Madjid Fathi, Marjan Khobreh, Fazel Ansari
(Editors)

Professional Education and Training through Knowledge, Technology and Innovation

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Preface

The Pro-Nursing Symposium held in Bonn, on June 24 2016, has provided an international forum for researchers and practitioners in the field of vocational learning, technology enhanced learning, and particularly vocational education in the domain of healthcare and professional nursing. Within the symposium a wide spread of researchers and practitioners from seven European states joined us for exchanging novel ideas and concepts toward shaping the future of education and learning, especially in the domain of nursing. The symposium target groups were human resource and knowledge management researchers and educators as well as vocational colleges, schools, universities, industries, and voluntary bodies.

The present book consists of the papers which were peer reviewed and presented at the symposium. The book thematic coverage includes the following topics:

- Job-knowledge management
- Learning analytics
- Technology enhanced learning
- Gamification in vocational learning
- New trends in adaptive Testing
- Personnel selection
- Training validation

I herewith would like to express my sincere thanks to the project partners and associated partners of Pro-Nursing and also to the researchers who joined the event in Bonn.

Madjid Fathi

General Chair of Pro-Nursing Symposium

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Professional Nursing Education and Training - An Overview

Statement of the Pro-Nursing Project

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Introduction

The demand for highly qualified nurses of the European health sector is great and growing (World Health Organization, 2002). According to the Federal Statistical Office of Germany (DESTATIS), care dependency across Germany will be 50% in the 2007-2030 interval. In Germany about 38% of nurses are aged 50 or older (Bundeszentrale für politische Bildung/bpb, 2016). In light of these developments, medical institutions, as employers, are looking for qualified nurses (job applicants) who have acquired the required competencies. Specifically, they need knowledgeable employees who are able to perform particular tasks in a reliable manner over time.

The theme International Nurses' Day (IND) for 2016 is: Nurses - A Force for Change: Improving health systems' resilience (International Council of Nurses, 2016). In this way, the International Council of Nurses leads nursing society to consider the importance of changes and resilience in the evolving nursing environment. To develop a strong health system, six key building blocks are listed by the World Health Organization (World Health Organization, 2007). A well-performing health workforce who should be competent, responsive, and productive and a well-functioning health information system are two out the six key building blocks to establish a strong health system (World Health Organization, 2007).

Kruk et al. in 2015 defined three factors of resilience which are i) flexibility to easily modify the process in the organization; ii) adaptability to change in order to fit in the situation, and iii) learning to continuously transform the organization. The International Council of Nurses (2016) considers nurses to be critical to resilience.

Forecasting and considering evidences of change is vitally important, especially due to the rapid technological changes in the health sector and new experimental findings in pharmacology, which directly and continuously affect processes and nursing protocols. Nurses need to acquire new knowledge and various skills to be able to perform their

tasks. Once they face new tasks, for example, due to a technology change, they should advance their knowledge and obtain the associated new skills. The key points, here, are firstly, how to apply skills and knowledge in various task situations, and secondly, how to acquire missing knowledge (for a more detailed treatment of how knowledge, tasks, and competences are related, please refer to (Khobreh, et al., 2016)).

Work-based education and training has a considerable impact on improving the performance of nurses, and detecting and compensating existing lacks in the nursing knowledge domain. The participants of this process are nurses, medical supervisors (employers), and educators. Employing Information Technology (IT) solutions may be expected to lead to nontrivial improvements in the quality and effectiveness of work-based education and training. Such a system should not only comprise the systematic assessment of knowledge domains in compliance with standard curriculums and the provision of learning contents, but also, and perhaps more importantly ensure a match with the requirements of identified nursing tasks and associated processes.

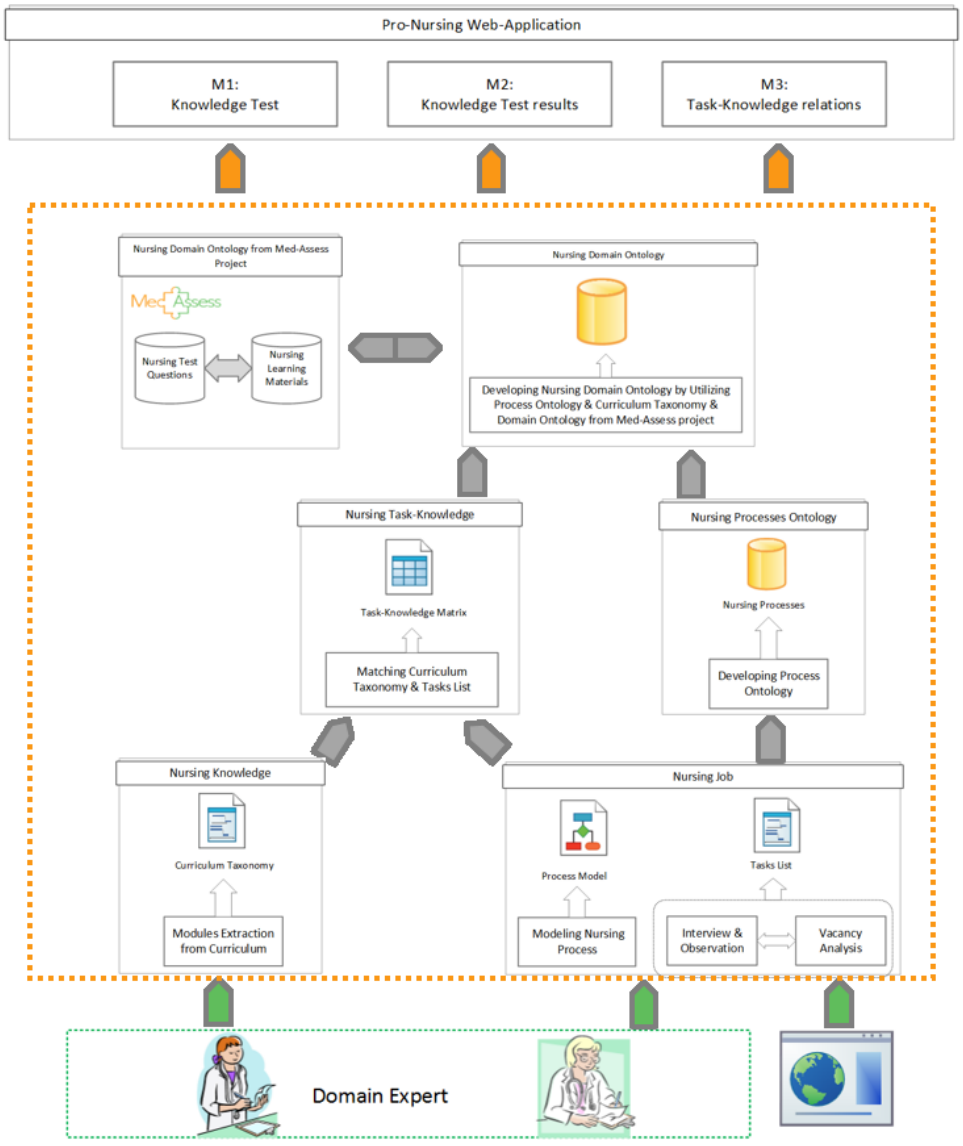

Figure 1. Pro-Nursing conceptual Framework

In light of these developments, Pro-Nursing aims at three main objectives; i) bridging between nursing tasks and nursing knowledge and representing the relation between them, ii) assessing knowledge levels of nurses and recommending appropriate learning materials to improve the knowledge gaps, and iii) monitoring the knowledge gaps of nursing inside the hospital (cf. Figure 1). To realize these objectives the Pro-Nursing web-based application, including an ontological back-end has been developed for supporting nursing students, professional nurses, and nurse educators. The Pro-Nursing application, hence, supports nursing educators and supervisors to ensure the quality of nursing care in the clinics and hospitals in the long run.

Methodology

To achieve the three aforementioned objectives of the Pro-Nursing project, which respectively represent the relation between nursing tasks and knowledge, assessing the knowledge level of nurses, and monitoring the nurses' progress the project went through three distinct steps:

- Systematic nursing job analysis and developing nursing process ontology
- Developing a nursing domain ontology
- Creating a task-knowledge matrix

Step 1: Systematic nursing job analysis and development of the nursing process ontology

Part of the Pro-Nursing project is to understand what tasks nurses are facing in their job. Tasks can be defined as clusters of activities or sequences of related activities directed as specified objectives. Tasks are a quite detailed way of describing the work and include action verbs, the object of the actions, the sources of information or instructions, and the results (Morgeson & Dierdorff, 2011; Voskuijl, 2005). The job analysis framework includes a way for collecting tasks based on the following criteria:

1. Existing vs. new methods: Based on cost and especially time considerations, rather than developing a completely new job analysis method (starting from scratch) we decided to draw from existing job analysis methods. This was expected to improve the quality of the Pro-Nursing job analysis, since there are several methods available in the job analysis literature that have already been developed with the aim of producing reliable and valid results.
2. Content: Since tasks are the focus in this part of the Pro-Nursing project, only known work-oriented methods for job analysis are eligible (as opposed to worker-oriented methods). This includes task inventories, functional job analysis (FJA), and the critical incident technique (CIT) (Brannick, et al., 2007). Task inventories are entail definining the population of tasks that are performed as part of one or more jobs (Brannick, et al., 2007). In contrast, FJA describes worker behaviors in terms of data, people and tings (Brannick, et al., 2007). The CIT is aimed at defining those instances of worker behaviour that distinguish effective from ineffective employees (Brannick, et al., 2007).

3. Expertise: Since the functional job analysis method is not available (only for trained consultants) (Brannick, et al., 2007), this method is excluded.
4. Level of detail: Since task inventories yield more detail than FJA, and at the same time are less context dependent than CIT (Brannick, et al., 2007), the former best met our purposes.

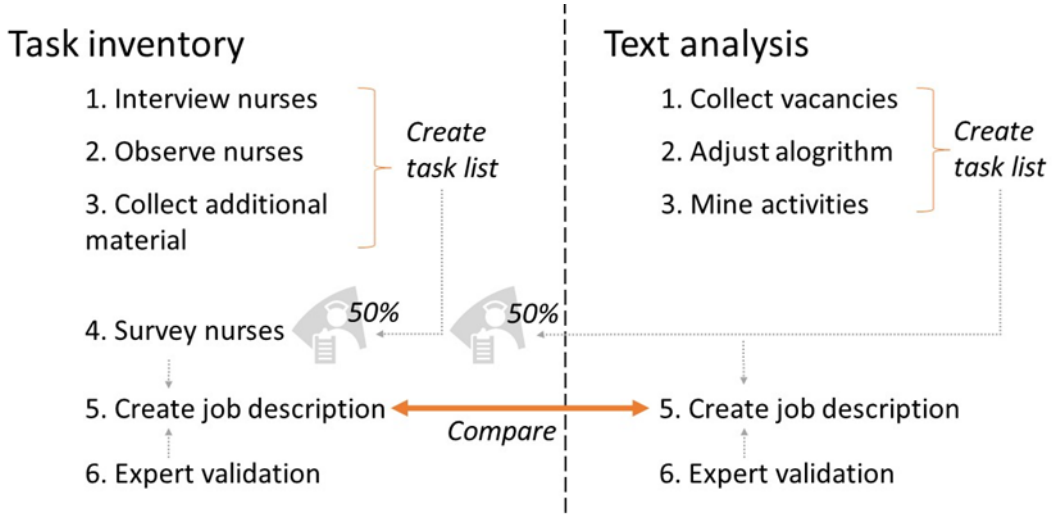

Figure 2. A schematic overview of step 1 (Task data) of the development process of a systematic framework for job analysis

In light of the fact that traditional methods of collecting job analysis data is at best cumbersome (Smith, et al., 2014), and at worst unreliable, the Pro-Nursing team also endeavoured to collect data from an alternative source, that is coming into vogue (McEntire, et al., 2006), namely job vacancies. Specifically, the job description field of these vacancies contains in depth information both about tasks and knowledge, skill, and ability prerequisites. Hence, in addition to collecting tasks through a task inventory at Beta Klinik, the Pro-Nursing team applied text analysis methods to vacancy data.

The result of observation, interview, and text analysis (cf. Figure 2) is the master nursing task list and nursing process model. The nursing process ontology have been formalized and implemented based on the results of this step.

The Nursing Process Ontology

A semi-automatic methodology has been worked out to extract and organize knowledge embedded in nursing processes, more precisely to formalize the nursing process ontology. Concerning formalization, the only thing that can be operationally handled is the piece of knowledge which is necessary to complete the given process stage. The BOC ADONIS modelling platform (BOC Group, 2013) has been used for implementing the process models. To enable the development of the process ontology, the semantics of ADONIS model elements have to be defined in the first step. Concerning formalization one can differentiate between a representation of ADONIS model language constructs

and a representation of ADONIS model elements. ADONIS model language constructs (like "activity"), as well as the control flow are defined in the ontology as classes and properties. Subsequently, the ADONIS model elements are represented through the instantiation of these classes and properties in the ontology. The following classes and relations have been defined in the metamodel of the process ontology: *Process stage*, *Actor*, *IT systems*, *Data object*, *Parallel*, *Merge*, *Decision point* classes and *followed by*, *performed by*, *uses system*, *uses input*, *produces output* relations (Ontology-based compliance checking on higher education processes, 2013)In the next step process models are exported into the ADONIS XML format. Every object from the process model forms an 'instance' in the XML structure, the attributes have the tag 'attribute', while the connected objects (such as the performer, or the input/output data) have the tag 'interref'. In the following step the "conceptual models - ontology models" converter maps the Adonis Process Modelling elements to the appropriate ontology elements at the meta-level. ADONIS model elements are expressed as a classes in the ontology and their corresponding attributes as attributes of the given class. This transformation is carried out by the means of the XSLT script that performs the conversion. A detailed explanation of this methodology is presented by Ternai and her colleagues (Corporate Semantic Business Process Management, 2016).

Step 2: Developing Nursing Domain Ontology

Besides collecting "what a nurse does at work", the Pro-Nursing curriculum analysis team collected information on "what a nursing student should learn at school". As Figure 3 shows, the nursing knowledge taxonomy has been defined based on the nursing curriculum of the North Rhine-Westphalia (commonly shortened NRW[1]) state of Germany. Each federal state of Germany has its own curricula in nursing, therefore, there is a need to identify these curricula and consequently use one or a combination of them as the reference for the project.

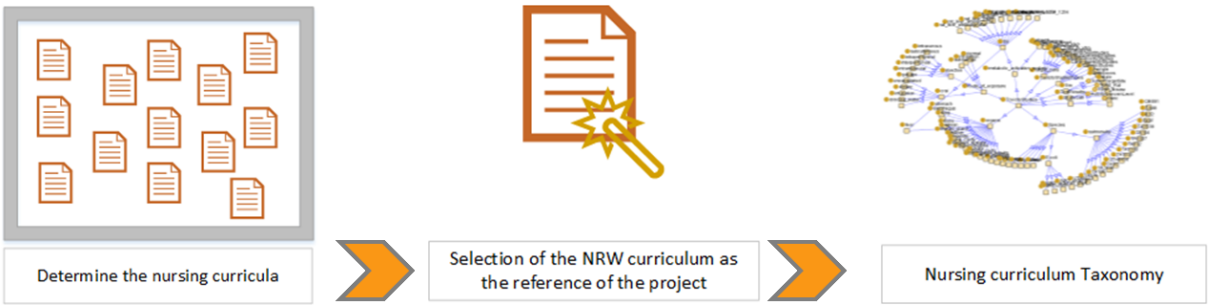

Figure 3. The process of creating the nursing curriculum taxonomy

The Pro-Nursing knowledge taxonomy consists of three levels; the learning area includes three nodes, sub-area includes 10 modes and content includes 60 nodes. The taxonomy has been used as a basis of wording and structuring the nursing domain ontology. The basis of the nursing domain ontology which was purified and enriched in the

[1] www.land.nrw

Pro-Nursing project was originally developed in the Med-Assess[2] project funded under Leonardo Da Vinci programme-EU. The Pro-Nursing project is the descendent project of Med-Assess which ran between 2012 and 2014 and received Theta awards for person-job-fit in 2015[3].

The Nursing domain ontology has been implicated based on the results collected in step one as nursing tasks and process and also the curriculum taxonomy.

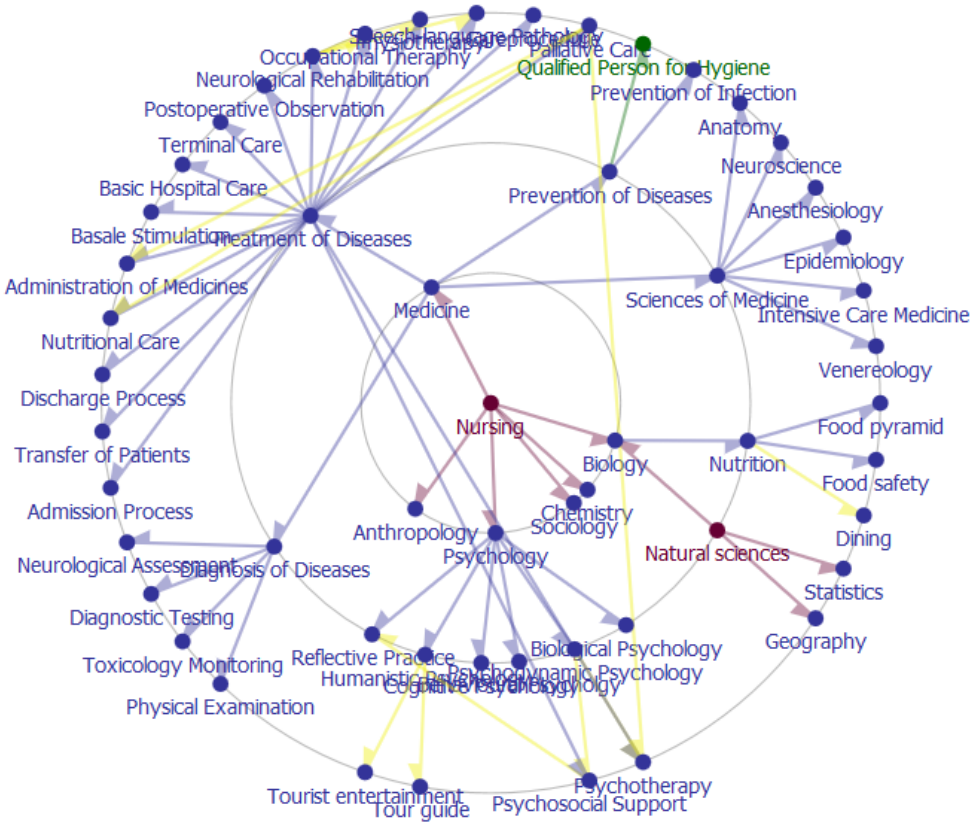

Figure 4. Part of the Nursing Domain Ontology

Nursing domain ontology

The Nursing domain ontology has been constructed in such a way so that it can efficiently support knowledge testing. Accorddingly, our solution applies the following domain concepts and relations: "The *Knowledge Area* class is at the very heart of ontology, representing major parts of a given domain. Each knowledge area may have several sub-knowledge-areas through the *HasSub-knowledgeArea* inclusion relation. Not only inclusion relations, but order relations connecting knowledge areas in a non-hierarchical way are also important as far as knowledge testing is concerned. In the ontology order is described by the *RequiresKnowledge Of* relation. In order to enable effective knowledge testing, the internal structure of knowledge areas also has to be described in detail. Elements of the *Basic concept*, *Theorem* and *Example* classes form the internal structure of a

[2] www.med-assess.eu
[3] www.cut-e.com/about-us/press-releases/news/article/777/cut-e-announces-winner-of-the-theta-award-2015/

knowledge area. The *HasPart* inclusion relation connects knowledge areas with their knowledge elements. In order to comprehensively describe the internal structure of the knowledge areas relationship between basic concepts, theorems and examples also have to be identified" (Vas, 2016). A part of the implemented Nursing domain ontology is represented in Figure 4.

The nodes of the domain ontology have been populated with test questions and respected learning materials. The domain expert of Pro-Nursing provided the required test questions and learning materials.

Step 3: Creating the task-knowledge matrix

The task-knowledge matrix is created to connect the world of labour to the world of education. To approach "that which is required on the job" and "that which is taught in VET" (Khobreh, et al., 2016), the first and second steps of the pro-Nursing are defined. Here the question is: "how are the tasks and knowledge related" (Khobreh, et al., 2016). In this way, the Pro-Nursing team included, end-users, domain experts, an ontology engineer, who provided the structure of the task-knowledge matrix, and a knowledge engineer, who extracted knowledge from the domain experts and also hard sources.

As Figure 5 shows, the matrix consists of a column of main tasks which is sub-divided into sub-tasks and rows of learning areas as the main knowledge domain includes the sub-knowledge and in a detail level content. The matrix, therefore, is represented in "n×m" dimensions, where "n" is the number of nursing tasks and "m" is the number of nursing knowledge domains. The cells of the matrix are valued in Likert format to identify the range of the answer to the question "How important is this knowledge domain for the performance of this task?" The answer can be 0 = Not Important At All, 1 = Of Little Importance, 2 = Of Average Importance, 3 = Very Important, 4 = Absolutely Essential. In this context, the relation between tasks and knowledge has been tangibly described by the domain expert.

			$Task_1$			$Task_n$		
			$sub-task_{1.1}$	$sub-task_{1.2}$	$sub-task_{1.x}$	$sub-task_{n.1}$	$sub-task_{n.2}$	$sub-task_{n.y}$
$Knowledge_1$	$sub-knowledge_{1.1}$	$content_{1.1.1}$	0	1	4	3	4	2
		$content_{1.1.2}$	1	2	3	0	3	0
	$sub-knowledge_{1.2}$	$content_{1.2.1}$	4	3	2	1	2	1
		$content_{1.2.2}$	3	2	1	1	0	0
		$content_{1.2.3}$	0	0	1	2	4	4
	$sub-knowledge_{1.x}$	$content_{1.x.1}$	0	1	4	4	0	2
		$content_{1.x.1}$	1	3	2	3	2	1
$Knowledge_m$	$sub-knowledge_{m.}$	$content_{m.1.1}$	2	1	1	0	1	0

Figure 5. Pro-Nursing Task-Knowledge Matrix

Pro-Nursing Application

Pro-Nursing mainly provided two kinds of results; a knowledge-base including nursing tasks, nursing knowledge, and test questions and learning materials, and the web-based

application, including the functions for the end-users to assess their knowledge levels, monitor the knowledge level of nurses in hospitals and nursing students at the schools by supervisors, and visualizing the relation between nursing tasks and knowledge.

Module I: Assessing the Knowledge Level by Studio

In STUDIO such knowledge assessment methodology has been worked out that enables the exploration of a test candidate's knowledge gaps in order to help them by complementing their training or educational deficiencies. Accordingly, the Adaptive Test Engine in STUDIO exploits the advantages of ontological descriptions of the nursing domain. Every test question resides is connected to one specific concept in the ontology. In the course of testing the Adaptive Testing Engine "walks through" the ontology structure and asks questions concerning each affected ontology concept. In this way the test candidate's knowledge of a certain set of concepts can be evaluated. The testing procedure starts the examination at the top of the hierarchy, meaning that those concepts are tested first that have no parent concepts in the given sub-domain. This means that testing typically starts with the evaluation of most general and comprehensive concepts. In the next step sub-areas of these comprehensive concepts will be tested. Only if the answers given to these questions are also correct, will the top level knowledge area be considered as "accepted" (otherwise it's considered as "rejected") The process continues until even the most detailed (bottom level concepts) are reached. In other words the testing engine executes a depth first graph search algorithm in such manner that it closes a branch if the test candidate does not know the given knowledge area or its sub-knowledge-areas and/or given basic concepts at an adequate level (Vas, 2016). Figure 6 shows the result page of "Test your Nursing Knolwdge" function.

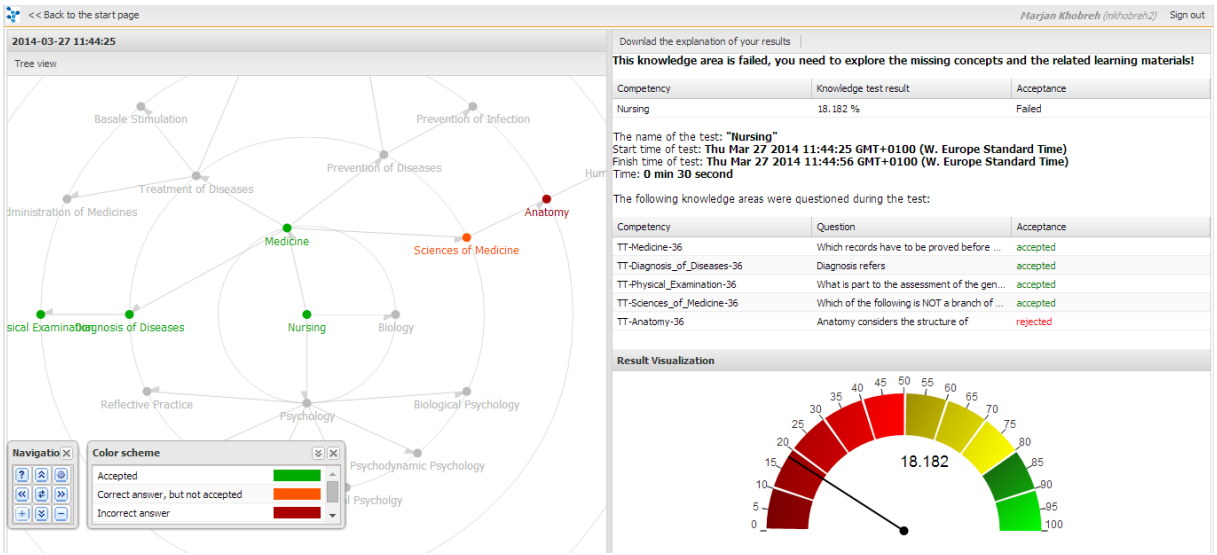

Figure 6. Result page of "Test your Nursing Knolwdge" function

Module II: Monitor Knowledge Level of your Nurses

Furthermore, the Pro-Nursing application provides the opportunity to monitor the knowledge levels and the progress of improving knowledge of nurses. In this way, not

only the nurses who need more training courses will be identified, but also knowledge areas for which the majority of nurses have a knowledge gap will be determined to arrange specific training workshops and/or improve the curriculum. The results are depicted and presented in graphical forms as Figure 7 shows.

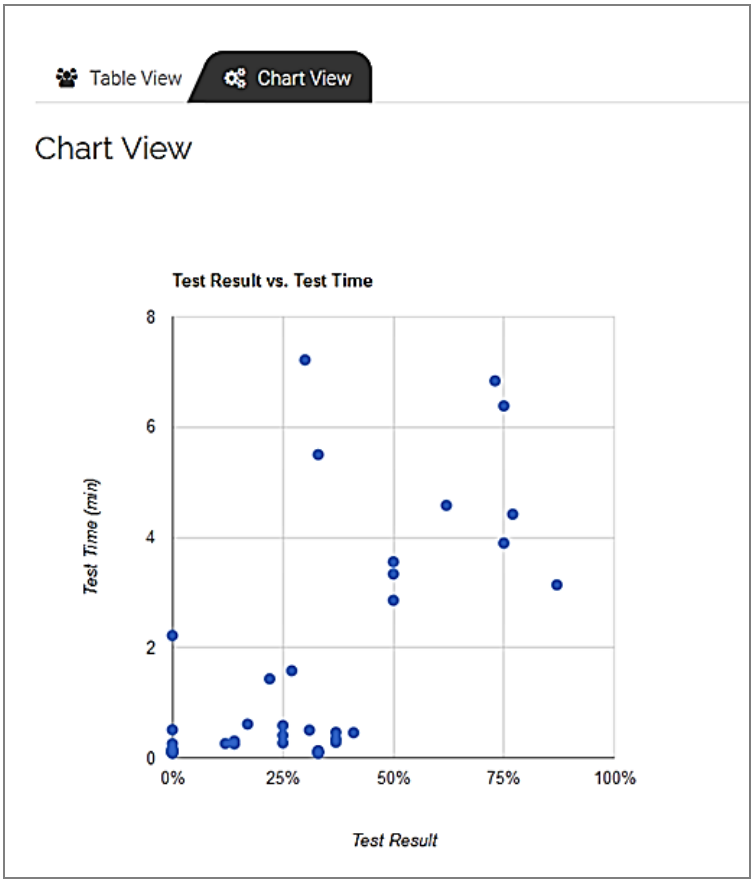

Figure 7. Chart View of "Monitor Knowledge Level of your Nurses"

Module III: Browse Nursing Tasks and Knowledge

The visualization of the relation between nursing tasks and knowledge provides the opportunity to identify “what knowledge is required to be able to perform a specific task”. In this module, the user may follow two directions. “Find Knowledge Using Tasks” allows the user to browse nursing tasks and receive nursing knowledge, which qualifies the user to perform the selected task. “Find Tasks Using Knowledge” allows the user to browse nursing knowledge and receive nursing tasks, which the selected knowledge qualifies the user to perform them. Figure 8 shows the result of selecting a task domain, a specific task and consequently receiving the needed knowledge to perform the selected task.

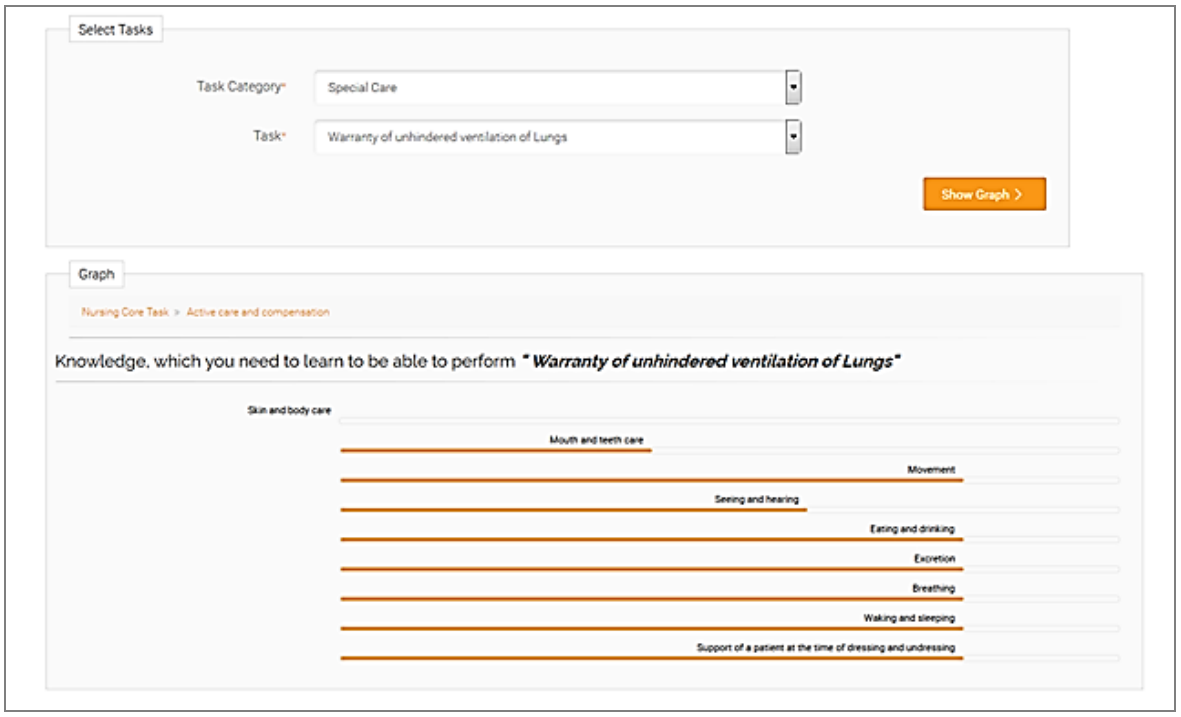

Figure 8. Find Knowledge Using Tasks

Figure 9 illustrates the function of "Find Tasks Using Knowledge". In this stage, after selections of knolwdge main section, section and content, the tasks required the selected knolwdge are listed.

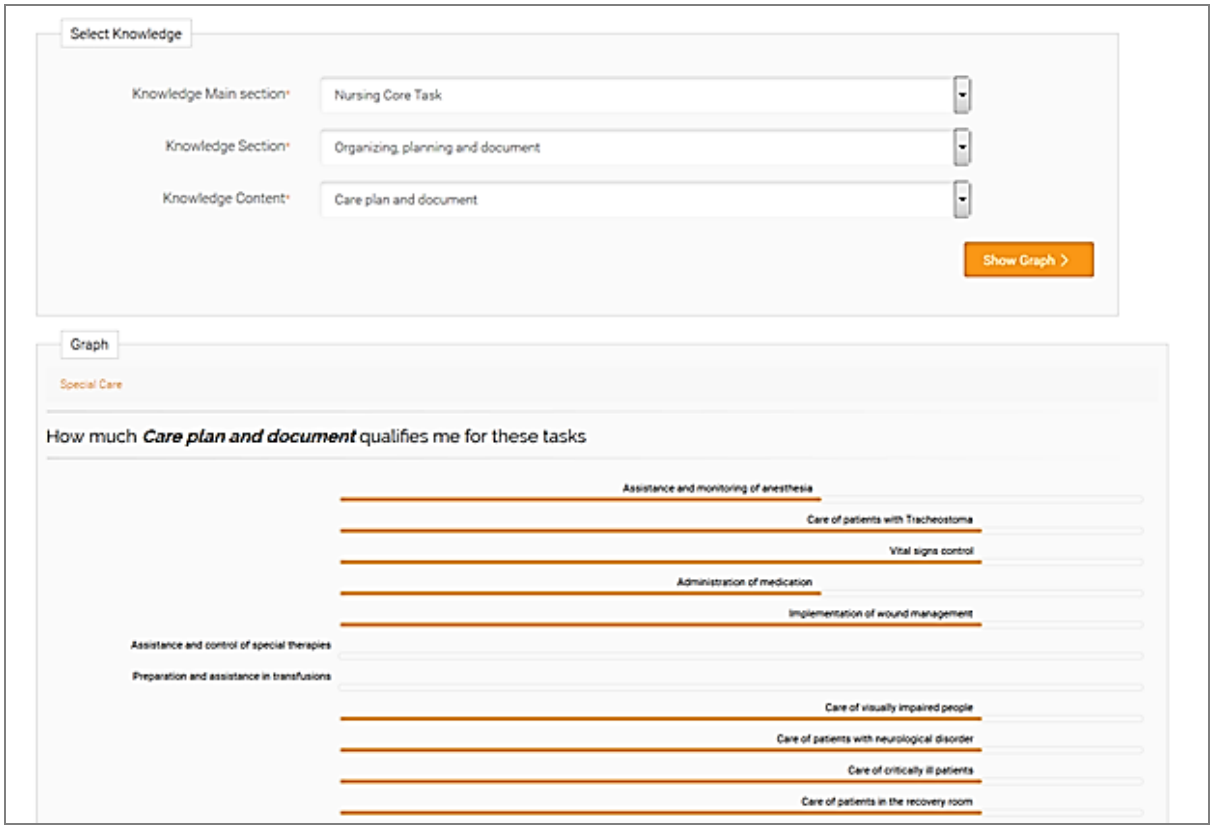

Figure 9. Find Tasks Using Knowledge

Future of Pro-Nursing

The Pro-Nursing project lays the ground of future research on nursing domain. Considering the trends to Industry 4.0 characterized by emergence of novel technologies which may enhance nursing and also confronting societal challenges such as the refugees crises and ageing society across Europe, we assume a transition of nursing society into a new cahllenging era which will raise demand to integrate migrant nurses into nursing systems, to utilize novel technologies such as cyber physical systems, augmended reality, and mobile technologies. Thus, the main responsibility of Pro-Nursing community is to consider the well alignment with future changes in nursing domain, and ultimately to respond the changes by further developing Pro-Nursing system, especially by enhancing its technology readiness level and maturity for supporting nursing society to overcome long-term challenges and associated organizational and technological risks.

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Emerging Skill Needs in Health Care and the Future of Nursing

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Introduction

As European society greys, healthcare and related social services are becoming increasingly important. The demand for those services that are provided by the public sector in many EU countries is creating unprecedented pressures on health care systems. To mitigate these pressures, the sector needs personnel with the right skills and competence.

New care needs, the expansion of health information technology and telemedicine will impact on the nature of skills demand in the sector: rising requirements of e-skills, clinical knowledge and the creation of new roles for medium and lower qualified professionals, for example in geriatric care and eHealth workers in clinical, social care, informatics and administration. Besides, health professionals increasingly need broader soft skills such as communication, team building to work interprofessionally in multidisciplinary teams.

This contribution sums up future challenges for the healthcare sector in Europe with a focus on new skills required by nurses. In the context of recent EU policy initiatives technology enhanced learning and interprofessional collaboration in nursing education are suggested to mediate task shifts, changing roles and new skill-mixes to respond to growing practice requirements in the field.

Healthcare sector - Challenges Ahead

In addition to the effects of de-industrialisation, tertiarisation and increased globalisation, skill-biased technological change (SBTC) has also been identified as influential for the demand for skills and has led to a demand shift towards high-skilled workers in Europe. The main idea behind the SBTC thesis is that the work of higher skilled workers is supported by new technologies such as ICT in a way that makes more educated workers more productive. Regardless of the degree of technological innovation in the European health sectors, skilled labour availability has an uncertain future. Technological innovation will impact the labour force: it will improve the working conditions by providing assistance for difficult and repetitive tasks, and it will require more highly skilled and technologically trained personnel (Dunkel, 2010).

Health IT (HIT) has created massive shifts in how health care professionals and patients gather health and medical information to make decisions. HIT has the capacity to transform care delivery, improve quality, decrease costs and reduce medical errors. But plan-

ning and implementing such technology, and foreseeing its effect on the skill formation and employment is a challenge (Abbott & Coenen, 2008).

Often personnel lack adequate skills both prior to entering the profession or as continuous career development. Vocational qualifications can facilitate entry-level career opportunities and open pathways to higher education to alleviate these shortages. Links between educational institutions and the employment system should be enhanced to prepare entrants to the employment system for existing careers options and to properly respond to changing labour market needs.

According to the European Commission there are growing concerns about a shortage of nursing and caring professionals in the EU. All European countries face major challenges with increasing health workforce shortages due to: an ageing health workforce, a relatively high proportion of nurses and caring professionals move from employment into retirement, difficulties to recruit and retain healthcare staff, and unequal distribution of labour force. Presently, nurses are mainly hired by employers to fill vacant positions rather than to provide specific skills, perpetuating an employment pattern that is insensitive to different and potentially more efficient skill mix configurations. One consequence of future demographic developments is that the number of elderly persons (aged 65 and over) in the EU-28 is forecast to increase by almost 60 % during the period 2014–54 (Eurostat 2014; EUROPOP 2013 main scenario). European healthcare systems will therefore need to anticipate future skills in order to match the supply of health professionals.

The health sector comprises hospitals, general and specialist medical practices, health clinics, medical laboratories, as well as dentistry. It involves personnel primarily delivering healthcare services such as health professionals (doctors, nurses, midwives, paramedics, pharmacists and dentists), health associate professionals, public health professionals, health management and administrative and support staff. Healthcare is highly labour intensive and one of the largest economic sectors in the EU – accounting for more than 17 million health and social care workers, including more than 13 million women, the health care sector accounts for an estimated 10% of all jobs in the EU (EU Skills Panorama, 2014).

Around 1.8 million new jobs are anticipated in health and social work between 2015 and 2025 (+7.8%) (Cedefop, 2016). However, the European Commission estimates a shortfall of around 1 million healthcare workers by 2020 due to retirement of the ageing workforce, shortages of specialist skills and inadequate health labour force distribution in many EU countries and regions rising up to two million if long term care and ancillary professions are taken into account (European Commission, 2014). There is also evidence that the cost containment measures to reduce public expenditure are strongly affecting the recruitment and retention of health care staff and in particular nurses, the largest health profession, in almost half of EU28 (European Commission, 2012a). This implies concerns over impacts on patient safety and quality of care. Health professionals are already among the top five occupations in the EU and, there is greater level of skills

mismatch among health professionals compared to other technical and professional occupations (OECD, 2016).

The New Skills Agenda for Europe at the Policy Level

The European Commission has adopted a New Skills Agenda in 2016. The aim is to ensure that the right training, the right skills and the right support is available to people in the European Union so that they are equipped for good-quality jobs and can fulfil their potential as confident, active citizens. It is expected to boost employability, competitiveness and growth in Europe by

- improving the quality of skills and their relevance for the labour market
- making skills more visible an comparable
- improving skills intelligence and information for better career choices (European Commission, 2016a).

In particular the action "Digital skills and jobs coalition" brings together Member States and education, employment and industry stakeholders to develop a large digital talent pool and ensure that individuals and the labour force in Europe are equipped with adequate digital skills.

In context with new healthcare skills the Action Plan for the EU health workforce adopted in 2012 covers forecasting of health workforce needs and workforce planning by a Joint Action, better anticipation of future skill needs and skills mixes in the healthcare sector, the development of good practice to improve recruitment and retention rates of health professionals, mitigating the negative effects of migration on health systems and the support of Member States in the implementation of the WHO Global Code of Practice on the international recruitment of health workers (European Commission 2012a).

Alongside the European Commission's eHealth Action Plan 2012-2020 provides a roadmap to empower patients and healthcare workers, to link up devices and technologies, and to invest in research towards the personalised medicine of the future. eHealth is defined as "the use of ICT in health products, services and processes combined with organisational change in healthcare systems and new skills, in order to improve health of citizens, efficiency and productivity in healthcare delivery, and the economic and social value of health. eHealth covers the interaction between patients and health-service providers, institution-to-institution transmission of data, or peer-to-peer communication between patients and/or health professionals" (European Commission 2012b, p.3). The EU eHealth Action Plan clarifies the policy domain and outlines the vision for eHealth in Europe, in line with the objectives of the Europe 2020 Strategy and the Digital Agenda for Europe. This means providing smarter, safer and patient-centred health services. Continuous professional development (CPD) has become a keystone of professional practice across all qualifications. The Action Plan for the EU health workforce addresses CPD as a tool to maintain patient safety within the context of cross-border mobility of health professionals and patients in the EU.

This underlines the importance of developing an adequate skills formation and the swift adjustment of training curricula to ensure a skilled healthcare labour force capable of meeting new healthcare skill needs in Europe.

Regulation, Mobility and Recognition

The EU constitutes a distinctive legal environment for health professional mobility. Regarding the health professions, the most important is Directive 2005/36/EC on the recognition of professional qualifications (Official Journal, 2013). As certification of qualifications and skills in the health care sector is regulated this Directive – modernised in 2013 – ensures portability of qualifications of medical doctors, dentists, registered nurses and midwives and facilitates the mobility of these professionals within the EU.

Mobility and migration can be seen both as a cause of and a solution to staff shortages. Mobility (i.e. within the EU) can prove beneficial for those countries that welcome professionals from other Member States but at the same time it can create staff shortages in the countries of origin.

Buchanan et al. argue that freedom to move has its benefits, but it also has some limits. The economic crisis led some countries restricting entry requirements for health professionals, but this national policy change has been directed at non-EU-trained workers. This resulted in rebalancing the level of EU and non-EU health professional flows into some countries in the region, with a relative increase in EU flows, which cannot be controlled to the same extent at national level and led to an unequal distribution (Buchanan et al., 2014, p.8).

Task Shifts, Changing Roles and Skill-mix at Different Qualification Levels of Nursing

Europe faces an accelerating transformation in both the education environment and health settings. The growing field of specialised health care education is an example of an important response to this change. New care patterns with shift to care closer to home and to cope with elderly patients with multiple chronic conditions are accompanied with the growth of emerging technologies, new medical appliances and diagnostic techniques. This has implications for both nurse educators and leaders as well as implications for knowledge transfer between novice and expert nurses.

Nursing students need to be taught how to synthesise facts to make nursing diagnoses and select a course of action between different alternatives. Many nurses, however, lack a systematic framework to support them distinguish clinical noise from the clinical data that signals risk; a crucial factor in nursing errors (Levett-Jones et al., 2010; Thompson et al., 2008).

Nurses' skills regarding clinical reasoning differ according to their experience and domain-specific knowledge. While novice nurses can only identify a few patient cues, have limited capability of putting them together to detect patterns and have difficulty in iden-

tifying complex diagnoses, expert nurses, can draw from prior experiences when challenged with complex issues and apply informal learning to solve them. Yet, they find it difficult to explicit their thinking and explain cognitive processes that seem rather tacit and implicit.

A considerable amount of work traditionally associated with medical doctors will be moved to specialised paramedical staff. Healthcare services become more patient-centred, therefore demand for more specialised medical skills which support integrated-care management will rise. Training arrangements must thus be developed to address these needs. Moreover, health information technology (HIT) changes the clinical practice; leads to redesign of the roles and skill mix of the health care labour force and the ways in which multidisciplinary teams will work together.

Nursing tasks cover a broad range from health promotion, to disease prevention, to co-ordination of care, to cure and to palliative care. Yet, primary nursing education focuses predominantly on the acute care knowledge domain, with learners mastering the care of acute chronic diseases rather than care management of complex chronic illnesses. Care coordination and management are skills demanded more and more. They are not an integral part of the classroom and clinical activities of nursing students and represent an example of a changing role that nurses have assumed through work based learning in delivery settings.

Sochalski and Weiner (2011, p. 385) suggest the new practice environment – in which a considerable amount of nursing and medical care is mediated and supported within an interoperable 'digital commons' – will support and potentially even require a much more effective integration of multiple disciplines into a collaborative team focused on the patient's individual needs. Likewise, interoperable electronic health records (EHRs) linked with personal health records and shared support systems will affect how these teams work and share clinical activities.

Dubois and Singh (2009) show that achieving optimal 'skill mix' options requires taking a much more dynamic approach to labour force by exploring the full range of skill flexibility and skill development that could lead to newly configured roles and more effectively deployed staff. This process would involve identifying and confronting any institutional and regulatory barriers to achieving the staff configurations needed to meet the cost and quality outcomes of these delivery system innovations.

Technology-led change of roles and responsibilities of health team members as Sochalski and Weiner (2011) argue could significantly affect the skill mix of the team and of nursing in particular. For example, HIT or other technological innovations may allow health care workers with less training to move into expanded roles with efficiency gains while maintaining quality, e.g. laboratory technicians moving into clinical lab monitoring from which nurses exit as they assume new roles in care management – also changes the skills mix of health team members substantially.

Changes in health service delivery reveal a greater degree of specialisation and lead to the creation of new job roles and the up-skilling of existing health occupations. A registered nurse (RN) can assume various roles during her career ranging from Labor and Delivery Nurse, Nurse Anesthetist, Patient Educator, Chief Nursing Officer, Critical Care Nurse, or Clinical Nurse Manager.

Consequently, some European countries have developed new occupational profiles according to the changed roles and up-skilled existing ones to better deal with some of the more routine tasks that doctors would traditionally undertake. For example, in Belgium, it has been noted that nurses in future will increasingly take over some general tasks from doctors (Fédération des maisons médicales, 2012). In the UK, nursing has become increasingly professionalised with new entrants required to have undertaken degree-level study. New roles such as nurse prescribers and nurse consultants have also been introduced to streamline the management of both minor illnesses and long-term conditions (Royal College of Nursing, 2014). This has also been associated with grow in ancillary occupations in health, such as the healthcare assistant.

In some countries there is a clear distinction between the operational fields of nurses (e.g. employment areas, tasks and duties, required skills, pay, independence and work organization, EU-mobility). This differentiation is subject to regulation. The title “nurse” is protected by law and is associated with higher level education. This leads to a differentiation in levels of responsibilities and competence and has implications for horizontal (further education at the same qualification level) and vertical (linking to higher levels: general nurse/RN, BA, MA, Ph.D) permeability.

In Germany, the vocational training for a “Healthcare Assistant” is a rather low (one year) qualification. This qualification is generally accepted to entry in a “Registered Nurse” course (three years qualification). However, due to the elementary character of the curriculum of “Healthcare Assistant”, this qualification is not recognised in many of the federal states. Therefore a different vocational training with a minimum duration of two years to obtain the qualification of “Nursing Practitioner” is proposed by stakeholders instead of the “Healthcare Assistant”, because this qualification is not entirely recognised and is considered as a basic qualification in health care. The “Nursing Practitioner” is a more professional than that of “Healthcare Assistants”. “Nursing Practitioners” can help reduce the current shortage of well qualified practitioners in health institutions like hospitals and also in residential care homes for the elderly. “Nursing practitioners” could more easily obtain the special competence and specific skills that are necessary to begin a further vocational training to obtain the status as a “Registered Nurse”. For hospitals, clinics and elderly residences that also mean that they can better ensure a coherent qualification process and finally win them as permanent staff members (CONTEC, 2014). A nursing reform with a focus on a generalist approach is presently discussed in Germany (Deutscher Bundestag, 2016).

Better digital skills with technology enhanced learning

The use of technology in nursing training and education has significantly changed teaching strategies and will continue to challenge nurse educators in the years ahead. The digital age is here to stay and the rapid growth of the digital age will continue. Here technology enhanced learning (TEL) comes at stake. TEL as understood by Health Education England (2016, para 2) "uses technology as part of the learning process. That use needs to be effective and appropriate in order to enhance the learning of healthcare professionals for the benefit of patients. There is clear evidence that innovative educational technologies provide opportunities for health and social care students, trainees and educators to acquire, develop and maintain the essential knowledge, skills, values and behaviours needed for safe, effective patient care. Such technologies include m-learning (mobile learning), e-learning, simulation, virtual and augmented reality technologies and many more".

Simulation may be used to provide synthesis to the training experience, whereby the students apply their knowledge, develop their skills, and acquire the experience necessary to complete the training. For this reason, simulation based on deliberate practices should be an educational characteristic that is carefully integrated alongside other educational events, clinical experiences, problem-based learning, and others. Learners may be introduced to simulation at an early stage of their curriculum to assess their level of practice and their psychomotor skills and, at a further stage, they may get involved in more sophisticated scenarios as the complexity of both their knowledge and the competence to be developed during training increases (Simbase, 2013). Simulation – that fosters problem-solving and critical-thinking skills in nurses will be essential for nursing education to produce sufficient numbers of competent, well-educated nurses.

Technology progress allows nurse educators and leaders to envisage new and innovative methods of preparing professionals for their changing roles without putting patients at risk. TEL simulations may offer a number of visual cues, some more significant than others, allowing the students to practice choosing whether or not to act on them, and practice identifying patterns. The learners are required to ask the right questions at the right time to obtain the relevant data regarding the patient's status and the environment. The Clinical Reasoning Cycle (CRC) Model as conceived by Levett-Jones et al. (2010) may be embedded in a scenario offering a variety of exercises to trigger the learner to consider the different steps in the cycle. It is anticipated that it is through the interactions with the virtual patient and environment that the learner will begin to systematically apply the CRC model and practice prioritising interventions.

Nearly all future jobs will be digital and emerging technologies require new skills. Educating a future skilled labour force and reskilling the current is a massive challenge that can only be addressed if governments, industry, educators, education and training providers, and all other relevant stakeholders work together in a strategic partnership. Digital skills relate to the capacity of all within healthcare to become and to stay technologically literate. This is to enable nurses to learn, work and develop effectively in a digital

work environment. TEL, particularly educational serious games, aims at immersing the learners in the system towards obtaining knowledge, developing their skills and learning. The human computer interaction placed the user in the centre to provide the system for the needs of the end-users and to pursue them to engage with what they need from the system. Thereby, the educational games enable learners at the same time to enjoy and to learn more through a user-centred approach. Testing-out various clinical reasoning pathways based on patients' signs and environmental cues allows the practitioner to become more aware of how they reason and recognise consequences of this reasoning on action. With limited opportunities to practice real-life care outside of acute-care settings, serious games could become an important tool offering a safe, consistent and efficient learning experience for health care professionals suggest Petit dit Dariel et al. (2013).

In the future nursing practice in each setting where it is rendered will have a significant digital dimension around a core electronic health record (EHR). Biometric data collection will increasingly be automated and diagnostic tests, medications and some therapies will be computer generated, managed and delivered with computer support. Patient histories and examination data will gradually be collected by devices that interface directly with the patient and automatically stream into the EHR. Therefore, it is important to integrate technology into nursing curricula. The rapid expansion of e-learning environments has increased the need to bridge the gap between the generational cohort of many teachers and that of today's learners. Educators need to remain update with developments in technology enhanced learning. Increasing numbers of students are entering nursing through the widening participation route. Here bridging programmes and seamless educational pathways may offer opportunities for increasing the overall diversity of the student body and nursing school regarding ethnicity, geography, social background, and personal experience.

Health care technology advancements connect developed and emerging markets – and participants along the health care value chain. Applying health information technologies such as EHRs, telemedicine, mobile health applications, and electronic medical prescriptions is driving change in the way doctors, nurses, patients and other sector stakeholders interact. New technologies such as genetics and genomics, less invasive and more accurate tools for diagnosis and treatment, 3-D printing; robotics, and biometrics will change the practice of nursing in the coming years. New skills required of nurses to aptly respond to these technologies include knowledge acquisition and distribution, being capable to use technology to facilitate mobility, communication and relationships.

The Future of Nursing Education

In the near future nurses will fill extended roles and need to master technological tools and information systems while collaborating and coordinating care across teams of health professionals. While Health IT will have its greatest influence over how nurses plan and document their care, all aspects of care will be mediated increasingly by digital

workflow, knowledge management, and decision support. New nursing education focuses on collaboration within the profession and across other health professions, communication, and systems thinking, and highlights interprofessional and team-based education and practice. Nurse leaders must envisage how emerging technologies will change nursing practice and design the educational models and skills development programmes necessary to assure that nurses will have the competence they need to cope with these emerging technologies (Institute of Medicine, 2010).

Across diverse work settings, nurses have to coordinate care and collaborate with a variety of health professionals, including medical doctors, social workers, physical and occupational therapists, and pharmacists, most of whom hold higher academic degrees. Hence, nurses should be enabled to achieve higher levels of education and training through an improved education system that is permeable to higher education. Nursing education together with other health professional schools should design and implement early and continuous interprofessional and interdisciplinary collaboration through joint classroom and clinical work-based learning opportunities. Thus, they should become full partners with medical doctors and other health professionals in reshaping health in Europe.

Health professional education and training through knowledge, technology and innovation places greater emphasis on:

- interprofessional education and practice;
- preparation and assessment of graduates with skills that support lifelong learning;
- increased diversity in continuing education methods and self-learning opportunities;
- greater use of technologies to deliver evidence-based information and assess changes in practice;
- application on the job.

Nurses are in the epicentre of balancing advancing science, transferring and applying research, and caring for patients across various settings. Preparing nurses to achieve this balance is a critical task. Amongst the challenges nurses will face is reconciling the conditio humana with technology, i.e. integrating new technology with the caring part of nursing. This also includes helping to establish the ethical conduct of technology application in healthcare practice. The education system should ensure that nurses have the right knowledge, skills and competence they need to provide healthcare in the future.

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Bridging Work-Based Education and the Labour Market

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Abstract of Keynote Speech

Higher education (HE) institutions has an important and proactive role in society. They participate in creating new knowledge, in transferring it to students, re-training employees in companies, and can be fostering service and product innovations. Thus, the HEIs cannot work isolated from the surrounding word. In concrete collaboration between labour market and HEs takes place at different levels in HE: policy, institutional and individual.

At policy level the collaboration between HE and businesses refers international and national strategy papers. In EU the HE – world of work -collaboration has been in the EU's Agenda for "Modernising Higher Education" (Healy, Perkmann, Goddard, & Kempton 2014). The EU policy paper reaches the level of individual by referring the importance of pedagogical skills and the development of courses relevant to social and labour market needs (High Level Group on the Modernisation of Higher Education 2013). At institutional level, collaboration refers to an impact on graduates' employability and to making the studies more working life relevant, by producing competent workforce. This asks for identifying the strategical clients and partners and making the contracts between the partners indicating the collaboration actions and benefits for both sites. In the individual level cooperation is embedded in various pedagogical practices and curriculum solutions developed by teachers in collaboration with labour market actors (Kallioinen 2008). Griffiths and Guile (2003) have analysed cooperation between HE and enterprises related to the curriculums. They found four forms of collaboration and concluded to present an ideal fifth form as a solution. Characteristic to this fifth form, which can be called 'partnership', is continuity, trust, mutual aims, boundary-crossing and the development of shared activities. In this form all the actors share the same aims and work towards them together, by using their own skills and competences as in a Community of Practice –model developed by Lave and Wenger 1991. For students, study processes that timeliness intertwine school-based and work-based learning, are motivating, while they can test and assess theories in practice, practice complex skills and develop deep conceptual understanding together with participating into the communities of practice.

This paper describes three separate surveys analysing the collaboration between HE and labour market. And according to the results, discusses the benefits and practices of the collaboration especially from the social and health care education aspect.

The data in all the surveys were collected by using internet poll and were analysed both quantitatively and qualitatively. First survey was sent to the members of a trade union, who were graduated from the universities of applied sciences (UAS) Finland (N=5405) (Väänänen, Laitinen-Väänänen, & Vanhanen-Nuutinen 2013) as part of a national development project. This survey indicated that collaboration with social and health care is mainly based on internship and thesis-processes and the collaboration with HE helps to recruit new employee, gain new knowledge and competences. However, the alumni's role in supporting the collaboration was minimal.

Second survey focused on analysing the entrepreneurs' opinions on the collaboration between companies and the UASes in Finland (N=1488) (Vanhanen-Nuutinen, Laitinen-Väänänen, & Ahmaniemi 2013). The results showed that the UASs have a positive impact on regional competitiveness, employment and entrepreneurship. In addition, the UASs strengthened the regional appeal and improved recognition and development of the business sector in the region. Compared to the respondents of small companies, micro-companies and sole entrepreneurs, the medium-sized companies had more experience and a larger variety of cooperation. The third survey focused on the analysing the current situation in collaboration between universities and business world in Russian (N=548) (Laitinen-Väänänen, Shashkin, Aristova & Shishkina 2014). It was conducted as a baseline study in larger EU-funded project aiming at improving the collaboration in four university. The survey revealed that more typical collaboration partner was a private company instead of public organisation or non-governmental organisation. Furthermore, the survey indicated that students and alumni were not as satisfied on the collaboration as teachers and working life respondents. Accordingly, there seemed to be a need for increasing the joint projects between universities and regional companies according to both the teachers, the last year students and the world of work.

Even though, the presented results are not comparative due the selected samples and variation among the survey questionnaires, it can be concluded that collaboration between HE and labour market exists.

Still, it can be asked that is the collaboration strategically directed and are the teachers aware of various kinds of pedagogical methods and do they own skills to implement the collaboration into the teaching and learning practices.

In addition, it can be argued that is the labour market aware enough of the possibilities the HE can offer in renewing the services and practices especially in the field of social and health care.

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Development and Validation of the Professionalism in Nursing Scan - Measurement of Performance in Nursing and Applications

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Abstract of Keynote Speech

The demand for highly qualified nurses is great and growing. At the same time, hospitals lack both adequate nurse workforce planning and a forecast model as tools for decision-making and for making strategic investments in, and for the management of, the nurse workforces. These tools are needed to manage the right nursing skills mix and the necessary nursing education programmes based on assessment and needs of all nurses. This lack has led us to develop a Professionalism in Nursing Scan.

The Nursing Scan is an online self-assessment using a Guttman scale with objective, verifiable answer options representing the position from beginner to expert. The aim of this paper is to present the practical framework and to discuss the outcome of several studies in a variety of hospitals. Firstly, this paper examines the development and validation of the Nursing Scan.

Next, we present our findings about possible application on the individual, team and organizational levels. We found no significant differences in job performance related to the different levels of initial nursing education considering one 'generic' nursing job description for nurses of different initial educational levels.

We found that differentiation in job performance description is needed to amplify what is learned at school. We also found significant differences in several aspects between normal care and intensive care performance. Here, the intensive care nurse can amplify, by analogy, to their nursing job/function description what he or she has learned at the post-initial nursing education.

The Professionalism in Nursing Scan appears to make validated contributions and give practical insights into Human Resource Management of organizational job performance, continuous professional development management and Strategic Management decision making. This strategy of self-assessment by nurses produces a tool for management that helps with decision making about setting targets to improve organisational and team performance, as well as being an aid for individual one-to-one meetings to improve the individual job performance. More research on the generalizability of the results is needed to find out whether the Nursing Scan can serve as a reliable and practical tool for nurse workforce planning and forecasting.

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The 'VQTS' model – An Innovative Way of Describing Vocational Competences Applied in the Context of the Erasmus + Project 'HealthCare Europe' (HCEU)

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Introduction

The 'VQTS' (Vocational Qualification Training System) model is an innovative and awarded[1] method that allows visualising and comparing vocational competences and qualifications of different European contexts with the objective of fostering mobility and recognition within the European Union. In the context of the Erasmus+ project 'Health Care Europe' (HCEU) the VQTS model is applied for the development of VQTS matrices for elderly care and nurses, which will feed into the development of different tools to support and simplify cross-border mobility of health care professionals.

HealthCare Europe (HCEU[2]) – Fostering Transparency and Recognition of Prior Learning to Support Geographical Mobility of Professionals in the Health Care Sector

More than any other sector, the health care sector is dependent on the mobility of workers across Europe and even on an international scale in order to overcome skill shortages that are strongly influencing this sector in EU Member States. So far the mobility of skilled workers is strongly hindered by highly complex and time consuming validation and recognition processes and by missing transparency among health care qualifications in the European Member States. The Erasmus+ project HCEU is intending to make a major contribution towards transparency of health care qualifications across borders and facilitates processes to formally recognize and validate healthcare qualifications acquired abroad as well as through in- and non-formal learning within different healthcare recognition and validation systems in the European Union. For this purpose the HCEU consortium makes use of the VQTS[3] (Vocational Qualification Training System, Luomi-Messerer, 2007) model. It does not focus on the specificities of national VET systems but uses learning outcomes and work processes to enhance transparency. It provides a 'common language' to describe competences and their acquisition and a way to relate these competence descriptions to concrete qualifications/certificates and competence

[1] The VQTS project has received the Helsinki Award 2006 and the Lifelong Learning Award 2007 in Gold for its contributions to the aims of the Copenhagen process.

[2] C.f. http://www.project-hceu.eu/

[3] More information about the VQTS model is available on the website: http://www.VocationalQualification.net.

profiles of individuals. The VQTS model relates on the one hand to the work process and follows on the other hand a 'logical development' differentiation of a competence profile. This makes it an ideal and comprehensive tool to appreciate the lifelong learning of health care professionals in the context of formal recognition processes. Based on this approach, HCEU develops VQTS matrices, profiles, tools and instruments for the health care profiles 'nurse' and 'carer for the elderly' for the national contexts of the project partners (coming from Austria, Germany, Greece, Hungary, and Poland) in order to facilitate recognition praxis in between those European Member States. In addition, HCEU develops transfer kits in order to facilitate the transfer of those tools also to other national (within and beyond Europe) contexts and to other fields within health care. Those tools are expected to make a contribution to the work of VET providers and recognition bodies/authorities involved in transnational mobility of health care professionals.

The VQTS-Model

The VQTS model was developed in the Leonardo da Vinci project 'VQTS I' and 'VQTS II' (Vocational Qualification Transfer System, Luomi-Messerer, 2007). This model uses a learning outcomes approach to enhance transparency, comparability and transferability between qualifications. The VQTS model describes competences and their development based on empirical investigations of work-related competences within a specific occupational field. This approach assumes that comparing core work tasks or work requirements in a certain field in different countries is easier than comparing certificates or curricula of VET programmes from specific national systems. Furthermore, it is assumed that the development of vocational competences can be described without referring to VET systems but instead by using a competence development model related to a certain sector. The VQTS model therefore provides a 'common language' for describing competences and their acquisition and also offers a way to relate these competence descriptions to the competences acquired in national-level training programmes.

Competence Matrix and Competence Profiles of the VQTS Model

Core elements of the VQTS model are the 'Competence Matrix' and 'Competence Profiles': A Competence Matrix structurally displays competences of a specific occupational field in a table. The competences are structured according to core work tasks in the respective occupational field and the progress of competence development. Competence Profiles (including Credit Points) are formed from individual parts of this Competence Matrix. The 'organisational profile' identifies competences relevant for a certain training programme or qualification. The ‚individual profile' is mapped on the organisational profile and notes the competences acquired by a person in training.

The VQTS model can be used for comparing qualifications and training programmes and be applied in different fields such as mechatronics, tourism, or the cleaning sector. Individual profiles can be used for mobility purposes. In the context of the Erasmus + project 'HealthCare Europe' (HCEU, 2015) a Competence Matrix and Competence Profiles are

currently being developed by the Erasmus + project 'HealthCare Europe' (HCEU, 2015) for the fields of nursing and elderly care.

Methodological Background: Development of a Competence Matrix

On the one hand, the VQTS model focuses on competences related to work process and identifies core work tasks within the context of a particular occupational field. On the other hand, the VQTS model follows a logical development differentiation of a competence profile (known as a competence development or acquisition model) and thus can also describe the acquisition of competences. Core work tasks have to be derived empirically using methods that include desk and literature research, surveys (e.g. with nurses), expert interviews, work-related comparison of existing qualification profiles and moderated workshops with epxerts from the respective occupational field. Based on these results, core work tasks and work processes can be defined and structured as competence areas. One competence area comprises various forms of competences necessary for completing core work tasks in a certain occupational field. Currently, the HCEU Competence Matrix 'Nurse' is work in progress and inmidst its validation and restructuring phase. So this example only allows a snap-shot of the work. The Matrix in its current status comprises five competence areas and two 'cross-cutting' competence areas:

- Competence area 1: Planning, conducting and assisting in diagnostic and therapeutic activities;
- Competence area 2: Planning & conducting patient care;
- Competence area 3: Creating & maintaining a health-promoting and safe environment;
- Competence area 4: Documentation, monitoring and quality assurance of the nursing care process;
- Competence area 5: Professional guidance of new staff;
- Cross-cutting competence area A: Communication & collaboration with different target groups involved in the nursing care process (e.g. multidisciplinary team members, patients, relatives)
- Cross-cutting competence area B: Continuous professional development and lifelong learning including self-reflection

For each competence area, the acquisition of a competence (the progress of competence development from 'beginner' to 'expert' level) is described. The nature of the competence area determines how many steps of the competence development process can be described. The steps of one competence development for one competence area does not necessarily correspond with the steps of another area (e.g. step 3 in a competence area with three steps does not necessarily express the same level of achievement as step 3 in a competence area with five steps). The left column of the table below contains competence areas, based on various core work tasks in the respective occupational field.

Competence Area	Steps of Competence Development Basic level ⟶ Expert level				
1 Planning, conducting and assessing diagnosis and medical care	1.1.a To support conducting the nursing assessment (anamnesis; health history; patient evaluation).	1.2.a To conduct nursing assessment under supervision.	1.3.a To conduct nursing assessment.	1.4.a To guide the conducting of nursing assessment.	1.5.a To create new guidelines, methods, instructions for nursing assessment.
	1.1.b To support the development of the nursing diagnosis (e.g. taking temperature, measuring pulse/blood pressure, ECG, etc.), and nursing care plan on the basis of the results of the nursing assessment care. Problems, care aims and care measures: prioritising patients' needs, e.g. short term / long term).	1.2.b To develop the nursing diagnosis and nursing care plan on the basis of the results of the nursing assessment under supervision.	1.3.b To develop the nursing diagnosis and the nursing care plan on the basis of the results of the nursing assessment.	1.4.b To guide the development of the nursing diagnosis and nursing care plan.	1.5.b To implement specialised nursing care plans (e.g. diets, blood sugar).

Figure 1 Part of HCEU Competence Matrix "Nurse" (DRAFT) - HCEU Competence Matrix 'Nurse'[4]

In a Competence Matrix, the description of competences should give a clear picture of how they can be applied in the work context. Therefore, competences on the various steps of competence development are described in a context-related manner. 'The competences are consistently formulated in relation to the work process and always align with the core work tasks within the context of the occupational field. Core work tasks are comprehensive tasks within the work context that a person with the respective occupational profile has to deal with. This means that work process-related competences are derived empirically from the work practice/work place' (Luomi-Messerer & Markowitsch, 2006).

Comparison with other Existing Approaches

Two main characteristics of the VQTS approach can be highlighted:

[4] HCEU - http://www.project-hceu.eu/

- Focus on work-related competences: The VQTS approach focuses on work processes. The occupational requirements or core work tasks – and the necessary vocational or professional competences – in an occupational field can be better compared than the training programmes in different countries for these competences. Descriptions of vocational competences gain significance only through their relation to the work context. The focus of the descriptions is on empirically derived work-related competences and not on the content of curricula ('in-put'). Contrary to existing taxonomy systems, holistic descriptions are used. Soft skills and key competencies are inherent in the respective descriptions. They are not described as specific competence areas on their own, but they are integrated in the context-related descriptions because of their relevance in this context. (Luomi-Messerer 2009).

- VQTS model follows a 'development logical' differentiation of a competence profile: The VQTS model can be considered as a further development of the Dreyfus & Dreyfus (1986) model: It uses this approach in such a way that the levels of competence development are not applied to overall professional actions (as shown for pilots, nurses, teachers and others), but to smaller entities of professional profiles. While strongly taking into account work-related tasks and contexts (objects, tools, work organisation), competence areas are defi ned and Dreyfus' ladder is applied to these new entities. Thus, Dreyfus' model is adopted in two ways: (1) applying the model to competence areas (corresponding to specifi c core work tasks) instead of using it for overall competence profi les (corresponding to professionals/experts); (2) making the model fl exible and dynamic by not restricting it to a certain number of levels, but only defi ning the differences between levels. (Becker et al. 2007; Markowitsch et al. 2006; 2008).

Remark: The VQTS model is not integrated so far into existing IT systems for competence and qualification assessment of health professionals.

Validation of the Approach and its Outcomes

The effectiveness of this approach and its expected learning outcomes in the context of nursing education and training are evaluated thoroughly in the course of the project in the following form:

- Validation/evaluation of the competence matrix via the project consortium. The project partners represent stakeholders such as VET providers in nursing / health care, research institutes, social partners and recruitment agencies. All play a key role in their country and field of work and have significant experience in the field of health care.
- Validation/ evaluation of the competence matrix in form of national validation workshops with experts/practitioners from the field of nursing education and training in the countries of the consortium members (Germany, Austria, Greece, Hungary, Poland).

Anticipated Outcomes

The VQTS model can be used for different purposes where the transparency of competence profiles is highly important (e.g. for transferring and recognising competences acquired within the official VET system as well as competences achieved through non-formal or informal learning; developing qualifications, training programmes and curricula; enhancing the visibility of differences in qualifications). The development of Competence Matrices in the course of the Erasmus+ project HCEU shall build the basis for further project results which support cross-border mobility of health care professionals through valid and reliable tools that increase transparency, comparability and the pace of recognition processes. Further results of the project which are built upon the matrix are therefore:

- Simplification of cross-border mobility of health care professionals through valid and reliable tools that increase transparency, comparability and the pace of recognition processes;
- appreciation of prior/lifelong learning of migrants holding health care qualifications as well as additional certificates and work experience related to the profiles addressed by HCEU through faster and more transparent recognition processes;
- provision of a common basis for comparing qualifications for recognition authorities/bodies in order to make recognition processes more transparent and efficient;
- provision of sets of training modules for VET providers that specifically address qualification gaps regularly coming up within cross-border mobility of health care professionals;
- increased planning reliability for employers in the health care sector when recruiting health care professionals from abroad;
- and tools for the HCEU project partners working within the facilitation of cross-border mobility of health care professionals for extending the geographical and vocational scope of the HCEU tools.

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Intersecting Research between Pro-Nursing and Eduworks Network

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Introduction

Inter-project collaboration provides a unique space for supporting research outcomes of individual projects and identifying common and/or overlapping research goals and associated contextual information which are possibly approached from different angels. This endeavor in fact facilitates knowledge exploration during project lifetime and also supports knowledge exploration in post-project phase. The objective of this paper is to explore the research space that exists between two European Union funded projects, Pro-Nursing and Eduworks. The Pro-Nursing project, funded under the Erasmus+ programme, "aims at bridging between tasks, knowledge domains and nursing curricula, the result of which could serve as a benchmark for other European states" (Pro-Nursing Project Consortium, 2016). The Eduworks project is a FP7 Marie Curie Action Innovative Training Network (FP7-MSA-ITN) which aims to "train talented early-stage researchers in the socioeconomic and psychological dynamics of the labour supply and demand matching processes at aggregated and disaggregated levels" (Eduworks, 2016). While the focus within Eduworks is more on career development of researchers, the research output from the project intersects with many of the Pro-Nursing objectives. This paper reviews three case studies where analysis of labour market dynamics and education can help improve the understanding of labour market dynamics in the nursing context.

Case Study I:

The first case study of interest was by Visintin, Tijdens, Stienmetz, and Pedraza (2015). The focus of this study is the variablility in wages, referred to as wage dispersion and the links to the tasks completed within an occupation. The dataset used for analysis was "a unique web-based dataset that allowed the measurement of the task implementation intensity at the individual level (10 occupation-specific tasks across hundreds of occupations and thousands of individuals) for the Dutch labour market" (Visintin, Tijdens, Stienmetz, & De Pedraza, 2015, p. 19). In particular, four healthcare occupations were captured in the analysis, nursing professionals, nursing assistant professional, health care assistants and health associate professionals not elsewhere classified. Table 1 shows descriptive statistics used in the analysis which allows limited inferences on the nature of nursing professions. The GINI index captures measures of income dispersion,

where the maximum value of 1 indicating maximum income inequality, and 0 indicating no inequality.

Table 1 – Occupation and wage heterogeneity for nursing and associated health professionals[1] - (Adapted from Visintin, Tijdens, Stienmetz, and De Pedraza, 2015, p. 10)

Occupation	**Sample Size**	**Median Wage**	**GINI Index**
Nursing Professional	85	17.40	0.1958
Nursing Assitant Professional	34	19.31	0.1166
Health Care Assistant	109	14.66	0.2169
Health associate professionals not elsewhere classified	34	14.10	0.1488
Overall Averages		15.11	0.1888

The descriptive statistics indicate that although nursing professionals have a higher level of responsibility within the workplace, the median hourly wage is lower than that of nursing assistant professionals. The varying sample sizes may offer one reason as to why this disparity occurs, however, the GINI index also indicates that the nursing assistant professionals are relatively homogenous in wages relative to the other groups. This means there is less variation in the hourly rate between nursing assistant professionals. In part the more homogenous wages within the assistant nursing professions is likely to reflect the nature of the tasks undertaken. This is supported when looking at the the tasks defined in the ISCO-08 group definintions (International Labour Organization, 2012). The nature of tasks undertaken by the assistant nursing professionals is a very well defined list of tasks with mostly practical tasks required, whereas the nursing professionals have more complex and managerial tasks incorporated into the description. As such, the differences in the tasks defined make a theoretical explanation as to the variation of the GINI indexes for the occupations. In conclusion, the work by Visintin, et. Al. (2015) showed that "task-related theories, which have demonstrated their ability to explain employment structure and evolution over time, can also help in explaining wage variation" (pg. 21).

In the context of the Pro-Nursing project, the results show broad trends associated with both the wages within nursing occupation categories in European states, along with measure of the variation of the tasks undertaken within these job markets.

[1] All Occupations values are average median wage and average Gini index. Wages are expressed as gross hourly values in Euro.

Case Study II:

Another study undertaken within EDUWORKS, analyzed job advertisements in the top 30 most frequently advertised occupations within the US. While there is no doubt; systematic differences between the US and European health systems exist, the analysis performed by Beblavý, Fabo, and Lenaerts (2016) demonstrates a method of analysis which can yield important information about the tasks, skills and knoweldge requirements needed for the employment in the nursing profession.

Within the dataset, two health related occupations were present in the 30 most frequently advertised. These included medical assistants and nursing assistant posititons with 40,127 and 96,937 advertisments analysed respectively. Across the whole data set analysed, on average 18% of advertisments included requirements of specialised training or licences. However, specifically to the health sector, 64% and 77% job advertisments in the medical assistant or nursing assistant roles had specific skills advertised (Beblavý, Fabo, & Lenaerts, 2016, p. 18). The result is expected in the context of the regulatory systems nursing professionals work within. However, this result also indicates that unlike the other occupations analysed in the top 30, nursing and medical assistant roles have both strong market demand and in turn, strong demand for specialised skills training. This is in line with current demographic trends observed within the EU.

In analyzing the adverts, Beblavý, Fabo, and Lenaerts (2016) divided the skills required within the positions advertised into several classes. Primarily, skills could be considered as either cognitive or non-cognitive skills. Within the cognitive category, skills could be consdered general (eg. ability to learn) or specific (eg. analytical skills). The non-cognitive skill set was also sub-divided into social non-cognitive skills (e.g. team-working skills) and personal non-cognitive skills (eg. Independence). Using this classification method, it was noticed that medical assistant advertisements frequently required stress-resistance as a chracteristic of the applicant (Beblavý, Fabo, & Lenaerts, 2016, pp. 26-27).

The method of classification used facilitated detailed factor analysis to also be undertaken to identify which combination of skills were most frequently required. Identifying five factor groups, it was noted that the most relevant occupation to Factor IV (which captures speicalised training, licences, ability to learn, and flexibility), was the nursing assitant occupation. This was also a major factor for medical assistants. Comparing the other factors that were important to these positions, Favtor V was also relevant to the nursing and medical assistant roles. This factor captured ICT/computer skills and previous workplace experience (Beblavý, Fabo, & Lenaerts, 2016, pp. 32-33).

The main contribution that this study makes to the Pro-Nursing project, is to help identify the skills most demanded for nursing professionals using online data sources. Furthermore, with specific software, it would be possible to create a more dynamic analysis of the nursing profession, where temporal data is used, and allowing changes in the demand for skills over time to be mapped across Europe. This would assist educators in

identifying which skills are going to be more in demand in the future, and which skills are becoming less relevant for attaining employment within the nursing profession.

Case Study III:

The final study of interest from the Eduworks project is titled "labour market driven learning analytics" (Kobayashi, Mol, and Kismihók, 2014). The objective of the research was to "develop an application that presents derived labour market information alongside student activity/performance data to guide students as they navigate toward their desired employment" (pg. 207). The research propses a method to link employment data to educational outcomes, allowing students to set educational goals that align with the skills rqeuired for employment. While the work is part of the on-going research within Eduworks, being able to "determine current demand for skills and the type of education and experience companies are looking for in job-seekers" (Kobayashi, Mol, & Kismihók, 2014, p. 209), could have a profound effect on helping inform nursing education and curriculum, which aligns directly with Pro-Nursing goals and has been already verified in cooperation with domain experts of Pro-Nursing.

In conclusion, three of the studies undertaken within the Eduworks project demonstrate spaces where the research project intersects with the goals of Pro-Nursing. This is not an exhaustive list of the research, and as the Eduworks project continues into its final stages, more publications that intersect with the Pro-Nursing project are expected. In context, understanding labour market factors such as wages, task heterogeneity, skills classification and real-time goal setting to meet labour market demand, in a specific profession such as nursing, will assist in better matching of job seekers to future employers. The complimentary research outcomes demonstrate that collaboration between projects provides an excellent space to enhance the benefits of both projects. Many of the similar concepts are joined in Figure 1.

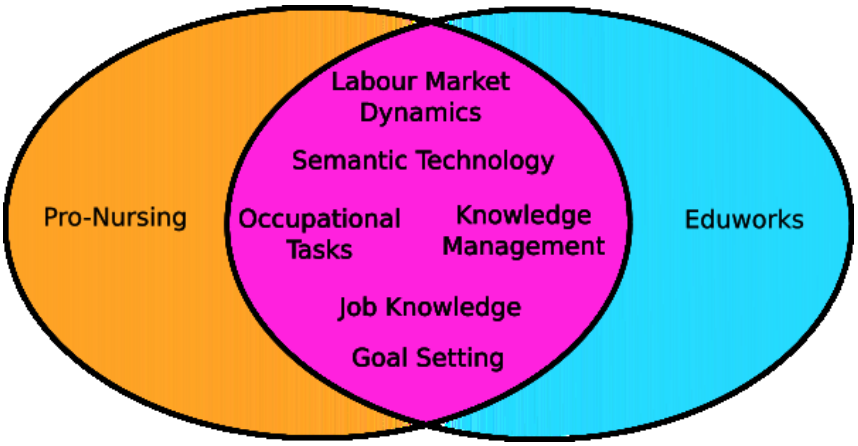

Figure 1 – Intersection of Pro-Nursing and Eduworks

To sum up, we anticipate a great potential for collaborative research on applying the methods and research findings of Eduworks network in the context of nursing. This reflects demands within the labour market to deepen its insight into the nursing domain, a

vital human resource required to deal with the challenge of an ageing society and demographic changes in Europe. The findings of Pro-Nursing, especially the master task lists and job descriptions of nurses in Germany as well as nursing knowledge domain ontology (Khobreh, et al., 2016), can be exploited for prospective research in the field of nursing across Europe. One interesting aspect is to generate a list of common data-sets (variable) between two projects towards pursuing collaborative research on applying the methods of job knowledge analytics and semantic technology (Mol, Kismihók, Ansari, Dornhöfer, 2013) (Khobreh et al., 2014) particularly in the domain of nursing.

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How to Learn More from Knowledge Networks through Social Network Analysis Measures

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Networks – or graphs – became an important and omnipresent approach to structure and visualize aspects of the daily life by modelling networks of concepts, knowledge or people and their relationships. Graphs, or networks, are used in a variety of disciplines, as mathematics (graph theory), social science (social networks and social networks analysis), biology (food-networks, neural networks), computer and engineering sciences (information-based networks as the internet or telephone networks), but also in human relationship applications as a tool of assessment and knowledge modelling (Bizer et al., 2005; Vas, 2016), for visualization and finally for reasoning, based on the modelled content and relationships.

In the recent years, technology enhanced social networks turned into a prominent application of network analysis. Indeed, the first steps within the field originate from the 1930s, when studying the problems of sociometry and group dynamics and investigation of dynamics in, essentially, (non-technological) social networks have been started (Scott, 2012). Social network analysis (SNA) investigates the relationship between people and how information flows within the network – based on context, relationships and communication patterns.

Taking people into account as bearer of knowledge, the interaction within social networks can be generalized to an interaction of knowledge holders. Finally, abstracting the concept, each person in the network possesses a different set of knowledge that could be broken down into a set of related sub-knowledge areas. Taking this into account, graphs could be suitable vessels to model the knowledge of people and how knowledge areas are related to each other. In other words, graphs can well represent expert-knowledge, that is crucial in knowledge intense occupations, just like in the health care sector, to efficiently support applications of learning, training and active knowledge transfer.

We propose to make use of the well-established methodologies within field of social networks analysis and apply them to networks of knowledge. The goal is here to derive a deeper meaning of concepts and their connectivity in knowledge networks. Especially when knowledge networks are used as blueprints for learning in specific domains, like nursing, applying social networks measures can help to derive a deeper meaning of connected concepts. Examples are here: bottlenecks in the network, like areas of concepts which connect only through selected concepts, central knowledge, with concepts which

connect to a high number of other concepts, or enabling concepts, which are concepts which are passed frequently when following learning paths through the knowledge network.

In the following we will explore the requirements to apply social networks analysis measures to knowledge networks and collect supporting theories to approach this new research. Furthermore, we will highlight the role of the STUDIO system, which offers a rich domain ontology for multiple domains of learning, together with a learning environment suitable to deliver hands-on data for first experiments. In future stages, Studio will be the implementation platform for prototypes, using new methods of learning and assessment, based on the deeper SNA-based knowledge network analytics. Together the improved analytics will facilitate a next stage of adaptive technology enhanced learning

To enable sustainable modelling and management of expert's knowledge, a frame, concerning the complexity and meta-structure that defines the possible compositions of knowledge elements, have to be defined. According to the overlay model, which is a user modeling approach (Brusilovsky, 1994), first, knowledge is captured on a general level – meaning the knowledge of a virtual domain expert has to be modelled – then the knowledge of a learner is projected onto this virtual expert's knowledge structure. Similar to the relationships between individuals, the relationships between knowledge in a knowledge network can model a quality. A prominent example from the field of biology of qualitative relations are taxonomies of animals (Huxley & others, 1940), modelling a hierarchy of animals to express a classification of animals into different species and subspecies, where the quality or semantic of the relations in the graph is "specialization". A more complex graph-based methodology to address concepts and their relations with different semantics are ontologies, expressing individual concepts and qualities of connections as elements of the graph (Hebeler, Fisher, Blace, Perez-Lopez, & Dean, 2009).

The STUDIO technology enhanced self-assessment and learning system, supported by a domain ontology, targets to accompany learners in a blended learning environment through different cycles of learning and assessment, where learners improve their knowledge in a process of learning and self-reflection. Each assessment and learning cycle helps to discover an individual learning path and continuously gathers information about the learners' performance and progress on the modelled domain. One core element of STUDIO is to model an educational field as a complex structure of interrelated knowledge areas in the form of a domain ontology. The structure is able to model different relations between knowledge areas, divided into sub-areas of knowledge to know, and therefore models the dependencies needed to master the education domain.

In this regards the semantically enhanced knowledge structure supports the tasks of learning and assessment, which can also be understood and abstracted as a network of domain knowledge. Learners use the knowledge network (e.g. the knowledge network from the domain or nursing, modelling the knowledge to know as a nurse) to learn the concepts and processes to be able to master job requirements in the field of interest. In this regards the network is the source for adapting what to assess and learn and de-

scribes what the learner should learn after each cycle of assessment. The network also describes the composition and topology of the given domain. While the structure is well capitalized for a successive learning, the abstracted knowledge network still yields the potential to make further conclusions on the specific structure and composition of the domain. The connectivity of the knowledge elements can here play a key-role in increasing the understanding of a modeled domain.

A theory to better understand the connection between the connectivity of knowledge and the impact of learning, is the learning theory of connectivism, envisioned by Siemens and Downes in 2005 (Downes, 2008; Siemens, 2005). Connectivism strengthens the view that learning is motivated by connectivity. To foster a higher understanding, the process of learning can be understood as a process of connecting experiences and external information, residing in external, potentially interconnected, sources. Learning may occur in environments with shifting core knowledge and connect multiple sets of information. Connectivism is focusing on the connections of knowledge elements, while connections which offer the learner to learn more are more important than the current state of knowledge. Connectivism grasps that decisions are based on changing foundations and it fosters the understanding that it is of a high importance to have the ability to differentiate between important and unimportant information. In this regards connectivism supports the assumption that a given knowledge network, as in the domain of nursing, may encode more than knowledge and its connections, but also encodes how the knowledge is connected and what part of the network fosters a better learning and a better understanding of the domain.

Considering the potentials of the measures, used within social network analysis to evaluate connectivity, and following the theory of connectivism, the ontology model of STUDIO can provide additional understanding about the domain by observing and measuring the connectivity of its concepts. In contrast to structural measures of the basic graph theory, here the field of centrality measures yields the key to connect measures about the connectivity to a meaning in the scope of mastering the expertise and applying it in the daily practice. Joksimović et al. highlight that a connectivity analysis have to include descriptive and statistical methods (Joksimović et al., 2016). Yet, focusing on analyzing the knowledge network with centrality measures, will enable to understand the initial frame and discover the real potentials for an extended statistical analysis. In this regards centrality measures will act here as a starting point for deeper insights.

Centrality measures reflect how concepts are connected and how a specific concept may account for the importance of other concepts (Newman, 2010). To initiate an explorative analysis through centrality measure we will start with a basic set of known indicators, which explore the connectivity dimensions of a concept within a network: degree centrality, Eigenvector-centrality, betweennes centrality and finally closeness centrality. To do so we will select a use case out of the pre-modelled domains of STUDIO which offers a suitable network to reason on different concept topologies and offers a sufficient data corpus of learning sessions with STUDIO. Candidates for existing STUDIO data corpora

are the domain of nursing (Weber & Vas, 2014) and the domain of business intelligence (Weber & Vas, 2016).

Applied onto the selected use case we will derive the selected centrality measures and connect the different calculated dimensions to the concepts of the knowledge network. The first stage of analysis will then investigate if a direct correlation exists between centrality measures and the performance on an assessment, based on the concepts and relations of the knowledge network. The second stage will zoom into single assessment tests and focus on each measures separately. Each measure formalizes a special semantic – "well connected", "connects well conglomerates of well-connected concepts". We will design micro-experiments where we compare the passing of questions to single concepts to the passing of surrounding concepts and evaluate if the meaning of the measured centrality can be mapped to a passing of connected concepts and answer questions as "Are well-connected concepts are predictors for the likelihood to master connected concepts?". Finally, we will, based on the gathered results, devise a recommendation matrix which contrast the investigated centrality measures against first insights about the semantic of the topology of the knowledge network. The derived matrix will then be an input for future design studies on concept networks and algorithms, to further capitalize the topology of existing networks.

The basic indicator among centrality measures is the degree centrality. Degree-centrality collects the number of edges, connected to a vertex or node and reflect the basic connectivity of knowledge areas. In contrast, the measure of Eigenvector-centrality capture also the neighborhood of concepts and increases the importance of an observed node, based on its connectivity but also based on how many other high important concepts are connected. Further, Betweenness-centrality measures how frequently a given knowledge area is part of shortest paths between other nodes and helps to model the flow of information within a network but also detect potential bottlenecks. Finally, Closeness-centrality accounts for how "close" a node is to other nodes in the network, across all shortest paths to all other nodes and may shed light on concepts which belong to different parts of the knowledge network but connect the majority of other concepts and therefore may be vital for an overall understanding. Together these initial measures will explore the basement of the connection dimensions to finally reason on a deeper understanding of the concepts' connectivity.

The above collected theories reveal the potentials and importance of deriving a deeper understanding of ontology-based knowledge modelling. There is a great deal of pressure on organizations – working in knowledge intensive, dynamically changing environments (like medicine and nursing) – to turn towards the development and application of innovative and modern technologies that enable their employees to easily access, understand and apply complex knowledge. The STUDIO ontology model enables organizations (including hospitals, nursing schools etc.) to create a comprehensive, unambiguous knowledge structures. The resulting domain ontologies are ready to be deployed in managing and are improving the training portfolio and enhance spontaneous learning of employees and creates a better understanding of learning materials and their interrela-

tions (applying concepts of connectivism and centrality measure methods). With the better understanding of the domain of interest, such personalized learning experience could be provided for employees, that besides supporting what employees wish to learn it is also determined how they should learn it.

It is dangerous to assume that the available knowledge is the right knowledge and that the knowledge is in the right place. Moreover, the relevance of knowledge may differ between organizational levels and may change over time. STUDIO can help organizations to overcome these challenges and to use and reuse organizational knowledge in multiple ways by combining its tools with methods of network analysis. While the potentials for an enhanced connection-driven use and analysis of the modelled domain knowledge are already eminent, the real extend of the added value has to be explored in experiments, by bridging the lessons learned from social network analysis to a novel knowledge network focused analysis.

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Automatic Extraction of Nursing Tasks from Online Job Vacancies

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Popular ways of collecting job Information for purposes of job analysis are the interview, questionnaires, observation, and participant diary or logs (Dessler, 2004, pp. 114–117). One potential source of job information that has been gaining a lot of research traction lately is the job vacancy(Gallivan, Truex, & Kvasny, 2002; Litecky, Aken, Ahmad, & Nelson, 2010; Smith & Ali, 2014; Sodhi & Son, 2010). A typical job vacancy may contain information related to human requirements, job context, and work activities among others. However, extracting these information types and sorting them to categories from job vacancies are challenging because the vacancies are written in free text and to arrive at a generalizable model one may need to examine thousands of vacancies. Current advances in automated text analysis may be able to offer a helping hand in developing an automatic and accurate procedure for the extraction and classification process.

In this study we explored the use of text mining procedures (Aggarwal & Zhai, 2012) to automatically extract a specific job information type, namely *tasks/activities* from online nursing job vacancies. We developed the method following the approach outlined in (Solka, 2008) consisting of text preprocessing, feature extraction, application of classification algorithm and classification evaluation. The online job vacancies were provided by an online recruitment agency called Monster[1].For each job vacancy, the first step is to remove unnecessary elements such as HTML tags (since the original vacancies are in HTML format). Only the free text of the job description were considered in the succeeding analyses. The output from this step is the job vacancy containing only the relevant text. The text is then fed to a sentence segmentor where individual sentences are extracted. The sentence segmentor is a rule based segmentation algorithm. The rules were logical if-then statements that were constructed to detect sentence boundaries. For example, if there is a line break (or a newline character) between two successive words then separate the two words; one word goes to one sentence and the other to another sentence. Identifying individual sentences in the German language is quite similar in the English language, thus, we borrowed some rules from the English language (e.g. sequence of period, space, and upper case letter signifies the end of one sentence and the beginning of the next). Moreover, we introduced specific rules that are idiosyncratic to job vacancies such as taking into account the enumeration of required tasks.

Each sentence is then represented based on the vector-space model (Salton, Wong, & Yang, 1975). In this representation, words are treated as the features and sentences are represented as vectors in which the elements are the weights of the individual words.

[1] http://www.monsterboard.nl/

The weights can be a simple 1 or 0, where the value is 1 if the word occurs in that sentence and 0 if not. In this study we chose the raw frequency as the weight, i.e. the raw count of words in each sentence. In this approach we treated the sentences as being independent from each other for simplicity. Since a labelled data set is needed for the training, we prepared a training corpus by manually labeling a number of sentences (approximately 2000 sentences). Each sentence is labelled with 1 if the sentence expresses job activity and 0 if not. Before we run classification algorithms we applied dimensionality reduction techniques. The dimensionality reduction served two main purposes, to merge similar words together (e.g. synonyms) and to reduce the number of features. Three techniques were tested, namely, Latent Semantic Analysis, thresholding based on term frequency–inverse document frequency (Tf-Idf), and Random Projection. The technique based on Tf-Idf does not really merge features but can nevertheless eliminate non-relevant features. The best dimensionality reduction was chosen by running Support Vector Machines (SVM) on the reduced feature set from each technique. The reduced feature set that resulted to the highest precision and recall on SVM was the final set of features used in the classification step. We selected precison and recall as performance metrics instead of the standard accuracy since the proportions of sentences in the categories are not balanced. In our training data, only 7% of the sentences are labelled as tasks.

We then run three text classification algorithms, namely, Random Forest, Support Vector Machines, and Naïve Bayes (Duda, Hart, & Stork, 2001) on the training corpus (with the reduced feature set). Instead of considering the prediction of each classifier, we found out that we got a better performance if we combine the predictions of the three classifiers. We combined their prediction through a majority vote. The combination of classification plus the dimensionality reduction constitute the classification model. We evaluated the model using 10 fold cross-validation.

Results from applying the three dimensionality reduction techniques is shown in Figure 2. The bar chart shows the comparison of Precision and Recall among the three techniques trained using Support Vector Machines. The three techniques have comparable Precision but LSA has the lowest recall. This means that LSA failed to detect many task sentences (i.e. many false negatives). This is to be expected since LSA generally does not work well with short sentences. Consequently, the choice was focused between Random Projection and Tf-Idf thresholding. Both have comparable performance in terms of the Precision and Recall but we preferred Random Projection due to the resulting reduction of the number of features. Using Tf-Idf thresholding we retained around 10,000 of the original features whereas Random Projection gave only 500 features. Note that we can vary the number of features for the Random Projection as this is usually set by the researcher. In our case, 500 features were enough to generate an acceptable performance. Thus, the final number of features was 500 which was an almost 13,000 reduction from the original. We then run the three classification models on the reduced data set and obtained the results as presented Figure 3. Naïve Bayes has the least performance. As can be seen from the figure, the voting approach that combined the predictions of the other three classifiers has yield the highest recall while maintaining precision. From the

results, the best model is the one that uses Random Projection for dimensionality reduction and instead of using just the individual prediction of the standard classifiers we combine them in a voting approach.

We then applied the classification on unlabelled sentences (numbering to 18,000). There were 2000 new tasks added after applying the model on unlabelled sentences. The prediction of the model was validated by having an expert check the correctness of the labels. Based on the input of the expert we reran the model and obtained new parameters. We ran several iterations of training and expert validation until no further improvement was been obtained. The final precision was 80%. This implies that 80% of the sentences identified as tasks by the classifier are true tasks as validated by an expert.

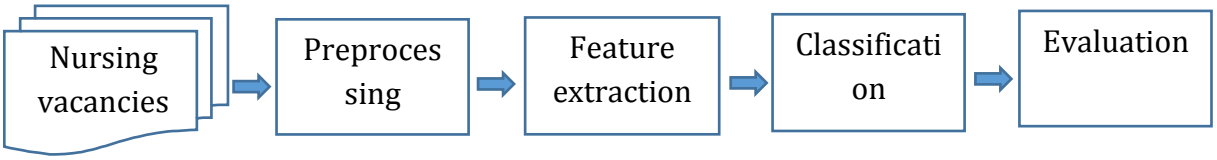

Figure 1. Text classification process for the extraction of nursing tasks from nursing job vacancies.

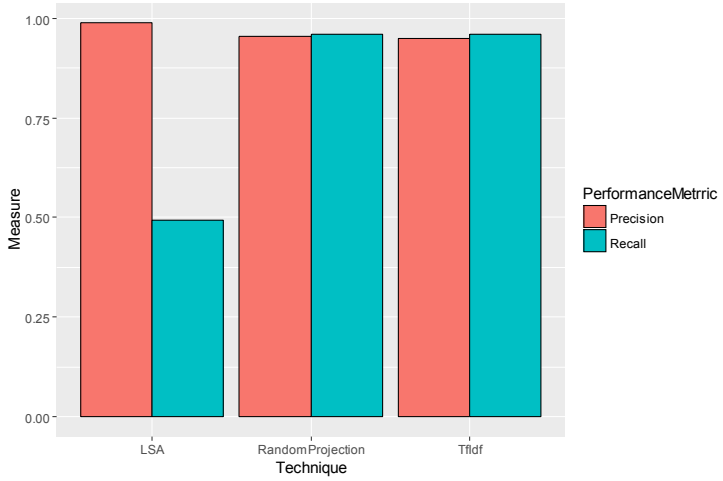

Figure 2. Comparison of different dimensionality reduction techniques on two performance metrics, namely, precision and recall. The performance metrics were derived from running SVM on the derived feature set from each technique.

The final step was to cluster (Jain, Murty, & Flynn, 1999) the extracted task sentences in order to get a more compact list of nursing job tasks and also to merge duplicated tasks. The clusters were obtained using topic modeling. We run Latent Dirichlet Allocation model (Blei, Ng, & Jordan, 2003) and constructed around 100 topics and each sentence was assigned to each topic. Here the topics were considered as the clusters. The constructed clusters were subsequently examined by an expert to further investigate whether it is still possible to merge clusters or break-up some clusters. We want to ensure that the clusters are as homogenous as possible. Moreover, the expert assigned cluster names which represent the general type of task in each cluster. Examples of labels include Basic Care, Medical Care, Internal Management, and Teamwork. The task clusters will be further validated by including them in a survey which aims to compare

nursing tasks obtained from traditional job analysis and tasks from text mining. As of writing the survey is still on-going.

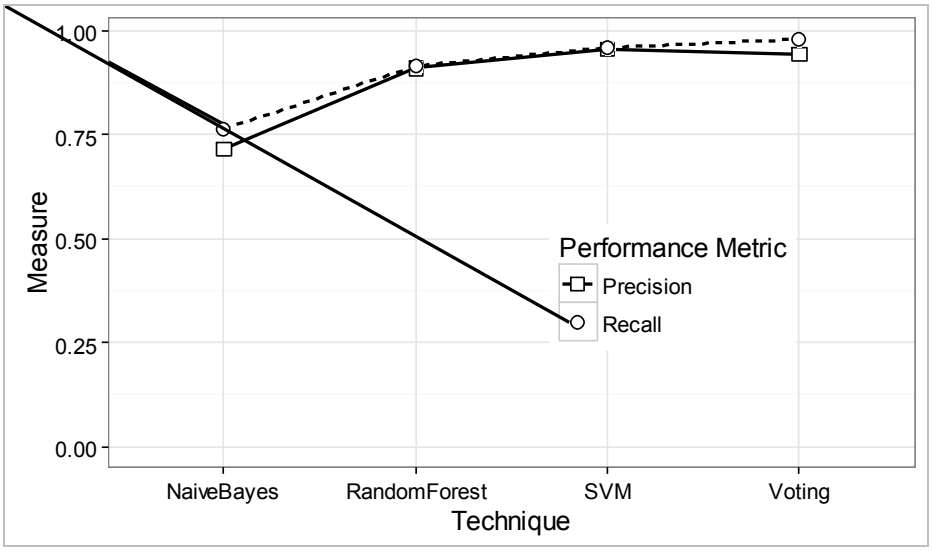

Figure 3. Comparison of four classifiers on the nursing task extraction. The voting approach combined the predictions of the other three classifiers using majority voting.

Based on the study, we find that applying text mining with expert validation on nursing job vacancies can offer an alternative, fast and efficient way of extracting job information. Also, the classification model is straightforward to apply in practice. The results are useful for a number of purposes such as job analysis for the nursing profession and for designing recruitment strategies. One lesson from this research is the importance of employing experts (e.g. job experts and job holders) in the model tuning loop since as we have found out, the precision from the training could be high but when applied to unseen sentences there was a sizable reduction in the precision. During training we got a precision of 90% but when applied to unseen sentences we got only 70%. Expert contributed about 10% improvement in the performance of the classification model.

We identified a number of limitations for our current approach. First we assumed that sentences were independent from each other. This is definitely not the case since at least sentences that come from the same vacancy must be somewhat related. Moreover, we found out that in many vacancies, task sentences are usually written close to each other. Another limitation is in the choice of features, we only considered word-based features though in our investigation we observed that structural and grammatical based features have the potential to substantially enhance the classification performance. Example is, task sentences are usually longer compared to non-task sentences and task sentences usually have more verbs than non-task sentences. Aside from the technical concerns, there is also the challenge of validating the extracted tasks. As of the moment we are dealing only with content validity by having subject matter experts assess the output of the classification, however, it is also desirable to address predictive validity. In the future we will deal with questions such as: How can these information about nursing tasks could better prepare aspiring nurses for this profession? These and other limitations gave us insight on how we can improve the models in the next iteration.

We plan to continue improving the classifier by relaxing the independence assumption for the sentences and exploring algorithms that incorporate order of sentences as they are written in the vacancies (e.g. HMM, CRF). We are convinced that the order by which sentences are written in the vacancies definitely play a role in what type of job information is expressed in each sentence. We also plan to explore other strategies for combining the prediction of individual classifiers and try approaches in semi-supervised learning for dealing with the limited number of labelled data.

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NurseTrainingGames - Development of Innovative Nurses Training throught Serious Games based on Virtualization of Real Scenarios and Narratives

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Background

In Italy the abrogation of the job description with Law 42/1999 together with the Ministerial Decree 739/1994 contributed to establish the precise nursing action field, identifying the health care professional as the subject who accomplish his work on his own knowledge, on greater autonomy, on professional responsibility with respect to the assisted people together with a strong discretion in putting it in action. This represents a radical and important step for the welfare activities at a national level.

The regulatory change represented a great innovation for the nursing profession, as nurses were no longer mere executors of acts and/or tasks assigned by a rigid list of activities (the job description), but identified as the professional manager of the entire care process.

This is underlined precisely in Ministerial Decree 739 where Article 1 states that "the nurse is responsible for general nursing". The nursing role is therefore connected with the identification of the needs of the individual and the community, with the formulation of objectives, the work planning and the evaluation of health care interventions.

The field of activity and responsibility of the nursing profession is determined:

- by the contents of the ministerial decree, establishing the professional profile of nurses and defining the compulsory teaching regulations of the undergraduate and post-graduate education paths;
- by the code of ethics of the profession.

Nurses are now expected to base their actions on strong and updated knowledge, in order to give to the person/patient the most effective assistance and care. In addition, the nature of nursing practice has to face users' needs, taking into account and promoting the scientific and technological development in healthcare. Therefore, nurses are expected to constantly contribute directly to the improvement of their professional profile and competences by updating their knowledge through lifelong learning programs, critical reflection on tested experiences (see evidence based simulation / use of serious

games and Virtual Reality -Virtual Environment/Virtual world: A computer generated reconstruction of a real or imaginary setting where the user is immerse within and where interactions take place) and innovative research, in order to increase their knowledge and skills and to ensure the care standards to patients and end-users.

State of the Art, Needs and Proposed Research

In the field of nursing profession, it can often arise a number of critical situations in which training and professional skills are not adequate to the requested intervention. The reasons may be different, driven basically by the speed of technological and scientific progress in the field of health that seems difficult to be controllable and requires increasingly high skills from health professionals' side. The nurse also needs to address increasingly complex problems, requiring specific skills linked to clinical different areas, problem solving, decision making and competences related to an integrated management of information useful to the diagnostic process evaluation and the ability in planning interventions, as well as interpersonal and communication skills.

In the regular training of nursing staff in Italian universities, it is delivered and practiced a teaching centered on oral transmission of information, with a passive attitude of students toward the contents. To date, in Italy the academic education path does not guarantee to train competent professionals in all the areas included in the professional profile: as a matter of fact, many recent graduates do not possess neither relational skills nor the capabilities required by many technical procedural practices. Many degree programs focus mainly on achieving learning objectives according to a mono-disciplinary approach. In addition, traditional training courses does not consider the variability of different clinical or assistance contexts; the only diversification is foreseen for emergency care.

Based on these premises, the use of innovative, interactive and engaging "tools" is our answer to the needs. The World Health Organization describes the ongoing training as the "educational process that takes a person at the end of basic learning process, in order to improve his knowledge and skills, a moral imperative that commits every professional throughout the whole lifetime. The training is a responsibility of the single professional in relation to his working activities and the impacted end-users; keeping it updated is a guarantee of good care and professional competence for the end-user point of view (patients, families, welfare institutions, etc.).

Competence, not knowledge, is the kernel (core issue). Training has to be centered on a competency based education, on a new approach based on acquired skills considered as the real learning outcomes, and based on the expertise coming from the analysis of the needs of society and individuals.

Serious gaming, which falls under the umbrella of simulation, is expected to take on a greater role in health care training. Bergeron defines serious games as ''interactive computer applications, with or without significant hardware components,'' created for the

purpose of imparting knowledge or skills, and which incorporate an element of scoring as well as challenging goals and engaging design. Serious games have been used effectively as educational tools in a wide range of disciplines. The use of different game genres were reviewed recently by Ryan Wang et al. (2016), experimented in the field of "health care professional" training, including nurses, with the learning goals of practicing guidelines, of patient educating and developing new research methods and statistics. According to the cited review, studies nowadays are heterogeneous in many aspects, including type and number of study participant, method of data collection and the study design. Nonetheless the majority (89%) of the included studies found significant differences between the intervention and comparison of control and experimental groups and significant improvements after serious game use.

Ryan Wang underlines that "The results of this review agree with those of Graafland et al, and de Wit-Zuurendonk et al; all 3 systematic reviews identify serious games in medical education as a growing field that requires continued evaluation and the establishment of best practices. […] This may serve educators contemplating building their own serious games, as the development of games is a major component of their use (unlike mannequin-based simulation, which generally uses already manufactured devices)".

Creating games and scenarios and training computerized exercises, developed differently for specialized clinical areas (e.g. rehabilitation, surgery, etc) can be one of the needed solutions, as it could offer the possibility to create the setting to afford increasingly challenging situations in nursing practice.

In an article by Day-Black, Merrill, Konzelman, Williams and Hart (2015), the focus is on gaming as a teaching-learning strategy for students in a community health nursing program. The term 'digital' students was given for anyone born after 1983. The article emphasizes serious games meant to be used in an informal setting. Serious gaming allows for a meaningful learning experience for the student, in a place that is relevant to them, combining kinetic and tactile learning styles of the digital nurse. The premise of the learning program is based on the first three levels of Bloom's taxonomy: knowledge, comprehension, and application. The laying of learning for the course was to provide a variety of methods of learning, including gaming.

The games must be evidence-based with clear goals and objectives focused on learning for the course. Considering peculiar aspects of learning in adults and referring to the recent literature, serious games could be the best way to engage the learning-nurses. Shareable scenarios, challenging outcomes and feedback, will encourage self-esteem in nurse team, professional engagement, autonomy, motivation to learn and improve competences. Furthermore, the required specialization in nursing for post-acute clinical rehabilitation settings are often needed because of the lack of training considering the variability of different clinical or assistance contexts, except of those for emergency care. Serious Game Scenario Development in this field is needed.

As Petit dit Dariel very effectively summarized in his article, Developing the Serious Games potential in nursing education, Nurse Education Today (2013), Serious Games

offer immersive and virtual environments that provide a realistic opportunity to practice and develop a variety of different competencies . They can be available on a computer terminal, facilitating access and personalising the learning experience by offering a learning tool that learner can use anytime-anyplace. Furthermore “By providing a realistic environment, learning can advance beyond simple knowledge acquisition towardsthe development of skills necessary to recognise, analyse, select andapply knowledge to different clinical situations. Such complex learning focuses on problem-solving, critical reasoning and meta-cognition [...]Thus far Serious Games in health care education have emphasized the development of procedural techniques [...] More pedagogical tools of this type areneed to provide authentic learning environment in which learnersare able to practice the development of their cognitive processes and facilitate the detection of relevant cues and contextual issues to help them make connections between accurate cue collection, nursing interventions and patient outcomes in a variety of clinical settings. Furthermore, few studies have explored the extent to which experiential simulation, such as Serious Games, can assist in the development of clinical reasoning (Charsky, 2010); and relatively little is known about methods for optimising the game design process (Hirumi and Stapleton, 2008). There is thus a need to create and evaluate a tool that will help enhance nurses' skills in reasoning clinically, detecting risk factors and intervening to prevent the worsening of a patient's chronic condition”.

The Project Outline

The research intends to develop a nursing training project based on skills improvement using simulation as a learning tool, with a first focus on the neurorehabilitation clinical context.

Simulation is defined as a model of reality that allows to evaluate and predict the dynamic development of a series of events or processes. The simulation, thanks to technological support, has the advantage of introducing directly the professional in an environment that reproduces more or less faithfully their working reality. The subject feels integrated into the environment in which he is introduced; he is motivated and actively interacts and participates in the training activities, because it is centered on real life.

There are several advantages of simulation training, like:

- The possibility to develop various scenarios, including unusual and critical situations in which a rapid response is required.
    - The possibility for the learner to see the results of his own decisions and actions: mistakes could occur, with no real risk for patients.
- The simulation of real clinical situations allows the learner to fully analyze the interpersonal interactions with other clinicians, training in teamwork, leadership and communication.
    - Interdisciplinary is stimulated and multiple choices could be presented
    - Through the use of audio-visual equipment in the simulated environment, the nurses could verify their ability to immediately correct themselves in

their performance: the learning experiences based on a quality feedback are deep and generally recognized as being able to slow down the loss of acquired skills.

Methods

As mentioned, the project idea will be necessarily developed thanks to a technological partner with great expertise in serious gaming engine, design and VR.

CCP will act as scientific expert in the user requirements analysis, in the field of nursing competences needed in neurorehabilitation sciences, in the deployment of clinical setting for gaming scenarios, in the realization of the pilot study and in the dissemination of the training method and efficacy.

The research project will be deployed in different work phases (tot. 24 months):

I Phase (M1-M2):

The training needs will be analyzed starting from

1) existing training national legislation requirements
2) existing technology used in the field of e-learning and training. In particular the use of Virtual Reality in training paths and advantages of exercises and games developed in realistic care settings will be deepened in terms of opportunities, such as:

   • to perform the exercises/challanges in environments from time to time changing, with different levels of difficulty, but safe and ecological;

   • to maintain the experimental control on the stimuli and enables a measurement of results;

   • to administer individually "sequences of exercises" and with defined objectives, in a personalized and motivating context;

   • to provide a sense of actual presence (immersive) and, consequently, the behavior that results is congruous with the situation of the learner in the environment;

   • to improve the functional abilities of the learner associated with the execution of graded tasks and increasing complexity;

   • It gives a chance to continue treatment in the own home;

   • to monitor and record the results related to the exercises, allows a detailed training vision of performance achieved, and allows the teaching team to intervene to appropriately set the features/setting parameters of the exercises;

- VR (in general new technologies) creates a real link, a privileged way communication channel between tutors and learners
- Multi experiential setting (visual, tactile, auditive).

3) nurses' training needs will be collected inside the clinic (Quality procedure ISO9001-2008). In the last year (2015) it emerged the request from young nurse to reach new competences in the specific context of neurorehabilitation, aging and frailty care needs.
4) consequent definition of the learning objectives and issues. A Scientific Technical Committee for Professional Training will be constituted and will be dedicated to the definition of detailed objectives to reach and expected results.
5) starting from main training topics and possible measurements, it will be possible to make decisions about the genre of games that are expected to be developed for the nursing training system, kind of exercises and evaluation criteria to define the cut points between success and the failure (feedback to the learner).

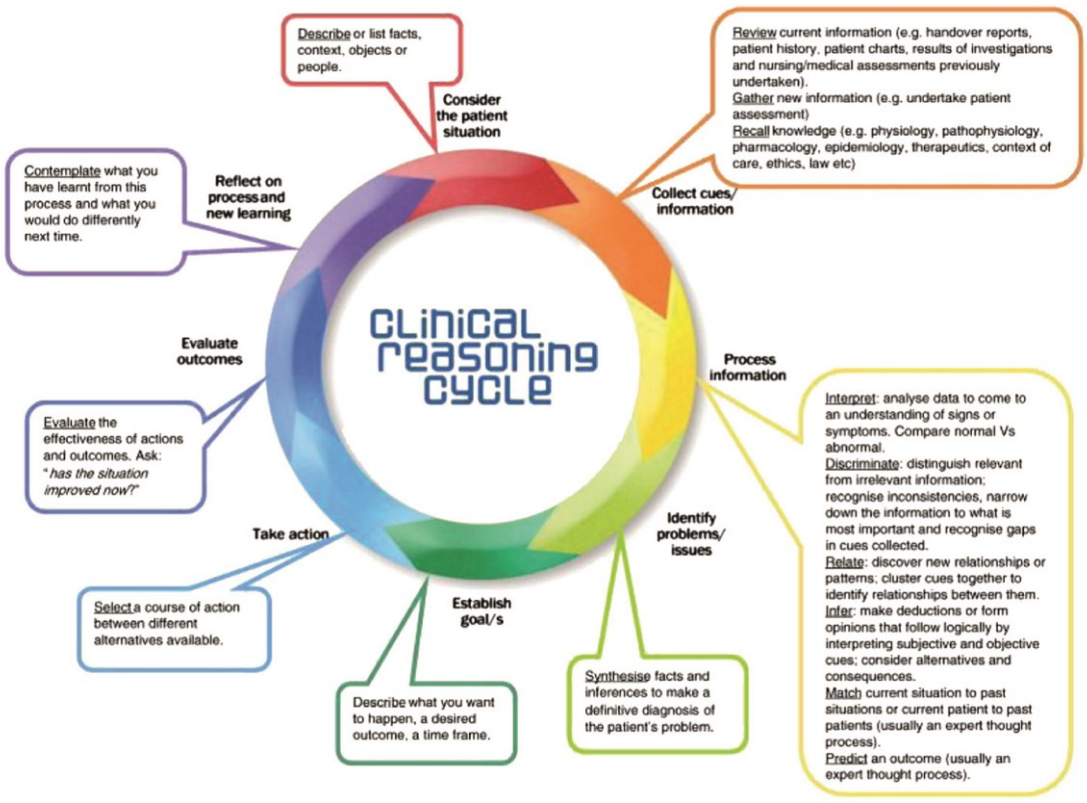

Figure 1. Levett-Jones et al. (2010) Clinical Reasoning Model

II Phase (M3-M6):

- A study design will be described in a detailed protocol, where modality, timing and testing methods, outcome indicators and expected results will be defined. 2 groups of 20 nurses each will be involved, a control group and an experimental group.

Groups will be balanced according to gender and age (between 25 and35) as Day-Black suggests in term of digital competences

- Starting from the main needs evaluated during the I Phase, the training Scenarios will be defined for a simulation process, in a multidisciplinary partnership.

Every narrative will be developed in sequences of requested intervention in terms of problem solving and decisional steps, based on scientific evidences and validated nursing procedures in the neurorehabilitation setting.

The clinical reasoning (CR) Cycle as described by Levett Jones et al. (see in Figure 1) will be the work model during the creative phase and the design of the games.

A multidisciplinary group will be dedicated to this phase: Nurses, therapists, neuropsychologists physicians (specialization will depend on the training topic of the scenario: neurologist could be needed in one of them, while a cardiologist in another- see fallowing example) of CCP will collaborate with external expert technologists and designer through a "participatory design" methodology aiming at creating effective training experiences.

The group will be composed by a mean of 8 experts for each Scenario.

1) Each Scenario will be based on a real situation and on a realistic clinical case.
2) A description of the starting situations and data will be provided (patient health condition, environmental inputs, professionals involved in patients' care and personal rehabilitation program, etc.)
3) The starting situation will propose a triggering event and will suggest different options to proceed with.
4) From that moment the situation will evolve in different scenarios. They will develop and change depending on the basis of the reasoning and decision-making processes undertaken by the learners.

It becomes crucial to build a path through virtualized environments, which gives nurses the opportunity to intervene with effective choices according to specific assessment criteria. Only virtually learners can have the chance to experience the consequences of their reasoning and decision making, through new scenes' chain, feedback, and possibilities of going back and correct the action reflecting on processes and new learning.

Some examples of interesting topics:

- taking charge of the patient: assessment and needs' evaluation for different pathologies and cases (i.e. the hypertensive patient, etc),
- Prevention management of pressure sores (variables in causes and effects, tools and care strategies)
- Cardiology / pneumological Emergency, in the field of neurorehabilitation, the emergency practices are not frequent, nurses needs to train and be prepared to assess situations as they arise and make the best choices in a short time

And others will be discussed.

III Phase (M7-M12):

External technical partner (supported by CCP scientific expertise) :

- Definition of system architecture
- Develop Virtualized environment and Games for training exercises
- Data and Metadata Management

VR, constant interaction and feedback, engaging challenges, test and quiz, will support the creation of effective Gaming as training tools. Scoring and levels of success will be defined on the basis of clinical parameters and objective measurements of timing in answering the problem, of the n. of correct answers, of self-correcting abilities (reasoning), etc.

IV Phase (M13-M22):

Once the Serious Games have been realized with the supervision of the group involved in Phase II, the a validation test be provided in CCP during internal training course, with the aim of validating the efficacy of the new Training Games and respect to the traditional approach.

As a proper controlled scientific research it will be based on the Protocl defined in Phase II and it includes:

1) Recruitment
2) Briefing/Training of participants
3) Trial- Training Phase and data collection
4) Data Anlysis and Evaluation

V Phase (M12-M24):

Dissemination activities: the outcomes of the project will be shared through numbers of internal nurses or external ones. Developed Scenarios and Serious Games will be shared and presented in training activities, towards enhancing the engagement of nursing students and early stage career nurses in learning activities, and ultimately fostering recognized continuous work-based learning. CCP, in fact, is a nationally recognized provider in terms of professionals' training and it responds to the Italian ECM system (http://www.salute.gov.it/portale/temi/p2_4.jsp?area=ecm), the infrastructure that allows the health professionals to have a Continuing Training in order to meet the needs of patients, the organizational and operational needs of the healthcare system and of their own professional development.

Expected Outcomes and New Knowledge

We expect that:

1. The practitioner acquires new knowledge, skills, values, attitudes, much more effectively than with the traditional didactic methods.

2. The Serious Games could be validated as a training tool for the specific developed topics, all related to the training needs in neurorehabilitation sciences and in specialized departments.
3. The learning methodology, with particular attention to the development of a Scenario, could be delivered in guidelines of best practice, bringing support to the requested continuing evaluation and establishment of Serious Games potential in nursing education in the most recent literature.
4. We also expect that the level of stress between nurses and charge nurses will decrease. As introduced, further demands have been added to the charge nurse position in many organizations: proficiency in computerized nursing records, coordination of the activity of the unit as a whole, and clinical expertise in a specialized field of nursing. The charge nurse is expected to be clinically competent, to assess patients thoroughly, to plan patient care, and to evaluate nursing interventions based on evidence, protocols, and procedures.

The simulations of real scenarios allow to approach unfamiliar or never experienced situations with a definitely different emotional involvement, while allowing the learner to plan and test future possible actions.

The learning objectives necessarily include the acquisition of basic theoretical knowledge, practical application of behavioral models inspired by the security, the acquisition of patient care standards to which conform welfare benefits. The simulation helps in valorizing the theoretical, cognitive and ethical knowledge that moves the nursing actions.

Expertise involved

The Nursing Technical and Rehabilitation Service (SITRA) of CCP will be actively involved with the Project Management Office in the realization and monitoring of the project activities. The nursing coordinator will identify the nurses, the therapists and the physicians in charge of the research activities. CCP's nurses will be involved in nursing group of the project and will be active in the discussions, providing the input for creating and designing the serious game applications. They will actively collaborate with the external technical partner, responsible for the development of the engine and the design of the serious games.

Experiences with VR and Serious Gaming

In the last year Casa di Cura del Polcilinico (CCP) activated different researches focusing on Serious Games and Virtual Reality for neurorehabilitation and patient engagement. Both at a European level (AAL- Brain@Home project) and at a local level (Lombardy Region funded "Rehability" project), the clinic is experiencing "ICT for rehab" and is involving therapists and other professionals all along the project paths (Requirement analysis, research design and protocols, innovative treatments in rehab, etc). We are developing RCT trials to validate the efficacy of computerized motor and cognitive training in im-

proving quality of life and cognitive and motor functions in different neurological populations. The co-creation of serious games and sequencing of exercises, based on clinical evidences and measurements, and of a scientific protocol, include a great multidisciplinary work and gives great outcomes yet in terms of motivation and participation. Technological partners deals with all the requirements in terms of engine and graphic design, while nurses, physiotherapists, physicians are working together in a scientific group. That's also why they are highly motivated in continuing the development of scenarios in the field of nursing training.

In 2016 we participated as a partner in two different European projects (Erasmus Plus and H2020- ICT-24-2016 "Gaming and Gamification", under evaluation) dealing with nurse training in neurorehabilitation and in settings of hospital emergency, both focused on development of serious games for professionals' training.

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How to map a Large-scale Organization, its Activities and its Training: Practical experiences with Application to Nursing 2014-16

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Why map organizations?

Organizations require employees to have appropriate knowledge and skills to complete their roles, this can be gained through specific training and working experiences. Training tends to be well documented, but experience can be difficult to track and manage over time in a reliable way. The knowledge and competencies of employees have a critical impact on the capabilities and the risks faced by the organization. Managers need clear information on knowledge and competencies to deliver effectively and to meet strict regulatory requirements. The information needs to be delivered to managers in a way which is useful – easily 'sliced and diced', quickly analyzed.

How to map organizations?

Concentra's OrgVue software offers a way to design and operate your organization to deliver ongoing business performance. Crucial to this is the ability to dynamically model and design a truly effective organization. The organization can be analyzed from any angle by connecting people, roles, processes and skills. OrgVue's innovative linking functionality lets you connect your organizational data for a deeper understanding of where your people are, what they are doing, how they are doing it and where efficiencies can be realized. These are the key questions that all organizations will want to answer in order to gain an understanding of the people and activties that make up the organization.

Mapping of the organization is maintained at high level by system administrators, typically from the Human Resources and Information Technology departments. However, in order to bring value to the entire business the mapping is updated on an ongoing basis using a survey which is filled in by the employee and/or their manager. This allows quick update of data, for example when new skills are acquired, which feeds back to the system and can be used for benchmarking of peer groups or a comparison of the current organization versus the target. Our experience is that this results in greater visibility across the organization, dynamic tracking over time motivates employees to look for new ways of improving performance. Advanced analytics can then also identify opportunities for optimizing ways of working and assessing impacts.

What steps are required?

In our experience, mapping activities and training requires the following key stages (Morrison, 2015):

1. Creating a taxonomy of activities, competencies or knowledge for the work done in the organization. This can be created from scratch within the tool or a pre-defined list, for example from a professional governing body or regulatory authority, can be uploaded. OrgVue's minimal data requirements mean that data upload is flexible and multiple data sources can be integrated.

2. Communicating this taxonomy to the staff to achieve understanding and buy in. Reports can be generated from OrgVue in order to visualize and communicate the data with staff. This along with strong employee engagement to ensure the purpose of the exercise is understood are key focuses during the early stages of the project.

3. Collecting the data via a survey which can be completed quickly and easily on a mobile device. To ensure accurate data collection, communcation must emphasise the type of information being sought and the planned use of that information. Conceptual issues can arise around the difference between competencies, activities and knowledge.To avoid this clear definitions must be established and shared before the survey is deployed as well as within the survey itself.

4. Processing the data and analysing the results. This is likely to involve some data validation, simple statistics and reporting on survey responses. In order to ensure data is valid and accurate any of the following a compination of the following is employeed: self-assessment, manager assessment, calibration reviews by a committee, peer-to-peer 360 assessments, outside assessment centers.

5. Example findings are gaps in knowledge, undesired differences in skill sets between teams, variations in the amount of time spent on like activities.

6. Sharing findings with the relevant teams. Once the data is available it can be leveraged to empower nursing teams. More informed decisions can be made about the development of teams and individuals. When these finding are agrregated they can help to inform organizational strategy. For example, the observation of a widespread deficit in a particular skill can help focus recruitment for the next cohort.

7. Modelling options for the future – job design based on what already exists, benchmarking variation in roles, job design for consolidation of like skills, job design during times of change e.g. digitalization.

What has been our experience?

We will share what has worked and the challenges we faced in Case Studies from:

- Skills mapping in the Water Industry – resolving taxonomies for technical skills to give a common method for tracking between different companies.

- Activity mapping in a Finance Company – making activities visible allowed costs to be connected from teams to processes to customers. This allowed greater transparency across the company and more informed strategic decision making.

- Objectives mapping for a Transport company – tracking of the annual process for submitting objectives and recording progress against these. Both managers and employees fill in the survey and can review each others' comments.

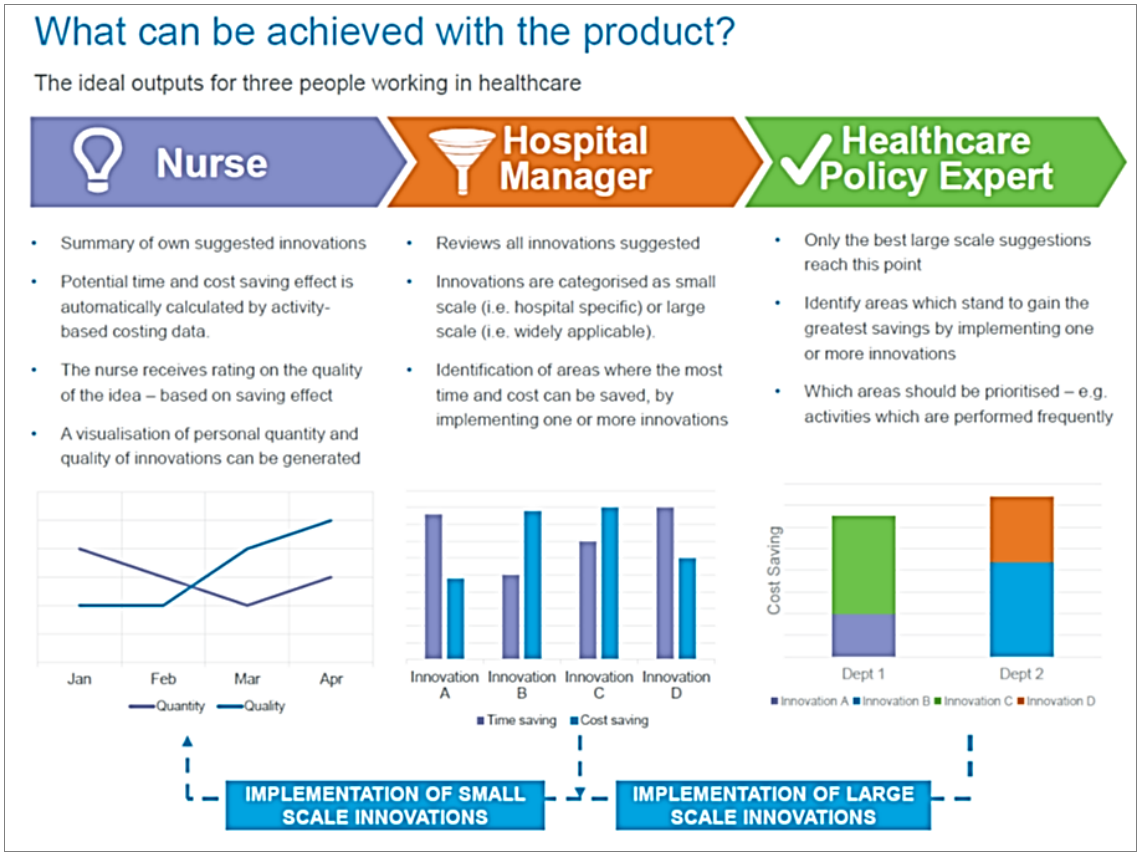

Figure 1. A proposed system for the collection of nursing innovations based on an individuals ideas and experiences, then reviewed by senior staff members to agree implementation of improvements to working practices.

What would this look like for nursing?

Making use of OrgVue a system could be designed whereby a common taxonomy of competencies and knowledge in the nursing profession are mapped. A survey is then filled in by nurses and their managers to agree which competencies are held by an

individuals and which training and experiences they have to back this up. Gap analysis can then be performed between the desired competencies and actual competencies, the data can be anonymized and shared within and between hospitals in order to benchmark competencies. This data can be used to plan future training and hiring efforts by the hospital.

Further to this the system a method for knowledge sharing can be included– when a nurse experiences a method for improving a particular process or procedure they can submit this, it can then be reviewed by senior staff and where appropriate shared with the nursing to community to accelerate the uptake of optimization opportunities. See Figure 1 for the process by which innovations would be submitted and reviewed.

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SOCIALCARE for Reflective Practice - A Form for Exchange between Experts, Professionals and Informal Caregivers

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Introduction

SOCIALCARE is a project for bringing formal and informal caregivers together and to empower communities in giving support to people in need. SOCIALCARE also empowers the patients to look for support and increase their activity in community and become more active again by using a digital platform. SOCIALCARE will be a central digital meeting point, where all stakeholders in a local community can come together. It will support communication strategies, clustering and common goal setting and every person is the main director of his or her own social care network. Additionally according to the care need, different functionalities and service providers can be added to the platform. It will be based on an already existing solution from one of the partners called wikiwijk (http://wikiwijk.nl), which will be further extended with different functionalities. The technological research and innovation will focus on the flexibility and adaptability of the functionalities and services to different communities, care needs and care organizations, integrating partly existing solutions and working on interoperability. It will provide for a set of services for mobile devices and administration interfaces for desktop computers. We will keep a technology watch on cutting edge technologies, such as smart watches and state-of-the-art phones, performing research on senior user acceptance and added value for SOCIALCARE services.

At this platform, requests for support can be placed like in a market space but also information and experiences as well as chattering. For his poster, two groups of stakeholders have to be distinguished: volunteers and care professionals. As care professionals are clear by their medical education, volunteers are people with the wish to give support and help to those in need of on several levels of competence – from housewife to lawyer. Important to this is, that they act in the role of a volunteer and by this are limited in their allowance to do certain tasks. The requested services can be either done by volunteers or care professionals. According to the needed level of qualification the request is available for the right group. Even more, also care professionals can state their need for support by volunteers and volunteers can state the need for support by professionals. With the basic idea of giving each other support where it is needed, higher efficiency for professionals can be achieved, a better social quality for care can be established for patients and a secure environment, guided by professionals for volunteers can be started.

This vision is also a chance for knowledge and experience exchange. SOCIALCARE will provide content for volunteers on an eLearning base about first aid, fall prevention and care essentials. But there is also going to be a class based learning option to go more into depth. These courses and classes will be asking for a consultation fee to finance a trainer or expert. This demand driven academy for informal care givers and volunteers will be a business opportunity. By this, quality assurance has to be done by a care organization that deals as umbrella organization for the regional academy.

By this, cooperative models and training between community nurses, community case manager and informal care givers can be established. Sharing experiences brings also an educational benefit to the professionals. Thinking about the model of reflective practice, this can bring a deeper understanding for the needs of the patients, the care setting and the own capacities and develop new service models as spin offs. The new service models for care are working on integration of health care professionals not just in a formalized organization but also in a local community. Following the idea of community care, models from the Netherlands (e.g. http://www.zorgcooperatie.nl/, https://www.austerlitzzorgt.nl/, http://www.stadsdorpzuid.nl/) are extracted and tested under which circumstances are able to be integrated elsewhere. New models for health service funding are discussed. Aspects of crowdfunding are discussed as well as classical insurance models. Especially, rural areas are very important to be covered in the upcoming years. Demographic changes and population movements (Statistik Austria, 2014) show that the border areas between countries are becoming “gray strips” as estate prices are cheaper near to the boarder and the mobility of seniors is increasing. But health care is focused on population centers. The former image of a land physician has dramatically changed. Also in some countries, the idea that the physician is travelling to a patient is out of date as the primary health care is becoming more ambulatory and health center oriented. Telemonitoring (Golbeck et al., 2011), new health services, mobile nurses (Fernando et al., 2014) and community care concepts can support in providing primary health care in rural areas:

- By this tendencies of social isolation shall be covered.
- By this land flight shall be evaded.
- By this, countryside shall become more attractive as a long term investment
- By this, aging at the countryside is becoming more attractive
- By this, a bigger customer group will increase attractiveness of countryside for shops, groceries etc.

SOCIALCARE empowers all related persons of the care process. The vision of the project is to provide a platform which takes care of caregivers. To fulfill this aim, SOCIALCARE follows an integrative multi-sectoral and multi-stakeholder approach based on the relations within the care system (Aumayr, 2015). The platform provides the environment for several branches of an economic cycle. Care professionals, communities/municipals, volunteers, local industry and merchants and commercial infrastructure is going to be brought together in one place for developing a new marketplace. By this, the transferred goods are expertise, care and time.

The cooperation between the sectors is funded on the exchange of expertise to give a start.

- Care provider give advice to local industry, give advice to informal care givers
- Informal care giver are supported, get better infrastructure for health care, are better included and supported by their neighbors
- Neighborhood is empowered and supports each other
- Community and municipals are supporting with legal advice and providing support (financial and in-kind) for the beginning period.

A crucial point in this mostly volunteer- and community-based setting is the long term motivation. To support the sustainability of this system, a "Motivational Value Approach" was designed to help understand how people can be motivated to engage work and cooperation in such a system.

Primary addressed content for starting the network is:

- First Aid
- Care Essentials
- Fall Prevention
- Monitoring and care documentation by e.g. wearables

Methodology

SOCIALCARE is researching on the societal impact of platform based community empowerment and community driven health care developments. To achieve this aim, several methods from different branches are used. SOCIALCARE works for the platform design with a participatory design and includes End Users in the platform design and service model development. By this, personas are being developed to identify prototypic users as target group definition. This is accompanied with requirements analysis in focus groups in Netherlands, Austria and Belgium. Also the legal requirements for volunteering work in the field of care and restrictions in health care on a European scope are analyzed. Legal regulations are compared on a base of task related paragraph analysis correlated to competence profiles.

Furthermore, the platform development is not seen as an isolated development but understood as a socio-technical system. By this, it is not solely about the needed interfaces and technical feasibility but also about the way, people would use such a platform and how they can get attached to it. With approaches of Maslow's hierarchy of needs (Maslow, 1954) and Rational Choice Theory (Jevons, 1871), principals for intrinsic motivation (Heckhausen,1989) are described and brought in context to the economic theories of Marx about the worth and value of work under pressure of commercialization and need of efficiency (Marx, 1867 (2013)). The results are mirrored with groups of volunteer managers to increase external validity of the concept in the motivational value approach. This is done in the Netherlands, Austria, Belgium, UK and Germany to ensure a European perspective.

The project will pilot in the Netherlands and Austria. Results are expected for 2017.

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The ***Pro-Nursing symposium*** has provided an international forum for researchers and practitioners in the field of vocational learning, technology enhanced learning, and particularly vocational education in the domain of healthcare and professional nursing. The symposium target groups were human resource and knowledge management researchers and educators as well as vocational colleges, schools, universities, industries, and voluntary bodies. The present book consists of the papers which were peer reviewed and presented at the symposium. The book thematic coverage includes the following topics:

- Job-knowledge management
- Learning analytics
- Technology enhanced learning
- Gamification in vocational learning
- New trends in adaptive Testing
- Personnel selection
- Training validation

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