UAS MASTER SYMPOSIUM IV

Smart Technology in Smart Use

PROCEEDINGS

Andrew Sirkka (ed.)

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2016

CONTENT

PREFACE

The 4th Master Symposium organised by Satakunta University of Applied Sciences (SAMK), Tiilimäki campus, is titled *Smart Technology in Smart Use*. The purpose of the symposium is to promote master's degree education at SAMK and offer a forum to discuss actual drivers, trends and development in European societies.

Digitalisation has opened doors to a rapid and still expediting transformation in the society. New technology is becoming smarter and more user-friendly bending into more individualised purposes. Use of smart technology is also increasing in health care and social sector offering a huge potential in solving challenges caused by economical and demographic drivers in European societies. When assisting the health care professionals in their work, technology is also enabling population live to full capacity despite of possible personal limitations and disabilities.

Nowadays, the technology itself may be implanted or wearable technology, or the kind of technology which is part of our environment. ICT, electronics and automation have already had a huge effect on various fields of business. The technology targeted for industrial use has also many applications in health and well-being. However, technology industry, health care industry and social sector services have not yet been accustomed to collaborate in a level of depth which is needed to make technology serve this purpose.

Smart eHealth and eCare Technology is "no-mans-land" due to its multidisciplinary nature and very few people have adequate expertise and experience from all fields concerned – technology, healthcare and social sector. The lack of joint understanding has led to wrong kinds of technology products not providing expected user-friendly and solutions requested in the real-life situations and service delivery systems. Nevertheless, the time is now ripe to foster joint development within the two different fields of business in order to create innovative solutions to meet the real user needs with the help of the latest technology achievements.

This symposium tends, in its part, to offer a forum for multidisciplinary discussions enlightening the challenges and potentials from education, entrepreneurship, research and development points of view. Therefore I express my sincere appreciation to all contributing this Symposium. I also wish that this publication could be increasing the much needed curiousity toward Universities of Applied Sciences' master degree education as means of enhancing multisectoral know-how and professional development.

Dr. Andrew Sirkka
Editor

2 RECENT RETURNS ON WELFARE TECHNOLOGY STUDIES AT SAMK

Andrew Sirkka
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Introduction

Master's degree programme in Welfare Technology has been run already since year 2000 at Satakunta University of Applied Sciences (SAMK). The first version of the programme was constructed around particular large scale project in Finland developing electronic patient record and national health insurance chip card. Information technology has ever since played an important role as the contents of the programme even if the focus has gradually moved more towards service design, smart technologies and innovation management.

This article tends to give the reader an idea of the variety of growing grounds the students and teachers are challenged and dealing with in Welfare Technology master degree programme at SAMK. Some returns harvested in master thesis terms and how the education is experienced by the students is presented as examples of selected work life development projects. Being a multidisciplinary joint programme having students with engineering, healthcare, social sector or commerce background, the spectrum of motivations, perspectives and educational needs form a colourful palette that challenge both teachers and student group. However, the long haul experience is more on positive side offering "bright moments" and flash of wits over multidisciplinary discussions urging to grow and widen one's professional horizons. In addition, close collaboration with international and regional partners, and close links with welbeinig enhancing research group activities play an important role offering wider vantage points in the education.

UAS Master's Thesis

Master's Theses at Universities of Applied Sciences (UAS) often differ from master's theses done at science universities. UAS Master's Thesis is expected to be tightly linked with students' background organisations and thereby intertwined in working life development in the region. A written agreement on each thesis is drafted as a mutual commitment to the project or research conducted. In general, master thesis takes one third of the required credits in UAS master level education.

Over the years, trends in working life development are clearly seen in thesis headlines. Recently, the most common topic is mobile technology with a variety of application possibilities. Students have analysed and generated various mobile applications used in personalised health (Marila 2016), home care (Hautaviita 2014), or even clinical settings (Kivinen 2016). Commercialised production of mobile technologies and software is rapidly increasing. Based on numerous reports, organisations are purchasing technology applications quite often with a very shallow level of knowledge about what they are buying. Constantly changing and updated applications and software, rigidity of deployed software and shortage of basic technology skills do unfortunately in its part increase people's aversion against modern technology in care settings. These are part of the challenges the welfare technology education is providing new competences and shared understanding cross-disciplinary to optimise solutions meeting the challenges in combining care and technology. The master's theses are available (in Finnish with English abstract) online at http://theseus.fi/handle/10024/154.

Technology to assist in daily work

Various technologies in a rather large scale are discussed, tested and developed over the Welfare Technology master degree programme from special high tech solutions to extended use of the embedded technologies in smart phones, from machine vision to game technology applications and generic topics about how to use available technology in novel ways.

The modern digital technology provides huge potential in developing various care services increasing a person's own involvement in one's own care but also improving effectiveness and safety in care procedures. Kivinen (2016) conducted a requirements analysis of a mobile application targeted at improving patient safety and to assist in every day postoperative nursing care performed in a post-operative intensive care unit. Basic purpose for application design was to expedite the deployment of evidence-based methods into every day nursing care, to improve decision-making and patient safety with defined checklists and reminder functions related to the quality standards, and thereby make evidence based data more accessible and cohesive. The application could also serve as a kind of data bank for nurses, and to assist a nurse to set the focus on patient-specific postoperative issues regarding the quality measures. Three basic functions are observation of vital signs with relevant check lists and reminder functions, ISBAR (Identify, Situation, Background, Assessment, and Recommendation) standards and tools for electronic pain measurement and reporting.

As to embeded technology in smart phones, Marila (2016) performed a requirement analysis on the properties of smartphones enabling physical data collection required to support life management and treatment in bipolar mental disorder. Monitoring abnormal mood fluctuations, forecasting their appearances and controlling them by prodromes are conventionally performed by means of mood diary and check-up appointments. Marila's work focused on generating a smartphone application to assist in assessing mood fluctuations. Physical activity is measured from a phone user's movements by smartphone's acceleration sensor. The application generates numerical value for physical activity. This value can be compared to personal citations that are formed by the application. Personal citations represent the correlation between physical activity and the experienced mood state. The value for mood is defined in accordance with the scale in personal mood diary. The application can independently assess user's mood after the personal citations has been formed.

An example of a specialised high technology solution as welfare technology master programme returns is Mini Unmanned Aerial System (MUAS) that was studied by Leppäniemi (2013). The new Mini Unmanned Aerial System (MUAS) could be used in civil crises management but also in rescue operations, and in various other supporting acts related to population's safety.

Service Analyses and Service Design

The availability of websites targeted on patient education is increasing in number. However, the sites vary a lot in regard with information found, accessibility, readability, understandability and functionality of ther search engines. Eklund (2016) analysed user experiences of mental health professionals working in Satakunta region regarding a novel electronic Mentalhub online services. The data was collected by an electronic questionnaire which contained 21 multiple choice and two open-ended questions. The key findings indicated that the electronic guidance was found beneficial in treating patients, making the guidance easier and more understandable for patients. The information provided in Mentalhub- service was seen useful and timely, relevant and reliable.

To give an example of service system analyses as master's thesis, Hilaja (2015) analysed municipal home modification services for senior citizens. The target group in this study was the personnel of Senior Citizen Services in the City of Pori. The data was gathered by a Webropol online questionnaire and analysed by a content analysis method. The main findings indicate that the service system for senior citizen's home modifications require clarification both within the organisation itself and for clients. The service system is rather fragmented and the clients needing home modification services are bounced from one department to another due to rigid division of responsibilities and complex financial support systems. The future challenge, based on this study, would be the clarification and more target group based integration of municipal services. The personnel need education related to home modification services, and client–based communication and collaboration between administrative departments need to be improved.

Another good example of the importance of analysing persistent constraints in prevailing service systems is "Social accessibility as experienced by adults with mental disabilities" by Piitulainen (2014). The study was carried out as a phenomenography with the aim to describe and comprehend the social accessibility as experienced

Photo 1. M-CT teachers and students on the first Campus Week

by the target group. The data was gathered by interviewing intellectually disabled adults and their responses were analysed by a qualitative contents analysis. In a socially accessible environment, all members can be as they are without fear of discrimination, bullying or harassment. However, the results of this study show, among other things, that the interviewees feel they should seek to hide their disability to avoid facing discrimination. In order to experience full citizenship by people with learning disabilities, the attitude atmosphere in the society still has some constraints. While each member's attitude in the society matters, especially important role play the attitudes and values of employees working with disabled people. The employees, instead of making the decisions alone, should encourage disabled persons in their independent decision-making. Above all, people with disabilities must be given the needed support, possibility and responsibility to build their lives as they want it.

Hand in hand with the increase of technology and its deployment into professional practices, increases the importance of user and usability research. Hautaviita (2014) researched the independent usability of telehealth equipment in the old people's daily life as part of a regional telehealth project. Nationally in Finland, the trend is to increase home care and reduce institutional in-patient care. The aim in this policy is to support older people to live in their own houses as long as possible. Technology and telehealth offer new means for residential services in home care and nursing homes but new effective means for management, guidance, support and monitoring, too. The key findings in this research indicated that the use of telehealth care technology was mainly successful and welcomed in the elderly care. The means used for various health measurements were familiar for most of the older adults, which made the measuring procedures easy for them even if sometimes physical well-being might bring restrictions to measure physical readings independently. Those older adults in good health and well motivated were able to measure their health values without problems.

European Master Care & Technology

Welfare Technology master degree programme started an intense collaboration with the international higher education consortium of European Master Care & Technology (M-CT) in 2014. The first master programme by the consortium launched out in September 2015 with ten students as the first cohort. A lot of modern

communication technologies are used to enable learning and teaching. Students are working intensely together by means of video-communication, WhatsApp, email etc. Video lectures are available whenever the student has got time to watch it, and regular videoconferencing sessions are held to support working on assignments and offering needed contact times with teachers and fellow students.

Certain drivers could be pointed out in terms of students' motivation to join the international programme, like seeking for improvement in technology competences, competences related to developing client-centred services, and ability to engage technology to obtain more accurate evidence on the care provided and its effects. In many healthcare and social sector organisations the technology use is on a low level or centralised only for certain specialised staff group. However, the organisations are increasingly searching how modern technology could make a difference in their service supplies.

Students' blogs about their motivations and experiences of the international master programme are available online at http://master-ct.eu/blog/.

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3 A EUROPEAN MASTER CARE AND TECHNOLOGY – ITS DEVELOPMENT AND FIRST EXPERIENCES

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Why this initiative?

Health care reports in the Western society indicate that demographic factors and increasing costs of healthcare services demand a change in healthcare provision. Not only to create sustainable health services but also to create a transition from a professional driven system to a user-oriented system. In such a system self-management of disease in a person's own living environment will become the major characteristic. The professional attitude will change from "taking care of" towards "supporting clients and informal caregivers in their self-management". Formal and informal care for people with special needs will shift from intramural treatment to extramural and ambulatory care. The development and implementation of care technologies can support this process. Technologies can for example facilitate in monitoring health conditions at a distance or take over physically demanding or time consuming tasks from the care provider. (OECD 2011.)

It requires a change in attitude and skills of the professionals to take full advantage of these opportunities. However, research has shown that the present generation of care professionals has a critical attitude towards the use of technology as part of the care delivery process (Yarbrough & Smith 2007). On top of that, lack of technology developers' knowledge on care practice is hindering them to incorporate the characteristics of care delivery as an essential input in the development of new technology. It is essential that knowledge about future users and conditions in which the technology will be used, are incorporated in the development process of care technology but also that the care processes are adapted to the new technology. Ideally, "use" and "design" work together in the definition and development of new technological approaches. (Kristensson, Matthing & Johansson 2008.)

In the development of care technologies the methodological perspectives of "user centred design" and "co-creation" become more and more leading in the research and development (R&D) process. In European R&D processes, this is mostly achieved by bringing together technology developers and user related organizations from different countries. Employees involved in the development and implementation of new care services need to have expertise that enables them to have an overview of this broad field of development and implementation of care technology. Their main task will be to build the bridge between the disciplines to stimulate new developments in the innovation of care provision. To be able to fulfil this role they have to rely on their personal competences to identify opportunities for change and improvement, to support meaningful and effective communication between persons with a different background, and to manage complicated implementation processes.

Ambition

To make sure that the developments in care technology do not fail to reach widespread implementation and application, the hindering factors, both at the level of the technology (usability, serviceability, costs) and at the level of care processes (applicability, feasibility, requirement of additional skills and rearrangement of work processes), should be overcome. Therefore, adjustments both in the R&D and in the implementation processes are required. Professionals that have a firm background in either care or technology can do this if they obtain enough knowledge of the adjacent discipline and if they learn to communicate with specialists of that field in an effective way. Therefore, the ambition of this Master of Science is to educate professionals in care or technology to an "Expert in Care and Technology".

Many technology-derived solutions are the result of internationally conducted research and development processes. Therefore the international R&D area seems a suitable environment to organize the education and training of such professionals. That is the rationale for the development of an internationally (EU-) oriented professional Master in “Care and Technology”.

Analysis of the present master courses in the health area reveals that such an integrated approach of care and technology at a professional master level was unavailable in the Netherlands. (Willems, Michel Verkerke & Oosterkamp Szwajcer 2012.)

Central theme

The theme of the EU Master Care and Technology is: Couple insight in human functioning to knowledge of technological developments in an innovative and scientific approach using strategies of co-creation to develop new approaches in – long term – care.

Once a student has reached that aim and has integrated all these different aspects in the own functioning, a level of “Expert in Care and Technology” is reached. Competences that need to be achieved during the master are built across the steps of the ‘product innovation cycle’ as a guide to the learning activities.
The product/care innovation cycle contains the following steps:

- Identify need of innovation
- Generate and select idea’s
- Design, test product, processes and or services
- Implement the result
- Evaluate the process as a whole

Students with a background in care or technology can enter the master. Depending on the competences already available at the start of the master, students will become a Care or Technology professional who is able to understand all steps in the product/care innovation cycle, participate in these processes in close collaboration between care providers and technology developers, apply and integrate the results of the discrete phases of development in his/her professional activities, and to participate in an European network of fellow professionals.

How to organize the educational framework?

To become an “Expert in Care and Technology” several competences have to be gathered. These were analysed and described by using two frameworks:

1. The Dublin-descriptors (Ministry of Science, Technology and Innovation 2005), which describe competences of bachelor, master and doctorate level in five competences: knowledge and understanding, applying knowledge and understanding, making judgments, communication, and learning skills.
2. CanMEDS (Frank et al. 2005) which is a classification that is used to describe medical professional’s competences; two roles are added the ‘professional’ and the ‘expert’ (able to integrate the different activities as well as to manage the resulting actions). In the accompanying figure (Fig. 1) a graphical presentation of these competences is given.

The outline of the competences and the curriculum were discussed in several consortium meetings as well as during dedicated sessions with experts in the field. They were also considered in the discussions performed as part of the market survey report. At present there are no (inter-)national standards available for professionals active in the health area that take into account the integration of care and technology. Organizations like the European Association on the Service provision to Persons with a Disability (EASPD) and the Association for the Advancement of Assistive Technology in Europe (AAATE) have expressed the need for professionals with a background in integrated care and technology.

Figure 1. M-CT Competences

Organization of the content

To become an expert in Care and Technology and gather all the needed competences described the Master Care and Technology is divided into 16 different modules. Each module consists of a distinct area of knowledge and procedures. Based on the domain of the knowledge content a brief presentation of the curriculum is given in the next figure. The domains are directed towards:

a) User orientation How to give way to development of new Care and Technology applications from a user perspective (this in contrast to the technology-driven approach that is currently dominating)
b) Business which conditions have to be taken into account in order to achieve a new development from a business perspective
c) Innovation How to organize a renewal of a care and technology process
d) Implementation How to apply renewal into practice
e) Improving own practice How to apply new insight in the own work-practice

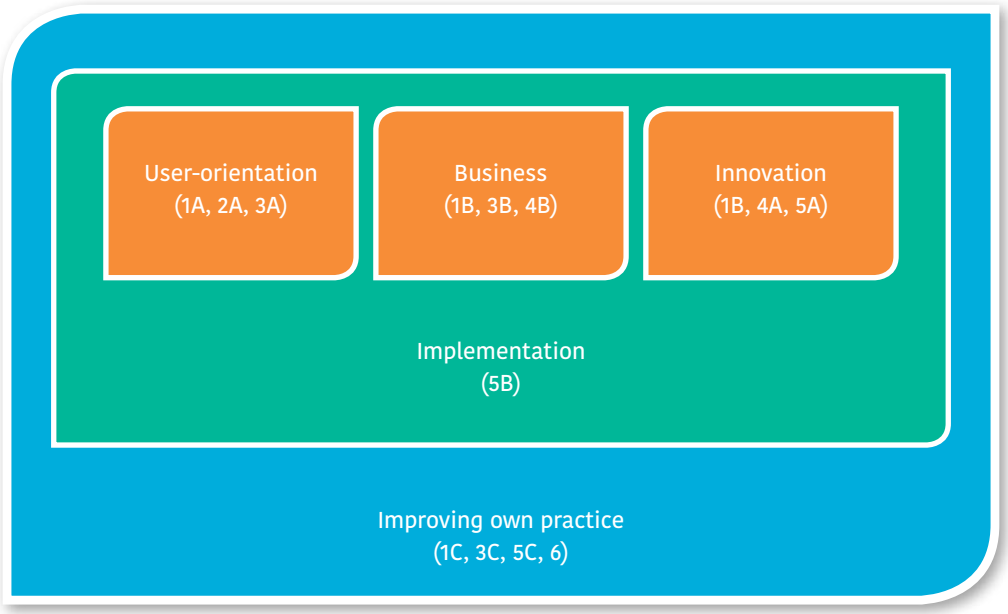

Figure 2. Organization of the Contents

On Accreditation and related issues

The organization of this course is a joint activity of 6 institutions of higher education in Europe; one from Portugal, two from Finland and three from the Netherlands. Together they designed the joined program and decided how to solve the organizational aspects that are involved. They agreed on a distance-learning environment in which content management and working together is supported. Students will work on practice-oriented assignments either by themselves or in small groups. The total concept of this course was submitted to the Dutch – Flemish Accreditation Organization. A review done by an international panel of scientists based on documents analysis and interviews with different persons valued the program and supported the qualification of “Master of Science” diploma that will be given to qualifiers.

Marketing activities

The program is organized as a part-time course. The firm study load (45 ECTS per year in a two year course) has to be combined by the students with a (partial) job application. This combination enables them to perform a practice-based research, in which they work on their own subject, and use their new knowledge immediately. The course is intended and marketed to professionals that have a background in their own discipline and are interested to learn more from developments in adjacent fields. Attracting students to such a master is a challenge. Especially if we take into account the different perspective that is given to participants throughout Europe in terms of the financial infrastructure to higher education. Tuition fees vary quite a lot and range from “free of payment by an individual” up to high prices. However expressed in marketing terms the eu master care and technology gives the following proposition to an applicant:

The innovative master education EU-M-CT represents a proposition for my organization that enables it to focus on innovation, quality improvement and costs reduction within a market environment of increasing complexity in care delivery and the care delivery process. Supporting an employee to follow this master course is an investment in the innovation of design, development and implementation of our services.

When expressed in Euro's an individual candidate may only determine the real value. Consequently we had to choose a marketing strategy that will bring us as much as possible into contact with potential candidates. In September 2015 we were able to start up the course with the first cohort of students. It allows us to determine the value of the course in practice.

First reactions by students

The first group of nine students that started has a diverse background although health care experience is dominantly available. They bring in a great practical motivation to make the combination between care and technology. During the first campus week in Heerlen the interactions were intense. They created a suitable base for the activities in the following weeks in which learning and working together at a distance is the way to operate. And than after 14 weeks the first practical assignments needed to be handed in. On the master program website (www.master-ct.eu/blog) students deliver content to a blog. That allows all to follow their activities and to spread their observations made during the learning process.

Photo 1. First cohort of M-CT students started in September 2015

The practical experiences are regularly evaluated. This first group of students appears to be a hard- working group that enjoy working together and having an open mind to the content of the course. They are also critical in terms of being able to give reflection to the learning material. They really enjoy the blended concept of the course. And by delivering their feedback they not only support improvement of the course but they also demonstrate that they personally are growing to become an "Expert in Care and Technology".

Hopefully this first cohort will create the scenery by which we are able to meet the challenges that are mentioned in the introduction of this chapter.

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4 FROM HEALTH 1.0 TO HEALTH 3.0, TOWARDS PERSONALIZED CARE

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Abstract

First step is the transformation from analogue to digital which main element is that hospitals start to gather and use digital data. Historically it was first mostly used for making insurance and billing tasks easier. Later digital patient data enabled doctors to start communicating better with each other and to do more informed medical decisions. Digital health records adoption by healthcare service providers forms the base and need for integrations. Data exchange systems and document standards have to be in place to move from local networks to broad networks. The central part of it is integrations and data sharing between different stakeholders. As increasing number of health related technologies and services are in the hands of the people themselves patient empowerment is starting to take place and it is not all about the healthcare service providers anymore.

While EHR are a leap forward in patient care there still persist problems and limitations between different EHRs interoperability. As there is growing number of EHRs the need for communication between these systems is crucial for effective large scale health information exchange (HIE).

The lack of standards for exchanging patient information between different healthcare providers means that EHRs that are built by different companies can't exchange information outside their private networks. The barriers of different systems not understanding each other is holding patient care from moving forward and realizing the true benefits in regards to health information technology usage and possibilities. The next developmental step is going from separate EHRs that can't change information with each other to using HIE that becomes a bridge between different systems and enables exchange of patient data on national or regional scale. HIE's purpose is to securely and reliably transfer healthcare related data among diverse systems at numerous facilities, organizations and government agencies. HIE enables doctors, nurses, pharmacists and other health care providers to access, retrieve and share patient data. It aims to improve healthcare delivery speed, quality and safety and reduce costs. As data is combined and standardised from various sources it can seamlessly integrate and give more complete patient records in the hands of the physician and improve care.

Personal health records (PHR) have evolved from health and training diaries and 1 device applications to personal health hub and cloud services and now moving towards becoming true health accounts where EHR and PHR merge together and add an extra layer of analytics that is extended to gene, environmental, social etc. data. The main difference of PHRs compared to EMRs and EHRs is that they are controlled totally by the person herself or himself. If the PHR makes possible to share data with a healthcare provider then it is up to the person to share it or not share it.

When we want to understand personal health records (PHR) it is necessary to first remember that EHR are legal records managed by healthcare professionals. Some people and organisations think that PHR is just an extension of the legal EHR. Others accept the view that PHR is a record owned and managed by a person and an organisation stores the PHR on the behalf of the person and handles the system.

PHR does not replace any legal record of the health care provider as they are two separate systems with two different viewpoints on the person's health. A more sophisticated PHR of a person usually consists of information collected and integrated from multiple different sources relevant to health, wellness and care. Any kind of health related data can be inserted or uploaded manually or automatically from apps and devices. The individual manages and controls this content and can grant permissions for access or share it with others.

5 PILOTING 3D PRINTING BASED TRAINING ENVIRONMENT FOR REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION

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Mirka Leino
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Abstract

The basis for this study is an evident need in technology development regarding patient treatment. The identified need for real world training environment for repetitive transcranial magnetic stimulation treatment brought together Well-being Enhancing Technology research team at Satakunta University of Applied Sciences and SataDiag diagnostic and pharmacological services public utility of Satakunta hospital district. This collaborative research led to a pilot study to generate a phantom head based on 3D imaging and 3D printing. The phantom head is now in test run and it is expected to be a significant advantage in personnel training.

Navigated TMS

Repetitive Transcranial Magnetic Stimulation (rTMS) is a non-invasive method used to stimulate brain. It is used for example in treating medication resistant depression. On traditional TMS investigations, the TMS coil is positioned over the head using external landmarks and measurements. In navigated TMS, the coil is positioned accurately over desired target by means of an on-line MRI navigation. Targets are located beforehand based on brain anatomy.

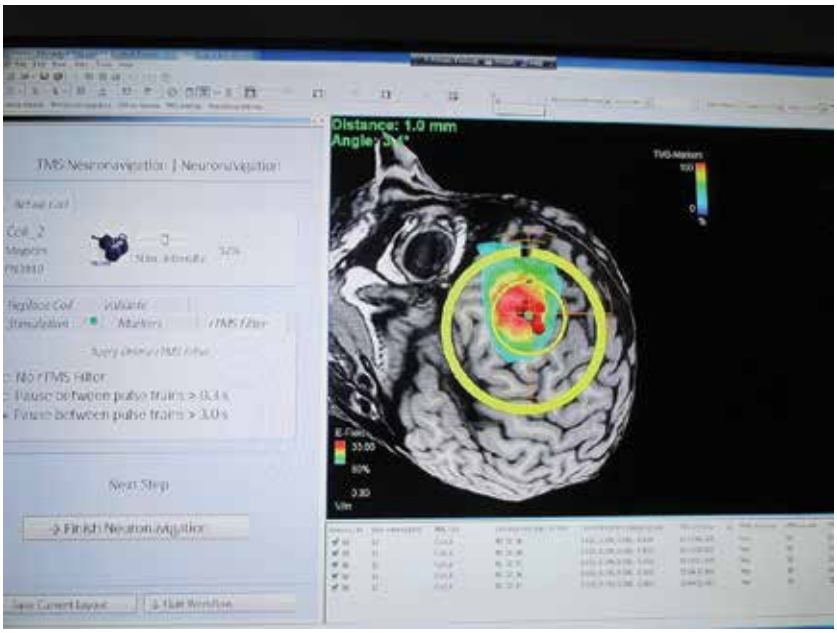

Figure 1. Correct positioning of the magnetic coil.

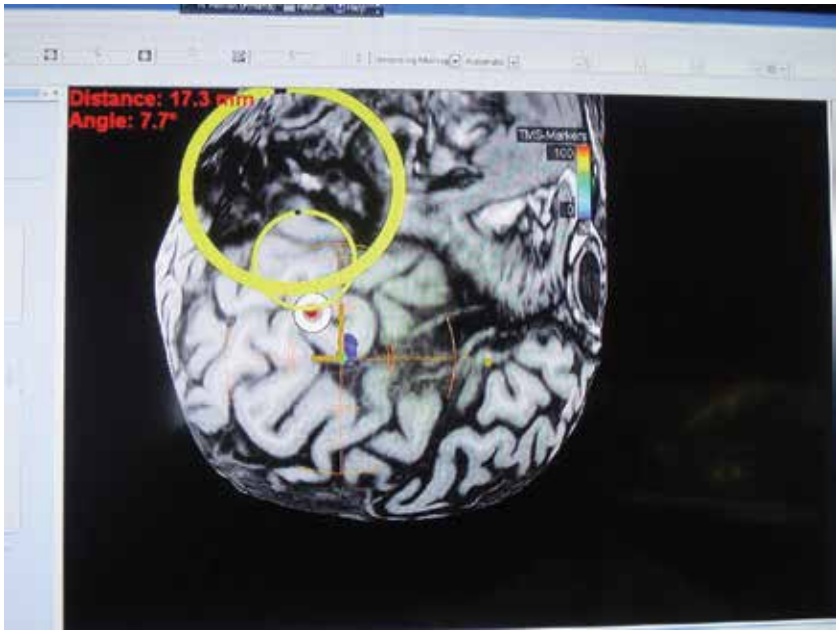

Figure 2. Navigation training of the magnetic coil based on MRI image and the phantom head.

Targeting tool in the navigation system indicates the distance to stimulation target and the orientation of the coil relative to desired orientation. In addition, estimation of induced electrical field is calculated in real-time and projected onto the 3D reconstruction of the brain.

Need for real world training environment

There are many TMS protocols used in clinical practice and personnel needs to be trained on implementation of these treatments. Coil placement depends on disease to be treated. For example, in tinnitus treatment the coil is placed over the auditory cortex of the brain, which is above the ear, whereas the coil is targeted over the pre-frontal cortex, i.e. forehead in depression treatment. Moreover, the treatment may be given on the left or the right side of the head depending on symptoms. This requires that the coil location should be done fluently in several settings and is sometimes needed to be done in reverse position the one is used to.

Targeting system of the coil resembles a crosshair with distance and angle information. Targeting the coil with acceptable accuracy level in reasonable time requires practising. Typically, training of the user to operate the system is performed on human subjects, which is costly. Thus, there is a need for a real-world training environment to optimise rTMS patient and coil positioning strategy.

Implementation

The implementation of the 3D printing based phantom head consisted of fringe 3D imaging, smoothing of the 3D model, 3D printing with two different 3D printing methods, and anthropological measurement verification. In this pilot phase, especially the 3D imaging and the 3D printing required multiple experimental set-ups in order to achieve the expected accuracy level.

Structural lighting based 3D Imaging

3D imaging is a widely known term thanks to 3D films and movies. In science and engineering the benefits of 3D imaging are also realized but the best data acquiring technique is often hard to find. There are several

technologies like stereo imaging, structural lighting, time of flight and fringe projection in the field of 3D imaging. Different technologies are designed for different purposes and they all have their advantages and limitations.

Structural lighting embedded in 3D imaging is based on lighting patterns generated by a computer and projected onto the object by a video projector. The lighting patterns on the object are deformed by an object's geometry. The 3D shape of an object makes the lines of the pattern bend. With each lighting pattern projected onto the object, the camera images the changes in the pattern and the changes are analysed by a computer program that creates the 3D model of the object. (Karpinsky & Zhang 2010.)

Figure 3 shows the 3D imaging set-up of a human head (on the left) and the 3D model of the head (on the right).

Figure 3. 3D imaging set-up (on the left) and 3D model based on the imaging (on the right).

After imaging, the 3D model was smoothened and finalised for 3D printing with Autodesk MeshMixer and netfabb software.

3D printing

The phantom head was first 3D printed in miniature size by a powder based 3D printer in order to verify the shapes of the model and the precision of the printing technique. Powder based 3D printers form the object by adding printing material layer by layer. A thin powder layer is laid on the bed, then for example an inkjet head adds binder liquid to desired locations. This binding could also be done with a laser, which melts the powder into a more solid substance. After the extrusion head has done the binding, the powder bed is lowered and covered with another layer of powder. This is repeated until the print is finished. Finally, the remaining, loose powder is removed and the final print is revealed. Powder based 3D printing requires no support material since the powder itself works also as a support. After the miniature sized head was printed successfully, the same head was 3D printed in real life size with the same powder based 3D printer.

The real size head was used in anthropological measurement verification. The anthropological measuring points used in this research were:

1. left pinna to right pinna
2. left corner of the left eye to the right corner of the right eye
3. head circumference
4. lower point of the lower lip to the hairline.

The anthropological measurements were done by comparing the measurements of the phantom head to the measurements in real human head. This confirmed that the 3D printed head is in 1:1 scale with the human head. After confirming the correct size and model of the 3D phantom head it was 3D printed using a plastic extruding 3D printer with a bit different orientation. Extruder 3D printers extrude printable material through a heated extruder. The 3D printer forms objects by extruding thin layers of printing material according to its program route. When a layer is finished, either the platform is lowered or the extruder is raised by a pre-set layer thickness. The layer thickness effects on the printing resolution, which usually is something between 0.1–0.5 mm. Material used in plastic extruding 3D printers most often is PLA (Polytactic acid) and ABS (Acrylonitrile butadiene styrene). Other possible material is nylon, HDPE, PCL, polycarbonate. Mostly these materials are available in variety of colours. Figure 4 shows examples of 3D printed phantom heads.

Figure 4. 3D printed phantom heads: Powder based print in real size (on the left), miniature size powder based print (in the middle) and the plastic print (on the right).

Conclusions

This experimental study was done in collaboration with a medical physicist, technicians, physicians and researchers and engineers on automation. With an interdisciplinary touch the real world training environment for the transcranial magnetic stimulation treatment could be designed and piloted. Two of the 3D printed phantom heads are now in test use and they will be further developed with additional features later this year.

6 USERS' EXPERIENCES AND EXPECTATIONS OF THE WELFARE TECHNOLOGY SERVICES IN THE CASES OF THE HYVÄKSI PROJECT

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Introduction

According to Melkas and Pekkarinen (2014, 210-213) welfare technology is used for maintaining or enhancing people's abilities, health, wellbeing, quality of life or independent performance. Welfare technology can be divided into assistive, communication and information technologies, social technologies and safety technologies. Also health technologies, patient information systems and gerontechnologies are welfare technology products and services. Welfare technology solutions can be either passive or active. Passive technologies don't require any actions of the user. Active technologies are used for supporting the actions and objectives of the user.

The Danish Centre for Assistive Technology (Mørk 2010, 7-8) defines welfare technology broadly for technological solutions that help to preserve or develop welfare services. Welfare technologies include technological solutions that citizens can use for compensating or supporting their abilities. Technologies can be utilized for example for enhancing independence, health and quality of life, supporting people living in their own homes, improving safety of citizens and staff as well as automating functions that require a lot of manual work and for reducing the risk of work-related injuries for staff and family.

Melkas and Pekkarinen (2014, 212) point out that the main issue is to transfer the focus from welfare technology itself to its use. Use of welfare technology should provide as many positive benefits as possible. The technology development should be even more emphasized on user-driven points of view and consideration of even greater entireties.

The customers expect products and services to be suitable for their personal use. That is why, when developing technology, it would be essentially important to know what kind of expectations the users have for the technology so that their wishes could be met. In products and services designing, the user information should be utilized more. The customers are more interested in influencing the development of services and giving their own opinions about them. With the help of user-driven development it is possible to produce products and services in higher quality to the market. (Saariluoma et al. 2010, 29, 47).

Aim

The purpose of this study was to find out the users' (clients and health care professionals) perceptions on the impacts of the welfare technologies and also clarify what kind of expectations and wishes users have regarding the technologies. This study is based on a qualitative content analysis of memos held over four different technology tests in Living lab environments.

The Living Lab methodology emphasises the real-life user participation in product development. Welfare technology products and services are tested in real life contexts in collaboration with public, private and third sector organisations. During testing processes, welfare technology suppliers receive valuable feedback, expertise and concrete development ideas from users and health care professionals to support their product development.

The material was collected in the project called HYVÄKSI (Common Weal) – Innovation network on Welfare Technology – Well-being enhancement by personalized and service designed client technology in Satakunta. The project aims at enhancing quality of life of citizens in Satakunta region by developing user-driven and customer-

friendly technology that enhances well-being. The welfare technology products and services developed in the project are targeted to facilitate and support the daily living of people with special needs, like older adults, people with memory disorders or impairments, people with learning disabilities, people with physical limitations, family carers and other relatives but also health care professionals. Welfare technology solutions can focus on enhancing physical, cognitive and social abilities of the users as well as fasilitating nursing practice of health care professionals.

The HYVÄKSI project is implemented by Satakunta University of Applied Sciences and a regional development agency, Prizztech Ltd. during 1.11.2014–30.9.2017. The project is funded by the Regional Council of Satakunta (ERDF), municipalities of Pori region (Pori, Ulvila, Harjavalta, Kokemäki and Pomarkku) as well as Satakunta University of Applied Sciences.

Results of the study

According to the clients and the health care professionals, welfare technologies have multiple positive impacts on the clients. These effects are related for example to quality of life, health and wellbeing. Also physical, mental, cognitive and social abilities of clients as well as safety, independence and sense of community are emphasized in the results. The use of technology also supported the development of care. Additionally the study pointed out that the technological services could be even further developed to meet the users' needs and wishes.

Based on the clients' and personnel's experiences, the welfare technologies enabled the clients' learning of new skills and increasing the social interaction between other clients and staff. The technology helped those clients' with tendencies of not speaking to open up for more communication, and especially verbal one. By using technology the personnel was enabled to support clients' concentration, produce positive feelings and give feedback of client's good performances.

Using technology in services increased the amount of time spent together, lifted team spirit between customers, alleviated the feelings of loneliness and enhanced the quality of life in general. Using these technologies and services created feelings of happiness and joy and the clients have had fun together. In addition, using technologies promoted shared actions to take care of each other. The technologies concerned have also been used for activating and motivating clients but also creating peaceful moments. The use of welfare technology was mainly experienced as pleasant and the activities created new and inspiring contents in the daily life. These services encouraged the clients to make an effort for themselves and their own wellbeing and health. For some clients even the smallest improvements have been significant achievements. According to the personnel, it was important for clients that welfare technology could offer them highly expected regular activities.

The technologies tested were perceived to increase the independence of the users and to support managing daily chores and tasks. According to the health care professionals, technologies increased the clients' feelings of safety and decreased the states of apprehension and fear. The welfare technologies also helped clients to calm down when needed. The clients were satisfied for the welfare technology services and they have become important and meaningful for them over the test period. Clients experienced welfare technologies mostly easy to use. Over the test period, the users were interested in possibilities the technologies created even so that some of them felt proud to be able to use technological solutions. Use of technology also increased the clients' confidence and courage.

On the personnel's point of view, the study findings pointed out that technology supports the instruction and guidance of clients used both for individual and group guidance. Technological services enabled the staff for better observation of several clients at the same time and defining their personal needs. Technology also increased and strengthened communication and social interaction between clients and personnel. The welfare technologies made having calming moments possible both for personnel and customers. The personnel felt happiness and joy due to participation and success of their clients.

Technological services changed procedures and working patterns, offered new tools for professionals, and created new possibilities in care. Welfare technology made a positive difference in developing their ways of working. Using welfare technology was noticed to save time.

Technologies improved the personnel's safety at work and sense of safety in general. The personnel used technology especially in communication between other employees. Technology was seen as equipment increasing their safety especially when working with customers with aggressive behaviour. With technology it was easy and effortless to make an alarm and receive help quickly. With the help of technology it was possible to prevent development of aggressive situations.

Based on the user experiences, the welfare technology product designing could be further developed to meet the user needs e.g. in terms of appearance of devices, functionalities of buttons and possibilities to use equipment. For instance functionality of networks, reliability and functionality of the operations of the products were still seen needing further development. As to meeting individual needs of clients, it was suggested that the content of the welfare technology services should be both simplified and diversed. The content of the services should be adjustable based on the user abilities. For example, by improving accessibility and increasing safety elements would lever the services to higher quality.

The experienced benefits from the technologies, the health care professionals found many new target groups who could benefit from technology and related services. Users requested more solutions suitable for learning and physical activities purposes. The user experiences highly indicate that independence could be improved by techniocal solutions that support life control and daily activities, like solutions for grocery shopping and use of money. Technologies could also be used for reminders. The test findings proved that technology provided the customers new incentives and offered them positive experiences.

Conclusions

Suitability of welfare technologies in care is confirmed by the fact that technologies are actively and regularly used and the users have been satisfied with them. The technologies were recognized to be useful, easy to use, beneficial and necessary for both clients and the personnel. The technological services were also experienced multifunctional. Using welfare technology created opportunities for care personnel to new services improving clients' physical, cognitive, mental and social abilities.

Using technology in care requires, among other things, redefining practices and responsibilities of persons in charge, increasing information security protecting user identities. Small improvements and changes in technological services could essentially improve usability and suitability of those technologies. According to the personnel's feedback, many of technology-based services could also be targeted to many other target groups than older adults. The organizations also identified how welfare technologies could serve their needs in developing service practices and processes.

Further study of the subject and the use of different kinds of technologies would offer even more comprehensive view on benefits of new technologies. It would also offer more information of users' expectations regarding technologies.

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7 RADIO FREQUENCY IDENTIFICATION (RFID) IN HEALTHCARE APPLICATIONS

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RFID Basics

RFID (Radio Frequency Identification) is a technology that is used for detection, tracking and identification of products and things. The technology is based on storing data in a RFID tag, and wireless reading of these data with a RFID reader using radio waves.

The benefit of the RFID technology, vis-à-vis many other automatic identification and monitoring methods, is readability of objects remotely, quickly, while maintaining data protection. Enclosed tags withstand rough handling and can preserve their usability for dozens of years. Moreover, tags can carry a large body of information. A RFID tag can be integrated in a product at its manufacturing stage or, alternatively, be added to the designated object subsequently e.g. with adhesive tape. The core idea of the system is simple: a RFID tag is attached to the designated object, data is written to and read from the tag with a RFID reader, and utilised using the back-end system.

RFID reading can take place without direct visual contact, i.e. for instance through packages or crates. Furthermore, it is possible to read dozens of RFID tags simultaneously, and their content can be altered in the course of the process. Because of all these features, RFID can be adapted to a number of different applications. They are used, inter alia, for monitoring of objects and processes, in logistics, movement and access control, retail sales and payment applications, as well as for identification and tracking of humans and animals in healthcare operations. The potential range of applications is countless, and continued development of the technology only increases their number.

RFID in Healthcare

In practise healthcare RFID applications can be divided in three categories: a) **patient identification and tracking** b) **material and equipment tracking and tracing**, and c) **passive sensing.**

Patient identification and tracking
One of the most important factors in the health care quality is securing the patient safety. RFID technology can perform various tasks in making this better, such as: locate patients in different situations, measure waiting and care times, and ensure the correct medication to correct patient.

Material and equipment tracking
The real time information of the equipment locations in large hospitals plays a big role in efficient hospital operation. With RFID, each of essential hardware can be automatically traced in real time, and the information can be brought directly to the correct person when needed. This reduces significantly the time which is used in finding all needed material in many occasions. In addition many a type of items in hospital environment require efficient tracing, information, such as medication, surgical tools, calibrated measurement units etc. It is needed to know when and where they have been used, what maintenance has been done, how long they have been used, what is the origin etc.

Passive sensing
Passive sensors are the latest addition to RFID application field. RFID creates a cost effective and standardized technology for sensor networks to energize the sensing as well as transfer the data from the sensors to back-

end systems. This has enabled the automation of many earlier manual and time taking procedures. Good example is lately introduced Smartrac Sensor Patch: disposable moisture sensing inlays that can be attached to the outside of any diaper to avoid irritation. This would enable caregivers to quickly and remotely detect if an incontinence event has occurred. This remarkably both reduces time allocated in patient toileting as well as increases patient dignity and quality of life.

Figure 1: Smartrac Sensor Patches (www.smartrac-group.com)

8 CHALLENGES IN MOBILE APPLICATION, DEVICE ADOPTION AND UTILIZATION IN HOME CARE

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Background of the Research

Most of the home care organisations in Finland have started to use mobile applications to support homecare processes. The main reason for that is the need to optimize resources as the population is ageing rapidly. In the future there are fewer personnel to take care of increasing amount of patients, and all the processes must be more cost-effective. The applications provide staff new possibilities in operational systems for planning to transform patient´s home visit details by a mobile phone or a tablet PC. Apps also enable most of the electronic health record-based functions to be performed at the point in care situations, in this case at patient's home. The law on elderly services obligates care providers to perform the planning of the home care together with the patient. Portable devices and applications enable assessment and care planning of a possible patient at his/her presence. Well-functioning mobile system for organizing patient data in home care services includes functions which enable nurses to automate care plans, collect vital signs, make and handle notes about current and recent visits, to have access to crucial patient details, to collect timesheet and location data, and to automatically verify visits on site (Herrmann 2012).

An operational system for care planning integrated with well-functioning home care application enables the management to be more aware of the time used at home visits. This data can facilitate the service delivery to be provided at the correct time and to assist in allocating personnel resources more efficiently. In another words, the accuracy of reported durations of home visits can be improved (Eveborn, Flisberg & Rönnqvist 2006).

Since there is no need to use time for patient information documentation at the office at the end of the work shift, more time could be used for care on site. That is important as most of the home care organizations in Finland have started invoicing the patient based on the monthly time used for care. So to say, all care related tasks, including the documentation should be performed at home.

Patient data mobile applications are still quite undeveloped. All of the patient information is not available via application. Product development is lacking behind the user needs. There are problems with interfaces between the main database and the application. For example, chart-formed information, such as blood pressure and INR (anticoagulant) charts cannot be delivered via the interface at the moment. There is a link to acceptance of these new work routines. Experiences from the field indicate that nurses have seen this kind of interruptions decreasing perceived usefulness of the application, because of the need to re-enter main database in order to finalize the documentation process. Double documenting is time consuming and has, at some cases lead to not using the app at all.

In the city of Nokia, a decision to deploy some of eService-based mobile applications in homecare practice was made in summer 2013. The city of Nokia is using Effica- database to handle patient information. Since Effica is being transformed into a web based solution, a natural supplier for the near future service was Lifecare by Tieto Corporation. All home care employees started to use smartphones at home visits in order to make required statistics and for writing patient reports.

In the beginning of 2015 Home care nurses and Tieto Corporation made an agreement to conduct a pilot study related to deployment of new tablet- version of Lifecare home care. Tablet- version is an advanced version, with possibilities to view more patient information, such as patients' medication, but also to document each home visit.

In the beginning, there were lots of problems in adoption processes. The technical implementation was poor and the software was not utilized to the maximum potential. The interfaces were not functioning properly. No suitable education material was at use. Lots of other development needs were introduced to the service provider. Tieto Corporation willingly started working on noted problems, and there has been an outstanding improvement in the system ever since. The product supplier created more interfaces from Effica to Lifecare and the development continues, but the issues with utilization mentioned above have not been solved yet.

The Research Design

The purpose of this master's thesis research is to investigate the home care nurses´ adoption process regarding the deployment of a mobile system and application of Lifecare homecare, and the use of mobile devices in home care context in the city of Nokia, Finland. The focus is on the user experiences of home care nurses, but not to miss the patient aspects.

The research task is to find out the current state of the acceptance and adoption process of home care nurses and to investigate the problems in it to gather information about changes that need to be made so that the system can support nurses on they work routines the best possible way.
Research question/objectives are: How to optimise the utilisation of mobile system in home care and management of changes related? Sub questions related are: 1. What are home care nurses' perceptions on deployment and utilization of the new home care mobile system? 2. How the change management aspects should be taken into account in regard with utilisation of mobile data systems in home care?

The approach will be qualitative research. The intended method for gathering data is the contextual inquiry. It is a specific type of interview for gathering field data from users. It is usually done by one interviewer speaking to one interviewee (person being interviewed) at a time. The aim is to gather as much data as possible from the interviews for later analysis. Important benefits of this type of interview are: Interviewees are interviewed in their context, when doing their tasks. At this case, at home of a patient, with as little interference from the interviewer as possible (Beyer & Holtzblatt 1998).

There are 11 possible interviewees; my plan is to conduct 4 contextual inquiries. Interviewees will be selected by using random sampling. Data should be gathered during interviews with little or no analysis; interview should result in raw data. Since this method produces vast amounts of data it is important to analyse the data. This can be done using the contextual design method or task analysis to verify the process. The most useful method to analyse the amount of data may be to create an affinity diagram (Beyer & Holtzblatt 1998).

Expected result: Obtaining information in regard with user experiences and management of change in order to further intensify the deployment and use of mobile system in home care.

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9 USABILITY OF INTERNET-BASED PATIENT EDUCATION

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The aim of this paper is to present my master's thesis that focused on analyzing and describing the usability level of a selected internet-based patient education web site provided by one Finnish Hospital District. The ultimate goal was to find out usability problems and present solutions for these problems.

Usability testing is a method to evaluate a product by testing it on users. It provides direct information how people use computers and what their exact problems are with the concrete interface being tested. Test users participating in usability tests should be as representative as possible of the intended users of the product. Also test task should be chosen to be as representative as possible of the uses to which the system will eventually be put in the field. Test task should provide reasonable coverage of the most important parts of the product. (Nielsen 1993, 165-185; Rubin & Chisnell 2008, 79-83.)

Patient education is important for purposes of helping patients to learn about health and care related issues and to become informed enough for decision-making in order to successfully manage their own care. Internet allows obtaining patient education regardless of time and location at all times. Particularly the internet-based patient education web site for surgical patients is concerned in this study.

Data for this study was collected by usability tests conducted in a seven-day period in January-February 2016. The usability test involved eight testees and it took place in one of the outpatient clinics at the Hospital District. All of the testees were surgical patients and had already been consulted by their surgeons. All the testees were enlisted for the surgical operation in the nearest future and selected to receive internet-based patient education before the operation.

During the usability test, all the testees did five assignments on the internet-based patient education web site. These assignments were given to the testees in writing one by one. Each testee was instructed to perform the assignments at his/her own pace and indicate when accomplished and ready for another one. When all the assignments were completed, the testees were interviewed about their experiences on usability of the website.

Usability test was done on a laptop and all the testees were using the same laptop provided by the moderator. The test situation was recorded by Screenflick screen recording program. It allows recording events on the computer screen, audio from computer's microphone and video from computer's web camera. This entire material Screenflick program collected together as one video file.

Collected data was analysed by a content analysis with inductive approach. Different types of usability problems occurred, inter alia, testees couldn't locate into the patient education web site, test users couldn't find correct information from the web site, and some testees were directed completely to wrong web pages when using of the internet-based patient education web site.

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10 SUPERCARDS – INVITATION TO GROW TOGETHER
Topic cards for Supervisor Peer Forums

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Background

Foorumix is a project to experiment Supervisor Peer Forum in small and middle-sized companies in Satakunta region in order to enhance competence improving activities in enterprises. The first circle findings of the pilot phase is the base for a new Peer Forum model to be used in versatile workplaces to promote well-being, efficiency and coping with work related factors.

A demand for long term peer forums has been approved in results of previous EU-projects and interviews realised by Satakunta University of Applied Sciences (SAMK). The project promotes the strength of peer forums both for the superiors and the entire work community. The aim is that forums become a permanent practice in companies.

The supervisors need an opportunity to share their experiences and to reflect their work as well as to develop management skills related to ability to work and to cope with the work load. Integration of new knowledge is not easy to do without a well-planned process. The model facilitates introduction and maintenance of Supervisor Peer Forums into practice. The permanent role of Peer Forums is significant also in change and development processes in general.

To ensure successful dissemination of the model, the project focuses on communication, education and cooperation between the stakeholders. Step by step material is prepared to facilitate implementation and planting of the model as a regular tool for management, and as a sustainable service in occupational health or other service providers. It is important, especially for small and middle-sized companies, that professional support will be available also after the project period. That is why some special material is prepared for the consultants working with enterprises and for the occupational health professionals.

In Foorumix, ability to work is considered as a wider concept. That is, personal life is seen as a central factor affecting ability to work, like combining family life and work or equal opportunities in work life despite of individual qualities. The central themes in the project also include diversity at work places and age management.

Supervisor Peer Forum Model in Practice

The Foorumix 2015–2016 pilot project on Supervisor Peer Forum is indicating the demand and necessity of a peer forum model in human resource management. In this project we provide Forums that gather supervisors from different enterprises and Forums within work communities. The key points have been trust, respect and continuity. There have been lively discussions in the Forums.

The subjects of the discussions have been about interaction and atmosphere in a work community, recognition of problems or overloads in time and predictive cooperation with the occupational health; how to talk about difficult issues, feedback and support for individual development. Even if the subjects have spontaneously been relevant, a need appeared for making material to ensure all relevant points of views and aspects in discussion.

SuperCards –Invitation to Grow Together

The topic cards for Supervisor Peer Forum – SuperCards – were made in autumn 2015. In the beginning the themes were picked up from the preceding project “Jengoilleen”, which conducted an inquiry for supervisors.

The results were gathered and published as an online guide (tyokykyopas.samk.fi) and a course called “Keys to competence improvement management” (Avaimia työkykyjohtamiseen). The data from that process was also the ground for developing the SuperCards.

In autumn 2015 we tested SuperCards in Supervisor Peer Forums and obtained a valuable feedback to improve the topic cards. Some of the preliminary main themes had to be changed because they created confused response among Forum members. Some words and expressions were changed and combined differently. Especially some original innovative and depicting expressions were selected to be used in the final version. All the supervisors wanted also to add some bates about how different personality types could deal with constant changes and what how supervisors could make the change as successful as possible.

How do the SuperCards look like?

In every card there is a main theme and four aspects to the subject, some of them even contents different points of view. There are positive and negative, easy and difficult points of view in each card. Altogether the package consists of ten thematic cards in order to provide a lot to think about.

The main themes are:

- Time and Age management (Aika- ja ikäjohtaminen)
- Special role of a Supervisor (Esimiesroolin erityisyys)
- Development and Change (Kehitys ja muutos)
- Feedback (Palaute)
- Rules and Adaptability (Pelisäännöt ja joustot)
- Culture of the work place (Työpaikan kulttuuri)
- Competence Improving Management (Työkykyjohtaminen)
- Occupational Health Cooperation (Työterveysyhteistyö)
- Supporting Structures in Work Community (Työyhteisön kantavat rakenteet)
- Together with Different Backgrounds (Yhdessä eri lähtökohdista)

The order of themes is not relevant when the SuperCards are on the table.

SuperCards are packed in a special envelope together with two instruction cards and a leaflet of Five Ways to Use SuperCards. Different ways to use the cards are presented to avoid the risk of feeling that all or most of the subjects should be discussed. The case is to choose the most inviting topic at the time to talk about. At its best, SuperCards ignites an inspirational and rewarding process.

Figure 1. The outlook of thematic SuperCards

Conclusion

Dissemination and further development are carried out in collaboration with regional and national partners. Material in the project website will be compiled in order to facilitate social innovations found over the project. The success stories and testimonials of supervisors and partners participating in peer forums play a central role in implementation of new practices to support management in various work communities.

The further refinement of SuperCards – Invitation to Grow Together to be published in English and modified in digital format (even as a basis for game application) would be more than welcome. In conclusion, the current products and project outcomes have approved themselves as usable and benefitting tools in competence improving management. Digital and English versions would make a difference in terms of wider dissemination of the generated Supervisor Peer Forum model.

11 PERSPECTIVES ON THE ROLE OF ASSISTIVE TECHNOLOGY IN EMPLOYMENT OF PEOPLE WITH DISABILITIES

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Introduction

It is well documented that individuals with physical disabilities face considerable difficulties in finding and maintaining employment. Employment as such has a positive impact on individuals self- esteem, sense of autonomy, interactions with others as well as on financial situation. In addition, being employed seems to impact how the people with disabilities are regarded by their neighbors, friends and by the wider community. (Isakson et al. 2006.) Assistive technology (AT) is seen as crucial in removing barriers to employment and productive work, especially for those with severe disabilities (Yeager 2006). The ongoing digital revolution has changed the way people live, work, learn, socialize, and participate in community life. The new technological products, systems and solutions create new possibilities also to people with disabilities to be more independent in their daily life, at school or at work and in other activities.

However, the rapid development of information and communication technology (ICT) may also cause exclusion from the society and working life, because not all individuals have sufficient skills, devices of funds to keep up with it. This gap between those who are able to use these technologies and those who cannot or do not is known as 'the digital divide'. The ENTELIS project aims at reducing the digital divide by fostering the development of ICT -skills of persons with disability and the older adults and increasing their ability to use ICT-based assistive technologies. One part of the project was an extensive literature review on current state of art, where issues addressing technology and employment were also studied. (www.entelis.net/). This paper is based on nine peer-reviewed scientific articles published 2003–2013 that approached the benefits and barriers of ICT/ ICT-AT and employment from different viewpoints: effects of the use of ICT/ICT-AT on employment, work outcomes and productivity, selection of the technologies and need of support and education of the users and the professionals working with them.

Effects of the use of ICT/ICT-AT on employment, productivity and work outcomes

A study by Strobel and Todd-McDonough (2003) indicates that while technology offers many effective options to assist a person with job tasks, it cannot complete a job for a person with a disability. The employee must be qualified for a position and be able to perform the essential functions of the job duties with or without accommodation, including the possible use of a personal assistant at the workplace as a reasonable accommodation. The type of assistive technology used in a situation will vary greatly depending on the nature of a person's disability. Thus, the individual's skills that can be maximized through the use of technology should be in the focus of the search, evaluation and implementation technologies for work. Wehrmeyer et al (2006) in turn, concluded that the variety of technologies and activities to which these technologies were applied, speak to the significant potential that technology can play in shaping positive employment and vocational outcomes.

Yeagera et al. (2006) conducted a survey to people with disabilities throughout California, to identify barriers to employment and to study use of job-related AT to overcome such barriers. Almost 2000 persons responded to the survey and about 1500 of them were in the working age. However, only 20% of them were actually working. It is noteworthy that most respondent perceived the disability itself as the main barrier to employment. A majority of working respondents reported using assistive technology (such as adapted telephones, wheelchairs, magnifiers, and adapted computer equipment) or services to perform job functions. The vast majority of those using job-related AT reported substantial benefits to their productivity and self-esteem. The results from different disability groups varied substantially; respondents with mobility or sensory impairments reported that they performed

their jobs making substantial use of various technologies specifically designed to accommodate their disability whereas people with cognitive or mental health disabilities reported relatively little on-the-job technology usage that could help improve task performance. Sauer et al. (2010) conducted a systematic review to explore the effects of assistive technology (AT) use on employment outcomes for people with cognitive disability. Eight out of nine studies support the beneficial effects of AT tools in the workplace. These articles reported increased accuracy, independence and generalization of skills following the implementation of AT.

According to Bricout (2004) barriers to employment for people with spinal cord injury (SCI) include physical limitations, worksite and community accessibility, medical complications, inadequate disability benefits, decreased self-efficacy, transportation needs, employer biases and stress. Telework, or paid work conducted from a remote location at least one day a week using Information and Communication Technologies (ICT), such as computers and telephones, is a promising work medium for improving the likelihood and quality of return-to-work for individuals with SCI. An argument can be made that removing the worker with SCI from the workplace obviates appearance based prejudices. According to Gamble et al (2006) the technological development has increased the accommodation options for workers with disabilities, on the positive side, and created a dilemma in identification of a specific technology for use in a particular employment setting, on the negative side.

Bryan et al (2007) conducted a study which addressed the employment of people with disabilities who use assistive technology from the employers' perspective. Their results suggest that while level of education is still important to employers, other skills such as time management, problem solving, communication, use of an understandable and standard voice, and basic technology may be even more so

Support and education

The role of education to use the technologies at work was discussed in several articles not only from the vantage point of the person with disabilities, but also health care workers', employment office workers' and co-workers 'perspective. Training on AT devices is essential to their successful use. The employee utilizing the AT requires training on the device in order to complete job tasks as independently as possible. Co-workers and personal assistants should also be trained in the event that regular maintenance or troubleshooting is required. (Strobel & Todd-McDonough, 2003.)

Yeagera et al. (2006) state that health care providers might be better educated in the availability and benefits of workplace AT, so that they could encourage people with newly acquired disabilities to begin using AT to help them continue to perform their job functions, and thus remain employed. For people with longer-term disabilities, there is also a clear need for greater awareness of the employment possibilities offered by assistive technology and assistive services, among both consumers and the agencies and organizations that provide services to them. Gamble et al (2006) emphasize that vocational rehabilitation professionals are the primary source of vocational services for people with disabilities. As such, one responsibility of rehabilitation professionals is to facilitate the access and use of AT for the consumers they serve. Having the necessary knowledge of AT and skills in working through a systematic selection process are critical to successful employment outcomes.

Keijer and Breding (2012) studied a development programme of the Swedish Labour Market Board and noticed that one of the problems was the professionalism of the staff. Occupational and physiotherapists, psychologist, vision or hearing educationalists and other behavior specialists were very good in their respective fields of expertise. However, many of them had no interest to go beyond their safe platform of knowledge and to navigate in unchartered waters, i.e. to explore what the new technology would offer for their basic task; that is to bring a person with disabilities from unemployment to employment. Only a limited number of the staff saw and understood the emerging opportunities. The researchers concluded that to improve the future ability of staff to work in this field it must be a part of professional skills to draw up a functional specification for some sort of device or system for the solution of a problem at hand. Most likely, this must be addressed in the ordinary basic professional education.

Bryéré et al. (2005) studied organizations' use of information and Web technology in HR processes, knowledge of computer/Web barriers to employees with disabilities and familiarity with assistive technology and resources. The results show that the HR personnel were not familiar with the common accessibility accommodations that can be used when working with a computer. More over only 13% of the respondents noted familiarity with guidelines for accessible Web design, with those from larger organizations (500+) more likely to report familiarity. The researchers point out that experience with accommodations or workplace adaptations can lessen the likelihood that disability will be perceived as a barrier for employment. They give four specific recommendations for lessening future workplace ICT / ICT-AT barriers: 1) increase the organization's specific expertise or technical assistance on technology accessibility issues 2) train technical staff about accessibility issues, 3)promote uniform guidelines to make Web-based employer processes accessible and 4) provide computer training for potential employees with disabilities.

Concluding remarks

According to several studies included in this review, for people with disabilities work remains the best route to independence and participation in society. Assistive and information technology are often essential in removing or decreasing the barriers to employment and productive work career. However, not only the users of ICT-AT but also the professionals working with them need to be better aware of the possibilities and requirements of the new technological systems and solutions. Also health care and social service providers should be better educated in the availability and benefits of ICT-AT, in order to be able to encourage their clients to find solutions that fit their situation and help them to get a job or to maintain employment despite disability.

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12 HYVÄKSI – WHERE TECHNOLOGY MEETS CARE AND WELL-BEING

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Introduction

Social and health care sector may seem distant and challenging field for technology developers but it contains tremendous possibilities for technology solutions. And what's best – the technology competence is already here! The bottleneck in implementing technology to enhance health and well-being is the lack of knowledge about different fields of business and lack of common language and terms. Technology developers is not necessarily aware of how their know-how is able to solve various real challenges in health and care, and care sector does not know about possible solution already available to meet their needs.

HYVÄKSI –project (Satakuntaliitto, ERDF) aims at colliding experts in different fields of business in order to introduce the technology potential and real customer needs and through this to enhance well-being, improve and maintain ability to function as well as quality of life. Various stakeholders are involved in the project including technology companies as well as public sector and private sector health and care organizations. The project investigates and identifies user needs and organizes technology pilots in real use environment. The technology is developed and modified in close collaboration with the end users and with the help of multidisciplinary research team. Various technology pilots are already in progress.

Versatile technology – from 3d printed heads to mobile games

Technology pilots, case studies, are autonomous mini projects inside the HYVÄKSI project. Case studies are carried out by SAMK and they are executed in close collaboration with working life experts from technology (involved in technology development and testing) as well as health and care sector (involved in need analyses and technology testing). Essential part of case studies is to research usability, user experiences as well as health and well-being effects of the technology used. The technology may be everything from 3d printed heads to mobile games for rehabilitation.

One example of a case study is mobile sensing. Wearable sensor technology provides various possibilities in physiotherapy and rehabilitation but it can as well be used for self-initiated activation and health promotion purposes. The sensor technology provides precise information on limb movement and it can be connected to various mobile applications. The technology is suitable for many target groups such as older adults, people with physical limitations and inactive persons, to name some.

Figure 1. Testing the mobile sensor technology

Interactive talking calendar software is developed in another case study (Fig. 2). The application is originally targeted for people with learning disabilities to help the clients keep track independently on their daily living. The software also helps care staff in planning activities. The calendar has special features to make the use accessible. The activities are presented as figures and speech since some of the clients cannot read. The app also has adjustable view (hours, day, week…) which can be modified according to the user. The user interfaces are designed and modified according to the needs and comments expressed by users and care staff. The activities are controlled by the care staff from locked, hidden view in the software so the only function the client has to make is to push one's own photograph on tablet screen to open the calendar.

The development of the calendar software has also led to other case study in which gaming is used as motivation to physical outdoor activities. An orientation game consisting of various minigames including physical and brain exercises, is under development. The progress in the game is dependent on achievement in the minigames and the real location of the tablet.

Figure 2. Talking calendar for people with learning disabilities.

Rehabilitation industry has a huge potential of application areas for many technologies. Also in HYVÄKSI project, technology is developed tor assist in rehabilitation of various target groups. The most essential technology design principle is adjustability according to the clients' function abilities. To give a concrete example, a lot of enabling technology solutions utilizing eye or head movements, could be developed for people with quadriplegia. In HYVÄKSI project, the first application under development in this area is a news reading application.

Another interesting case from rehabilitation is so called "mobile painting" (Fig. 3). In mobile painting, body movements are used to control a virtual paint brush. The painting may be projected on different environments and objects, like on walls (also outside). The controlling method can be adjusted according to the clients' rehabilitation program and functioning (body part which needs rehabilitation, intensity, difficulty…). Mobile sensor technology is used to track the movement of the body part which is used in controlling painting. The sensor technology may be embedded into exercising equipment, like a balance board. The client keeps the balance while standing on or when sitting only placing feet on the balance board and tilting it. The balance board movements control the paint brush. Doing this when seated is the option for wheelchair users whose legs still have some capacity to move. The embeddable sensor technology enables even paralyzed people to paint massive visual artwork attaching controller in forehead, and paint by head movements. Also a cell phone can be used as a brush controller. Cell phone is easy to be attached into different body parts according to the rehabilitation needs.

Third case study in rehabilitation field is related to increasing rehabilitation clients' safety and to improve the quality of the services of rehabilitation center clients by engaging near field communication technology (NFC). The technology may be helpful especially to people with communication challenges. The content of services in a rehabilitation centre could be individualized and tailored according to the interests of the clients without any need of producing speech. In this case, the information about the needs and interests is carried by the client in a small tag placed in a bracelet or attached in clothing, for example. The use of NFC provides mobile device access to the information alolocated in tags. This NFC technology could also be used to improve client safety by inserting other crucial health information to the same wearable tag, like diagnoses, medication or allergies tha might have an impact on acute situations.

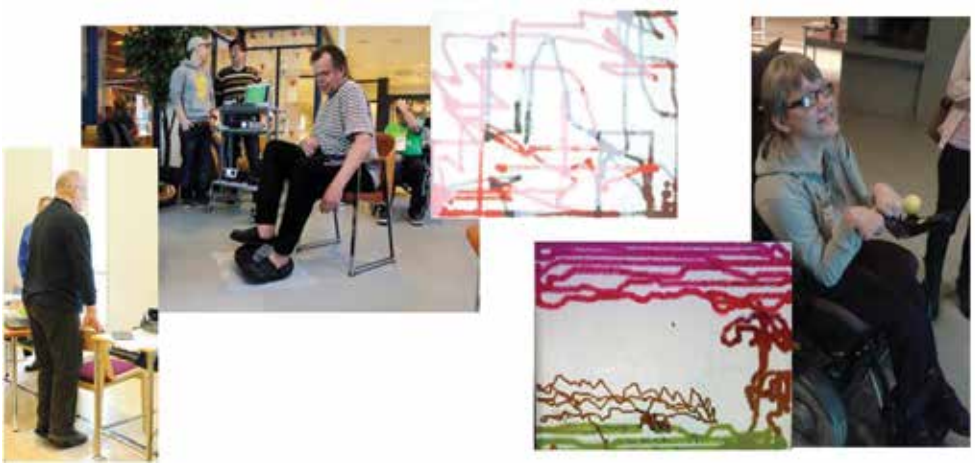

Figure 3. Mobile painting with rehabilitation clients.

Rapidly developing 3D technology provides huge potential for health and care sectors. 3D imaging, modelling and printing is very useful tool to produce dummies. In HYVÄKSI – project, this technology is used to create real size replica of a human head (Fig. 4) which is used in calibration of a magnetic treatment device. It also facilitates learning about how to use the equipment and how to conduct the magnetic treatment concerned. For similar learning purposes, other organs are under development at the moment.

Figure 4. Real size and a scale model of a human head, imaged and printed with the help of novel 3d-technology.

HYVÄKSI in brief – Innovation network for well-being enhancement by technology

In addition to various other technology pilots, HYVÄKSI project is all about networking. The stakeholders of the network include actors from technology development to experts in care (Fig. 5). Challenges in communication, knowledge transfer, and general lack of knowledge between various actors have emerged bottle necks in welfare technology development and implementation in a variety of projects implemented by SAMK. HYVÄKSI (Commonweal) project was specially established to meet the above mentioned challenges. HYVÄKSI project focuses on establishing an Innovation Network on Welfare Technology for well-being enhancement through personalised and service designed client technology in Satakunta region. The project welcomes various agencies and interest groups in the fields of care and technology together to generate new patterns of collaboration, to clarify the roles and division of tasks, and thereby create synergy among several actors concerned. The established network is not supposed to function only over the 3-year-project period but aims at boosting business opportunities also in the future by means of supporting innovations and increasing communication and expertise through knowledge transfer between public, private and third sector organisations. The project goal is, through technology development and service designing, to enhance daily well-being and prevent further functional impairments among people with limitations, their family members and care givers.

Figure 5. HYVÄKSI –innovation network for well-being enhancing technology.

The HYVÄKSI innovation network creates best practises in multidisciplinary partnership building (Fig. 6). The network helps in discovering the real needs in care sector, as well as illustrates the possibilities of the technology and skills alrea dy existing among the partners. The main goal is to match and harness the technology skills into meaningful and need-based innovations to enhance well-being. This years UAS Symposium is part of the multidiscipline discussion the project aims at.

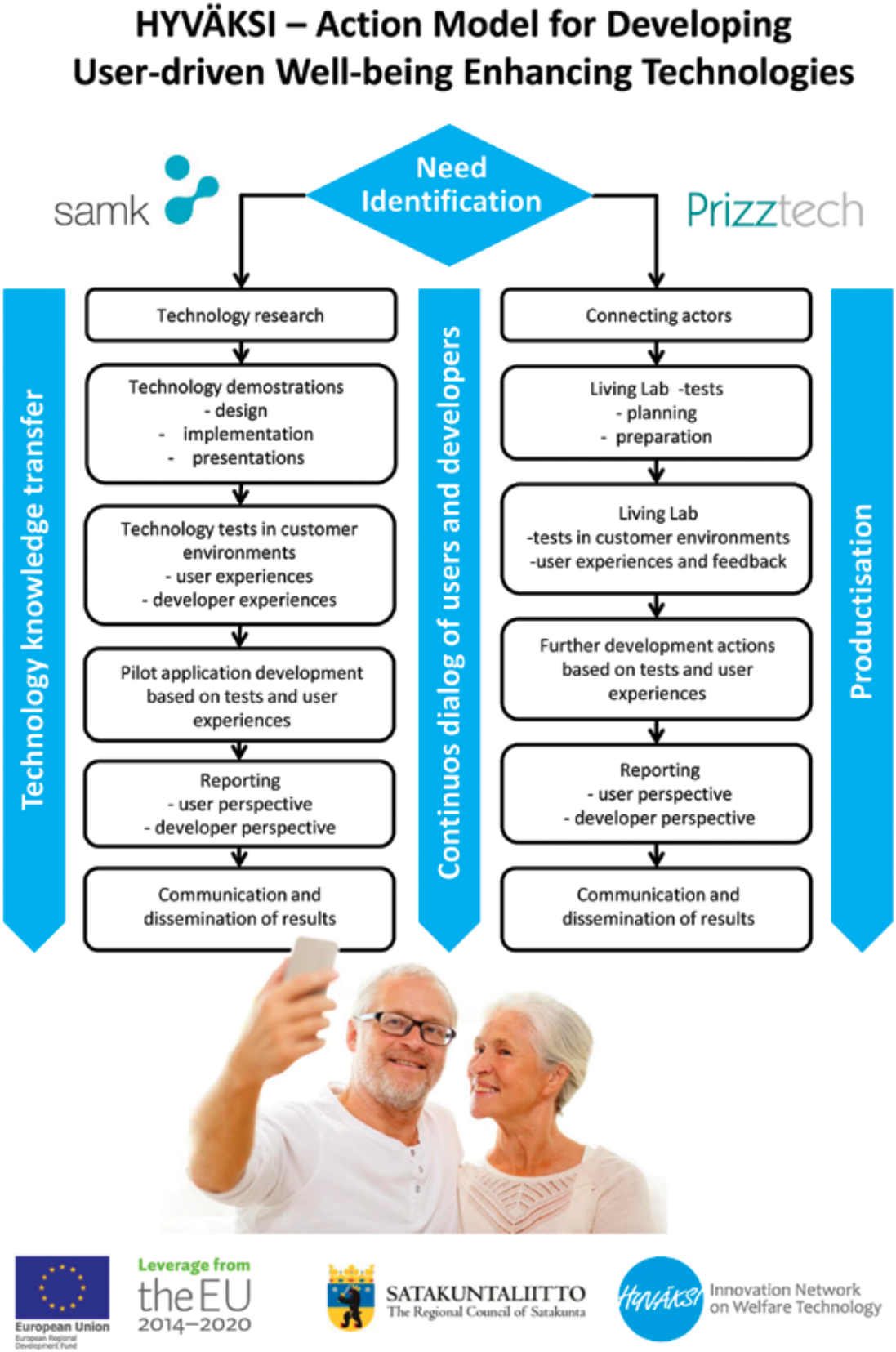

Figure 6. HYVÄKSI – Action Model for Developing User-driven Well-being Enhancing Technologies

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13 THE FINNISH DOUBLE FLIP – CODING LESSONS

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Introduction

According to OECD's 2012 PISA study about the connections between the use of the computer and learning results, almost all (99%) of Finnish adolescents 15-16 years of age who participated in the study had access to the Internet at home. One fifth of Finnish young people have been using Internet for the first time at age 6, and the majority (80%) has commenced use of the Internet no later than the age of 9. Strikingly, however, despite early initiation of the Internet for young people, young Finns instrumental use of the technology and the acquisition of information management have repeatedly stated as quite inadequate. Young people also evaluate their own skills as poor. (eg. Kaarakainen & Kivinen 2015; Kiili 2012; OECD, 2011.) The term digital natives can be misleading and results to not teaching children the adequate IT skills. Children are often regarded as information technology savvy, but their IT readiness is often very narrow. In most cases, they only play games with a computer, smart phone or Ipad and use the social media.

Educational technology is a tool to assist in teaching. Technology itself does not teach. To use technology most effectively in education requires skilled teachers and appropriate pedagogy. Recent OECD study reports that the successful integration of technology in education is not so much about choosing the right device or digital book or how much time to spend with the device. In many cases, the teachers were not prepared to use teaching methods which utilize technology in the best way. The important element for success is the teachers, school leaders and other decision makers who have the vision and the ability to build a link between the students, computers and learning. (Avvisati 2015.)

School systems need to find more effective ways to integrate technology into teaching and learning to provide educators with learning environments that support 21st century pedagogies and provide children with the 21st century skills they need to succeed in tomorrow's world. Technology is the only way to dramatically expand access to knowledge. To deliver on the promises technology holds, countries need to invest more effectively and ensure that teachers are at the forefront of designing and implementing this change. (Schleicher 2015.)

The new national curriculum and the phenomenon-based learning

The new curriculum deals with phenomenon-based learning and socio-constructive conception of learning. The starting point is phenomenon-based learning and constructivism instead of individual subject areas focusing on the themes of phenomena. The different disciplines are combined, in order to explore the matter from different perspectives and therefore it can be examined wider. (Silander 2015; Opetushallitus 2014). Halinen (2015) emphasizes that the new curriculum in the various subjects will not be abandoned, but the aim is for 1-2 broader topics to be taught during the school year. Learners are seen as active builders of knowledge constructed as a result of problem-solving. When the phenomenon-based learning takes place in a community, it supports the socio-constructivist and socio-cultural theories of learning where knowledge is not only seen as an internal element of an individual, but instead the information is seen to be taking shape in a social context.

Kyllönen (2015) discusses how flipped classroom pedagogy can be utilized in the phenomenon-based learning. The teaching will focus on supporting the learning process and critical thinking, and anchoring learning into authentic and relevant phenomena of life. Teachers and the students' cooperation is essential in creating inspiring learning environments and communities. Collaborative learning is the learners' interaction process, which the teacher facilitates. Socio-constructivist method and for instance pair discussions, group work and projects, increase social skills and cooperation.

Flipped classroom- pedagogy

Technology can be a great tool in education. A teacher needs effective pedagogy to bring technology successfully into classroom. Flipped classroom-pedagogy can provide a solution to use of education technology in a classroom environment. Flipped classroom-pedagogy means that the lecture and homework change places and that can be implemented in different ways. Less lecturing and more interaction during the lesson is the main point in the pedagogy with the help of learning videos. (Khan 2012.)

According to Toivola (2014), flipped classroom-pedagogy means a change in teaching where learning technology has an essential role. Videos were not given as homework but a coding video was shown at the beginning of lessons. Also, instead of a teacher conducting the lesson, the primary 3 pupils were made into coding lesson teachers and facilitators. This is where the playful term “the Finnish double flip” originates from.

Experimentation and research

Overmyer (2014) discusses the teacher’s role as a facilitator in the flipped classroom model. In his research it was noticed that if a teacher had not received any guidance for flipped classroom-pedagogy, or the teacher taught both traditional and flipped classes, the students mostly were just given their tasks and the teacher disappeared behind the teacher’s desk to do his/her own work. The students did not receive adequate assistance and help in their tasks. In this case both classes, the traditional and the flipped class, received very identical results in their learning. This result supports perhaps the key element which is the need for guidance to facilitate effective learning.

In Pearson’s (2013) case study 95 percent of the students stated that they preferred flipped classroom-pedagogy to traditional one. Study also showed improvement in their results in mathematics when flipped classroom-method was used. In the primary school, children create various skills, knowledge, attitudes and motivation basis for further learning. They provide a good foundation for succeeding in secondary school studies and through post-graduate studies. Bad attitude towards one’s own learning ability is a poor foundation for lifelong learning and self-development.

According to Dill (2012, 9), need to deal with problematic behaviour exists more frequently during traditional lessons than in flipped classroom-pedagogy. Furthermore, after a two-week experiment the learning results improved in flipped classrooms (98.7%) but remained almost the same in the traditional teaching (81.4%). In the traditional classroom the average scores of the grammar test (75 to 76%) and a written task (89.7 to 87%) were approximately the same. In the flipped classroom students got better results, as well as the grammar (78 to 88%) that a written task (87.3 to 92%).

American medical students wanted to minimize the workload of teachers by producing the contents of education in nutrition education. They planned and implemented flipped classroom-pedagogy for 4th grade pupils, 9-10 years of age. Teachers were satisfied with the experiment, and according to them, videos, and activities in class to communicate nutrition information worked successfully. In this experiment the medical students’ knowledge was shared effectively to teachers and students through the use of videos. Videos helped to reduce the workload of teachers in planning content and lessons. (McEvoy et al 2014.)

British Columbia University professor Louis Deslauriers (2011) researched 850 students in a physics course. Students were divided into two groups, and both groups received the first 11 weeks teaching in the form of lectures. At week 12, the students in group 1 received flipped classroom teaching. Class time was spent problem solving and discussion when the acquisition of the content remained the task of students outside the classroom. Students in group 2 continued to study the lectures in the 12th week. At the end of the week, the students did a test. The average of the results of the group 2 test was 41% and the average of group 1 was 74%. The test results were significantly better in the flipped classroom.

Computer science

The new national curriculum framework for primary education in Finland discusses computational thinking and coding as the means to reach the target. The new curriculum states that programming (coding) should be part of all education. It was not made a specific subject, because coding should be connected to the subject matters of the various lessons. (Toikkanen 2015.)

Linda Liukas (2015) argues that the world is increasingly run by software and we need more diversity among those people who are building it. Not all students will be software developers or writers, doctors or translators. The main point is to provide a basic understanding of society and fields of science and at the same time provide equal opportunities for all the learners.

Hour of code – collaboration and joy of learning

The Hour of Code is a one-hour introduction to computer science, designed to demystify code and show that anybody can learn the basics. Computer science helps nurture problem-solving skills, logic and creativity.

Figure 1. The hour of code-website

A simple, easy to learn and repeat lesson plan for coding was created and instead of asking the teachers to teach the lesson for other children, the responsibility was given to the pupils. The children were introduced "each one, teach one"-principle and explained how coders use and share the information on different forums, working together to solve problems. The 4th grade pupils taught in less than a year nearly 200 other pupils to code with the help of the lesson plan, a video about coding and the hour of code-website. Pupils play the key role during the lesson.

The coding lessons awoke interest in wider co-operation within the municipality and neighbouring schools. The regional newspaper, Satakunnan Kansa, and the school principal were participating in one of the lessons and were impressed by how coding was introduced from a pupil to another. There was a completely different learning drive than if a teacher would be lecturing in front of the class about coding.

Varjonen (2015) observed and commented in his newspaper article how primary school pupils taught neighboring school students in coding, and admired the co-operative and inspiring educational event. Lesson was not developed just like that but it needed many skills to perform. Not only logical reasoning ability and skills in English were needed but also presentation skills were requested. The enthusiasm in the class was really

Figure 2. The keywords stayed on the chalkboard and pupils could use them to deliver the introduction to coding.

Figure 3. More keywords were added on the chalkboard and they've stayed the whole year. The A4-paper states "do not wipe!"

tangible. Learning insights arose in connection with the coding game instantly. The biggest surprise was not how fast the 21st century pupils understood the meaning of the command queues but how naturally pupils taught each other.

The coding lesson supports phenomenal learning, which is introduced in new national curriculum. Children can practice their skills on the English language, IT, team-work, communication and presentation. Pupils do the presentation together and they help each other. They have presented the lesson in front of several teachers and pupils, visitors and international quests. Among other visitors, two teachers from the European School of Brussels visited Finnish schools and also followed the coding lesson.

The lesson follows the same format with a video and writing on the chalkboard being used to introduce coding and its importance. The pupils have improved in guiding others and have become braver at sitting next to and offering assistance to an unfamiliar pupil from a neighbouring school or other classes.

The project has been going on for over a year now. The basics of coding have been introduced for all of grades in the school (grades 1 to 6). The experiment began with the 6 graders, and it was interesting to observe how older pupils' attitudes changed during the lesson. When they came in, they did not understand how younger pupils could teach them anything. However, when the lesson began, all of the pupils were attentive and curious to find out what coding was, and the 3rd graders introduced the topic with clarity and confidence catching older pupils' complete attention. Older pupils accepted younger pupils' advice noticing the younger ones being "coding ambassadors" who mastered the topic.

The pupils wrote feedback and evaluation of their coding lesson. According to their teacher, the pipils wrote really well and some of them even more and longer than before, really trying to make an effort. They also made learning videos for first graders on gamified lessons to support use of collaborative learning in the whole school. The pupils continue coding by creating their own games and doing other exercises that the hour of code-website offers.

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NEW TECHNOLOGY IS BECOMING SMARTER AND MORE USER-FRIENDLY BENDING INTO MORE INDIVIDUALISED PURPOSES.

Smart eHealth and eCare Technology is “no-mans-land” due to its multidisciplinary nature. Very few people have adequate expertise and experience from all fields concerned – technology, healthcare and social sector. The lack of joint understanding has led to technology products not providing expected user-friendly solutions usable in real-life situations and service delivery systems.

This symposium tends, in its part, to offer a forum for multidisciplinary discussions enlightening the challenges and potentials from education, entrepreneurship, research and development points of view.

Smart Technology in Smart Use is the title of the 4th Master Symposium organised by Satakunta University of Applied Sciences (SAMK).

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