



***Between the Tacit and the Explicit: ICT as a  
Facilitator for Knowledge Creation and Learning in  
Physiotherapy Education***

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# Abstract

It is a national aim to increase the pedagogical utilization of ICT in higher education and to use ICT to promote learning and innovation. E-learning tools and projects are prime examples for meeting this aim. Much research in this area seems to focus on economical, organizational and user satisfaction issues. Less is focusing on which type of knowledge the tools represent, and it seems to be a tradition of choosing a technological platform prior to its intended use in teaching. This study investigates a project, Fysio-nett, made to support a decentralized study program in physiotherapy at Tromsø University College, Norway through a qualitative, interpretative approach. The research material is analyzed with theories on knowledge perspectives, Communities of Practice and Actor Network Theory with the objective to analyze how knowledge and learning is represented in the project. It is also an objective to look at how sustainability can be created for the project. The study shows that Fysio-nett is a different approach to creating and implementing an e-learning tool in that knowledge can be identified as the driving force for its creation. Knowledge creation has occurred both in the creation and utilization phase of the project, mainly through interaction between tacit and explicit knowledge. It is also shown that the tool is highly dependent on being an integrated piece of technology in a Community of Practice. Finally, utilization and sustainability for the project is suggested improved through the recognition of that the flexible design of the tool demands that organizational measures are taken to compensate for this flexibility.



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# Contents

<b>ABSTRACT .....</b>	<b>III</b>
<b>ACKNOWLEDGMENTS .....</b>	<b>V</b>
<b>CONTENTS.....</b>	<b>VII</b>
<b>INTRODUCTION.....</b>	<b>1</b>
MOTIVATION, EXPECTED CONTRIBUTION AND TARGET AUDIENCE.....	3
STRUCTURE OF THE THESIS .....	4
<b>THEORY CHAPTER.....</b>	<b>7</b>
INTRODUCTION .....	7
PERSPECTIVES ON KNOWLEDGE.....	8
<i>Defining knowledge .....</i>	<i>8</i>
<i>Tacit and explicit knowledge .....</i>	<i>9</i>
<i>Knowledge conversion and creation.....</i>	<i>11</i>
<i>Knowledge in health care and physiotherapy.....</i>	<i>13</i>
COMMUNITIES OF PRACTICE.....	16
ACTOR NETWORK THEORY - A SOCIO-TECHNICAL APPROACH.....	18
<i>Overview.....</i>	<i>19</i>
<i>Inscription and translation.....</i>	<i>20</i>
<i>ANT, CoPs and knowledge .....</i>	<i>21</i>
<b>METHOD CHAPTER.....</b>	<b>25</b>
RESEARCH DESIGN.....	25
<i>Quantitative versus qualitative research.....</i>	<i>25</i>
<i>Types of qualitative research.....</i>	<i>26</i>
<i>Ethnography and Information Systems research.....</i>	<i>27</i>
<i>Klein and Myers' seven principles.....</i>	<i>28</i>
<i>Involvement .....</i>	<i>29</i>
RESEARCH MATERIAL COLLECTION.....	30
<i>Interviews .....</i>	<i>30</i>
<i>E-mail questionnaire.....</i>	<i>31</i>
<i>Informal discussions .....</i>	<i>31</i>
<i>Log .....</i>	<i>32</i>
<i>Other.....</i>	<i>32</i>
RESEARCH MATERIAL ANALYSIS .....	33
REFLECTIONS ON METHOD.....	33

<i>Prejudices, preconceptions and their development</i> .....	33
<i>How was the study defined?</i> .....	34
<i>Access to the field</i> .....	35
<i>Refinement of research questions</i> .....	36
<i>Role of the researcher</i> .....	36
<i>Key informants</i> .....	38
<i>Changed approaches to the inquiry</i> .....	38
<i>Impact of theory</i> .....	39
<i>How the research material is made trustworthy</i> .....	40
<b>EMPIRICAL CHAPTER</b> .....	<b>43</b>
INTRODUCTION.....	43
RESEARCH CONTEXT.....	43
<i>Tromsø University College</i> .....	43
<i>The Physiotherapy Department and Fysio-Nett</i> .....	43
<i>Creating the decentralized program</i> .....	44
INTRODUCTION TO FYSIO-NETT.....	45
FROM IDEAS TO PROJECT – HOW FYSIO-NETT WAS FORMED.....	50
<i>Why Fysio-nett?</i> .....	50
<i>Searching for technology</i> .....	51
<i>Visions and ambitions</i> .....	54
DEFINING PHYSIOTHERAPY AND BUILDING THE KNOWLEDGE BASE.....	55
USING FYSIO-NETT.....	61
<i>Intended use and users</i> .....	61
<i>Written material</i> .....	63
<i>Unprocessed video-material</i> .....	64
<i>Processed video-material</i> .....	65
<i>Students' video-material and feedback cycles</i> .....	66
<i>Integrating written material and video in learning</i> .....	68
ADDITIONAL PERCEIVED BENEFITS OF FYSIO-NETT.....	68
<i>Reflection over time – adding distance</i> .....	69
<i>Closeness to practice</i> .....	69
<i>New methods for doing research</i> .....	70
CRITICISM.....	71
<i>Ethics</i> .....	71
<i>Can't learn without interacting in real life</i> .....	72
<i>Questioning the usefulness of ICT in education</i> .....	72
<i>Quality issues and copyrights</i> .....	72

STUDENTS' FEEDBACK .....	73
PROJECT FAILURES.....	74
<b>DISCUSSION CHAPTER .....</b>	<b>77</b>
PART ONE: INITIAL PHASE.....	77
<i>Externalization – negotiating knowledge trough technology.....</i>	77
<i>Combination – a simpler process.....</i>	79
PART TWO: UTILIZATION PHASE.....	79
<i>Fysio-nett enables learning trough externalization.....</i>	80
<i>A virtual form of socialization.....</i>	80
<i>Fysio-nett challenges traditional view on learning.....</i>	81
<i>Fysio-Nett enables learning in and between CoPs.....</i>	81
PART THREE: CRITICISM AND FAILURES.....	83
<i>Limitations of Knowledge .....</i>	83
<i>Low Utilization Rate – a Problem of Weak Inscription?.....</i>	85
<i>Extending the Network – Increasing problems.....</i>	86
PART FOUR: THE BIGGER PICTURE.....	87
<i>Fysio-nett represents knowledge as a process .....</i>	87
<i>The power of not making knowledge explicit.....</i>	89
<i>“Knowledge base” as a concept – a contradiction in terms?.....</i>	90
<b>CONCLUSION CHAPTER .....</b>	<b>91</b>
CONCLUSION.....	91
CONTRIBUTIONS.....	92
FURTHER RESEARCH .....	93
<b>REFERENCES .....</b>	<b>95</b>

**Figures and tables:**

Figure 1:	p 46
Figure 2:	p 46
Figure 3:	p 48
Figure 4:	p 48
Figure 5:	p 49
Figure 6:	p 49
Figure 7:	p 57
Table 1:	p 31



# Introduction

Information and Computer Technology (ICT) has found its way into most, if not all, of our society's structures and functions. From banking to travel agencies and television to libraries, almost every aspect of our living lives can be linked to the use of ICT. ICT has also in a large scale found its way to the bearing structures of our societies like health care and education. This thesis covers aspects of where ICT, health care and education cross; in the educational institutions of future health care professionals, more specifically in the education of physiotherapists in Norway. It aims to investigate aspects of knowledge and learning in regards to the use of ICT in the education of such health professionals.

The arena for this investigation is the development and use of an Internet based learning tool, Fysio-nett, at the physiotherapy department of Tromsø University College (TUC) in northern Norway. This tool was created to support a decentralized, part time program in physiotherapy at TUC and started its development in 2003. It is an Internet based learning tool and knowledge base for physiotherapy which utilizes different types of media, and combinations of these, to fulfill its purpose. The tool was implemented in October 2003 and is still running.

It is an explicit goal on a governmental level to utilize ICT in higher education in Norway. In the governmental plan "Program for digital competence 2004-2008"

(Forskningsdepartementet, 2004, p. 7), two of the main goals are expressed as follows:

- *"In 2008 the Norwegian educational system should be at the front line in the world with regards to development an pedagogical use of ICT in teaching and learning"*
- *"In 2008 ICT should be an integrated tool for innovation and quality development in Norwegian education, based on organizational models and ways of working that promotes learning and innovation"*

The development of Fysio-nett fits very well with these two goals, and that makes it interesting and highly relevant case to investigate.

E-learning, of which Fysio-nett is a representative, has become widely used the past decade and in an increasing number of fields (Childs et al, 2005; Keegan et al, 2007; Kroepelien, 2003; Moule, 2006; Padalino & Peres, 2007; Peacock & Hooper, 2007). Much research has been directed towards organizational, technical and economical issues that could improve the success rate of such projects (Keegan et al, 2007; Childs, 2005; Ruiz & Mintzer, 2006). In addition come a focus on user satisfaction (Ruiz & Mintzer, 2006) and a focus on analyzing how these tools function when they are used (Gold & Begg, 2004; Moule, 2006; Padalino & Peres, 2007). There does however seem to be little focus on the content of these tools; what are they filled with? What type of knowledge do they represent and do they represent what they intend it to represent? How do they aim to utilize, in best way possible, the possibilities which lie in ICT in order to improve education? It seems like there has been a general idea that the tools at hand is automatically suitable for any type of profession and that learning easily can be transferred to already existing platforms like forum tools and platforms for Computer Supported Cooperative Learning (CSCW) (Orlikowsky, 1992). And this has been done without really investigating or doing an in depth analysis of whether the tools suit their needs, or whether it is possible to get even more out of it through different approaches.

The creation of Fysio-nett is such a different approach. The project started in a different end than most projects; it built the technology around the profession, and not vice versa. The reason for doing it this way seem to be that the creators had a very clearly stated view on what type of knowledge they wanted the tool to represent. This thesis aims to document and analyze the development of from idea to implemented tool. It aims to look at how the creators went about to define a human and practical-work oriented profession like physiotherapy, into a hard piece of technology. And it aims to analyze how knowledge is represented and communicated through the creation and use of this tool. In this way the thesis sheds some light on aspects that are not well documented earlier. It sheds light on the creation process of such a tool, and it sheds light on the knowledge perspectives with regards to the utilization of ICT in higher education, specifically for health care and physiotherapy.

No project is however successful without users. This is also the case with Fysio-nett, which has its struggles of finding its place within an organization. Therefore it is also a goal to look at factors that can contribute to Fysio-nett finding its place as a sustainable service and to reach certain goals for utilization. Many factors can contribute to this, but the main theme in

this thesis is knowledge and learning, and also the issue of utilization will mostly be investigated through these perspectives. The following research questions have been set:

- How can ICT contribute to knowledge creation and learning in physiotherapy education?
- How can Fysio-nett become an established, sustainable service for all students and teachers at TUC?

The theoretical tools for this investigation will be perspectives on knowledge and learning. The concept of tacit and explicit knowledge (Nonaka & Takeuchi, 1995; Polanyi, 1983), knowledge creation as a process between the two (Nonaka & Takeuchi, 1995) and current views and about valid knowledge within medicine and health care will form the basis for the discussion. The Communities of Practice Framework (CoP) (Wenger, 1998), a social learning theory, and Actor Network Theory (ANT), (Monteiro, 2000) will be used to extend the discussion into a view on how knowledge, humans and technology interact in communities or networks. The research questions will be sought answered through a qualitative, interpretative approach.

### ***Motivation, Expected Contribution and Target Audience***

As a certified physiotherapist I have ever since physiotherapy school been interested in the concept of knowledge within physiotherapy. This grew as a lot of the clinicians I met during my education and later, had what I felt as little interest in reflecting over these to me paramount issues. Not only is my feeling many clinicians do not show interest in gathering new information, they also lack interest to reflect over own work. This does in my opinion not prepare the ground for good practice.

To reflect on your own work, to develop, to learn and to do research (on any level) is important in my eyes. In developing physical therapy for the future, it would make no sense to me not to utilize all the possibilities within ICT to store, share, make searchable and develop information and knowledge. In fact I think it is necessary to do so. But you will need a tool which can grasp the wider definitions of what knowledge within physiotherapy is. Fysio-Nett

is an attempt to offer both conventional knowledge in the form of “facts”, and the more tacit forms of knowledge as body language, how to conduct an physical assessment, clinical reasoning etc through audio/video and more narrative or reflective use of text. It tries to link these forms of knowledge within the knowledge base, and it provides an arena for the users to collectively reflect on the knowledge. Without knowing whether Fysio-nett had succeeded as a tool for this I became interested in Fysio-Nett as a concept and I found it interesting as a case for further study.

I hope that this thesis can contribute on at least three levels. First of all I hope it can contribute through adding some interesting perspectives on how to design and create e-Learning tools for the future, specifically for the health professions. Secondly I hope to give some perspectives on how to make such projects sustainable, all though I’m just aiming to add a small piece of the puzzle in that regard. Thirdly the thesis could give a contribution to the discussion of knowledge, what “valid” knowledge is or should be within physiotherapy and health care in general.

This suggests a target group that consists of those interested in developing e-Learning tools, especially within healthcare or other fields with a traditionally strong practice based view on learning, and professionals that are interested in perspectives on learning and knowledge in the health professions.

### ***Structure of the Thesis***

The rest of this thesis consists of a Theory Chapter, a Method Chapter, an Empirical Chapter, a Discussion Chapter and a Conclusion Chapter.

The Theory Chapter consists, as already mentioned, of a set of theories regarding knowledge and learning. There has been an aim to integrate the different theories so that it together constitutes a richer, integrated framework for analyzing the research material. The Method Chapter then follows, which covers the rationale for choosing a qualitative, interpretive approach for the study and a description of the process of gathering and analyzing research material. Also included is a reflection on the method, my position as a researcher in this context and how theoretical and methodological aspects have influenced my work.

The Empirical Chapter presents the research material. After the context for which this study has taken part is described, and after a short introduction to Fysio-nett and its core functions the first main part covers the period before Fysio-nett was created; the search for technology and visions and ambitions. The second main part describes the design and creation of Fysio-nett. The third main part explains how Fysio-nett is being used, and why it is being used in the way it is. Then the last part of the chapter covers perceived benefits, student's feedback, criticism and project failures. There has been a goal to tell and document the full story of Fysio-nett rather than just fragmented pieces of information, so the empirical chapter could hopefully be useful also as a standalone exemplification on how such a tool could be developed.

The Discussion Chapter discusses the research material in light of the theory already presented while conclusions, possible impacts of these and possible future research are summarized in the Conclusion Chapter.



# Theory Chapter

## *Introduction*

The main topic for Fysio-nett as a project is knowledge and learning. The concept of knowledge is at the core of the creation of Fysio-nett and equally important for its intended use as a tool in learning. A thorough discussion on knowledge and different aspects on knowledge are therefore in its right place. I start out trying to define knowledge itself before I progress into discussing the important difference between tacit and explicit knowledge and how tacit and explicit knowledge interact in various ways to enable the creation of knowledge. There are many different ways in which different types of knowledge can be categorized, but the chosen tacit-explicit perspective is chosen due to the perceived importance of tacit knowledge in health care. This will be discussed in a part covering knowledge perspectives in health care and physiotherapy.

Moving from theoretical aspects on knowledge I continue to discuss learning which is of course strongly related to the concept of knowledge in that knowledge is in fact what learning aims to develop or transfer. The Communities of Practice (CoP) framework is a social learning theory which I consider having the possibility to contribute to shed some light the use of Fysio-nett as a learning tool. The reason for introducing a social learning theory is because of the strong focus on learning in and from practice at TUC. CoP as a social learning theory fits well with this general idea, and it is a goal for this thesis to see how Fysio-nett places itself in all this.

The last part of this theory chapter discusses Actor-Network Theory (ANT). The purpose of introducing this is threefold. Firstly it will establish a framework for discussing the relationships between humans and technology. This is among other things important for discussing my research question regarding sustainability of Fysio-nett as a long term project, but it also will make it easier to discuss aspects regarding the utilization of technology as a

vessel for knowledge and values. Secondly, knowledge can be included as a unique actor within this actor-network, thus further manifesting the link between humans, technology and knowledge. Thirdly it should be mentioned that ANT has also been used as a method in my field work. ANT has aspects of being both a methodology and a theory, and it has greatly impacted the way I have conducted my field work and how I have analyzed my data. The reflections on this last part will be covered in the Method Chapter.

## ***Perspectives on Knowledge***

### ***Defining knowledge***

The concept of knowledge is a large and extremely complex one and is not easily defined as one concise definition (Rowley, 2007). Jaspahara (2005, p. 16-17) says that “*there is still no consensus on the nature of knowledge, except that it is based on perception that can provide a rational justification for it.*” Rowley (2007) however, points out that many attempts for a definition of knowledge somehow tries to relate the terms data, information and knowledge with each other. So to contrast the terms data, information and knowledge is assumed to give some insight in what we regard as knowledge.

According to Ackoff (1989) data are defined as symbols that represent properties of objects, events and their environment. They are the products of observation, but are of no use until they are in a usable, relevant form. The difference between data and information is a functional difference rather than a structural one. Information is then contained in descriptions, answers to questions that begin with such words as who, what, when and how many. Information systems generate, store, retrieve and process data and thus one can say that information is inferred from data. Knowledge on the other hand is “know-how” (rather know-what or know-who), and is what makes possible the transition from information into instructions. Knowledge can be obtained either by transmission from another who has it, by instruction, or by extracting it from experience.

As I see it this means that data are symbols (for instance numbers, letters or letters that form words) that represents “something” about reality, but unless put into a context through some kind of question they do not give any meaning. And when you do just that (put it into some

kind of context), it becomes information. Knowledge on the other hand is your ability you use this information into executing specific tasks.

These definitions of data, information and knowledge are important for discussing Fysio-nett later on. However there are aspects of knowledge as a concept that can be of additional help in this. It is already mentioned indirectly and vaguely by Ackoff's definition of knowledge in that knowledge can be obtained either from instructions or through experience. There are two categories of knowledge that are usually thought of as being connected to these two types of knowledge transmission; that is the concepts of tacit and explicit knowledge. This will be discussed next.

### *Tacit and explicit knowledge*

The concepts of tacit and explicit knowledge are by many regarded to originate from the work of the scientist and philosopher Polanyi who started to investigate the fact that we seem to “*know more than we can tell*” (Polanyi 1983, p. 4). Tacit knowing is about this part that we cannot tell, still we “know something”. Polanyi exemplifies this tacit knowing through an experiment performed by scientists in 1958 (Polanyi 1983). A person was during conversation exposed to an electrical shock at the times he uttered certain “shock words”. The person did after a while avoid the shock through not using the “shock words”. Upon interview after the experimental setting, the test person could however not explain why he stopped uttering certain words. So the subject got to know a practical operation, but could not tell how he worked it. Or we could say that he had developed some kind of knowledge, but it was tacit.

Explicit knowledge is then knowledge that we are aware of, that we can “tell” in some way or another. If the test person were consciously aware of the link between the “shock words” and the shock – if he could explicitly tell “I avoid these words in order to avoid the shock”, then the knowledge would be explicit. The implications of this difference are substantial. Just imagine how much easier it would be for the test person to teach this experience to another test person if the knowledge was explicit instead of tacit. In fact it, in this specific case it would be almost impossible for the test person to teach somebody else this link, without making it explicit first. This shows how important and effective it can be to make tacit knowledge explicit and mechanisms for doing this will be discussed in detail later in this chapter.

I have deliberately chosen to continue Polanyi's use of the term "tell" instead of verbalize, said, written down or similar when referring to the distinction between tacit and explicit. Patel et al (in Sternberg and Horvath, 1999, p. 77), as an example, use the word "verbalize": *"It is commonly accepted among scholars in diverse fields that there are two types of knowledge: knowledge that can be verbalized, such as facts and concepts, and knowledge that cannot be made verbal, such as intuition and knowledge of procedures."* The use of verbalize in this matter can be deceiving, or at least confusing, since it easily can lead to the assumption that explicit knowledge always have to be put into words, and that if it is not put into words then it is tacit. This is not the case as indicated by the use of "can be verbalized" by Patel et al, it does not necessarily have to be verbalized, but it "can be". So using the broader term "tell" implies that it can be told in numeral ways; by numbers, letters, writing, speech, photos or video or practical work. Sometimes it is easier to show something than to write down something, or sometimes people have not bothered to write down what can be written down. The knowledge is still explicit, since it can be explicitly told by the person knowing – even though he might not choose to or he might choose to do it through other means than verbalizing it. Again, looking at Polanyi's example, if we consider that the test person later on realized the link between the specific words and the shocks, it would become explicit knowledge even if he did not choose to share this knowledge with anybody. This distinction is important for discussing research material for this paper later on.

Nonaka and Takeuchi (1995, p. 215) points in the same direction and comments on tacit knowledge as

*"... highly personal and hard to formalize making it difficult to communicate to others or share with others. Subjective insights, intuitions and hunches fall into this category of knowledge. Furthermore, tacit knowledge is deeply rooted in an individual's action and experience, as well as in the ideas, values or emotions he or she embraces"*

Nonaka and Takeuchi seem to have a much more general and fuzzy description of the term than what can be interpreted from Polanyi, but the attributes they connect to the term is still valid and important in relation to my interpretation of Polanyi. Nonaka and Takeuchi further segments tacit knowledge into two dimensions (Nonaka and Takeuchi, 1995). The first is a technical dimension, and the second is a cognitive dimension. The technical dimension has to do with the practicing of skills or crafts for instanced performed by a master craftsman. The

cognitive dimension consists of our mental models, schemata, beliefs and perceptions; it has to do with our image of reality and how we perceive the world around us.

The archetype of explicit knowledge is often thought of as that which you can read in a book, what can be found in an encyclopedia or what is defined in a firm's collection of procedures. This, of course is correct, but remember throughout this text that explicit knowledge is not limited to such written material. Nonaka and Takeuchi define explicit knowledge as something that is "*transmittable in formal, systematic language*" (ibid, p. 218). This does however not contradict my view of explicit knowledge as not limited to such type of transmission; they are however a bit unclear in their definitions as I see it. This is not ideal because it creates a grey area between tacit and explicit knowledge that can be difficult to address. If an organization is interested in collecting and sharing the collective and individual knowledge present in a firm there will be a large difference between investigating the "real" tacit knowledge (as per my definition) or individual knowledge that is explicit but that the individual for some reason has not shared with the rest. To manage the first task will be a much more difficult one since it involves more complex processes than just collecting the unshared explicit knowledge.

### ***Knowledge conversion and creation***

So far we have discussed the differences between tacit and explicit knowledge. It is however important to realize that tacit and explicit knowledge are not independent of each other but rather "*mutually complementary entities*" (Nonaka & Takeuchi 1995, pp. 219-223). The two dimensions of knowledge interact with each other, and through this interaction "knowledge conversion" happens. This conversion also makes it possible for new knowledge to be created. Nonaka and Takeuchi have presented a framework for understanding these processes through four modes of knowledge conversion and this will be outlined next.

The first type of knowledge conversion is called socialization and describes the conversion from tacit to tacit knowledge. Socialization happens through the sharing of experiences and is a process that happens between people without using language and through this one can acquire tacit knowledge directly from others. Master – apprentice relationships are the typical way of utilizing this mode of knowledge conversion where the apprentice acquires knowledge through observation, imitation and practice.

The second mode of knowledge conversion is called externalization and covers the conversion from tacit to explicit knowledge. This is the quintessential knowledge creation process and often takes the form of conceptualization, making models, metaphors and analogies and is often regarded as a difficult and complex task to manage. If we look back to the shock experiment mentioned by Polanyi, externalization would be the process where the test person realized the connection between the “shock words” and the shock, and could if he wanted to express this in words. However this is not a very complex example. It often becomes more complex in a real world setting and the complexity of the situation often results in a discrepancy between a mental image of something and what can easily be expressed for instance in words. Nonaka and Takeuchi describe this discrepancy between images and expressions as a vessel for promoting reflection and interaction between individuals.

Combination is the third mode of knowledge conversion and describes the process from explicit to explicit knowledge. This is about combining different bodies of explicit knowledge resulting in a reconfiguration of existing information through sorting, adding, combining and categorizing explicit knowledge, which in turn can contribute to the creation of new knowledge. A typical example of such a process is what takes place in formal education, for instance me writing this Theory Chapter. This type of knowledge conversion can be facilitated through the use of computer technology. One example of such use is computerized knowledge based systems, often called expert systems (Coiera, 2003) which contain clinical knowledge and are able to draw conclusions like diagnosis and treatment plans from this knowledge based on input in the form data from a patient.

The fourth and final mode is called internalization and covers the conversion from explicit to tacit knowledge. This is closely related to “learning-by-doing and embodies all the experiences a person gets from socialization, externalization and combination, and internalizes this into an individual’s tacit knowledge base. Such type of knowledge conversion can, according to Nonaka and Takeuchi, be facilitated through the use of verbalized or diagrammed knowledge in the form of documents, manuals or oral stories.

These four types of knowledge conversion modes all contributes in what Nonaka and Takeuchi call the “knowledge spiral”. The main point of this knowledge spiral model is that when tacit and explicit knowledge interact, innovation or knowledge creation occurs. The

interaction of tacit and explicit knowledge is shaped by the shift between all of the four different types of knowledge conversion.

### ***Knowledge in health care and physiotherapy***

We now have established a basic understanding of what knowledge is, the difference between tacit and explicit knowledge and how it gets converted, created and in a sense transferred between individuals. Knowledge and knowledge perspectives, what is regarded as valuable knowledge does however vary from field to field and even within fields. The health field is a very clear example of this. Since Fysio-nett, the case for this study, is a case from the health field and aims to deliver knowledge to the health field it makes sense to discuss Fysio-nett on the basis of different knowledge perspectives in health care and medicine. Such perspectives will be presented next as a basis for this discussion.

In recent years the term Evidence Based Medicine (EBM), the more general term Evidence Based Practice (EBP) or similar more or less field specific branches (Evidence Based Physiotherapy, Evidence Based Nursing, Evidence Based Healthcare)<sup>1</sup> has become a focus of attention for people working within the field of medicine and health care (Bjørndal et al, 2000; Ekeli, 2000a-d; Helewa & Walker, 2000; Jamtvedt et al, 2002; McGovern, 2001). The evidence based system is an attempt to create guidelines for health workers regarding what is considered best practice. The ambitions for this system are not modest as McGovern (2001, preface xi) explains in the opening of his book: *“Evidence Based Medicine (EBM) is a beacon which helps clarify areas of uncertainty. EBM epitomizes modern general practice and the essence of clinical governance by promoting the most effective care for individual patients.”* So EBP give promises of promoting “the most effective care.” That is a lot to promise.

But how does EBP try to fulfill this promise? The core of it all is guidelines for deciding what valid knowledge is in healthcare, resulting in a set of rules that can be utilized to promote what is thought to be the best possible research available. This hierarchy of evidence (ibid, p. 13) can be summarized in the two following lists. The first one shows how categories of evidence are ranked from highest to lowest “quality” (ibid, p. 14):

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<sup>1</sup> I will in this text use the general term Evidence Based Practice or refer to the concept as “the evidence based system”, except when citing specific sources. For all practical purposes I will treat and look at these terms as equivalent.

1. Category Ia: Meta-analysis
2. Category Ib: Randomized Controlled Study (RCT)
3. Category IIa: Non-randomized controlled study
4. Category IIb: Quasi-experimental study
5. Category III: Descriptive study
6. Category IV: Consensus report

From this it is evident that the quantitative methods are preferred over qualitative/descriptive methods. For the quantitative studies the EBP system has set up a ranked list:

1. Systematic review
2. Meta-analysis
3. RCT
4. Cohort
5. Case-control
6. Cross – sectional
7. Case reports

This shows that the RCT is considered the backbone of the evidence based system, since a systematic review or meta-analysis of results from RCT studies will be regarded highest. Further, the EBP system sets guidelines for how to perform the different types of research mentioned above.

Based on these guidelines a common definition of the system is *“The conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of EBM means integrating individual clinical expertise with the best available external clinical evidence from systematic research.”* (Sackett et al in Jamtvedt et al, 2003 p. 17). An additional contribution to this set of rules is the “Cochrane Collaboration” which main purpose is to run the “Cochrane Library” (Bjørndal et al, 2000, p. 158) which is a database consisting of published research articles that fulfills the requirements set by the EBP-system thus being the prime source for EBP material.

All though EBP has been embraced by many professionals in all health professions, there is also a great deal of skepticism towards this way of claiming ownership to what knowledge is or should be. Especially is this true for the typical health professions like nursing and physiotherapy. The skepticism is of course directed toward whether EBP is a suitable system for delivering best possible healthcare, but there are several factors contributing to this view. Ekeli (2000a-d) points to some of these factors when discussing the introduction of EBP in physiotherapy in Norway. The first point is that it is difficult to find an explicit theory grounded reason for why EBP should be the center of attention in clinical practice. Ekeli (2000a) points out that the “evidence” for EBP as the best way of conducting clinical practice actually seems to be built on experience and belief, which is quite a paradox looking at the strict rules that the EBP system sets for evidence. Secondly Ekeli (ibid) questions the validity of the knowledge produced with the gold standard of research, the RCT, in clinical practice. The reason for this is that the type of knowledge RCT produces is de-contextualized and therefore often does not fit well with reality. The methodology behind RCT demands de-contextualization in order to get significant results. Within the health sciences in general and in physiotherapy specifically there is a much stronger tradition for relying on knowledge developed through practice, in the meeting between patient and therapist, through the therapists’ qualitative assessments, tactile perception and so on. These are qualities that are based on the view that the human body is not just a biological measure, but also consists of life experience, cultural and social phenomena and therefore has to be understood in a contextual sense. The information about a patient this type of assessments produces is not easily documented within an EBP paradigm (Ekeli 2000d) since the core of EBP, the RCT, as mentioned implies de-contextualization. The information will often be of a descriptive and interpretive nature which in the EBP-system is regarded as low quality information in comparison to quantitative information. Relating this practice oriented, contextual nature of

knowledge to Polanyi and the tacit knowledge dimension we can see that in physiotherapy (and other traditional health fields like nursing) there is a focus on this tacit dimension that is not evident in the same way within the EBP-system. There is an underlying assumption that not everything can be made explicit, and an assumption that tacit knowledge is an important part of our collective knowledge.

### *Communities of Practice*

The CoP framework have frequently been used to look at organizational learning, and how working, learning and innovation can be seen as closely related forms of human activity that are interrelated and complementary forces rather than the more traditional view that they conflict each other (Brown & Duguid, 1991; Orr, 1992). It has also been used for looking at how online learning communities function (Moule, 2006), and indications from such studies indicates that it is difficult to develop effective CoPs through such channels. This way of working is however in an early development, so much can possibly be done to improve the results of such projects.

As stated earlier, the rationale for introducing this theory is to see how Fysio-nett fits into a study program with much focus on learning in and from practice. To introduce a tool that in some way or another does not fit well into this general idea of what learning should be could be regarded as counter intuitive. It is my view that the CoP framework fits very well with the practice based type of learning that TUC, physiotherapy department fosters. So this framework will be used to look at how Fysio-nett fits into all this. The CoP framework is a fairly large framework, and only the basic, general ideas can be presented here.

The CoP framework is developed and presented by Etienne Wenger (1998) in his book from 1998. This social theory of learning presents an alternative to the view on learning as something that happens in institutions, is an individual process, that it has an beginning and an end, that it is a separate activity, that it only can be obtained by teaching, and that it must be performed out of context (ibid). It is his view that through this type of learning the presented knowledge can be perceived as boring and irrelevant and thus contributing to that many would-be learners conclude that they are just don't capable of learning.

This different perspective implies that learning should be placed in the context of our lived experience of participation in the world, that learning is an integrated part of human nature and that learning is fundamentally a social phenomenon reflecting our own deeply social nature as human beings (ibid). The full conceptual framework aims to make it possible to derive a set of general principles and recommendations for understanding and enabling learning.

Wenger starts with four premises for his theory (ibid, p. 4):

1. *We are social beings. This is a central aspect of leaning.*
2. *Knowledge is a matter of competence with respect to valued enterprises. As we can see this fits well with the notion of knowledge as something regarding “know-how” as opposed to “know-what” presented earlier.*
3. *Knowing is a matter of participating in the pursuit of such enterprises, that is, of active engagement on the world.*
4. *Meaning – our ability to experience the world and our engagement with it as meaningful – is ultimately what learning is all about.*

Wenger points out that the primary focus of the theory is on learning as social participation, and that a social theory of learning has to integrate the components necessary to characterize social participation as a process of learning and knowing. These components can be summarized in the following four (ibid, p. 5)

1. *Meaning.* A way of talking about our changing ability – individually and collectively – to experience our life and the world as meaningful.
2. *Practice.* A way of talking about the shared historical and social resources, frameworks and perspectives that can sustain mutual engagement in action.

3. *Community*. A way of talking about the shared historical configurations in which our enterprises are defined worth pursuing and our participation is recognizable as competence.
4. *Identity*. A way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities.

It is pointed out that CoPs are found everywhere; from families struggles in everyday life, the workers organization on a workplace, people engaging in virtual spaces on the internet to the children playing at the playing field. Each of these can be looked at as CoPs constituting its own meaning, practice, community and identity.

Placing the focus on learning on participation has large implications for how we should act in order to understand and support learning (ibid). For individuals it means that they have to engage in and contribute to the practices of the communities in which they take part. As I see it this means that merely sitting behind a desk in a classroom passively registering everything that happens, is not a good way of learning. For communities it means that learning is an issue of refining their practice and to make sure new generations of members are recruited. We can see that individuals cannot learn without a community, and the community cannot learn without the individuals; they depend on each other. Lastly this view on learning means that for organizations it is important to foster the interconnected CoPs that exist within it in order to foster learning.

### ***Actor Network Theory - A Socio-technical Approach***

Marc Berg (1999) outlines the need for a socio-technical approach when investigating practices where technology and humans work so close together, for instance in the health care sector. A socio-technical approach is described through the recognition of that practices are heterogeneous network of people, tools, routines and documents, which also applies to Fysionett as a project. Actor Network Theory (ANT) is an example of a theory that uses a socio-technical approach (Berg, 1999; Fontaine, 1999; Fox, 2000; Montiero, 2000; Walsham 1997) ANT can be viewed as both a theory and a methodology, and in this thesis it is used as both. I

will start with briefly outlining the main concepts in ANT before progressing with a more in depth explanation of a couple of these concepts. These are the concepts that are most important for the analysis of my empirical material. The end of this section tries to establish a link between ANT and the concepts we already have discussed in this chapter; knowledge and CoPs.

### *Overview*

ANT emerged in the mid 80ies from the work of Michel Callon and Bruno Latour and can be considered to be a development of one strand of the wider school of thought on the social construction of technology. ANT is concerned with the creation and maintenance of coextensive networks of human and non human elements; a socio-technical approach. Earlier work in this field has often been associated with treating the social and technical as separate elements, all though both treated equally seriously. ANT on the other hand treats these elements as inseparable and gives them equal explanatory status within a network.

Monteiro (2000) explains an actor network a consisting of and linking together both technical and non-technical elements and gives an example about driving a car. When driving a car not only the car's engine capacity influences your driving, but also your driving training. We could take this even further and introduce other drivers, other drivers driving training, laws and legislation, the road and traffic lights. The network theoretically never stops. Therefore ANT talks about the heterogeneous nature of actor networks where all entities in such a network are given the same explanatory status.

To describe this hybrid network, we need to define some key concepts within ANT (Walsham 1997):

1. *Actor*: An actor can be human beings or non human actors. Non human actors can be both technological artifacts, other artifacts or for instance laws and standards.
2. *Actor-network*: A heterogeneous network of aligned interests including people, organizations and standards.
3. *Enrolment and translation*: Creating a body of allies, human and non-human, through a process of translating their interests to be aligned with the actor-network.

4. *Delegates and inscriptions*: delegates are actors who “stand in and speak for” particular viewpoints which have been inscribed in them.
5. *Irreversibility*: the degree to which it is subsequently impossible to go back to a point where alternative possibilities exist.
6. *Black box*: a frozen network element, often with properties of irreversibility.
7. *Immutable mobile*: network element with strong properties of irreversibility, and effects which transcend time and place, e.g. software standards.

The major empirical focus of the theory is to trace and explain the processes whereby relatively stable networks of aligned interests are created, maintained or fails to be established. Successful networks are created through the enrolment of a sufficient body of allies, and the translation of their interests so that they willingly participate in ways of thinking and acting to maintain the network. ANT can be considered both a theory and a methodology; it provides not only theoretical concept as a way of viewing elements in the real worlds, it also suggests that it is exactly these elements which need to be traced in empirical work.

For the purpose of this thesis I will take a special look at the concept of inscription and the concept of translation and this will be discussed next.

### ***Inscription and translation***

Inscription refers to the notion of that technical artifacts embodies patterns of use (Monteiro, 2000). This means that somebody, presumably those who created the artifact, has put into the artifact some premises of how it is supposed to be used – there are some inscribed interests in the artifact. This inscription can be more or less flexible. If we for instance look at an ATM-machine it has very little flexibility. You put your credit card into it, you have a few very specific choices, you get a certain predetermined type of feedback, and you finally get your card back. If we look at a football, this is much more flexible. It can be used for its main purpose which is to play football. It could on the other hand also be used to play many other games on the playing field, it can be used as a tool for training hand-eye coordination in stroke rehabilitation and if you get it signed by your favorite football player it can even

become an appreciated item for display in your living room. We are talking about weak/flexible versus strong/inflexible inscriptions. It should be noted that the degree to which an inscription can be judged weak or strong will depend on the network in general and more specifically the irreversibility of the network. If you introduce a new football to a team of professional footballers the inscription would appear rather strong. The users are in a network that is created and exists only to play football, it is a high level of irreversibility in that regard. If you put the same football in the toy collection of a kindergarten, things will look very different.

This brings us over to the concept of translation. In ANT terms design is translation (ibid). I see this as that if you introduce an artifact to a network, the network might or might not use it the way it was intended to be used – it might or might not follow the *program* of action. If it is not used in a way that suits the interest of the creators or the users – if it follows an *anti program* - a translation process will have to start in order to align the interests in the network. The translation process then could involve modifying the artifact in such a way that it makes it possible to align interests. Latour gives an example of such a process (Latour, 1991) with a hotel manager's need reduce the number of missing room keys as the context. Due to the number of missing keys the manager started a design or translation process to align the interests in the network. First he started with putting up a sign that requested the guests to deliver their keys before leaving the hotel. This was not enough – so the inscription was not strong enough. His next attempt was to include oral messages to increase the level of returned keys. This improved the situation, but not satisfactory. Finally he started to add weight to the keys, which after a process of putting on more and more weight to the key finally resulted in that most of the guests leaved the anti program (not delivering the key) and joined the program of action. Trough this translation process the interests of the network got aligned.

### ***ANT, CoPs and knowledge***

In reference to Nonaka and Takeuchi's model for knowledge creation some sees the CoP framework as a very different view on knowledge. It is argued that Nonaka and Takeuchi see knowledge as an entity that can be possessed and traded (Hayes & Walsham, 2001). There might be some truth in that, but the part of the theory of knowledge creation from Nonaka and Takeuchi presented here does, as I see it, not contradict the use of a social learning theory like CoP where knowledge is a process that is closely tied to practice. On the contrary I find that they complement each other. Nonaka and Takeuchi's theory can help explain how knowledge

can be created within these CoPs; what happens when a student and his supervisor discusses how to treat a patient if not a subtle interaction between tacit and explicit knowledge? And using this knowledge creation theory in a CoP setting could help ensure that the knowledge created is connected to and drawn from real life, that it is in fact contextualized. As I see it the main contribution of CoP theory is that learning happens in a social setting and cannot be parted from real life practice, but it does not explain in depth *how* knowledge is created. CoP theory is also not sufficient to explain processes involved when making tacit knowledge explicit like writing a book or creating a learning tool – one of the main goals in Fysio-nett. The Nonaka and Takeuchi theory could be of analytic help here.

That there is a link between a social learning theory as CoP and the concept of knowledge has already established and can hardly be surprising since knowledge is the ultimate goal for learning. Less intuitive is perhaps the notion of looking at knowledge as an actor in an actor network. The same can also be said about combining ANT and CoP – to look at a CoP as an actor-network.

Hanseth (2004) describes how knowledge in ANT terms can be at least partially thought of as a non-human actor and how this actor can be both autonomous and powerful. If we look at knowledge as an actor we can see that it is linked to not only practices but to the tools, instruments, organizational and physical structures in this practice or network. This means that when knowledge for some reason changes within an organization these other structures also has to change in an coordinated manner.

Fox (2000) argues that CoP and ANT can successfully be used together and enrich each other. This is in contrast to the origin of ANT that, according to Fox, could be interpreted as a constructive critique of CoP theory. Fox gives at least four interesting points for how and why CoP and ANT can be used together. Firstly he makes the point that networks of humans and non-humans learn. This learning process is described through an example of a process which resembles what I would consider as a translation process. Secondly he makes the point that CoP theory is almost silent when it comes to how people work *together* with materials, while it is taken for granted that people work *with* material. ANT can help the CoP theory in explaining how people and material work together, how both human and non-human actors have the capability to act back, granting or refusing translation. Thirdly it is a point that changes in action of both human and non-human actors have the possibility to increase

knowledge in a network. This means as I see it that it could make sense to look at a CoP as an actor-network, using ANT terminology and concepts to describe some of the processes that happens within this CoP. Lastly he makes the point that it does not make sense to think of a knowledgeable-skilled person outside the context of his tools and working materials – that we need to look at the learner as cyborg, a hybrid of material and knowledge.

As we can see this suggests that there could be a useful strategy to look at ANT and CoP together and to include knowledge as an actor in this complex actor-network, and that CoP theory and Nonaka and Takeuchi's theory on knowledge creation could complement each other. The total of all this should be a good theoretical basis for discussing Fysio-nett.



# Method Chapter

This chapter covers issues regarding methodology. I will start out arguing for the choice of a qualitative approach, before I start positioning my work within this qualitative context. Then follows a description of the process of gathering and analyzing the research material and finally a section on reflections on method concludes the Method Chapter.

## *Research Design*

### *Quantitative versus qualitative research*

Quantitative research is often associated with a fixed design (Robson 2002, p. 87) and collection of quantitative data (numbers). It can be used in an experimental or in a non-experimental setting. In an experimental setting the main goal is to measure the effect (outcome) of some kind of introduced change to a context. The Randomized Controlled Trial (RCT), as mentioned in the Theory Chapter, is the gold standard of such research, often used in medical research to measure the effect of an intervention. In non-experimental settings the object of the researcher does not involve introducing change, but rather to quantify some needed parameters in for instance a population at a given time. To use a quantitative design, the research question has to be possible to answer with the use of quantitative data in a meaningful way. Stoop and Berg (2003) further describes that quantitative methods are most suitable for establishing the size, extent or duration of a phenomena or to establish causal relationships. In addition to the RCT they also mention other more or less rigid designs like meta-analysis, cohort studies, case-control studies and observational studies.

According to Robson (2002, p. 87) qualitative research is often associated with a flexible design and collection of qualitative, non-numerical data<sup>2</sup>. Usually this involves gathering data that cannot be measured, but needs words to describe a situation. Stoop and Berg (2003) defines a qualitative approach as suitable when addressing questions regarding the what, why and how of a social phenomenon. Examples of such are how users perceive and experience a system, why an implementation strategy gets different outcomes in different organizations, and how a new system influences the social and organizational issues in a workplace. So it is about understanding a phenomenon from the users' perspectives in its particular social and organizational context.

The research questions proposed above are all about understanding certain processes involved in complex human-technology relationships. They are questions seeking to understand challenges and opportunities and what causes them. As earlier mentioned, such questions are best described through a qualitative approach and that is what has been chosen for this study. However, there are many types and strains of qualitative research and this will be discussed next.

### ***Types of qualitative research***

Robson (2002, pp. 177-193) describes three main strains of research traditions in qualitative research. These are: Case studies, ethnography and grounded theory.

Case studies have a focus of using single or multiple cases to perform an in-depth analysis. The origin is from political science, sociology, evaluation, urban studies and several other social sciences. Collection of research material is usually in the form of documents, records, interviews, observations and/or investigation of physical artifacts. The analysis of the research material usually involves description, themes and assertions.

Ethnography is often used to describe and interpret a cultural and social group. It originates from anthropology and sociology and uses primarily observation and interviews over an extended time period as its method for research material gathering. Analysis of the research material involves description, analysis and interpretation.

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<sup>2</sup> The term "data" when referring to research material in qualitative research can be misleading. As described in the Theory Chapter data is de-contextualized information and thus does not fit well with what you aim to gather in qualitative research. I will therefore use the term "research material" in this context unless I am directly citing or discussing other sources which have chosen to use the word "data".

Grounded theory studies focus on the development in new theory on the basis of data from the field, it origins from sociology and typically uses extensive interviewing as the main method of data collection. Data analysis often involves different types of coding and the creation of conditional matrices.

The aim of my study is to explore factors for success and limitations of an ICT project. It is not intended to create new theory. We are therefore talking about a study performed in the landscape between a case study and ethnography.

### ***Ethnography and Information Systems research***

Several papers discuss the use of interpretive case studies in Information Systems-research (IS-research) (Walsham, 1995; Klein & Myers, 1999), and similar use of ethnography as a method (Harper, 2000; Forsythe, 1999). In these papers the concept of interpretive case studies and the term ethnography are hard to part; they seem to have much in common. They can as I see it both be put under the umbrella of an interpretive or constructive approach (Robson 2002). Robson uses the term constructive to make the point that the reality such a study investigates is socially constructed. The use of the term interpretive then, as I understand the concept, reflects back on that this construction is inevitably interpreted by the researcher. Ethnography traditionally is associated with extended periods of field work (ibid), so the time period in the field could help part the two concepts, but in real life science there will be a large gray are between the two. My study is therefore influenced both on ethnography and interpretive case studies.

It is said that such interpretive research has been increasing the past decades (Walsham, 2000; Klein & Myers, 1999; Forsythe, 1999) within the field of IS research. Klein and Myers (1999) states that this type of research can help IS researchers to understand human thought and action in social and organizational contexts and that it has the potential to produce deep insights into information systems phenomena, including management of information systems and information systems development.

Walsham (2000) defines the philosophical stance for this type of research as research with a non-positivism or normativist epistemological stance combined with an ontological view of internal realism or subjective realism. This means that the researcher sees scientific knowledge as either a combination of facts and values (non-positivism) or ideological and inevitably conductive to particular sets of social ends (normativism). This epistemological

stance is in contrast to the common positivist view in quantitative research – a view that states that facts and values are distinct and that scientific knowledge only consists of facts. For the ontological aspect it means that the researcher believes that reality is an intersubjective construction of the shared human cognitive apparatus (internal realism) or that each individual creates his or her own reality. This is in contrast to the common view in quantitative research that reality exists independently of our construction of it (external realism). I personally place myself, for all practical purposes, in a non-positivist and internal realism view.

Walsham continues to suggest 3 ways of using theory in research. Firstly as an initial guide for creating study design and for data collection. Secondly as a part of an iterative process of data collection and analysis. Thirdly it can be used as a final product of research. I have been using theory as the two first points suggest, and do not expect to be creating theory as a final product of this work.

### ***Klein and Myers' seven principles***

Klein and Myers (1999) define seven principles for conducting interpretive field research. I have used these as a guide for how I conduct my work. I will in the following explain the principles and where possible give short examples on how they have influenced my work so far. More in depth examples will be given in the reflection on method section.

*The fundamental principle of the hermeneutic cycle:* This is the basic principle and a basis for all the other principles. It suggests that human understanding is achieved through an iterative process between trying to understand interdependent parts and the whole that they form. I understand this as that in order to grasp a complex situation or processes we as humans do that through looking at each of the parts in this situation. But this can only be done if we have some kind of notion of what the “whole” constitutes. Then the investigation of each part will give us a new understanding of the “whole”, and the process can start over; every iteration giving us a new and hopefully improved understanding of the “whole”.

*The principle of contextualization:* This means that it is important to understand and reflect on the whole context of the research setting, for instance the social and historical background. To relate this to Fysio-Nett, failing to know about the knowledge perspectives for physiotherapy at TUC's physiotherapy department could impact some aspects of the results of the study.

*The principle of interaction between researchers and the subjects:* Data is socially constructed through the interaction between the researcher and the participants. This means that the researcher always in some way will have an effect on what data he gets, it is impossible to serve as a neutral agent. This should be reflected on during the process.

*The principle of abstraction and generalization:* This has to do with relating your findings to theory and general concepts that describe the nature of human understanding and social action. To me this works as an ongoing process during the interview helping me to choose my next question, to follow up what has been said, as well as a process after the interviews has been conducted.

*The principle of dialogical reasoning:* This has to do with being ready to revise your preconceptions based on findings so that you might have to alter your research design. I have already discovered that I have had to do this with regards to where I thought the conflicts lie within the teacher groups. I initially thought this conflict was rooted in the already mentioned Evidence Based Medicine conflict, while the teachers actually share the same views on that matter. So they all agree on what physiotherapy should be, but they disagree on to what extents Fysio-nett can help promote this view.

*The principle of multiple interpretations:* You have to be sensitive that different persons can have different interpretations of the same situation.

*The principle of suspicion:* You should never take anything at “face value”. Be sensitive to possible biases and systematic distortions – people do not always say what they do or do what they say, for several different reasons. I have not experienced clear instances of such yet, but it is clear to me that when I interview people in a small group that know each other well, it is likely that some of them at least weight their words well when talking to me. This has to be taken under consideration when interpreting what is said and done.

### ***Involvement***

I conducted my work under the realization that my presence there and my work there could inevitably affect what happens around Fysio-nett. I have already been given signals that that is happening. My interest alone in Fysio-nett seems to have been used by the department in planning of what could happen around Fysio-nett in the future. I also know that my discussions and interviews with the involved actors in around Fysio-nett could impact the way

they are reasoning. So there will, whether I intend to or not be at least a small element of action research (Robson 2002) in my work. This is also related to the principle of interaction between researcher and the subject, if you also see it the opposite way; that the subjects also act as interpreters.

Knowing this I try to weight my words carefully when I discuss with the subjects. For instance did one of the actors once ask what I thought of Fysio-nett. I felt slightly uncomfortable because the tool and the situation around it is very complex and the question could not be answered easily or at least not quickly. Knowing that they possibly could use my presence as an “expert” in other settings, I would not give them preliminary conclusions that I could not stand for further down the road. On the other hand I felt uncomfortable not giving some kind of positive answer because I was afraid this could impact my relationship with them, making them more suspicious on me. So I gave a quite generic answer on a small aspect of Fysio-Nett which I liked very much, and it seemed to solve the situation at the time.

All though this is not a project with intention of performing action research I hope and aim to make the end result in form of my thesis of some use for the Physiotherapy Department, but not until it is a finished and well thought through product.

### ***Research Material Collection***

Several methods have been used for research material collection. The research material was gathered from February 2007 up until May 2008 with the main contributions of interviews were from November 2007 to April 2008.

#### ***Interviews***

The main method for data collection was through interviews. 6 teachers have undergone one or several in depth interviews, ranging from 45 to 75 minutes. The interviews were of a semi-structured nature, with a large possibility of getting into topics that prior to the interview was not thought of as a main topic. The interviews were performed from November 2007 to May 2008. Table1 shows the different informants among the teachers, named by the role they take in this context. These names have been used throughout this thesis.

Informant	Number of interviews	Total length (Minutes)
Project Coordinator	2	110
Head of Physiotherapy	1	65
Project Member	1	75
Teacher 1	1	55
Teacher 2	1	65
Teacher3	1	55

**Table 1 Informants for interviews.**

All interviews were digitally recorded and transferred to a PC for further analysis.

### ***E-mail questionnaire***

A questionnaire with 5 open ended questions was sent to all of the 15 students in the decentralized program. The main theme of these questions was to get an overview of whether their view on Fysio-nett as a learning tool was positive or negative, and what factors contributed to their view. 5 students responded to the questions and one returned a blank e-mail which was by me, in the original e-mail, suggested as a way of responding if they couldn't or wouldn't respond.

### ***Informal discussions***

From the initial phase from the spring of 2007 until the end of the project, several informal discussions have been made. The informal discussions were used to sort of “map the field” in the initial phase of the project. They made it possible to get an overview of practicalities like getting access to the informant, where to conduct the interviews etc. Some initial research material on Fysio-Nett as a project was gathered during this process. In the later stages (from

the fall of 2007) these discussions has decreased and the number of planned interviews have increased. The informal discussions include:

- Several informal discussions with the project coordinators ranging from 10 – 30 minutes.
- A joint discussions with the project coordinator and the head of the physiotherapy department, approximately 60 minutes
- A 20 minutes discussion with one of the teachers more remotely involved in Fysio-Nett.
- A brief discussion with a group of students in the normal program.

Towards the end of the project, these informal discussions were more suited to confirm or shortly elaborate on different topics discussed in the interviews. Notes from these discussions have been made during and/or after the discussions.

### ***Log***

A log was created in a book where all meetings, interviews and discussions were registered and some short notes were made. The notes included the main themes for the meetings (made prior to the meetings), and additional themes and reflections after the meetings. The book was also used as a place for writing down more or less unstructured, unfinished and sudden thoughts/ideas emerging during everyday life.

### ***Other***

*Literature review:* The project coordinator has written a lot of papers, mostly unpublished or in press, about the project. These have been read as background material before starting up with the interview, but also as raw data for the case.

*Practical work:* I have been granted access to Fysio-nett, and have tried its features to have some basic understanding of how it functions and what parts it consists of.

*E-mail correspondence:* This was used when there was a need for an elaboration or explanation of a limited topic, often related to something being unclear in a previous interview. Sometimes this was, as mentioned, also done through more informal face to face discussions.

### ***Research Material Analysis***

The main methodological question with regards to data analysis was how to treat the more than 7 hours of audio from the interviews. It was in the end decided not to go with a full transcription of the material. The interviews were instead listened through several times (3-4) and during this process there was made a minute by minute overview of what topics were discussed. Each time listening through the interviews, this was done weeks or even months apart, made it possible to do remarks and additions to the text for future reference. These remarks were often done as a consequence of new information from other sources of data that suddenly cast a different light of the importance of certain information. This made it possible to find quotes for use in the Empirical Chapter at a later stage.

The answers from the questionnaire did not need much analysis, but was used directly as results in the form of quotes where suitable in the data material.

### ***Reflections on Method***

#### ***Prejudices, preconceptions and their development***

When entering the field I had a background as a student in the very same field I now entered as a researcher. Because of this it was difficult to not have any preconceptions on the teachers, the program (the normal program which I attended) itself and the decentralized program.

First of all I have to say that I generally had a feeling that what was going on at the department was very solid. As a student I really liked the approach to learning, strongly influenced by group work in the form of Problem based Learning (PBL). In general I also felt that the teachers in the program were very solid, knowledgeable and hard working.

The Tromsø School is almost famous, or infamous, depending on your standpoint, for their view on knowledge in physiotherapy which among other aspects is strongly based on closeness to practice. As a student there I often felt that this focus was too strong, generally underestimating the value of more factual knowledge in various form, since it was my belief that factual knowledge was an important basis for all working practice. All though I still think factual knowledge is important, I do now feel that the strong practice oriented tradition at TUC is very valuable, and I have gained a solid insight in the importance of those aspects.

Regarding the decentralized program I actually was a student at TUC when the planning phase started. I remember us all, me included, being very skeptical to this idea. This was first and foremost because of we felt that it could undermine the role, or the relative status physiotherapists have, or at least like to think they have, among health professionals. We felt that a decentralized program would not look “serious” enough seen from the outside – and that it was almost a step closer to introducing a letter-course in physiotherapy. We also felt that it was wrong to introduce such a program, when resources already were scarce as they were. Regarding Fysio-nett I cannot recall of hearing about it until I entered the Master’s program in Telemedicine and e-Health at Tromsø University several years later.

The negative view on the decentralized program is as of today non-existing. For the record also have to state that I in general look with very positive eyes on Fysio-nett as a learning tool. This feeling has developed over months as I have read and interviewed and slowly gained more insight in this universe. The main insight is in the value of the knowledge Fysio-nett tries to represent, but I also do think that Fysio-nett manages do convey this knowledge to a large extent. It have at times been difficult to try to really listen to and reflect on negative comments regarding Fysio-nett, but I have done my best. The majority of comments in this thesis is on the positive side, but I truly believe that this reflects reality and not my own thoughts and values. That does however not mean that the criticisms that exist are to be taken lightly.

### ***How was the study defined?***

When I started the Master's program in Telemedicine and E-health at Tromsø University I was searching for a suitable case for my thesis. I wanted to utilize my formal background as a physiotherapist and combine this with the new field I was entering. When I heard about Fysio-Nett I quickly became interested and made it the case for my Master Thesis.

The opportunity to make this a case for my master thesis came almost out of the blue. In the autumn of 2006 I had been discussing with a professor the possibility of utilizing ICT for documenting and sharing knowledge in physiotherapy and we agreed it could make an interesting case for a thesis. Just a few hours later I randomly met the project coordinator of Fysio-nett (a tool I did not know existed yet), and I immediately felt that this could turn out interestingly. Next semester I then made Fysio-Nett a case in several smaller and one final exam in a course on my study program. During that period I discovered that Fysio-Nett absolutely could make a suitable case for my thesis, since it in a very nice way combined my background as a physiotherapist with my new knowledge within the e-health field.

### *Access to the field*

In the spring of 2007 when first contacting the physiotherapy department, I was told to put in a formal “application” to the department where I explained why I wanted to be able to contact the teachers for interviews. This application was then processed by the teacher group and accepted without any objections. On the contrary they applauded that somebody would come and “look at their cards”.

I was relieved with this way of doing it. Since the beginning, when I first started talking to the project coordinator, I sensed that there had been some kind of conflicts in the group. I would not feel confident in my work if I was afraid to stir up an old, or worsen a ongoing conflict with my work. This application, and the result of it, made that lesser of an issue since I took the appraisal of my initiative as a indication of that this was not a very sensitive area, at least not anymore. Also, this arrangement meant that all teachers knew that I could come to contact them and why, making the whole scheduling process much easier.

Also knowing that all the teachers knew what I was up to, and that I also was free to contact the students whenever I wanted, meant that the risk for a future conflict with me accessing the field was minimal. The resulted in that I felt I could move and act more freely.

Due to privacy issues regarding the patients in the Fysio-nett database, it was not so easy to be granted access. A chance came when I unexpectedly was given the possibility to be a replacement teacher for two weeks. This meant that I could, or in fact had to, use Fysio-nett for the preparation of my work. I did however feel this arrangement a bit troublesome because it was not quite clear to me how to treat the two roles I had. I mean, as a researcher I could not really gather information from my Fysio-nett experience, so it was difficult to know where to

draw the line of which material to use and not. The end result was that I used my experience first and foremost in the interviewing process and not in written work. In written work I used my experience to better understand what others (the project coordinator) already had written, and not to write anything that had not been published before.

### ***Refinement of research questions***

I first set out to do this project solely looking at it as yet another IT project implementation “in trouble”. I saw actors with conflicting interests all over the place, and I saw problems due organizational change (like changes in the workload/workflow). I wanted to investigate this further. I see now that this view was somewhat based on what we were reading and discussing in our courses at that time, with papers of Actor Network Theory and also a lot of reading on organizational consequences of implementing IT-systems. This does still look as an interesting perspective to me, but I now also find it interesting looking at the challenges and possibilities of using an ICT-tool in creating, storing and sharing knowledge within physiotherapy. It is an interesting and appealing project to try to fit a field with extremely strong practical “learning by doing” traditions and a field saturated with the need for rich information (including wide use of tactile information) inside the world of ICT. To many this seems intuitively “wrong”, to me it looks interesting. Therefore the research questions after a while developed into questions regarding knowledge perspectives and learning, far from the ones initially asked. This was a challenging process since it implied that my search for suitable theoretical perspectives had to start all over again.

This change or at least development of the research question is described as a part of the method in interpretive case studies and ethnography. In fact one of the seven principles above implies just this. The principle of dialogical reasoning addresses this in a way when it says that you have to be open to revise your preconceptions based on your findings. So if an initial research question does not make sense after performing some field work, then you will have to change or develop it. The same is described by Robson (2002, p. 188) who says with regards to ethnography that “...an initial research question are not ruled out, but you should be prepared for these to change.”

### ***Role of the researcher***

In this study I cannot clearly define myself as neither an insider nor an outsider. From the insider's perspective, I do clearly share some of the basis as the teachers at the department do

in that I am an physiotherapist myself, I know the physiotherapy field quite well both when it comes to the fields internal discussions on knowledge and such, and of course common concepts within physiotherapy which in some instances are very limited to just this world. But my insider abilities go even further than that. I did at one time attend this school as a student, being taught by the same teachers which I interviewed. So I actually know these teachers also on a more personal level. The fact that I was taught physiotherapy by these teachers myself, that in some way they had a part in creating me as a physiotherapist also contributes to make me an insider. This is enforced by the fact that the teachers at TUC strongly believe that the view they have on physiotherapy differs from what are taught other places, and this is strongly reflected in the education. If I came from a different school of learning (literary), they might have been more skeptical with regards to my motives.

On the other side I am not a full insider. I am not part of the teacher group, and I am not a part of the group around Fysio-nett. I still am “somebody” from “somewhere else” coming to look into their world.

All in all I do however think that I am more of an insider than an outsider. With that I mean that on the scale from being a total outsider (for instance an IT-trained IS-researcher entering the health field for the first time) to being a full insider (one of the teachers involved in the creation of Fysio-Nett) I am closer to the latter than the former.

Being an insider could compromise the ability to critically view different perspectives and abilities to discover hidden work as mentioned by Walsham (1995). Especially since I am trying to discover and in some way evaluate the way they conduct the teaching of physiotherapy there is a risk that I can lack some critical perspective on this since I in many ways share the same physiotherapy-paradigm as they. There is no doubt that I do share the creators view on teaching physiotherapy – thus making this more of a project of describing how they tried to translate this type of learning to an ICT-platform, and whether or not their methods for doing this makes sense. If I did not share this common ground the discussion could easily have been more focused on whether it is the “right” view of physiotherapy they try to promote with this tool.

Bal and Mastboom (2005) describe in their paper their mixed feelings on being an insider to a project. They aimed to become insiders and because it made them more able to influence the project in which they were involved. On the other hand they feared having a lack of critical

perspective if they got too involved, that it would compromise their role as researchers. They did however find that they were able to point out heterogeneity in spite of their insider role. This suggests that it is possible to have a critical perspective on a project, even though you are an insider. But it is important to reflect on this before, during and after the field work.

### ***Key informants***

The key informants in this project are first and foremost the project coordinator and her colleague who together created Fysio-Nett back in 2003. Then we have one teacher that openly has had a lot of critical questions on the usability of Fysio-Nett as a system. The head of the physiotherapy department also proved to be a valuable resource. The rest of the teachers that were interviewed all contributed in an important way to the research material although not cited in equal amounts.

The selection of these key informants manifested itself in one of the joint discussions with the head of the physiotherapy department and the project coordinator. They openly mapped out each of the actors and roughly what their position on Fysio-Nett was.

Among the students I regard the students from the part-time study as key informants. The turn this thesis took, focusing on the underlying mechanisms of creating and using Fysio-nett, they did however become less important than I initially thought. It went so far that I for a while was thinking of not including them at all. However, the teachers did refer to these students a lot, and I thought it would be a good idea to verify whether the teachers' impressions of the students as very satisfied users, were correct or not.

### ***Changed approaches to the inquiry***

There have been no big changes on the general approach to the inquiry, but rather a development as my horizon (theory-wise) has been broadened. For instance through the seven principles of Klein and Myers described earlier. The methodological aspects and general approach to the field has remained the same throughout the whole period.

However, my approach in the interviews developed into slightly different questions than I originally had in mind. This is obviously related to the change of research questions already mentioned. The clearest change in this regard is focusing more and more on Fysio-nett as a knowledge base or learning tool and how this tool was created and used rather than looking at the project as “yet another problematic implementation project”. This shift was done for two

reasons. First of all I truly felt that taking on this knowledge perspective could produce more interesting results than analyzing this as a implementation of technology project. Secondly, and probably a factor contributing to the first reason, was that this was what my informants were talking about. It was what made them talk, and get enthusiastic and elaborate on things. I have not abandoned the organizational part all together, but the shift is very clear.

With regards to the data gathering, as mentioned, the use of an e-mail questionnaire was introduced.

### ***Impact of theory***

As mentioned in the Theory Chapter, ANT can be regarded as both a theory and a methodology and that for this thesis it has been used as both. As a methodology it has had a large impact on my work. The key concepts of ANT mentioned in the Theory Chapter has been very important for the way I have structured my field work, what I have been looking for and in the next step how I have interpreted the findings before I returned to the field again. I have been thinking about my informants as actors and even more importantly I have been thinking about technology as important actors in the actor network that presented itself during my work.

Equally important in much the same way has been the seven principles of Klein and Myers. To give a couple of examples on how these have directly impacted my way of working we can start with the principle of contextualization by referring to the Project Coordinator:

*“We feel that the physiotherapy program at TUC represents something slightly different than the other national programs, and we saw this (creating Fysio-Nett) as an opportunity to show what we think physiotherapy is, can be, should be ... to show our knowledge profile to the rest of the world. This profile is about looking at physiotherapy as a strongly relational meeting between patient and therapist, that physiotherapy is not a set of techniques applied to a patient, but rather something that exists between the patient and the therapist. This is on some levels in conflict with large part of the physiotherapy field who focuses more on aspects of evidence based medicine, a focus which we believe undermines the importance of the relation ... “*

This has to be seen as a part of a large and at times hard debate between different groupings within the physiotherapy field and is further described in a series of articles by Jamtvedt and

Hilde (2000abcdefg) who advocate the view that introducing Evidence Based Medicine in physiotherapy is necessary to comply with the society's demands to the health services. Ekeli (2000abcd) replies to this in a series of articles with promoting the view of the physiotherapy department at TUC. This has already been mentioned in the Theory Chapter.

My point is that this is an example of a part of a context that easily could be overlooked, and in doing so could impact the interpretation of what is going on around Fysio-Nett. This because it is such an important part of what Fysio-nett has become – of what type of knowledge it represents. So here the principle of contextualization shows its importance.

The second example is regarding the principle of multiple interpretations. I have experienced this very clearly with regards to the interpretation of the conflict level during the creation of Fysio-Nett. One of the teachers explains:

*“The situation was difficult for a while. I don't think conflicts had to arise, but it did. I think there was a lack of openness and communication that created them.”*

Another actor had a different interpretation of the situation:

*“I would not call it conflicts, but we had some discussions. Most of them felt very unfruitful and I did not have the energy to involve myself in them.”*

So one of them felt a conflict level to the extent that it impacted her workday, the other one just registered some discussions. This is a clear example of multiple interpretations.

### ***How the research material is made trustworthy***

The trustworthiness of the research material starts, as I see it, already with the gathering process. The use of a digital recorder and a log should result in research material that could be trusted in the following analysis. The material from the interviews is recorded, and citations will be used in the text. There has been a deliberate choice to include an extensive use of quotes from the interviews. This is done to put the reader in the best possible way in the context of which a sentence or a meaning is expressed. It is my strong belief that this ensures that the reader in the best possible way can assess whether the authors interpretation of something is in line with reality.

Golden-Biddle and Locke (1993) presents three dimensions of how to convince with an ethnographic text. The first, authenticity, is about the importance of having firsthand experience – to convey that the researcher has grasped and understood the members' world. The second, plausibility, has to do with creating a story that seems to make sense. The first two strongly depend on that you have data that represents the real world, a task that I have described above and that is highly prioritized. The third and last dimension is criticality. This is about the researcher ability to critically review and analyze the data and to convey this in a written text to the reader. These three points have been my guide in making the data trustworthy.

The open and honest reflections in this chapter are also meant to contribute to the trustworthiness of the research material.



# Empirical Chapter

## *Introduction*

This chapter outlines empirical data gathered for this project. The main theme in all this is knowledge and learning and how Fysio-nett's creators have tried to make it a tool for sharing knowledge and stimulate to learning.

I start out with giving a brief introduction to the context in which this study and the creation of Fysio-nett has taken place. Then I give a short introduction to Fysio-nett's features. The main empirical part then follows by telling the story of why and how Fysio-nett was formed, how it is utilized and challenges for the project.

## *Research Context*

### *Tromsø University College*

Tromsø University College is Northern Norway's largest University College with around 2700 registered students (Høgskolen i Tromsø). The college consists of 4 departments: Health, Economics and Engineering, Art Studies and Teacher Education.

The Health Department is the largest of these departments with around 1200 students and is offering bachelor level education in nursing, occupational therapy, radiology, dental care, bioengineering and physiotherapy. In addition to this there are continuing education programs in the various fields.

### *The Physiotherapy Department and Fysio-Nett*

In 2003 the physiotherapy department, at that time responsible for the education of about 80 students, started up a part time (4 years versus the normal 3 years) decentralized study

program on a trial basis for 15 students. This came as an addition to the normal 3-year program and was a result of a decision made by the TUC council on basis of a suggestion from the Physiotherapy Department made several years earlier. To support this new program, the physiotherapy department created an Internet based solution called Fysio-nett. Fysio-nett is a knowledge base and learning tool consisting of several parts including tools for video analysis of patients, a term-base and communication tools. All though Fysio-nett was created because of, and has a strong connection to the decentralized study program, the system is intended for use for the students in the normal program as well.

The Physiotherapy department at Tromsø University College has 13 teachers. These cover the ordinary physiotherapy program, the decentralized part-time program, a graduate program and a single year study within physical activity and health. All though teachers are organized in groups to cover different parts and/or classes of these programs, they all, to some extent, are utilized on other classes and courses.

The normal study program spans over a 3 year period, with the students being on campus most of the time. However there are 3 long periods of practice out of school, lasting from 7 to 10 weeks. These are in the second (two of the periods) and third year (the longest period). The decentralized program spans over 4 years with the same three periods of practice and with the same exams during the course of the program. These students have shorter periods on campus, but spend most of their time off campus. For learning and practicing basic practical skills the students are under supervision by a physiotherapist where they live and use patients to train on these skills. The students of the normal program to a much larger extent will have to rely on their fellow students to develop and train these skills.

### ***Creating the decentralized program***

Two teachers were in the January of 2003 chosen more or less to be taken out of this structure to plan the decentralized program. It is important to understand, in the continuation of this text, that from January 2003 until launch of the new program in the fall of 2003, these two people did most of the planning for the new program and developed Fysio-nett. This resulted in a very high workload. One of them became the Project Coordinator, the other one could be regarded as a Project Member. This whole process did not happen without problems as the coordinator explains in one of her papers:

*“Due to the size of this project we wanted to anchor Fysio-nett as a project within the Physiotherapy department and its work through a project group and a planning group. This could not be done. This led to that the project got an unclear position within the department and in relation to the departments work and responsibilities. The resources were also scarce, resulting in severely limited possibilities of involving all teachers within the department to help produce Fysio-Nett.” (Aars, 2006, p. 6)*

From the autumn of 2004, this changed some. There was room for creating a planning group consisting of 5 teachers including the Project Coordinator and the head of the department. Still the resources were scarce, and there were difficulties in getting the human resources needed to create content for Fysio-nett. This seems to have been the situation throughout the trial project and after.

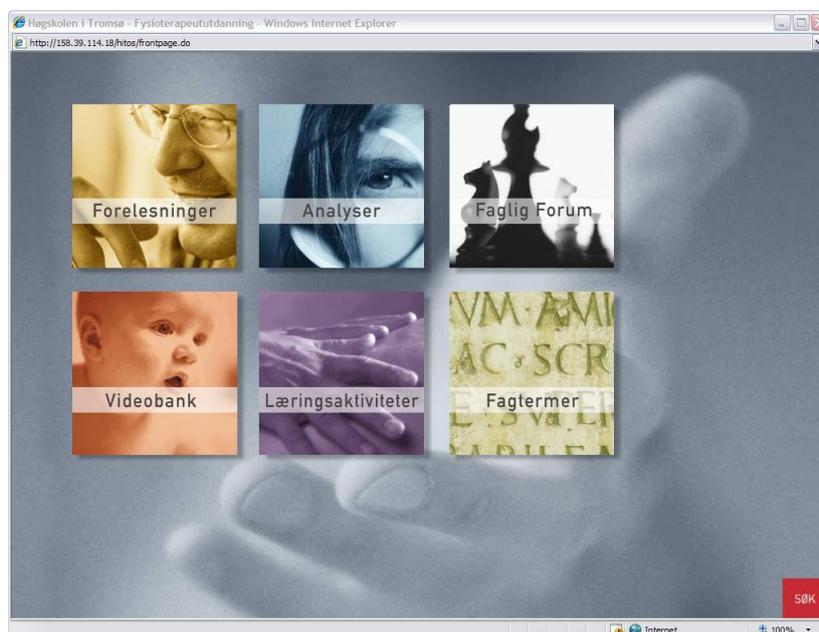
The part-time students ended their education in the spring of 2007, thus ending the trial program. However, Fysio-Nett continued to exist and there was an ambition to utilize it in the normal program; an ambition which has proven difficult. Due to the perceived success of the decentralized study program, it will be reintroduced again in the fall of 2008. Fysio-nett will again be an important tool for the program, and there are plans, or at least a wish, to improve Fysio-nett through expanding the content and implement new functions.

### ***Introduction to Fysio-Nett***

Fysio-Nett is an interactive knowledge base/learning tool built to support, stimulate and to be a starting point for students learning. Through its structure it is meant to not only to be used with more traditional theoretical aspects, but it is also a tool for documenting and making visible the more tacit knowledge within physical therapy.



**Figure 1** Fysio-Nett's login window



**Figure 2** Fysio Nett's welcoming window gives access to the six different parts of Fysio-Nett.

Fysio-nett consists of six parts (Figure 2)<sup>3</sup>:

1. “Lectures.” Key lectures are uploaded. The intention is to use ICT to connect video and text and through this shed light on concepts traditionally poorly presented in books. Not all lectures use video, some of them are text based with the possibilities of using hyperlinks to elaborate on certain concepts.
2. “Analysis.” This is described below to exemplify Fysio-nett’s core functions and design.
3. “Forum.” Not yet fully implemented. Its intended use is today provided by ClassFronter. Synchronous and asynchronous communication with the students is the main theme. In the future this is intended to be used for discussing physical therapy.
4. “Video Vault.” A collection of videos of people in daily activities suitable for students’ analysis.
5. “Learning Activities.” Users can make their own analysis like the ones provided in “Analysis”. Possibilities for publishing for the rest of the user group.
6. “Term Bank.” Short definitions of key concepts within a broad range of fields (science, human studies etc.)

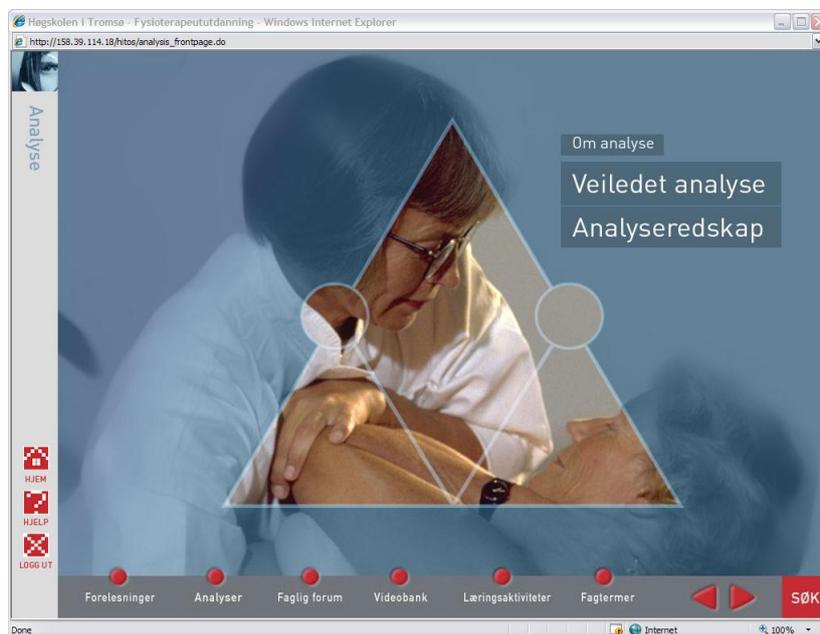
It is important to understand that these are not isolated structures. As we will see later, content in one part can via hyperlinks link to information in other parts. In the remaining of this thesis, the English translation of the Norwegian terms in 1-6 above will be used.

To briefly illustrate some of the more unique features of Fysio-Nett I will present the Analysis feature. It stands out since it’s highly interactive, and not as easily grasped as some of the other features. It also shows quite a bit how the system is intended to work through linking different parts of the database together via hyperlinks.

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<sup>3</sup> I have used the English translation of the Norwegian terms in Fysio-nett. The English translation will be used throughout this text. The translations are: 1. Forelesninger to Lectures. 2. Analyser to Analysis. 3. Faglig forum to Forum. 4. Videobank to Video Vault 5. Læringsaktiviteter to Learning Activities. 6 Fagtermer to Term Bank. Other translations will be introduced as needed

The term analysis reflects to the task of analyzing patients' movement patterns, a task commonly done in physiotherapy. In this context it refers to not only that, but also a analysis of the total situation where a therapist treats or assesses a patient; verbal and non-verbal communication, patient reactions, physiotherapist's clinical reasoning etc. Pressing the "Analyser" button in figure 2 takes the user inside the "Analysis" utility and gives the user two options: "Veiledet Analyse" ("Guided Analysis") and "Analyseredskap" ("Analysis Tool") (Figure 3).



**Figure 3** The "Analyser" welcoming window.

"Guided Analysis" presents the clinical reasoning physical therapists perform in assessment and treatment of a patient. Through video and text the user will be able step by step to follow a real life physiotherapy session and the therapist's judgments and thoughts.

The "Analysis Tool" provides additional info about concepts (physical therapy related) important in these thoughts and judgments. The information is given in text and pictures and can be extensive. In short it is a database of physical therapy concepts, concepts which are put into context with the use of video. This is an important structure inside Fysio-nett, which will be described later.

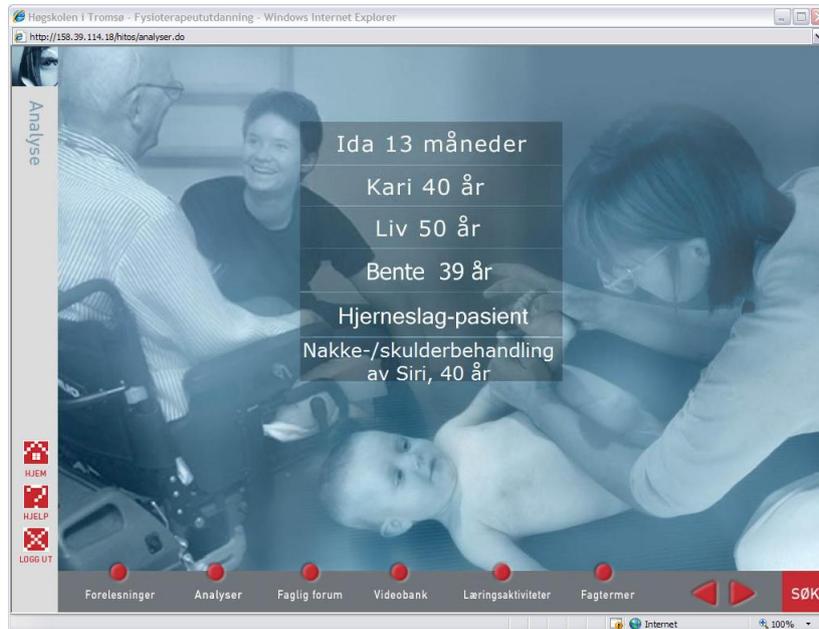


Figure 4 Choose your session. A list of different patients is displayed.

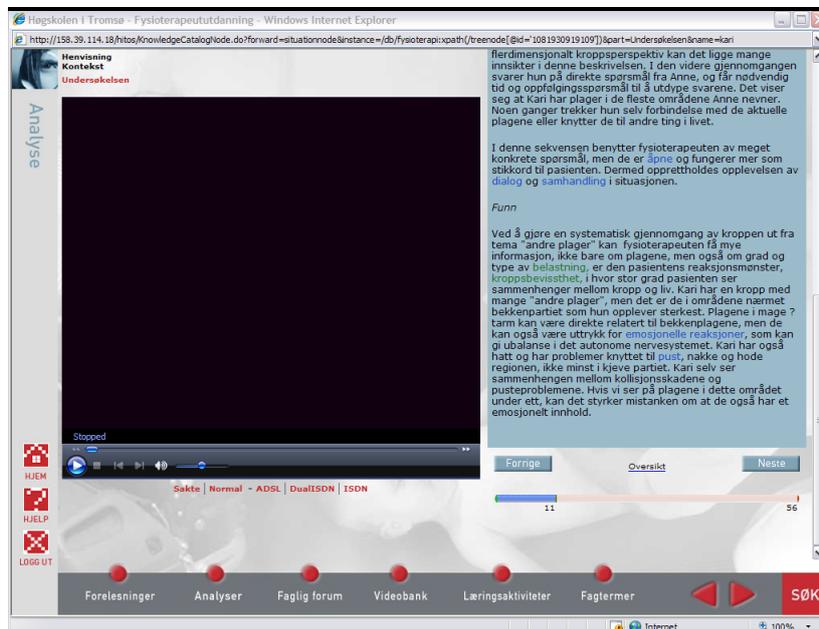


Figure 5 The “Guided Analysis” tool. Video and text is combined to make sense of a complex situation. Hyperlinks in green refers to terms in the “Term Bank”, hyperlinks in blue refers to terms in the “Analysis Tool” containing the hierarchal structure.

Figure 5 shows the video windows within “Guided Analysis” after choosing one of the patient-physiotherapist sessions in figure 4. On the left is the video and the text is on the right. In the text we can see there are some green and blue words. These are hyperlinks and by clicking, the term/concept will be elaborated further in other parts of Fysio-Nett (green refers to the “Term Bank”, blue to the “Analysis Tool”). The session is here cut into 56 smaller video-parts, each accompanied with text explaining how the physiotherapist reasons, findings etc. And, as already mentioned, this text also includes hyperlinks to other parts of the system.

Most of the analysis in Fysio-nett today are provided by the teachers and/or experienced physical therapists. There is however also possible for the students to perform their own analysis and to get feedback on these. The means for making the analysis, including video editing tool, are embedded within Fysio-Nett.

This was just a brief introduction to Fysio-Nett’s functionality. All content are provided by the teachers and some hired external resources, this is a product made fairly from scratch. The development is funded through both Tromsø University College and through governmental funding. The budget during the first four years of the project is several million Norwegian Kroner.

I will now start from the beginning of the project and try to tell the story about how Fysio-nett was created.

## ***From Ideas to Project – How Fysio-nett was Formed***

### ***Why Fysio-nett?***

The decision about starting a decentralized study program in physiotherapy was made by the TUC council in November of 2002. There were at that point no decisions taken on how this task should be solved. However, the physiotherapy department had suggested such a study several years earlier, and did at that time develop a draft for a study plan. In January 2003 the work on finalizing the study plan and the organizational issues around the decentralized program continued. The people assigned to the task of planning the program were quite clear already from the beginning that they wanted to utilize IT-technology, as the project coordinator explains:

*“All we knew was that we wanted ... needed ... some kind of knowledge base to support the daring project it in fact was to start a decentralized program ... we had in mind some kind of framework for “showing” physiotherapy ... and to kind of connect the different parts ... the periods at school, in working practice and home studying ... together.” (Project Coordinator)*

*“It was very clear to us that if we were to take on this task (creating the decentralized program), then we wanted to show that we wanted something more out of it, we wanted to create something new. We wanted something that utilized the Internet, but did not quite know what or how yet.” (Project Coordinator)*

So a strong motivator for creating Fysio-nett was that they wanted to create something new, and to not just go with the old way of doing a decentralized program.

Since there has been no attempt to do a full decentralized study program earlier, it is not clear what this “old way of doing it” involves. However there has for several years been a decentralized study program for continuing education in psychomotor physiotherapy. This has been done with e-mail as the main tool for communicating in between the periods at school. For other decentralized study programs at TUC, as well as in the normal programs, it is common to use ClassFronter<sup>4</sup> as a CSCW platform to various degrees. So the new way of utilizing IT in the decentralized program had to involve something more than these tools already offered.

### ***Searching for technology***

After deciding that they wanted some kind of platform that could be used over the Internet, they started searching for a technical solution. In the early phase of this process it seems like they had some trouble finding a solution that would meet their requirements on several levels. First it is important to understand that the time factor was really limiting their possibilities. From the beginning of this work in January 2003, it was only about 10 months until the

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<sup>4</sup> ClassFronter is according to the developer “an open learning platform used by more than 3000 learning institutions across Europe. Fronter combines almost 100 easy to use web-tools that have been carefully selected by the users through our reference groups. Once a new idea, concept or technology proves to be valuable for teaching and learning, it is implemented into Fronter’s fast growing collection of tools” (Fronter, 2008). It focuses on the use of virtual classrooms for each subject, classrooms that can be filled with files, forums, calendars and other tools. It is regarded as useful for its purpose but should not under any circumstances be thought to offer the same functions of Fysio-net. Fysio-nett is tailored around physiotherapy while ClassFronter is a more general tool.

system had to be up and running. And not only the technical system, but the whole finalized study program had to be ready for October 2003. They were at this stage only 2 people responsible for executing this. The time factor is clearly stated in an interview with the Project Coordinator:

*“After contacting NST (Norwegian Centre for Telemedicine) and talked to them about what we needed, what we were interested in ... movement and movement analysis ... we were offered a video conference with a guy in Bodø. We was told that we had to find out what was available in the market and so on ... it seemed like a 10 year project, very big ... and we recognized that we did not have capacity to take on such a task ... to map everything in the market and to analyze which application fits our needs” (Project Coordinator)*

Secondly they had a general idea of how they wanted this system to function, and they had difficulties finding something that was in line with this idea. Almost out of the blue an opportunity presented itself when the team attended a seminar regarding an IT-tool used in Art studies. This had its origin from Bergen University and the main creator was a Professor in art studies there. The way the Project Coordinator talks about this encounter makes it almost sound like an epiphany:

*“So ... it was something in the way she talked about it [the system for Art studies] that made us look at each other and really jump in our chairs and ... YES!”(Project Coordinator)*

This was in fact the beginning of a long, intense working relationship with the Professor, and the Project Coordinator clearly expresses that without her it would never be a Fysio-nett in its current form.

There were especially two aspects of this system, or the philosophy behind it, that made them “jump in their chairs”. The first aspect has to do with how she talked about how they defined the knowledge in the tool, how they extracted knowledge and made tacit knowledge visible:

*“It was the way she talked about how you could make visible some of the tacit knowledge in an art historian. What is it you analyze in pictures for instance? It is shape, depth, color...? She had experts to define which things we can extract as important factors when students analyze pictures. What are you, as an expert, doing?”*

*And it hadn't been verbalized in this way earlier. The categories you are looking for ... we related this to our own field of physiotherapy ... how do you make visible the experienced clinician, the experts' competence. What is it, which factors would we like our students in physiotherapy to be guided to look for?" (Project Coordinator)*

In some way they could strongly relate the way an expert in Art history analyzed a painting, to the work of a physiotherapist. In my experience as a clinician this makes sense. The work of a physiotherapist is strongly visual and analytic. It also, as with art, has to do with analyzing and in some way describing things that are not so easy to quantify. The quality of movement, the body language of a patient and the constant process of reading between the lines when you talk to a patient are just some examples.

The second aspect has to do with what the starting point for creating such a knowledge base should be. The creators of Fysio-nett had a strong belief that it should, as far as possible, be the knowledge or the field of profession that dictated what type of technology that should be used:

*"And then there was this aspect of that it was the field of profession first ... it was art history ... other seminars we attended it was always the "system", and all the wonderful things you could put into it. But she started with art history, the profession. That was what was supposed to go out to the students. And after that came the structure and what tools we wanted in our database. Maybe we needed a media-bank ... maybe other things ... but first and foremost it was the profession. Elsewhere ... for instance in ClassFronter you will first arrive in a virtual classroom, but what is supposed to happen there? That is supposed to be implemented later. But with her system it was just straight into the profession, and afterwards you can make activities related to that. This was the exact opposite way of thinking of everything we had been introduced to earlier." (Project Coordinator)*

This meant that their ideas of how such a system should be was very well taken care of. In addition to that the professor from Bergen had the time and the willingness to help out with this project. Most importantly she meant that this could be done before the startup in October. That concluded the quest for a suitable system.

### *Visions and ambitions*

Implicit in the project lays the ambition to create a platform for supporting the new decentralized study program. There is also a strong intent to utilize the system for the students on the normal study program, and this is today done to some extent. However, from the interviews the Project Coordinator describes three areas of ambitions for Fysio-nett that goes beyond this, ambitions in a much broader sense. The first one has to do with Fysio-nett as an arena for knowledge-development within the teacher staff at TUC.

*“We thought of this as a possible knowledge development project for the whole staff. We were very clear on that we wanted to express some of our tacit knowledge, and we imagined that we could have many discussions among the teachers regarding concepts, terms and important factors within physiotherapy ... We have a lot of discussions among the teachers, but it does not materialize itself in some kind of “product”. So to show our knowledge to discuss it, to disagree, to revise, change and ... that was a very clear ambition.” (Project Coordinator)*

This describes a strong intent to use Fysio-nett within the teacher group as a base for reflection on physiotherapy, to make these reflections visible in a “product” and thereby suitable for further discussion.

The second area is also with regards to the possibility to make knowledge visible. It is the vision of using Fysio-nett to show what type of knowledge the Tromsø-school represents in the world of physiotherapy. This has to be seen in the light of that the Tromsø school truly feels that they represent something unique when it comes to their views on what physiotherapy is or should be:

*“We feel that the Tromsø-school represents a slightly different way of thinking physiotherapy in respect to the other schools. We saw that this could be an opportunity to show to the world what we think physiotherapy is, should be, can be ... To show our professional profile.” (Project Coordinator)*

The feeling they have of that their way of looking at physiotherapy represents something different, is crucial for the development of Fysio-nett. It is the basis for the knowledge they try to represent in the database, and it seems like the conception of physiotherapy described above by the Project Coordinator is widely accepted within the teacher group:

*“It seems like that the ideas embedded in Fysio-nett today, is wholeheartedly supported by everybody. I have no reason what so ever to think anything else. So to conclude that this is on track with our way of thinking, that is absolutely certain. And that is important. Because our way of thinking, our conception of physiotherapy at our school, has to be defined as an identity that is buried in the consciousness of the teacher group” (Head of Physiotherapy Department)*

The third ambition is regarding the utilization of Fysio-nett. There are ambitions of utilizing it not only as a tool for teaching students within the TUC, but also as a tool for physiotherapists in the field of practice. In this way there could be a close relationship between physiotherapists and TUC or between other parties, which both sides could benefit from. In addition to this they see possibilities for Fysio-nett on the international arena, where some times borders can be difficult to cross physically:

*“This way of making our profession visible and to reflect on it has good possibilities also across borders. That is a clear vision for us.” (Project Coordinator)*

So far we have covered the ambitions for Fysio-nett as seen from the creators themselves. Stated from a person (Teacher1) in the peripheral of the project the words are a bit different, all though pointing in the same direction:

*“I think the ambitions were to make visible a humane and healthy view on physiotherapy. Good physiotherapy ... there were very idealistic goals for the project. It has to do with which concepts one puts into such a system. And about how one connects knowledge, what type of knowledge one makes relevant in different teaching situations. On these matters the project has very good intentions.” (Teacher1)*

This comes from a teacher that we later will see is one of the persons with most questions regarding the usability of Fysio-nett as a knowledge base.

### ***Defining Physiotherapy and Building the Knowledge Base***

The technology had been chosen, and they had visions of what this database should be. In addition the physiotherapy department at TUC carries with them a common view on

physiotherapy knowledge and practice. As mentioned above by the Project Coordinator and the Head of the physiotherapy department, these were important aspects to include in Fysio-nett. This identity gives us an indication of the knowledge perspective fundament for building Fysio-nett, and is therefore an important aspect to understand. The project coordinator and the Head of physiotherapy department describe this identity as:

*“This includes that the importance of relational aspects should be made very clear. That it is not techniques that are applied to the patient, but that physiotherapy is something that plays out in the meeting between patient and therapist. Competence of sound judgment is important. This makes it kind of a contrast to the thinking of Evidence Based Medicine, where the real life knowledge, the constant assessments and judgments and the relational aspects kind of disappears to some extent” (Project Coordinator)*

*“First of all it has to do something with closeness to practice. That it is important to explore practice as it presents itself in reality. Strong closeness to practice is important. Then it is a type of holistic thinking, phenomenological thinking, about the physiotherapy profession, that is a cornerstone for us. This is in contrast to ... as you might already have heard ... an EBM way of thinking ... a more dualistic way of thinking.” (Head of Physiotherapy Department)*

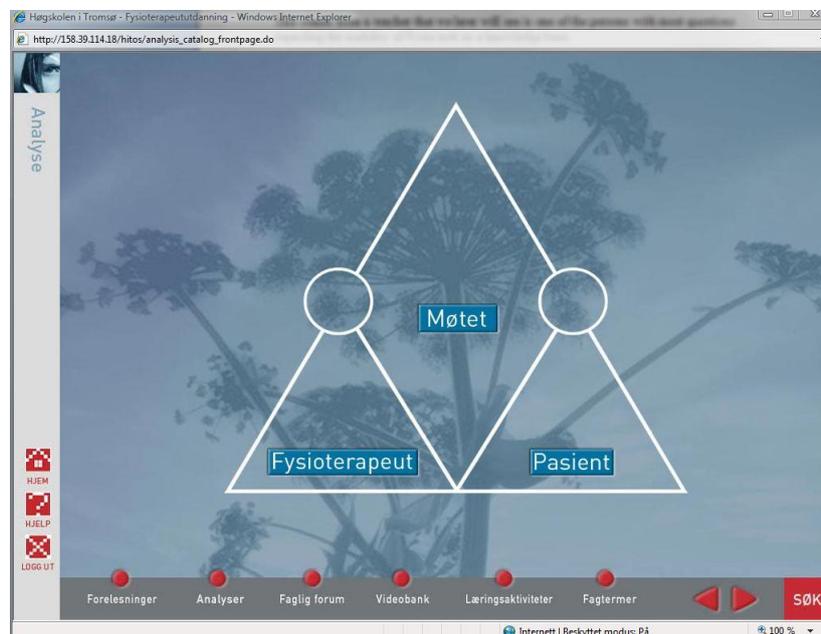
This means that closeness to real life practice, relational aspects of physiotherapy and a holistic and phenomenological way of thinking are important for defining this professional identity. They both also see this, to some extent as a contrast to the EBM-based systems.

With all this as their basis, the task of defining the structure for the knowledge base started. This involved trying to make some kind of structure, to define some important concepts to build the knowledge base from. The project coordinator explains:

*“She ... [The Professor from Bergen] ... said that we first had to make a hierarchic structure over what we thought physiotherapy is. What defines the profession physiotherapy? And we struggled a lot with that. We had these posters all over the walls. And we had an early draft sent out to the teachers and did some small adjustments, but it was mainly me and [Project Member] that worked on this. The teachers attended some meetings, but it didn't evolve beyond that. The others did not*

*really take part in this. So it was me and [Project Member] that struggled. So after a lot of struggling, moving around concepts on these posters, with some help from external experts, then we finally found that we wanted to express physiotherapy as a triangle with the physiotherapist and the patient in their own triangle, and the relational meeting between these as a rhombus between the two. We were very pleased with this model because of the strong visualization of the relational aspect of physiotherapy” (Project Manager)*

The model they agreed on after this stage is visualized in Figure 6



**Figure 6** This screenshot is from the Fysio-nett application. It defines physiotherapy as one whole consisting of three interdependent factors, all equally important in defining physiotherapy.

It seems like the process of defining physiotherapy was not a straight forward process and that there might have been several iterations in this work. Because, after defining this model, they then again went back to the posters and continued their work on the hierarchical structure:

*“When this model finally was defined ... then it was ... what does this consist of ... how can we further divide these three sides ... and further and further ... We was working with the posters for weeks. When we finally were finished we then had a*

*hierarchical structure which we sent to the programmers in Bergen. They implemented it in the database, and then we could start elaborating each of these elements”*  
(Project Coordinator)

The other project member elaborates on the process of defining the hierarchical process:

*“We had a blackboard. We always used a blackboard. And we had large sheets of papers. We had a blackboard where we kind of tried out our ideas. We wrote down ... this is the main node, do we agree on that? And then we agreed on that for a while, and then I could say ‘no, this won’t work’ ... and we had to change it. It was an ongoing process.”* (Project Member)

She further describes the discussions they had during this process:

*“... and I thought, I just don’t agree with this. And the same with her ... you know ... So I thought, it just don’t add up! And then we brought it up and discussed it, and asked each other ‘how do you see it?’ In this way, through listening to each other, we always made progress ... always made progress together. Because we sort of ... in the discussion and disagreements we made visible and made clearer what we really meant. Then it was much easier to place it. And through these discussions it was extremely interesting to really dig into the field of physiotherapy and to think ‘What is physiotherapy?’ and ‘What is important for the students to learn?’ And to make visible that there are always disagreements in physiotherapy, and there should be. This is because there are no ‘correct’ answers.”* (Project Member)



**Figure 7** The picture shows the large sheets of paper used in the process of defining the hierarchical structure.

So, much time was spent on defining this structure. Before we progress I think it is necessary to recapture what Fysio-nett consists of. It does consist of the six parts described above; “Analysis”, “Video Vault”, “Term Bank”, “Forum”, “Lectures”, and “Learning activities”. The structure they struggled to define is actually a part of a sub-part of Fysio-nett. This is the “Analysis tool” within the “Analysis” function. However, there are links to this part from other parts of Fysio-nett and vice versa. Regardless of its physical placement in Fysio-nett, the structure with its main three nodes (patient, meeting and therapist) has to be considered as the backbone of the whole tool. Still, what this means is that it is not only the important hierarchical structure that needs to be filled with content, but also the other parts in the

database, for instance the “Term bank” and the “Video Vault”. It seems like this was done in at least three steps. The first step involved filling out and defining concepts in the hierarchical structure itself, and in the “term-bank”. Some of this was done by students as paid work, and some of it was done by the teachers at TUC. The students took care of the pure definitions of for instance medical terms, terms which could be easily defined through using books and encyclopedias. The more complex nodes in the structure were produced by the teachers. Examples of this could be nodes that discussed different aspect regarding the patient. The teachers had a specific goal when writing these parts, as Teacher2 explains:

*“The point with the content is that it should not just be taken directly from a curriculum book, but that it should consist of material from different sources and to present it in a way that fits with the structure we have. This could mean that you would have to retrieve material not only from different books, but also from different fields. This has to be done to produce the type of knowledge we are trying to connect together to show some of the fields we are discussing. So the point is obviously to create something that delivers more than you get with just reading a book“ (Teacher2)*

The importance of the material being something different, something more than what can be found in the curriculum books are also described by the Head of the Physiotherapy department:

*“One thing, that has kind of been our leading star during all this ... and this is with help from [The Professor from Bergen] ... is that we were only going to use the Net to the things that can be done in a better way than through other media.” (Head of Physiotherapy Department)*

The second step was producing the guided analysis. Due to the earlier described time constraints for the project, they did not finish many of these analyses before the launch in October, but they rather expanded it later. The same can be said for different parts of the tool, it is highly expandable. The guided analysis was, as with the complex text parts, also done by the teachers. It seems like a lot of this was done through cooperative work among some of the teachers, and this process was regarded as very rewarding by those involved:

*And then I was working on video and video analysis ... me and [Project Coordinator] worked together on that one ... recorded the first video for Fysio-nett ... it was about*

*children. And then we analyzed it together ... [Project Coordinator] wrote the text ... but we analyzed the video together. And that was great fun! This was because it ... kind of ... because of the way Fysio-nett contributed to our knowledge development, the way our knowledge got expressed, formulated and made more conscious. A lot of this was things that we also talked about in lectures, but there it never got written down, it was only something that we said. So this was very stimulating, to really put into words all this and to write it down so that all this not just was words that flew around for a while and then disappeared. And it was important that we worked two and two together as teachers ... it forces you to constantly reflect, ask new questions and think further ... instead of working alone. So in a way your own knowledge was added to and developed.” (Teacher2)*

The third step was to include all the content that did not need any processing. These include the taped lectures and the content of the Video Bank. This was more of a straightforward process in that it just involved the recording of activities that was commonly performed in the programs, but, as we will discuss later, also gives important additions to Fysio-nett.

### ***Using Fysio-nett***

This part covers the use of Fysio-nett in the education. The goal is to describe the different ways knowledge is extracted from Fysio-nett in a broadened sense.

#### ***Intended use and users***

All though Fysio-nett was created because of the decentralized program it is also thought to be useful for the students in the normal program. In fact this has been a key point in using time and money to create Fysio-nett; that it can also be used on campus. This section on how Fysio-nett is used thus will not discriminate between the uses in the normal versus the decentralized program. The students in the decentralized program have utilized it to a much larger extent than the other students, since the platform has been necessary to finish the study for this group of students. It should be noted that Fysio-nett has not easily found its place in the normal study program so far, but they are working on improving this. However, old ways of doing things can easily be continued in the normal program, and this is in fact what has

happened most of the time so far. The sum is that there is a clear goal to utilize the system in both programs, as explained by the Head of the physiotherapy department:

*“The whole rationale for this ... an important basis for this ... is that it should not only exist as a service for the decentralized students, but that we are developing knowledge within physiotherapy that are important for the whole department and that can be used on campus as well” (Head of Physiotherapy Department)*

It is important to realize that Fysio-nett is not intended as an encyclopedia. All though there are terms in the database that can be accessed with a search function, it is not meant to be a full database of physiotherapy terms. The terms in the database are carefully chosen to support the other more prominent features of Fysio-nett. The creators of and contributors to Fysio-nett are very specific on this point. So it is not simply a collection of facts that can easily be retrieved and read, like an encyclopedia or a book. This is the starting point of how to describe and explain how Fysio-nett is intended to contribute to the students' knowledge development. The Project Coordinator explains that the indented use is to stimulate to reflection on important aspects:

*“Some students wanted to use it as an encyclopedia, to find The Answer ... and they got frustrated when they couldn't. And I told them ... 'oh ... it is not supposed to be used like that ... that's not why you are logging on'. It is more so that you can think like ... 'ah...so you can think like this about balance ... that it isn't just ... that you also have balance in life, balance within yourself, neuromuscular balance ... and all these are connected'. It is about getting challenge to think beyond what is described in the books. If you look something up in a book you will get a very short and neat definition. We try to give them more input to make them reflect on different issues.”*  
(Project Coordinator)

This seems to be on trail with what the Head of the physiotherapy department explains as the main philosophy behind the teaching on the decentralized study program. Again we see that it is not a matter of finding the easy answers, but rather to stimulate to processes of learning:

*“In this decentralized study program we have focused a lot more on the process than on the finished product. That is the process in itself is valuable ... for instance if they*

*deliver something, they get feedback, they revise it ... so the importance of being in a learning process has been given more credit” (Head of Physiotherapy Department)*

She too stresses the point that it is supposed to give something else, something more than you will get from reading a book. As quoted earlier she goes even further, saying that the content in Fysio-nett should only be there if it is better to present it in that way than in other ways.

Fysio-nett is all about stimulating to reflection and processes of learning, in some way in contrast to a focus on a finished product. The ways they try to stimulate to these processes, the way the different media are utilized in multiple ways, is explained next.

### ***Written material***

Written material, produced by the teachers as described earlier, is basically found in the Term Bank, the nodes in the Analysis tool and the in the lectures. They seem to have kind of an unclear position in Fysio-nett when you look at them as standalone features. With this I mean that the teachers seem uncertain whether these parts are used for knowledge gathering, whether the students use this as one of their preferred sources when they try to discover or learn something in physiotherapy. So although the students use the text in conjunction with other features of Fysio-nett (as we will see later on), it is unclear whether it also is used in other ways. Do the students watch or read the lectures that have been uploaded if not told directly to do it? Do the students explore any of the 700 node big structure in the analysis tool without being instructed to do so in a way? These are questions that seem to be unanswered:

*“We have not followed up these questions, we have not investigated this. But I do believe that both study programs use it less than we imagined that they would”  
(Teacher2)*

The solution so far has to try to be persistent in referring to the database when something suitable comes up in other arenas for teaching. This has however not been easy and is described as easy to forget. In addition to that, there seem to be a big difference between different teachers on how much they try to remind the students of this. It can be concluded from this that there is an intention to use the written text as an independent source of information when the students encounters different challenges in their education – challenges that is not already put in the Fysio-nett framework through various assignments. It could be used to complement information from other sources when solving for instance group

assignments. It does however seem that the teachers doubt that they have succeed to convey this to the students.

### ***Unprocessed video-material***

The unprocessed video material can be regarded as consisting of two types and are mainly found in the Video Bank. The first type is that which is trying to show spontaneous movements not instructed or influenced by a therapist. This will allow the user to study normal and abnormal movement patterns in detail. In the second type the therapist is in some way included in the session. This could for instance be that the therapist instructs the patient what to do. In this second type the user does not only obtain knowledge on how to spot normal movement patterns from pathological ones, but also can gain some insight in how a physiotherapist behave and conduct their work in different situations.

The use of video in this way is not new in physiotherapy, and is considered a valuable resource for learning as one of the teachers explains:

*“We have uploaded a lot of movies that has not been analyzed by us. They are there for the students to exercise themselves in analyzing ... its practice. The same movies have also been used as assignments for the full time students. They have used them as a starting point for group work where they define their own topics and problems with the help of the movie. We have also used these videos as a starting point for some mandatory exercises the students have regarding practical physiotherapy ... In that one we used a movie where a physiotherapist did a clinical assessment of a patient. The other movies I mentioned were movies where we watched a patient or a child’s function ... without any interference from a physiotherapist. This is depending on whether they are interested in the functional aspects of movement or whether they are interested in physical assessment. So what type of movie you need depends on where in the study progress you are.” (Teacher2)*

The teachers can in this way deliberately guide the students to use some of the videos through the type of assignment, and to guide them to use a suitable video for the objective of the assignment. This ensures the use of the material. Whether students use these videos as a result of their own initiative, in contexts outside these given assignments, are as with the use of written text not known.

As mentioned, the use of video in physiotherapy education is not new. What is new in this context is that the use of Internet makes the videos more available for the users independently of time and localization. It also provides the possibility for access control on videos that are not intended for the general public depending on what consent the persons on the video has given for use. This makes the knowledge embedded in the videos easier to distribute and is regarded as a great benefit also from teachers that are generally more skeptic towards Fysio-nett:

*“We probably need some kind of ‘bank’ – where we can have videos hidden from the public and only available for those with username and password. In that regard I find it very useful. With the use of videos in other ways – discs and cassettes – there is a lack of security. We have the library with some public ones you know, but apart from that it should be controlled by informed consent and such things ... it should be stored in specific ways ... so there are a lot of considerations to make which makes it difficult to use videos. I think this can function as system to make that easier.” (Teacher1)*

Looking at Fysio-nett as a video bank, the use of videos in the education is much more convenient. There is no need for booking and obtaining the physical copy of the video and there are no worries about losing or forgetting the tape or disk somewhere.

### ***Processed video-material***

The processed video material is found in the “Guided analysis tool” and in the “Lectures” section and are both processed in the way that it has been thoroughly analyzed and includes text to make the description of the situation fuller.

The “Guided analysis” seem to be one of the features of Fysio-nett that are most valued by the teachers. It is processed in the way that it has been edited and commented on section by section to give the user a comprehensive and rich description on what is going on in the video. The video has been cut into smaller chapters, each with text that includes the physiotherapist’s views on what is being said and done in the situation. The goal is to present how a physiotherapist work, how he performs clinical reasoning both on physical findings and through a continuous interpretation of what plays out in the meeting. The text seem to have a certain structure for each video chapter: A ‘description part’ describing what happens in the chapter, an ‘comments’ section giving the physiotherapist thoughts and reflection on what is going on and one ‘findings’ section that describes the physical findings in the assessment. In

the written text there are also hyperlinks to the Analysis Tool (the hierarchical structure) and the Term Bank – each type in different color. It now becomes more apparent that much of the reason for putting effort into the production of text is to support other structures in Fysio-nett. It is not necessarily meant as a standalone feature that can be read from the beginning to the end.

The benefits of this tool are explained by the Head of the Physiotherapy department:

*“The guided analysis makes it possible to make visible part of what physiotherapy is ... the parts regarding closeness to real life practice. Just imagine that you are looking at a physiotherapist doing a physical assessment. If you are doing this in real life everything happens very quickly ... so everything happens very fast for you as a student – you can’t possibly see and notice everything. But in Fysio-nett you can pause and say: ‘...but do I see the same as the physiotherapist has commented in the text?’ You can halt the video and watch again, and in this way you can develop your skills in watching and analyzing. So even though this happens online I feel it all becomes very close to real life practice and very relevant in obtaining a holistic view of the patient”*  
(Head of Physiotherapy Department)

It is here also commented that this technical tool which by many are feared for creating a distance to real life practice, by some are considered having the opposite effect – to make learning closer to real life practice. This is a view that is shared by others but since it does not only relate to this specific part of Fysio-nett, it will be more thoroughly discussed later.

With regards to processed video in the Lectures part of Fysio-nett, video has been used in conjunction with text to illustrate for instance specific physiotherapy techniques or procedures for assessment or treatment. It has also been used to illustrate parts of or concepts in the text via hyperlinks. For instance if the term “physical assessment” is used, clicking it will start a video giving an example of a physical assessment. The teachers seem uncertain of whether these lectures have been used by the students.

### ***Students’ video-material and feedback cycles***

The interactive part “Learning activities” in Fysio-nett has by every informant been characterized as a very useful tool. It resembles in some ways the “Guided analysis tool”, with the important exceptions that the students make and upload the video including the analysis,

and that there is an asynchronous communication tool so that the students can get feedback on their work. After some cycles of feedback and improvements the final product then can be published for all the students to watch and learn from.

This type of work can be performed in any stage of the study program, but it is perhaps most conveniently used when the students are off campus for longer periods of working practice. There they will have close contact with patients that can be used for their video. During the four year trial of the decentralized program, the students performed this procedure at two occasions. According to the teachers this type of work was greatly appreciated as a very good way of learning, all though it created a heavy workload.

This way of working closely follows the thoughts of the Head of the physiotherapy department earlier mentioned, about emphasizing process rather than the finished product. The learning here lies in the process of videotaping, analyzing, reflecting, getting feedback and improving the work. That the finished product can be published for other people to watch and learn from is an added bonus.

*“You always seek to make the students reflect over their own practice, to describe what they do, so it is a very good tool to help you take a look at yourself ... to get rid of some of the “blind spots” and to evaluate your own practice” (Teacher1)*

A not so obvious benefit from the use of such a tool, described by several of the informants, is not only the fact that you are enabled to reflect on your own practice, but also that you get used to that other people look at how you do your work. A lot of practitioners are scared of letting colleagues to close into what they are doing, how they are performing their work. This does of course inhibit discussion and reflection in the work place. That the students early in their training get used to letting other people look into their work could possibly change this.

*“Physiotherapy today is performed without anybody looking into our cards ... you can get the impression that this is quite scary. If students become used to critically reflect on other’s and own practice this might be something which can be transferred to later work. So that they learn that to develop knowledge through practice is useful, effective, necessary and good. Knowledge development is not only to read articles and to utilize theory in practice.” (Project Coordinator)*

### ***Integrating written material and video in learning***

Each of the different parts of Fysio-nett, and how it tries to promote learning has been discussed. All though each part can be used as standalone features, there has been an attempt to integrate the functions so that they can benefit from each other. For instance through the use of hyperlinks in virtually any text part to for instance the term bank. Without this integration some of the core aspects of Fysio-nett get lost. The effort put into defining the hierarchical structure is of no use if the hierarchical structure, the nodes, is not used. Remember that these do not aim to cover every aspect of physiotherapy, but rather a set of well thought through terms and concept chosen to define physiotherapy the way the physiotherapy department at TUC sees it.

The glue that bonds all this together seems to be the use of assignments, or rather the way these assignments are given. These assignments are not an integrated part of Fysio-nett but have to be formulated and given at each teacher's own initiative. When the students are given a task of producing a video from their own practical work they can for instance at the same time be given the specific task of including one or several terms from the hierarchical structure in their analysis. This forces the students to explore this structure to find suitable terms or concepts for their work. This way of utilizing the base is seen as a necessity as explained by the project coordinator:

*“When given the task of producing their videos, their own guided analysis, the students were given as an assignment to make a hyperlink to one concept – one node – in the analysis tool; a concept or term which they found relevant for their case. To guide the students this way is alpha and omega I think.” – Project Coordinator*

In this process the students also got the possibility to shape the content of the analysis tool in that if they had an idea of a concept or term not already defined, they could notify the teacher which in turn would consider the suggestion and possibly implement it in the tool.

### ***Additional Perceived Benefits of Fysio-nett***

So far why and how Fysio-nett was created and how it is utilized to promote learning has been covered. The main underlying perceived benefit introduced by this system is of course that in

contributes in a positive way to students learning. Some of the ways in which it does this has been described in the last part about utilization of the different media types. These include to stimulate to reflection and learning processes, as an easily managed media bank, the utilization of Internet to make the content easily available and to make students used to give and get critique of their or others work as physiotherapists. Other perceived benefits were also mentioned and these will be outlined here since the presentation of these not easily could be integrated in the last part.

### ***Reflection over time – adding distance***

Stimulating to reflection has already been mentioned as a key feature of Fysio-nett. To stimulate to reflection can be done in many ways, including seminars and class room discussion. Fysio-nett, according to some informants, adds to this reflection a certain distance to the material which improves the reflection and learning processes. For instance if we look at the cycles of feedback resulting from the students video analysis upload a quite different type of feedback can be given than the one you will have in a classroom education. This is explained by Teacher2:

*“And then I read what the student submitted, I watch the video, I think for a while, watch the video again ... then I write back and then she goes through the same processes ... so time is a factor and this results in a totally different feedback and reflection from that you would give the student if you were physically there with the student. I think this results in a longer and deeper process and ultimately results in more learning.” (Teacher2)*

### ***Closeness to practice***

Fysio-nett is by some regarded as a tool for bringing the students closer to real life practice. The reason for this is the possibility to do in depth analysis of human movement, patients and therapists in different real life situations. It makes it possible to retrieve these situations regardless of time and geography and the media itself is reusable so that it can be viewed over and over again, and situations can be uploaded directly from the field of practice regardless of location. This means that the field of practice, what happens in real life physiotherapy is no longer limited to being out in the field.

*“It is interesting that a tool initially associated with creating distance to real life actually can do the opposite. Even though Fysio-nett is Internet-based it is my opinion that for instance the guided analysis contributes to show the ‘closeness to practice’-part of physiotherapy” (Head of Physiotherapy)*

In a similar way to how Fysio-nett is perceived to bring practice closer to the student, it is also regarded as a tool to bring the school closer to the field of practice. This results in a closing of the gap between the school and the field of practice and can through this create channels for communicating between the two. This gap has been identified as a challenge since it means that the school has little (or at least less than ideal) control over what students do and learn in their longer out-of-school practice periods. And practicing physiotherapists as students’ supervisors have little information on what students learn at school. The result can be frustration for the students who get confused over what is “right” or “wrong”. Fysio-nett has the possibility to remedy this.

#### ***New methods for doing research***

As a continuation of the last point, one of the informants points out that closing this gap also makes it possible to do research in a different way than today. Rich information in the form of video directly from the field of practice can be excellent material for doing research. Analyzing video as a part of research is of course not new in physiotherapy, but a tool like Fysio-nett makes the data more available, it can be retrieved from more sources and it can be discussed with anybody regardless of time and space. Moreover this way of using ICT to connect research teams, whether at educational institutions or elsewhere, and the field of practice is seen as a possibility to develop new ways of doing research within the health field, a field which today is focusing more and more on the EBM system and RCT-studies.

*“So to tie the field of practice and research together, that research must be rooted in real life practice, to be able to involve practicing physiotherapists and to team them up with researches through the use of such a tool is a good idea. Because there is a need within the health science field to develop new ways of doing research. We are now doing research the way it is done today – RCT – because this is the only method that has been developed and focused on and therefore we tend to believe that this is the only way of doing it” (Project Member)*

## *Criticism*

So far there has been little said about criticism raised against Fysio-nett. One reason for this could be that many of the informants have been at the core of Fysio-nett, its creators. It is natural that these will have a positive view on the tool. But even when moving away from this inner circle and intentionally seeking those who openly have been reported to have some criticism towards Fysio-nett, there still is a general positive attitude towards it. None of my informants have in any way labeled Fysio-nett as useless, dangerous, inappropriate or similar. However, there have been concerns regarding some factors around Fysio-nett, and this will be outlined next.

## *Ethics*

Fysio-nett is aiming towards filling a database with sensitive content. Identifiable patients are seen as one of the main contributions to the database. It is a goal to let this database grow. Some informants raise questions regarding how this can be done in an ethical and legally correct way<sup>5</sup>, and whether these issues have been taken seriously enough so far. At least if one think of an expansion of the size and use of Fysio-nett.

*“I don’t know if I would like to be a patient if I knew that there was a possibility that these videos could flow around in a whole class. So, first of all I think that information to the patient is very important ... that they know what they actually are taking part in and what this is going to be used for. And last but not least it is important to say something about when the material is supposed to be erased. I have raised these questions, but to me it still seems a bit blurry.” (Teacher3)*

Questions have also been raised whether users are technically skilled enough to make sure that only intended users have access to the data. The more such a system is spread, into people’s home and different clinics, the higher the risk is that somewhere somebody that shouldn’t have access gets access. In this is also the concern that users might not understand the sensitive nature of the data enough to take appropriate measures.

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<sup>5</sup> There are no indications in my material that indicates that law and legislation has not been followed up until now. However, it looks these factors have been taken care of in a limiting way for future expansion of use and size and could be a problem at a later stage. Ethics on the other hand can be discussed also regardless of rules and legislations.

### ***Can't learn without interacting in real life***

One of the most frequently expressed skepticism towards Fysio-nett is about how physiotherapy only can be learnt through interacting in real life, about how important it is to talk and communicate with patients and fellow students to develop skills and knowledge in physiotherapy.

*“It is important that students are together, that they work together both to develop practical skills, but also to develop ways of talking to each other. No one develops a language without speaking to somebody... I don't think online chatting is suited to develop such skills” (Teacher1)*

This is much in line with what the Project Coordinator also have received in comments when she has been presented the project in different conferences, all though the majority of the feedback has been positive.

### ***Questioning the usefulness of ICT in education***

A question regarding the usefulness of ICT in higher education is raised by one of the teachers. This teacher emphasizes that if we are going to use ICT, it has to add something significant to the education. The teacher is not convinced that Fysio-nett does that.

*“It is kind of an overall will to modernize higher education and to spend money on equipment and development, but there are not so many ideas about what makes this good for us. How this can improve the education. It is kind of underlying political interests that take control over these processes.” (Teacher1)*

This implies that political will to reform and improve through the use of ICT is not grounded in a factual need to improve in the suggested way. Or that it is not the best way to improve the quality of higher education.

### ***Quality issues and copyrights***

One of the teachers expresses concern regarding the quality assurance of the content in Fysio-nett. Text books and journals have always some kind of quality assurance procedure before it is published, and after it is published it is at the very least open for everybody to access, discuss and critique. These quality assurance mechanisms do not happen with the content in

Fysio-nett, as it is not published in the same way, and it is not open for everybody after it is published.

*“With other things there are always referee committees or publishers who can approve the quality of a publication. This is more like ‘home made’” (Teacher1)*

It is also raised a question whether the content of Fysio-nett serves a real demand of such material, or whether the quality and depth of the material might fall between two chairs as one teacher expresses:

*“Fysio-nett can quickly fall between several chairs. It does not have the depth and thorough discussion of a text book, and it does not have the lightness of Wikipedia. What is in Fysio-nett is not problematic or wrong, except that it lacks depth.” (Teacher1)*

It is also mentioned that due to not having all the developed material published in a more common way, the situation regarding copyrights are a bit unclear and it is unclear who should and can be allowed to refine or revise the material in Fysio-nett.

### ***Students’ Feedback***

All though the main focus for this thesis is to discuss the creation and use of Fysio-nett from the perspective of the creators and from a knowledge perspective, some data were also collected from the students from the decentralized study program. This was done for two reasons. First of all there seems to be a general feeling among the teachers that Fysio-nett is a useful tool, all though there are problems with getting it used as a tool in the normal program and in spite of that not everybody embraces it equally wholehearted. So it made sense to see how the general feeling towards Fysio-nett was among the students. Secondly, the teachers often referred to the students and said that they were very pleased with the tool. In contrast to this it would be interesting to see whether the teachers’ interpretation of this was correct.

The data gathered from the student shows a near unanimous positive feedback. Two very important reasons for this positive feedback can be identified. First, the importance of Fysio-nett as a starting point for further investigations is mentioned:

*“It was a useful database to seek answers, to find clues or to start thought processes when I was stuck in work or a casus ... It was often easier to use Fysio-nett as a starting point instead of doing extensive searching in literature first. The references to other literature in Fysio-nett were highly appreciated in this regard” (Student1)*

Secondly the different video material, especially the guided analysis tool was presented as an important tool:

*“I had some rather bad practice periods with little real life practice both in regards to assessment and treatment. In these periods it was very nice to have Fysio-nett with the movies which I could analyze over and over again. It beat a bad practice period by far!” (Student2)*

Of negative feedback the main theme was that the tool felt at times unfinished and under constant development. It was also mentioned that sometimes there was a feeling of spending too much time in front of a computer.

*“Another issue was that you could not always get full benefit from the system because the process of putting knowledge into the system not always kept up with what we actually were studying ... I also wish that the time spent in front of the PC could be limited. The worst thing about the decentralized program was to be so tied up to the PC. Fysio-nett has to be very exciting to compete with all the other stuff you can use a PC for like e-mail, assignment writing, Facebook, chatting, games...” (Student3)*

## ***Project Failures***

All though Fysio-nett successfully supported the students of the four year decentralized project, two very clear intentions failed to become reality. First of all there was an intention to use Fysio-nett as a knowledge development project for the whole teacher staff. This failed dramatically and today some of the teachers clearly state that they do not have much idea of what are going on inside and around Fysio-nett. This failure is also clearly the view of the Project Coordinator:

*“We have not managed to get the knowledge development processes started among the teachers. Such a tool is never quite finished; texts have to be revised, carefully read and critiqued together and so on. We have not done these things. But that intention does not feel so strong anymore.” (Project Coordinator)*

The reason for this apparent failure is explained by several of the informants to be the result of lack of resources and, for some of the teachers, some skepticism toward teaching physiotherapy on the net. The head of the physiotherapy department elaborates:

*“I think that such a project is so new and innovative that you have to have time to really get into it in order to get interested. But in order to achieve that you got to have time and we didn't have the resources to get time for everybody. In addition to that some was just not interested. There were voices that said it was wrong to invest time and money in a net based education of physiotherapists ... that we rather should focus on the issues close to practice, face to face” (Head of Physiotherapy Department)*

Another failed intention has been to integrate the tool into the normal program, all though sporadically used. There is still a strong intention expressed by the Head of the Physiotherapy Department to change this, to make it use both off and on campus, but so far it has been difficult to make it a natural, integrated part of the normal program. None of my informants have any clear answers to why this has failed but it is mentioned that it has been each and every teachers own choice on whether they wanted to use Fysio-nett or not. This should also be seen in the light of the previous quote from the Head of Physiotherapy with regards to general interest, time issues and skepticism towards Fysio-nett.



# Discussion Chapter

The discussion chapter aims to shed some light on the story about Fysio-nett with the theory from the Theory Chapters as a tool. Through this it is a goal to be able to answer the research questions, but that does not exclude that other issues more peripheral to the research question also will be brought up. I will divide this chapter in four main parts which to some degree follows the structure of the Empirical Chapter. The first part discusses the role of knowledge in the initial phase of the project. This is the phase where the tool was planned and created. The second part discusses knowledge and knowledge creation after the decentralized program was started; we are entering the phase where Fysio-nett is an implemented and utilized tool. The third part will deal with discussion related to the projects failures and the criticisms raised against Fysio-nett, while the fourth and final part will attempt to discuss the bigger picture.

## *Part One: Initial Phase*

### *Externalization – negotiating knowledge through technology*

The initial phase is the creation of Fysio-nett and its structure – the phase where they tried to define physiotherapy into the tool. If we look at what happened when the two project members worked on creating the hierarchical structure and ended up with a model of what physiotherapy consists of (Figure 6; the therapist, meeting and patient model) this is a clear example of externalization (Nonaka & Takeuchi, 1995). As we recall, this externalization was regarded the quintessential knowledge creation process and is described as a difficult task to accomplish. Implicit knowledge was through a long process finally attempted made explicit in the model. Other similar, all though not resulting in such substantial structural impact on the design of the tool, is the creation of some of the Guided Analysis. Teacher2 explained how she worked together with another teacher to analyze and write the comments to one of the videos – which at least partially could be regarded as externalization. It is an interesting point

that this also happen trough a process involving collaboration and joint discussion and reflection, just as with the massive task of creating the structure for Fysio-nett earlier on.

If we look at what happens in this phase through the eyes of ANT we can identify an actor-network that is quite small. If we start at the very beginning it consists basically of two teachers, the Project Coordinator and the Project Member, who are trying to create a new tool. Knowledge could be regarded as a separate actor and together they are trying to enroll (Monteiro, 2000; Walsham, 1997) a forth actor, which is some sort of technology. It is interesting that knowledge here is such a powerful actor that it strongly influences and limits the choices for technology – but there are already at this point some sort of negotiation process going on between knowledge and the other two actors.

When the technology finally is enrolled as an actor, a new negotiation process started. This was done when they wanted to define the knowledge into the technology – they wanted to inscribe their view on knowledge in physiotherapy into a technological tool. It became apparent that even with a starting point of the perceived unified view on knowledge that the two human actors had, knowledge still had to be negotiated in order to stabilize the network. This process took a lot of time working with definitions, concepts and the hierarchal structure. As described in the Empirical Chapter they spent weeks with blackboards and large sheets of paper in order to manage this. This could be said to show that knowledge, even though a strong actor, is fluid and very far from what we could call a black box (ibid) in the network. Knowledge is very complex and could perhaps in itself be looked at as a network. But in this fluid view of knowledge it is a network that will be impossible to gain full insight or agreement on. We might recall the comment from the Project Member: “... *there are no correct answers.*” And again we can see how powerful knowledge as an actor is in this network. First it strongly influenced their choice of technology, and secondly it made the human actors go through a very demanding process of translation in order to finally agree on what to inscribe in the tool.

Moreover I think it is a point that Nonaka and Takeuchi’s externalization concept actually seems to also could be expressed as a negotiation or translation process in an Actor Network. It is also interesting to see that if it wasn’t for technology itself, the presence of technology, these processes would not have occurred. Technology is the reason why these processes started, without technology the knowledge represented in Fysio-nett might never have been

documented in the same way. And this knowledge is created and can be used regardless of the utilization of Fysio-nett. The model representing physiotherapy is transferrable to other mediums.

### *Combination – a simpler process*

In creating Fysio-nett there was also a substantial contribution from knowledge creation in the form of combination (Nonaka and Takeuchi, 1995); the combination of different sources of explicit knowledge in order to create new knowledge. This has been done both with regards to the content of the hierarchical structure and with regards to some of the lectures. It has been a stated goal to make in some ways new knowledge through combining other sources. This work seems to have been carried out alone as a contrast to the cooperative work in the externalization processes. Parts of this work have also been delegated to people presumably less knowledgeable than the teachers that initiated it. This could be seen in light of that externalization generally is thought to be a very difficult task. It could also reflect back to the fact that tacit knowledge as defined by Polanyi is a very personal and context dependant type of knowledge (Polanyi, 1983), so it makes no point in delegating such work as the knowledge you try to process then suddenly is not at hand any more.

We can see that knowledge creation through combination did not challenge the network to the same extent that externalization did. It was even possible to extend the network into including other human actors to contribute to the knowledge creation based on combination process.

### *Part Two: Utilization Phase*

The second phase began at the time the students started using Fysio-nett. For the purpose of trying to understand how learning happens through the use of Fysio-nett I would like to look at all the learning that happens with each student using Fysio-nett as limited, distributed examples of knowledge creation. All though maybe a bit out of Nonaka and Takeuchi's ideas when defining their framework for knowledge creation, I feel that using their theories in this way can give valuable insight in how learning happens in Fysio-nett.

### ***Fysio-nett enables learning through externalization***

If we look at externalization-like processes we can find at least something similar to this when the students analyze their own videos. This process has the ability to make some aspects of a student's previously tacit knowledge explicit, at least to the student. Some of this might even be documented in the comments the student writes for the video. The online interaction between the student and the teacher in this matter, the cycles of feedback and revision, is similar to the process that occurred when the teachers made Fysio-nett; it is sort of a negotiation process. Again we can see that this process involves action through involving oneself in analyzing the video, and interaction with the teachers in the feedback cycles. Even if we take away the interaction part it is still a large amount of action left in the task of analyzing the video and it is this action that enables the externalization processes. However, this explicit knowledge cannot appear out of thin air – the tacit knowledge it was based on has to originate from somewhere. One example could be the type of knowledge that the student has gained at school but might not have fully understood earlier. It could be a technique that was learnt at school but which the student did not quite fully understand the aim, benefit or range of – it is just mimicking, maybe even without being aware of it, what the teachers do. Analyzing the video could make the student aware of things he does subconsciously, and it could make him realize *that* he does it, *how* he does it, *when* he does it and *when it is sensible* to do it. This does however suggest that to benefit from Fysio-nett in this manner it is a necessity that you have some kind of input that you bring with you into the process, some kind of – explicit and tacit – knowledge obtained from somewhere else. This is an interesting aspect of Fysio-nett that I will discuss later as a part of looking at Fysio-nett and its role in a CoP.

### ***A virtual form of socialization***

It is my view that the use of rich media, for instance in the Video Vault – videos of real life physiotherapy - also makes it possible for socialization (Nonaka and Takeuchi, 1995) to occur. This from tacit to tacit conversion is generally thought to be a product of real life human interaction, for instance in a master – apprentice relationship. However, video is able to communicate a lot more information and possibly knowledge than what can be told. Some of this could be transferred to the observer in the form of tacit knowledge, tacit knowledge that in turn also could become explicit if the right processes occur as explained above. We can through this see what Nonaka and Takeuchi refer to as the knowledge spiral (ibid), how

knowledge gets created as a result of interaction between different types of tacit/explicit knowledge conversion types.

### ***Fysio-nett challenges traditional view on learning***

Combination (ibid) in a traditional sense is not very dominant in the students' use of Fysio-nett and this is an interesting observation since combination often is regarded as the typical educational form of knowledge creation through writing assignments and thesis (Nonaka & Takeuchi, 1995; Wenger, 1998). One could argue that the reason for this is Fysio-nett's focus on action and reflection processes based on real life examples.

The students do use knowledge that has been created by the teachers through combination and they also use this type of knowledge in conjunction with video to enrich the processes they are involved in. It does however seem like traditional combination has more of a supporting role in the way Fysio-nett enables learning. This fits very well with the comment from the Head of the Physiotherapy Department regarding the focus on the process rather than the focus on a finished product.

Even though this way of promoting learning is in contrast to what happens in many educational institutions, it is very much in compliance with the view of learning and knowledge that is established at the Physiotherapy Department at TUC. It seems like they in this regard have found a tool that suits their needs.

### ***Fysio-Nett enables learning in and between CoPs***

Wenger's first premise for his social learning theory discussed the importance of the fact that we are social beings in relation to learning. Fysio-nett has not, at least not yet, utilized possibilities of establishing an online community and to sort of create an online CoP. As mentioned in the Theory Chapter, such communities seems to have had limited success so far (Moule, 2006), all though this is not the reason for not trying to do something similar in Fysio-nett. The main reason for this seems to be lack of resources and the existence of another strong competing actor in ClassFronter where tools suitable for such collaborative work are already implemented. My main point is however that there is very little human – human interaction in Fysio-nett, at least in a group or community perspective. So it could be argued that CoP as social theory of learning does not fit well with Fysio-nett. Or is there perhaps another way of looking at it?

I did include the CoP perspective since I felt that it in a lot of ways fits well with the general view on learning at TUC, and to then investigate how Fysio-nett fit into all this. This does not necessarily mean that Fysio-nett in itself, as a standalone feature, is built on and uses the same principles of learning as presented in CoP theory. As already mentioned I have a general feeling that the lack of a real online community inside Fysio-nett implies that a CoP perspective on Fysio-nett alone might not fit well. However, Fysio-nett does not exist in a vacuum, it is impossible to look at it as a standalone feature, it nurtures and is used *in* a CoP, by *participants of* a CoP. Fysio-nett would be totally useless if it could not exist in such a community, it needs people that work together, that act and interact and reflects in order to obtain any content. The content, since much of it is taken directly from the field of practice, is at the same time taken directly from a CoP. On the reverse side it is also apparent that the use of this tool inside the CoP has the potential to give something back to this CoP in the form of knowledge. It could also be argued that Fysio-nett in fact connects together several CoPs that did not have such strong connections earlier. The school could be regarded as one CoP, which usually is only loosely tied to the CoPs surrounding each and every student when he or she is out in their longer periods of practice. Fysio-nett has the ability to connect the school with each of these CoPs (which are typically the health service in a municipality or a large institution), and even to make connections between the different CoPs represented by the students out in their practices. One might even suggest that this has the potential to develop one large CoP out of several smaller, but I think this depends on how strong the links that is created are. Generally, the way Fysio-nett is today without an online forum for larger scale active discussion between the involved CoPs, the links is in my view not that strong. But the links could serve an important role in giving each and every CoP a glimpse of what happens in other CoPs and ultimately result in learning.

This way of looking at Fysio-nett inside a CoP brings forth associations to the combination of CoP and ANT (Fox, 2000), that Fysio-nett, in ANT terms is an actor, non-human such, within this CoP or Actor-network (or both, depending how you look at it). It becomes apparent that technology plays an integrated and important part of the learning processes that happens within a CoP. To me this suggests that Fysio-nett could play an important role in the learning processes. This integration could also be the reason for comments from my informants regarding how Fysio-nett seems to create closeness to practice rather than the distance one intuitively would imagine technology could create. This feeling of closeness could be due to the close integration of this piece of technology, and that it nurtures from this CoP, directly

from real life practice, and that it brings closer those parts of real life practice (other CoPs) that earlier did not have any connection.

It should be mentioned that not all feel it this way. Some informants seem to feel that it creates a distance and takes away focus on real life interaction. It is difficult to pinpoint why this is the case, but I will try to investigate it later on.

When taking the non-existence of a “social” part in Fysio-nett out of the equation there is however some aspects of Fysio-nett that fits directly into the views on learning in the CoP framework. This has to do with the view of knowledge as related to “know-how” rather than “know-what”, and it has to do with participating in the pursuit of knowledge of valued enterprises. Fysio-nett also shares the same view on learning as something contextual – that it is deeply tied to what we actually do, to real life practice. All though not real life practice itself, the use of rich media is a fuller substitute for real life experiences than text, and when the videos are recorded in real life settings this makes it even closer.

However, some things are lost in Fysio-nett. The bodily experiences, referred to by Nonaka and Takeuchi as the technical dimension (Nonaka & Takeuchi, 1995) - are non-existent. The focus on the cognitive dimension is abundant. But again, this is correct only if we look at Fysio-nett as an isolated structure – once we put this in its place as a closely integrated tool in a CoP, not something that you do isolated from everything else – there is also a possibility that technical skills will develop. Actually this seems to an important point, that the reflection and cognitive engagement the users perform during use of Fysio-nett will increase the effectiveness of the technical training through increased awareness of one’s own actions. It brings to the surface important questions, themes, areas of problem that can be used in practice. And these questions and themes are highly relevant because they are taken directly from the field of practice – they are highly contextual.

### ***Part Three: Criticism and Failures***

#### ***Limitations of Knowledge***

A problem with knowledge created the way we up until now have discussed, and probably one of the main reasons for the EBP community to criticize experience based knowledge is

that human conception sometimes can be faulty. If you look at yourself in a video, you can realize that you are doing something in a certain way, and you can hypothesize on why you are doing it, whether it is good or bad, how it can or should be reused and so on. You can share this experience with others in your CoP, you can discuss it and you might come to a common conclusion. But with what certainty can you call this conclusion knowledge? How do you know that you are not misled by your senses or your preconceptions? This is of course what the EBM system tries to remedy (Bjørndal & Flottorp, 2000; Jamtvedt & Hagen et al, 2003; McGovern, 2001). The problematic thing is that the prescription for this is to introduce a system that to a large degree produces out-of-context knowledge that might not be useful in a real life setting (Ekeli, 2000a-d). It might be valid in its own right, but useless none the less.

Due to the nature of the illnesses physiotherapists see this becomes a real issue. The nature of the illnesses are very often extremely complex, they are of a very complex and maybe even idiopathic origin which makes it very difficult to perform “gold standard”, RCT research. This is in clear contrast to for instance an infectious disease with a singular, known virus or bacteria as the culprit. In the latter case it is much easier to design a study meeting EPB standards, and the results of this type of research have been very good. The same cannot be said when attempting the same methods for complex, multi causal, hard to detect or measure illnesses like fibromyalgia, depression or chronic fatigue syndrome.

So it is a “catch 22” situation. You cannot always trust what your experience, and you cannot always use the limited usability of EBP-knowledge. The answer is probably somewhere in between. To use sound judgment and pick the best from both worlds and perform to the best of your ability based on this. Fysio-nett has implemented some functions that provide more fact like or EBP like knowledge that can be linked up to the analysis of the videos. Both the hierarchical structure and the term base have more factual like knowledge which is makes an interesting combination. In my eyes the other aspects of Fysio-nett are more prominent though, and it could be interesting to see whether the tool could implement a stronger integration of knowledge inspired EBP. This could for instance be done through some sort of automated search for keywords used in other of Fysio-nett’s structures.

### *Low Utilization Rate – a Problem of Weak Inscription?*

The low rate of utilization outside the decentralized program is a core problem in Fysio-nett. I think we could get valuable insight in why this has occurred through the eyes of ANT (Hanseth, 2004; Monteiro, 2000, Walsham, 1997).

First of all, if we consider the knowledge represented in Fysio-nett as an actor in the actor-network consisting of the creators, the teachers, Fysio-nett and knowledge it is interesting to see that knowledge as an actor is aligned with the network. There are no big discussions between the teachers whether the knowledge represented in Fysio-nett is suitable. In fact the network seems totally aligned in this regard. There is however some discussion on whether Fysio-nett is the right vessel for conveying this knowledge. The issues mentioned point on that Fysio-nett don't have enough depth, that it takes the focus away from real life practice and that there are some unanswered ethical and/or legal issues in the extensive use of patients as "data" in Fysio-nett. The latter one seem to be a matter of communication, this has not been discussed as openly as some actors would like to see. The other two issues on the other hand there seem to be totally different views on in the network.

It has been argued that Fysio-nett lacks depth. The creators however have clearly not intended it to be used as in depth literature; it is a totally different approach to learning. How can this conflicting view have been established? It seems to me that Fysio-nett might suffer from weak inscription (Monteiro, 2000; Walsham, 1997). Suffer is perhaps not the best word, because it implies that weak inscription is something solely bad. That is not the case, because the weak inscription also gives freedom and flexibility which is a core part of Fysio-nett. However, when entering Fysio-nett it is not intuitively clear how the tool is supposed to be used, what the intentions for its main purpose should be. This is also illustrated by the students cry for help when they realized that they could not use it as a pure encyclopedia or reference book – and the project coordinator's response that it was not supposed to be used that way. This weak inscription gives room for interpretation – interpretations that can go against what the intentions with Fysio-nett are. For instance can it be interpreted that it lacks depth since the written material is not extensive enough in comparison with a text book.

The same could be said about the fear that it takes away focus form real life practice. It is not supposed to do that, nor has it been used in that way in the decentralized program. Again the weak inscription opens up for interpretations.

This means that in order to align the network, some kind of translation has to occur. As I see it this can be done with two different approaches. The first option is to change the technology, to change something in Fysio-nett to make the inscription stronger. How, if at all, this can be done without sacrificing some of the flexibility in Fysio-nett is difficult to say. A second way is to change things outside Fysio-nett. To improve the communication of what Fysio-nett is and how it is supposed to be used – to strengthen the inscription through organization. Depending on how much effort has been put into similar approaches earlier this might be an easier and more beneficial way to go. There is for instance an open admittance that the inclusion of the teacher staff in the development process failed. This failure could have resulted in that some of the teachers did not get deep enough insight in the intentions of Fysio-nett as a learning tool. It is pointed out by the Head of Physiotherapy department that maybe Fysio-nett is so innovative and new that to really understand it one really needs to get involved.

An alternative way to improve the utilization rate could be for those in charge to set certain rules. Rules that implied that Fysio-nett should be used by all teachers and not by only by those who want to use it. This top-down approach could maybe work, but it could disrupt the network in other ways, creating conflict if there was no consensus on the usability of the system. So to do this without at the same time somehow translating the interests regarding the usability of Fysio-nett is as I see it perhaps not the best way to do it.

### *Extending the Network – Increasing problems*

If we look at the problems and failures that has occurred with regards to Fysio-nett, I think there are two interesting points that can be illustrated through looking at what has happen with the aid of ANT. The first point is that the problems grew as the network grew. The second point is that – once again – it is mainly knowledge as a very powerful actor that introduces the problems.

First, if we go back to the network described in this chapters first part – the initial phase – we remember it to consist of the Project Coordinator, the Project Member, the chosen technology and knowledge itself. This network was stabilized through a series of negotiations on technology and knowledge, with knowledge as an important actor. We can then look at what happened when the primary users was introduced, the decentralized students. These did not introduce substantial instability in the network. However these were actors that had to use the

tool in order to complete the program in which they attended. The inscription was relatively strong in some regards. Along with these students came some teachers that did not fully embrace Fysio-nett, but the rules were kind of set. The nature of the program demanded that the tool had to be used, so utilization was not a problem. We can perhaps say that organizational structures around the program increased the strength of the inscription. Problems occurred when expanding the network even further. They occurred when including the students in the normal program and all the teachers along with them. This was done without any organizational or other changes – which led to a relatively weak inscription. Or rather the inherent weak inscription in Fysio-nett was not compensated for through other means – the need for some kind of translation was not met.

The second interesting point in this regard is that it once again seems like knowledge stands out like a really strong actor. All though there is a common understanding and agreement on what type of knowledge the network wants and has, this knowledge, the identity this knowledge brings to the network is so important that it brings forth conflicts. These conflicts are then not regarding type of knowledge, but how to represent this knowledge. The fight is not regarding knowledge itself, but it is about the vessel for delivering it. If knowledge wasn't such a powerful actor, one would hardly start arguing over how to deliver it. This was not a problem when the network was small, only consisting of the creators.

## ***Part Four: The Bigger Picture***

### ***Fysio-nett represents knowledge as a process***

Fysio-nett is by its creators referred to as a knowledge base. It has the aim to promote knowledge in physiotherapy for the students. If we compare this to another knowledge base often referred to in medicine and health care, The Cochrane Library which is supposed to represent EBP-type knowledge (Bjørndal & Flottorp, 2000; McGovern, 2001), it seems almost strange that two so completely different entities are used for the same ultimate purpose; to improve the quality of health care. So what does this imply? Does it mean that one of the attempts is faulty? Is it correct to label both Fysio-nett and The Cochrane Library as knowledge base?

The differences are striking. It could possibly be argued that to compare these two entities is pointless, that they are two completely different things all together. I do however think such a comparison is useful to contrast the completely different perspectives on knowledge that these two entities represent. Through this I think it is easier to fully understand what Fysio-nett is and how it is supposed to function, what role it has.

The articles and reviews in the Cochrane Library consist of knowledge represented only by text and numbers, apart from the occasional illustrative image or graph. There is a strict set of rules of how to produce the type of knowledge in which can be eligible for the library and an even stricter set of rules for finally being included (Ekeli, 2000; McGovern, 2001). The output from the library is classified by the creators, the Cochrane Collaboration, as evidence and is supposed to give a clear and concise advice on how to perform your work as a health professional. If we should try to describe this knowledge it is very clear that we are talking about explicit knowledge in its purest form (Nonaka & Takeuchi, 1994; Polanyi, 1983). The knowledge will often be at least partially de-contextualized since the RCT often will demand a controlled environment that is not in full compliance with a real world setting. If we look at this in Ackoff's data, information, knowledge perspective (Ackoff, 1989; Blacker, 1995) one might be tempted to not call this knowledge, but rather information. At least it you would need a decent amount of additional knowledge in order to use the information in a sensible way and this knowledge could be of both explicit and tacit origin, the information in the library does not necessarily present or manifest itself as knowledge in the user without a large amount of additional knowledge.

The research material suggests that Fysio-nett in most aspects is the complete difference of the Cochrane Library. It does not consist of a clear set of guidelines for physiotherapy conduct; it is not presented as evidence. In fact it has been clearly stated that it means not to do just that, but rather to initiate a response, a process in the user which is supposed to create knowledge. It is also clear that Fysio-nett uses a much broader spectrum of media, and a combination of these, to make certain points or to more effectively initiate the wanted processes in the users.

In my view Fysio-nett promotes a view on knowledge as something that cannot be passively transferred from a piece of paper to somebody's brain or, ultimately, work. Knowledge in Fysio-nett happens through processes, it is something that happens during reflection and

engagement (Wenger, 1998). The EBP system represented by the Cochrane library seem to promote knowledge as more of a commodity or something that can be possessed and traded (Hanseth, 2004; Hayes & Walsham, 2001) that it can be put into words, made explicit, through a set of rules and then without any loss or error be directly transferred to the professional. I am not saying it is not room for both views, actually I think both types of knowledge has its valuable use, but the difference is substantial and illustrates clearly why the debate often get heated when these issues get on the table. We are talking about two different worlds.

### *The power of not making knowledge explicit*

As described by the informants in the research material, one of the goals for Fysio-nett has been to make parts of the profession physiotherapy visible or explicit, to show some of the tacit part of physiotherapy, as among others mentioned by the Project Coordinator. I think it is an intriguing question to ask whether this is what they first and foremost have done in Fysio-nett. At least if you interpret their goal as making tacit knowledge explicit in a Nonaka and Takeuchi externalization sense (Nonaka & Takeuchi, 1995). As already discussed this has happened to some extent, but is this where the main contribution is? Is this what could lift Fysio-nett as a learning tool beyond for instance a book? In the previous part we discussed how a virtual form of socialization occurred when the students use the tool, and how this could not have happened without the use of rich media. I argued that the use of video makes it possible to communicate tacit dimensions to a much larger extent than with less rich media. Maybe one could argue that it is one of Fysio-nett's strengths that it enables socialization, tacit to tacit knowledge conversion or transfer, transfer of knowledge without necessarily going through the process of making tacit knowledge explicit first. As described this process is difficult and is almost per definition impossible to succeed 100%. The opposite would result in the possibility that we eradicated all tacit knowledge through making it explicit, which seems highly unlikely to say it the least. I would at least argue that this aspect of Fysio-nett is very important, and at least equally important to the knowledge which in fact has been made explicit through text, video and the audio connected to it. This does by all means not imply that the creators of Fysio-nett have not met their goal of making tacit knowledge explicit, they might not just be fully aware of the potential that which haven't been made explicit in Fysio-nett.

***“Knowledge base” as a concept – a contradiction in terms?***

Assuming my view on knowledge represented by Fysio-nett as something process oriented is correct one can make an interesting suggestion. If knowledge is not treated as a commodity, if it is deeply tied to processes and action, can it then be stored in a base? Can a “knowledge base” really exist or is it a contradiction in terms? The term “knowledge base” to me implies that knowledge is “stored” somewhere. That it can be stored and retrieved later. This does not comply with the view of knowledge as a process. Maybe it is better to put aside this term and call it a “learning tool” or a “learning platform” or similar.

In any case it is clear that those who are more prone to the view on knowledge similar to what is presented in the EBP system, will have big difficulties with calling Fysio-nett a knowledge base since what it represents is not defined as knowledge in that system. The same could probably be said the other way around – whether what the EBP system represents can be called valid knowledge – and thus whether a collection of such material could be called a knowledge base.

# Conclusion Chapter

## *Conclusion*

The study suggests that there are several different types of knowledge creation and learning processes occurring in the Fysio-nett project.

First, technology is proven a strong facilitator for knowledge creation through externalization in the creation phase of the project. This externalization process could also be regarded as a translation process in order to stabilize an actor-network through negotiating knowledge. This knowledge is independent of the technology that initiated the definition of it, and can be used with other type of media in other arenas. These processes proved very demanding due to the powerful position of knowledge as an actor in the actor network which created Fysio-nett, and a lot of negotiations had to occur. The processes proved successful. In the same initial phase knowledge was generated through combination processes. This type of knowledge creation did not challenge the network to the same extent and the tasks could be distributed to other, presumably less knowledgeable persons.

Secondly, learning and knowledge is through the use of the system mainly initiated through externalization and what could be thought of as a virtual form of socialization made possible through the use of rich media. It is important to realize that the use of rich media has the ability to transfer tacit knowledge without making it explicit first, and that maybe this is one of the core strengths in the use of Fysio-nett. In this phase it does however become apparent that Fysio-nett as a learning tool is deeply embedded in Communities of Practice and nurtures and grows only as an integral part of such practices. Fysio-nett in itself does facilitate to learning through some of the same factors which is suggested in CoP-theory; through active engagement linked to practice. It does however lack the social community aspect of CoP as a standalone feature.

In order for Fysio-nett to become an established, sustainable service for all students and teachers at TUC it seems apparent that the organization has to be aware of the weak inscription in Fysio-nett. This weak inscription, which is one of Fysio-nett's strengths as a learning tool, has to be compensated for when expanding the actor-network in which Fysio-nett exist. Once again knowledge proves itself a very strong actor since it is the issue of how to represent knowledge which is disrupts the network. The study suggests that this disagreement on whether Fysio-nett is a suitable tool for conveying their common view on knowledge in physiotherapy could, again, point back to the issue of weak inscription since some of the research material might suggest that all actors might not fully understand how Fysio-nett is intended to be used.

### ***Contributions***

The thesis builds on a single case study. It further builds most of its discussion and conclusions on theoretical perspectives in the form of frameworks and concepts – starting from scratch with mapping a new approach with these theoretical tools. Due to the rather new approach this study takes on, there is little previous work done in order to compare and strengthen the validity of the findings. This being said, that is the way it has to be when doing something new. It is my view that the thoughts and ideas in this thesis could provide a valuable starting contribution to the following six themes.

First it represents an example of how to let knowledge be the guide in a design process of a learning tool instead of letting technology dictate knowledge. This could be valuable insight for people dealing with the creation of such tools. It also describes an example of how this has been done.

Secondly, the study points out how such a tool co-exists and works in the very core of what we do in our daily lives. It is my belief that one of the strengths of this tool is in the fact that it is so deeply tied to real life practice. Maybe previous work that has shown difficulties with creating effective online communities has focused too much on the virtual communities on behalf of the integration of the tool in real life practice. This might be something to consider for future development projects.

Thirdly the study illustrates and analyses different ways in which learning is initiated through the use of such a tool. Important in this regard is how explicit and implicit knowledge plays together. Also interesting is that the use of rich media might enable knowledge transfer that is not relying of making tacit knowledge explicit first.

Fourth, it is exemplified how technology can facilitate to the creation of knowledge that is not necessarily tied to the technology after it has been created. Still, the knowledge created could not have been developed in the same way without the task of negotiating knowledge on the basis of the technology at hand.

Fifth, the study makes a point of knowledge as something that is created in processes rather than a commodity that can easily be transferred. A result of this view is that the term “knowledge base” could be regarded a contradiction in terms. Maybe it is better to use a work like “learning tool” or “learning platform”.

Sixth, as a theoretical contribution, the study has shown that CoP and ANT can effectively be used together in order to explain how technology has a role in CoPs. In addition to that, Nonaka and Takeuchi’s four modes of knowledge creation can be used in conjunction with both these in order to explain how knowledge is created within these networks or practices.

### ***Further research***

A lot have now been written in this thesis about Fysio-nett, and how it is *supposed* to work. I regard that as a valuable starting platform. It would be interesting to take a deeper analysis into whether Fysio-nett really works the way it is thought to. It would also be interesting to look at how effective Fysio-nett is as a learning tool; and whether it ultimately can create better physiotherapist.

Other interesting fields would be to look at how Fysio-nett might introduce some integration of EBP-based knowledge into the platform. It would also be interesting to investigate how one could in a beneficial way integrate a tool for online communication and to create an online CoP that did in fact contribute in a positive way to learning and knowledge creation.



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