachers Expect and want to use in the RMP

Teachers	Low extent	Neither high nor low	High extent
Live-send lectures	3	1	7
Streamed lectures	0	1	10
Preparations for case	3	5	3
Case	6	2	3
Simulations	6	0	3
Seminars	3	4	3
Examinations	7	1	2
Communication	1	1	10
Information for students	0	0	12

The results indicate a dominance of digital technology-assisted lectures, together with information and communication with students. In cases of the lowest extent, simulations and examinations are expected to be used via digital technologies.

Table 4 shows that when teachers perform live-send lectures they expect to communicate with students in the same location to a higher degree than with students in other locations. It also indicates that teachers and administrators perceive more alternative ways to communicate with students within the same location (26 ratings among teachers and 9 among administrators). The administrators' role is primarily to support students in the same location, which can explain the low communication with other locations.

Table 4: Ways in which Teachers and Administrators Expect to Communicate with Students

Teachers								
Students within:	Lectures	Physical meetings	Moodle	Chat	E-mail	Paper	Video conference	Total
Same location	5	8	7	1	3	0	2	26
Other locations	2	1	6	2	4	0	2	17

Administrators								
Students within:	Lectures	Physical meetings	Moodle	Chat	E-mail	Paper	Video conference	Total
Same location	0	2	4	0	3	0	0	9
Other locations	0	0	2	0	0	0	0	2

Expected Changes when Implementing the RMP and Use of Digital Technologies

In this section, some findings from the open questions are presented. One of the main findings shows that four administrators and seven teachers believe they have to change their existing teaching practices due to the implementation of the RMP and related digital technologies. Mostly the concern is about expansion of streamed lectures, pointed out as: *In particularly, more streamed lectures* (3). Other expected changes include construction of strategies for engagement and communication with students, mentioned as: *A need to come up with a strategy to communicate with students* (11). The communication also entailed anticipated problems regarding the distribution of students: *Risk of poor communication with students who are distanced in cases of lecture elements* (10). This was also pointed out as: *The absence of students in the same physical location probably requires that I must better engage students in other locations* (1).

Most of the teachers and administrators feel there is support from management for making changes to educational practice. Ten of 12 teachers also believe that the students will change their ways of studying — in particular, that they will see more streamed lectures instead of live-sent lectures, and use the Internet to a higher extent: *Maybe choose to see a streamed lecture instead of go to the video-linked one* (6) and: *More used* [the students] *to search for info on the net* (8). The students are also expected to handle their own studies more independently: *Plan their studies more by themselves* (5). Among the administrators, only one believes that students will change their study patterns.

Most of the teachers and all administrators think that the RMP, with its intertwined digital technologies, will become equal or better in terms of educational quality. The teachers also expect the RMP to provide equal learning opportunities for students, regardless of regionalization or location. The advantages are mainly the improved review of course content via Moodle, expressed as: *Improvement expected, review of materials that can be presented in a more modern way* (2). Further benefits regarding improved communication and possibilities for students' levels of participation are pointed out as: *Easier to communicate. It is not tied to lectures in the same way* (5); *More active seeking of info themselves* [the students] (8).

The development of the course platform has contributed to a high level of online access of educational materials (e.g., lecture content, number of examinations, course structures, etc.). This contributes to a high degree of transparency in the program regarding both content and structure. This is perceived as a positive dimension of RMP among the majority of teachers and administrators. One teacher, however, adds that *it requires that the teachers prepare well in advance* (10). Almost half of the teachers express a fear of technology problems, such as technology hassles and lack of user experience. This is

pointed out as: *Do not know until it has been tried, but as usual it can be expected that the technology does not always work as intended* (4). Furthermore, the decreased personal contact with students is expected to affect the medical students' professional development: *Personal contact with students can be more restrained, more difficult to incorporate "soft" skills for their future profession* (11). Another teacher thought there was limited time to learn how to use the technologies: *Very hectic and a little time to test yourself to learn more* (16). There is also a modest positivity among the teachers related to the implementation of the RMP and the extended use of digital technologies. The benefits are particularly in the review of the teaching: *Review of the whole of the teaching* (5); the reduced travel: *Training can be conducted with great coverage without having to travel to a specific location* (9); the opportunities to learn how to use the digital technologies: *Opportunity to develop skills in teaching with technology* (10); and the 24/7 access: *Knowledge and information are available around the clock, not just certain occasions, as for example at lectures* (11).

When it comes to communication, 11 out of 11 teachers consider (in an open supplementary question) that teacher-student and student-student communication have a major impact on student learning. Even communication between students and administrators is considered by most teachers to have high or very high impact on student learning.

Discussion and Remarks

For the first time in Sweden, a medical program is being carried out in a regionalized mode. For a highly established medical program, the transformation to an RMP entails modifications and solid transformation of work. As pioneers, the teachers and administrators in the Swedish RMP do not surprisingly perceive challenges that the medical program must undergo to push through the implementation phase. In this section, some of the findings in terms of preparation, expectations, challenges, and understandings among teachers and administrators will be discussed.

When starting the Swedish RMP most teachers seem to expect mainly to use digital technologies for four teaching activities: information, communication, live-send, and streamed lectures (see Table 3). Learning activities such as cases, seminars, examinations, and simulations are expected to be used to a lower extent by teachers (see Table 3). The expected usage indicates a focus on content and 'accessing stuff', where access to lectures and information seems to be most important. According to Ellaway and Masters (2008), the content dimension is often the first to be implemented and used by teachers in digitalized medical programs, which is often the result of people's understanding of e-learning as 'accessing stuff'. Another reason can, according to Koller et al. (2000), be a deep-rooted culture of lecturing and transmitting of knowledge, a culture that often remains the same despite the use of digital technologies. However, as research indicates (Kirkwood & Price, 2005), the use of digital technologies for transmitting knowledge, which seems to be the case in the Swedish RMP, will probably not in itself contribute to any major changes in fundamental educational practice. One

possible benefit, however, is that the students can participate regardless of time and location (Kirkwood & Price, 2005). This is also the case in the Swedish RMP, where the RMP supported by digital technologies is a chance to meet the medical students' growing demands for a flexible medical education.

The implementation of the Swedish RMP and digital technologies are, according to teachers and administrators, understood to provide an equal or better education for students. There seems to be expectations that students will gain better access to course material and become more active in relation to their own studies. However, an expected challenge among some teachers seems to be establishing a ground for communication and personal contact with students. Some teachers do, for instance, perceive a risk of poor communication through the use of digital technologies which is understood to threaten students' future professional development to become medical doctors. Such perceived worries can also be a reason for not using digital technologies for setting up and carrying out process-oriented learning activities such as cases and seminars. Ellaway and Masters (2008) claim that cases online is something that should not be performed before the medical teacher show high skills and feels comfortable in using digital technologies for teaching and learning.

In the light of more thoroughly developed RMPs, the transformation of the Swedish medical program to an RMP can most likely be viewed as a "somewhat old-fashioned and precautious" attempt to implement digital technologies and build a foundation for TEL, especially in reference to the growing accessibility to more advanced educational technology-based design solutions (Olofsson & Lindberg, 2012). Even so, there is evidence of the importance of a step-by-step implementation whereas the first step is, according to Brakels et al. (2002), to acquire access to and get comfortable with digital technologies. The second stage contains the discussions of how digital technologies can be used in a pedagogical way. In the third step, the key appears to be continuously open for new and innovative technology educational solutions such as process dimensions and more complex learning activities (Koller et al., 2000), which accordingly seems to come further ahead in the future for the Swedish RMP. Nevertheless, it seems to be important for the Swedish RMP not to linger and become too comfortable in the first step, but instead to look for possibilities for continuing development, e.g., paving way for pedagogical discussions and initiate implementations of more advanced digital technology solutions.

Lastly, it should be noted that before the start of the Swedish RMP, teachers felt that they were sufficiently prepared for the implementation and extended use of digital technologies. This was the case despite the lack of previous experiences of distance education and the web-based Moodle course platform. This is might be the result of the management's initiatives in taking the process step by step and the informal practice-related preparation for faculty, instead of formal digital technology courses that according to previous research often fails to provide a link to the academic educational practice (Schneckenberg, 2009). In the Swedish RMP, faculty preparations involved development and structuring work of Moodle and streamed lectures with proximity to the practice of teachers, administrators and program content. Problems and difficulties arising during the

preparation and implementation appear to have been resolved close to the administrational and educational practice. Teachers and administrators have further had the opportunity to gradually become comfortable with the digital technologies, while professional scaffolding has been available at all times. Previous research (Ellaway & Masters, 2008) also points out that allowing inexperienced teachers access to digital technologies to live-send and record streamed lectures is a promising starting point when implementing digital technologies in medical education. In addition, the ability in the Swedish RMP to make the employees feel comfortable and prepared through the faculty preparations may constitute solid ground for future development (Olofsson & Lindberg, 2012).

To conclude, by having implemented the first step and having built a foundation for further development, the program seems to be on the right track in establishing educational practice and culture, or in other words, appears capable of successfully pushing the Swedish RMP towards becoming a modern medical program.

Implications for Future Research

For the future, this study has raised new questions concerning teachers' beliefs and experiences of educating medical students though the use of digital technologies and TEL in the RMP. In addition, how the use of TEL will influence the future development of the educational practice of the RMP would be important to explore. Questions have also been raised regarding how medical students experience TEL and social media for their learning and how design and implementation of a TEL process-dimensioned learning activity can enhance the medical students' learning.

Acknowledgements

The authors of this paper would like to acknowledge financial support from the Faculty of Medicine at Umeå University, Sweden. We would also like to acknowledge teachers and administrators of the Swedish RMP for their openness and enthusiastic reception of this research project.

References

Brakels, J., Van Daalen, E., Dik, W., Dopper, S., Lohman, F., Van Peppen, A., et al. (2002). Implementing ICT in education faculty-wide. *European Journal of Engineering Education*, *27*(1), 63–76.

Brown, G., & Manogue, M. (2001). AMEE Medical Education Guide No. 22: Refreshing lecturing: A guide for lecturers. *Medical Teacher*, *23*(3), 231–244.

Callas, P. W., Bertsch, T. F., Caputo, M. P., Flynn, B. S., Doheny-Farina, S., & Ricci, M. A. (2004). Medical student evaluations of lectures attended in person or from rural sites via interactive videoconferencing. *Teaching and Learning in Medicine, 16*(1), 46–50.

Cardall, S., Krupat, E., & Ulrich, M. (2008). Live lecture versus video-recorded lecture: Are students voting with their feet? *Academic Medicine, 83*, 1174–1178.

De George-Walker, L., & Keeffe, M. (2010). Self-determined blended learning: A case study of blended learning design. *Higher Education Research and Development*, *29*(1), 1–13.

Eley, D., & Baker, P. (2009). The value of a rural medicine rotation on encouraging students toward a rural career: Clear benefits from the RUSC program. *Teaching and Learning in Medicine*, *21*(3), 220–224.

Ellaway, R., & Masters, K. (2008). AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment. *Medical Teacher*, *30*(5), 455–473.

Granger, C. A., Morbey, M. L. Lotherington, H., Owston R. D., & Wideman, H. H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning, 18*, 480–488.

Janes, R., Arroll, B., Buetow, S., Coster, G., McCormick, R., & Hauge, I. (2005). Rural New Zeeland health professionals' perceived barriers to use of the Internet for learning. *Rural and Remote Health, 5*(4), 1–11.

Kirkwood, A., & Price, L. (2005). Learners and learning in the 21st century: What do we know about students' attitudes and experiences of ICT that will help us design courses? *Studies in Higher Education*, *30*(3), 257–274.

Kitsantas, A., & Dabbagh, N. (2010). *Learning to learn with integrative learning technologies (ILT): A practical guide for academic success.* Greenwich, CT: Information Age Publishing.

Koller, C. A., Frankenfield, J. J., & Sarley, A. C. (2000). Twelve tips for developing educational multimedia in a community-based teaching hospital. *Medical Teacher*, *22*(1), 7–10.

Lau, F., & Bates, J. (2004). A review of e-learning practices for undergraduate medical education. *Journal of Medical Systems, 28*(1), 71–87.

Laurillard, D. (2008). Technology enhanced learning as a tool for pedagogical innovation. *Journal of Philosophy of Education*, *42*(3–4), 521–533.

Maley, M. A. L., Harvey, J. R., De Boer, W. B., Scott, N. W., & Arena, G. E. (2008). Addressing current problems in teaching pathology to medical students: Blended learning. *Medical Teacher, 30,* 1–9.

Mattick, K., Crocker, G., & Bligh, J. (2007). Medical student attendance at non-compulsory lectures. *Advances in Health Sciences Education, 12*, 201–210.

Olofsson, A. D., & Lindberg, J. O. (Eds.) (2012). *Informed design of educational technologies in higher education. Enhanced learning and teaching*. Hershey, PA: IGI Global.

Power, M. (2008). A dual-mode university instructional design model for academic development. *International Journal for Academic Development, 13*(1), 5–16.

Schneckenberg, D. (2009). Understanding the real barriers to technology-enhanced innovation in higher education. *Educational Research*, *51*(4), 411–424.

The Swedish Government Office. (2007, September). Press release: Medical education is being expanded. Retrieved February 10, 2011 from http://regeringen.se/sb/d/9419/a/87880

Wang, R., Mattick, K., & Dunne, E. (2010). Medical students' perceptions of video-linked lectures and video-streaming. *ALT-J: Association for Learning Technology Journal*, *18*(1), 19–27.

Worley, P., Silagy, C., Prideaux, D., Newble, D., & Jones, A. (2000). The parallel rural community curriculum: An integrated clinical curriculum based in rural general practice. *Medical Education*, *34*(7), 558–565.

Fanny Pettersson is a PhD student at the Department of Education, Umeå University, Sweden. In her longitudinal oriented thesis she is following the implementation and uptake of digital technologies and TEL in the Swedish regionalized medical program (RMP). Her thesis is aimed at analyzing and comparing perceptions, knowledge and practices that are incorporated and developed at different levels of the organization when the Swedish RMP and digital technologies are implemented and used. After winning the UFV Graduate Student Paper Prize for the paper this article is based upon, she accepted an invitation to sit on the ICICTE Publications and Promotions Committee. More information on her work and a list of publications may be found at http://www.pedag.umu.se/om-institutionen/personal/pettersson-fanny

Anders D Olofsson is an Associate Professor, PhD, and Director of Research Studies, at the Department of Education, Umeå University, Sweden. Over the years he has developed a deep research interest in the field of educational technology and the design of technology-enhanced learning. He is a teacher and researcher in the field of medical education. Dr Olofsson has contributed numerous book chapters, journal articles and papers to conference proceedings in his field of expertise. He has co-edited two books with Dr J Ola Lindberg: *Online Learning Communities and Teacher Professional Development. Methods for Improved Educational Delivery* (2010) and *Informed Design of Educational Technologies in Higher Education: Enhanced Learning and Teaching* (2012). Dr Olofsson was named "Friend of the Conference" in relation to International Conference on Information and Communication Technologies in Education (ICICTE) in 2009. A list of publications may be found at http://www.pedag.umu.se/om-institutionen/personal/olofsson-d-anders

Tor Söderström, PhD, is an associate professor at the Department of Education, Umeå University, Sweden. He supervises doctoral and masters students. His prime field of expertise concerns technology-enhanced learning and simulation-mediated training and learning. He is leading research projects on online learning and learning-design of simulated environments (e.g., medical training, firefighter training). He is involved in several development and research projects within the field of online learning and learning in simulated environments. Over the years, he has contributed book chapters, journal articles and papers to conference proceedings on the topic learning and information and communication technology. More information and a list of publications may be found at http://www.pedag.umu.se/om-institutionen/personal/soderstrom-tor

Christina Ljungberg, MD, PhD, works as associate professor and consultant in hand surgery at the University Hospital of Northern Sweden in Umea, Sweden. Her medical research deals with regeneration of peripheral nerves and aims to finding better treatment methods for nerve injuries. Her interest in medical education has led to co-supervising a

PhD thesis on the implementation and use of digital technologies in the Swedish regionalized medical program. She is chairman of the board of the Medical Program, Umea University, Sweden. Dr Ljungberg is in addition responsible for inspections of the specialist training in hand surgery on a national level.