

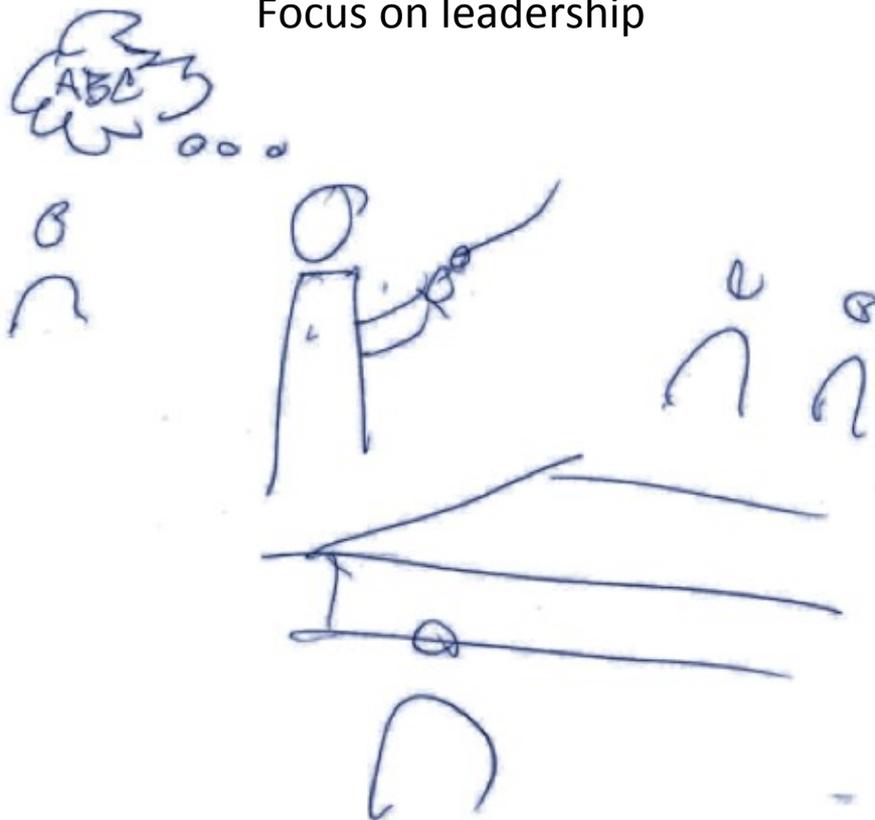


# PHD THESIS

Ture Larsen

## CONDUCTING THE EMERGENCY TEAM

Focus on leadership



Academic advisors: Randi Beier-Holgersen, Peter Dieckmann, Doris Østergaard

This thesis has been submitted to the Graduate School of the Faculty of Health and Medical Sciences, University of Copenhagen

Submitted 02.01.18



The studies in this PhD thesis were conducted between 2015 and 2017 at SimNord, Nordsjællands Hospital, University of Copenhagen and the Capital Region of Denmark

For further information, contact

Ture Larsen

Oldfuxvej 20

2400 NV

Denmark

Mail: [ture@besked.com](mailto:ture@besked.com)

Phone: +45 311 272 81

Website: <http://turelarsen.dk/phd.html>

ORCID: <http://orcid.org/0000-0002-5410-6340>

Front-page illustration:

A quickly drawn sketch of the parallel between the conductor and the clinical team leader (by TL)

## **ACADEMIC ADVISORS**

Randi Beier-Holgersen, Associate Professor, MD, MHPE. Senior Surgeon, Department of Gastrointestinal Surgery, Nordsjællands Hospital, Denmark

Peter Dieckmann, PhD, Dipl.-Psych. Psychologist, Senior Scientist, Copenhagen Academy for Medical Education and Simulation (CAMES), Capital Region of Denmark and University of Copenhagen, Copenhagen, Denmark

Doris Østergaard, MD, DMSc, Professor, MHPE. Head of Institute, Copenhagen Academy for Medical Education and Simulation (CAMES), Capital Region of Denmark and University of Copenhagen, Copenhagen, Denmark

## **ASSESSMENT COMMITTEE**

Jacob Rosenberg, MD, DMSc, Professor, chief surgeon, Dept. of Surgery, Herlev and Gentofte Hospitals, University of Copenhagen, Denmark.

Niels Qvist, MD, DMSc, Professor, chief surgeon, Dept. A. of Surgery, Odense Universitetshospital, Denmark

Peter Ettrup Larsen, Dr. of Musical Arts (DMA), Conductor, MA in Musicology and Rhetoric, Associate Professor of Digital Conducting Studies , The University in Stavanger, Norway

## **FUNDING**

The PhD project has been supported by Tryg Foundation, Laerdal Foundation and Nordsjællands Hospital, Denmark.

## **ACKNOWLEDGEMENTS**

Thanks to Randi. Thank you for creating this crazy and innovative idea. All ideas, theories, views, and decisions were created jointly in our research partnership. No ideas have ever been rejected and all thoughts and associations have been followed, understood and discussed in depth, thoroughly, seriously and with lots of laughs. It has been a great privilege and experience to present the project on our many trips from Singapore over Istanbul, and Glasgow to Toronto, Quebec and Vancouver.

Thank you to my colleagues at SimNord. Thanks to Susanne to realise the potential and possibilities in Randi's idea. Thanks to Rikke and Gitte for many discussions, support and engagement. Thanks to Linda for always being ready to help. Thanks to Erik and Casper for listening, discussing and supporting. I have been well received and felt like part of SimNord.

Thank to HR and the Research department at NOH for helping realizing the project and for financial support.

Thanks to Peter for as well support for the idea as well as criticism of methods, methodology, ontology, epistemology, conclusions and writing. This has only intensified my desire to sharpen my work and my points.

Thanks to Doris for participating in the project group, it is highly appreciated that you choose to add your name and knowledge to this different research project.

Thanks to Jette for helping with the challenging search in the literature as well as support and inspiring discussions.

Thanks to Susan Laube for proofreading on the articles. Thanks to Nigel Barnard for proofreading on Thesis.

# TABLE OF CONTENTS

<b>PAPERS INCLUDED IN THE THESIS</b> .....	<b>8</b>
<b>ABBREVIATIONS AND DEFINITIONS</b> .....	<b>9</b>
<b>SUMMARY OF THE THESIS</b> .....	<b>11</b>
<b>SAMMENFATNING PÅ DANSK</b> .....	<b>13</b>
<b>STRUCTURE OF THE THESIS</b> .....	<b>15</b>
<b>BACKGROUND</b> .....	<b>16</b>
The Conductor.....	17
Emergency in healthcare .....	17
<b>AIMS</b> .....	<b>18</b>
<b>CONCEPTUAL FRAMEWORK</b> .....	<b>18</b>
Different ontologies .....	18
Qualitative methodology considerations .....	19
<b>LEARNING THEORY CONSIDERATIONS</b> .....	<b>21</b>
Theories supporting conceptual change or transformation.....	21
Embodied Cognition.....	21
Transformative Learning Theory.....	21
Apprenticeship .....	21
Flow theory – a pedagogic ideal .....	22
Anxiety counteracts learning .....	22
Thinking, fast and slow .....	23
Learning pyramid, NTL .....	24
<b>ANALYSIS CONSIDERATIONS ON EXTRA LINGUISTIC DATA</b> .....	<b>24</b>
Incongruence between oral and extra linguistic communication .....	24
Semiotics .....	25
Multimodality (extra linguistic communication) .....	25
Video analysis.....	26
Conductors and video .....	26
Video and simulation in healthcare .....	27
<b>PRE-UNDERSTANDING</b> .....	<b>27</b>

<b>METHOD.....</b>	<b>28</b>
Systematic Review .....	28
Qualitative content analysis as a method.....	28
Video .....	30
Transcriptions .....	30
Evaluations.....	30
<b>ETHICAL CONSIDERATIONS.....</b>	<b>31</b>
<b>PRESENTATION OF THE INCLUDED PAPERS .....</b>	<b>32</b>
Study 1 .....	32
Study 2 .....	34
Study 3 .....	36
<b>DISCUSSION .....</b>	<b>39</b>
Development and conduction of a course addressing leadership .....	41
Feedback .....	43
Faculty .....	44
Assessment of the impact of the course .....	46
<b>STRENGTHS AND LIMITATIONS.....</b>	<b>46</b>
<b>CONCLUSION .....</b>	<b>50</b>
<b>PERSPECTIVES .....</b>	<b>51</b>
<b>TRAINING RESIDENTS TO LEAD EMERGENCY TEAMS [PART ONE]: A SYSTEMATIC REVIEW .....</b>	<b>53</b>
<b>TRAINING RESIDENTS TO LEAD EMERGENCY TEAMS [PART TWO] .....</b>	<b>79</b>
<b>CONDUCTING THE EMERGENCY TEAM: A NOVEL WAY TO TRAIN THE TEAM-LEADER FOR EMERGENCIES .....</b>	<b>93</b>
<b>APPENDIX .....</b>	<b>122</b>
<b>ONLINE APPENDIX.....</b>	<b>122</b>
<b>REFERENCES.....</b>	<b>124</b>

## **PAPERS INCLUDED IN THE THESIS**

### **Paper 1**

Ture Larsen, Randi Beier-Holgersen, Jette Meelby, Peter Dieckmann, Doris Østergaard.

Training residents to lead emergency teams [Part One]: A Systematic Review

*Submitted to Annals of Surgery (December 2017)*

### **Paper 2**

Ture Larsen, Randi Beier-Holgersen, Doris Østergaard, Peter Dieckmann.

Training residents to lead emergency teams [Part Two]: Barriers, Challenges and Learning Goals concerning training residents to lead emergencies: a Qualitative Review

*Submitted to Annals of Surgery (December 2017)*

### **Paper 3**

Ture Larsen, Randi Beier-Holgersen, Peter Dieckmann, Doris Østergaard.

Conducting the emergency team: A novel way to train the team-leader for emergencies

*Submitted to Lancet (December 2017)*

## ABBREVIATIONS AND DEFINITIONS

LBDQ	Leadership Behaviour Description Questionnaire <sup>1</sup>
NOTECHS	Non Technical Skills behavioural marker system. A method for assessing an individual pilot's nontechnical skills (e.g. leadership, decision making, teamworking, situation awareness). <sup>2</sup>
NTL	The National Training Laboratories' average retention rates for different training and teaching methods
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses. PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses <sup>3</sup>
GRADE	Grading of Recommendations Assessment, Development and Evaluation. The GRADE process develops recommendations, the evidence profile, and Summary of Findings table. Grade describes the process for framing questions and identifying outcomes <sup>4</sup>
CASP	Critical Appraisal Skills Programme <sup>4</sup>
Abduction	Theory → Data ↔ Data → Theory → Analysis → Conclusion
Deduction	Theory → Data → Analysis → Conclusion
Induction	Data → Theory → Analysis → Conclusion
QCA	Qualitative Content Analysis
GT	Grounded Theory
Ontology	Knowledge about being (the nature of being) <sup>5</sup>
Epistemology	Knowledge about knowledge (science/knowledge) <sup>5</sup>
<b>Positivist:</b>	
Positivist's ontology	Believes there is one single reality and believes in universal concepts <sup>6</sup>
Positivist's epistemology	Empiricist: collecting – hypothesis – test hypothesis objectively using statistical. No interpretation.
Positivist's methodology	Theory developing: Hypothetic deductive method
<b>Constructivist</b>	
Constructivist's ontology	There's no single reality, reality is <i>constructed</i> in the context <sup>7</sup>

Constructivist's epistemology	Interpret reality (puts oneself in the project)
Constructivist's methodology	Inductive (look at single cases studies)
Written communication	Linguistic is based on words and sentences. The value of a word is rarely completely neutral, as there are typically connotations to a word. Furthermore, it is possible to talk about the surface content of the text as well as interpretations of the underlying meaning <sup>8</sup>
Extra linguistics	Non-verbal communication, pictures, videos, all means of multimodal communication <sup>9</sup>
Oral communication	Speaking, lectures, and presentations: Linguistics, including the possibility of adding extra linguistics
Face to face communication	Interpersonal communication: all communicators actively participate and are responsible for its creation. Linguistics, including extra linguistics
Semiotics	The range of different kinds of signs that can be found as compared to language that comprises abstract symbols. <sup>10</sup> Charles Sanders Peirce (1839-1914) described thoughts not as 'ideas' but as 'signs,' external to the self and without meaning unless interpreted by a subsequent thought. His general theory of signs – or semiotic – is especially pertinent to methodologies currently being debated <sup>11</sup>
Multimodality	Describing other meanings than based on language and linguistics. There is visual language, gestural language, and so forth. It is socially produced, cultural resources for making meaning. Situations are given where text only gives a partial account of what is going on <sup>12</sup>

## SUMMARY OF THE THESIS

The specific approach to this thesis is to explore a different approach to train the emergency team leader with help from another profession. Furthermore investigate existing aspects of training of the team leader in emergencies in healthcare.

This thesis is based on an abductive approach. The main idea is conceived in collaboration between a surgeon and an orchestral conductor who realised a parallel between leading a medical team and leading an orchestra in terms of the non-verbal communication that demonstrates that the leader has assumed leadership.

It has been described in the literature for the last 30 years that there is an urgent need to train residents and medical students in leadership in acute medical situations. The literature describes the need for the team leader to rise to the occasion when called upon to act as leaders of emergency teams: many residents/rescuers feel unprepared to adopt the leadership role in emergencies. It is important to assume leadership during the teamwork that takes place in the critical situation, as lack of leadership is concluded to be one of the causes of poor outcomes for the critically ill patient.

The conclusion of a systematic review that included all the intervention studies found, focusing on whether or not found adequate training in the team leadership role among residents, is unfortunately that no focused leadership training has taken place.

Instead, literature revealed a large number of taxonomies aiming at measuring the ability of residents to implement various professional algorithms without specific focus on the leadership role. The literature has devoted time to developing measuring instruments in the form of taxonomies and has not focused on the development of leadership. It is possible to conclude that focus has substituted from how to *train* leadership to *measure* leadership.

In a qualitative content analysis of the found literature, it was concluded that leadership training is a necessity which is needed to be addressed, but efforts has so far been focused elsewhere and a useful leadership training in emergencies it is still in demand.

By further review and qualitative content analysis of the literature, including all the opinions and reviews found, it was identified that a crucial factor to address is the anxiety residents can experience when they are to take on leadership in acute critical situations. The literature itself

describes how the residents should be trained in mentally assuming leadership, radiating calmness and credibility and demonstrating authority in the critical and chaotic situation. By reviewing the literature, learning goals that should be the focus of an upcoming training were identified. Those should address the actual needs the resident has in the situation.

The course was developed in a non-medical challenging context, but closely related to the clinic. Musical exercises were used, which made the course harmless to the individual medical participant who was not expected to be able to handle the challenges and 'obstacles' in the exercises.

However, the musical 'obstacles' brought the participant into the mentally challenging state, resulting that all of the participant's personal inappropriate non-verbal expressions were revealed in the situation. This enabled the orchestral conductor to address these, give personal and direct feedback to participant, and thus the participant was enabled to recognise own weaknesses and guided by the conductor was given opportunity to strengthen these expressions. In addition, the musical exercises gave the participant an experience of *flow* when conducting, and the individual participant experienced the intense *feeling* when all communication takes place through the leader.

The courses were evaluated using video recordings, transcriptions of these, evaluations from the course participants, as well as written comments from two students who helped to transcribe the transcriptions. The latter did not attend the courses and were blinded to the idea of the course. Again, a qualitative content analysis was conducted and the conclusion is that the course is able to support the individual participant's ability to gain insight into his / her own leadership challenges and to provide advice and assistance in developing his non-verbal appearance and expression.

In general, this thesis has described how collaboration between two very different professions has managed to exploit the various ontological approaches to the experience of the world in a positive and constructive way. It points out that it is beneficial to allow to see beyond own domain or profession.

## SAMMENFATNING PÅ DANSK

Formålet med denne afhandling er at undersøge om det er muligt at bruge en anden profession til at træne teamlederrollen i akutte medicinske teams. Derudover undersøge om der findes andre holdninger eller aspekter vedrørende træning af teamlederrollen i akutte situationer i klinikken.

Denne tese er baseret på en abduktiv tilgang. Ideen er undfanget i et samarbejde mellem en kirurg samt en orkesterdirigent, der så en parallel mellem det at lede et medicinsk team og et orkester mht. bl.a. den non-verbale kommunikation, der viser, at lederen har påtaget sig lederskabet.

Det er gennem de sidste 30 år beskrevet i litteraturen at der er et behov for at træne yngre læger og medicinske studenter i lederskab i akutte medicinske situationer. Litteraturen beskriver et behov for at teamlederen træder i karakter og påtager sig lederskabet under det teamsamarbejde der foregår i den kritiske situation, idet manglende lederskab konkluderes at være en af årsagerne til dårligt outcome for den kritisk syge patient.

Konklusionen på et systematisk review med inklusion af alle fundne interventionsstudier med fokus på om der findes eller har fundet fokuseret oplæring i team-lederrollen blandt yngre læger er desværre, at der ikke har fundet fokuseret ledelsestræning sted. I stedet findes i litteraturen et stort antal taxonomier til måling af yngre lægers evne til gennemførelse af forskellige faglige algoritmer uden specifikt fokus på lederrollen. Litteraturen har fokuseret på at udvikle måleinstrumenter i form af taxonomier og har ikke fokuseret på udvikling af oplæringssituationer i lederrollen. Man kan konkludere at fokus er substitueret fra hvordan træner man lederskab til hvordan man måler lederskab.

Ved en kvalitativ indholdsanalyse af den fundne litteratur er konklusionen at lederskabstræning er et nødvendigt behov, der skal dækkes, men at indsatsen indtil videre har været fokuseret andetsteds og at den fortsat efterspørges.

Ved yderligere en gennemgang / kvalitativ indholdsanalyse af litteraturen, hvor også alle fundne opinions og reviews medtages, findes, at den afgørende faktor, der skal adresseres er den angst som yngre læger oplever, når de skal påtage sig lederskabet i akutte kritiske situationer. Der beskrives, hvordan de yngre læger skal trænes i at mentalt påtage sig lederskabet, udstråle ro og autoritet i den kritiske / kaotiske situation. Ved gennemgangen af litteraturen findes hermed de

læringsmål, som bør være fokus i en kommende træning, hvis træning skal fokusere på de behov den yngre læge har i situationen.

Kurset blev udviklet i en ikke medicinsk faglig kontekst, men med tæt relation til den medicinske verden. Der benyttes musikalske øvelser, hvilket gør kurset ufarligt for den enkelte medicinsk faglige kursist, der ikke forventes at kunne håndtere de "benspænd" der er i øvelserne. De musiske benspænd formåede dog at bringe kursisterne i den mentalt udfordrende tilstand, der medførte at alle de u hensigtsmæssige non-verbale udtryk, som er en udfordring vedrørende lederskab i teamledelsen, kom til udtryk. Dette gav orkesterdirigenten mulighed for at hjælpe den enkelte kursist til at erkende, hvor egne svagheder fandtes samt mulighed for at arbejde med disse. Derudover gav de musiske øvelser en oplevelse af flow i ledelsessituationen, hvor den enkelte kursist oplevede den følelse det er, når al ledelse foregår gennem lederen.

Kurserne blev evaluerede ved hjælp af videooptagelser, transskriptioner af disse, evalueringer fra kursisterne samt kommentarer fra to studenter der hjalp til med at fortage transskriptionerne. Sidstnævnte deltog ikke på kurserne og var blinde for tankerne bag kurset. Igen blev gennemført en kvalitativ indholdsanalyse, og konklusionen på denne er, at kurset formår at understøtte den enkelte kursists mulighed for at få indsigt i egne udfordringer i lederrollen samt at give råd og hjælp til at udvikle sit non-verbale udtryk.

Overordnet har denne tese beskrevet hvordan samarbejde mellem to meget forskellige professioner har formået at udnytte de forskellige ontologiske tilgange til oplevelsen af verden på en positiv og konstruktiv måde. Den påpeger det frugtbare i at tillade sig at se udover egen faggruppe/profession.

## **STRUCTURE OF THE THESIS**

The first chapter presents the background. The second chapter presents the conceptual framework; the ontology and the methodology of the thesis. Furthermore this chapter presents theories considered relevant to the thesis; learning theories, discussion on anxiety and learning, the intuitive and the rational way of thinking, and an assessment model of the impact of learning. Finally, the chapter presents several approaches to non-linguistic or extra linguistic language. The third chapter presents the methods used and data acquisition and analysis. The fourth chapter provides a brief description of the three studies. Chapter five presents a discussion of the implication of the findings in the thesis. Chapter six discusses the limitations in the three studies, and finally concludes on the three studies, highlights implications for practice and suggests future research.

Study one examines the medical, pedagogical and psychological databases if there is a well-functioning training of the clinical team leader in emergencies, 27 articles were relevant. In addition, it examines by a qualitative content analysis whether there is consensus on the importance of leadership.

Study two examines the 27 articles found plus additional 13 articles if it is possible to identify challenges and learning goals concerning leadership training in emergencies.

Study three presents the intervention of the thesis, a course conducted and designed by a conductor and a consultant for residents, medical students and senior nurses at the emergency room.

At the back of the dissertation an online appendix that presents the comprehensive results of the qualitative content analyses is situated. In addition, a log from the course containing field notes, transcribed dialogues, and evaluations. Finally, links to two documents presenting videos from the course is present.

## BACKGROUND

Team leadership in emergencies is reported as being important for the quality of the performance of teams<sup>13-24</sup>, for patient outcome, patient safety and patient care<sup>22,23,25-35</sup>. The quality of team leadership may even influence patient mortality and survival rates<sup>19,23,27,32</sup>.

However, many studies identify that leadership training has been inadequate<sup>1,16,17,23,27,29,36-39</sup>, and a recurrent call for *a workable* leadership training programme has been expressed explicitly<sup>1,14,16,17,21-23,26,27,29,34,36-43</sup>. This need has prevailed throughout the 30-year period addressed in our investigation.

The literature affirmed that targeted leadership training is very important. It is necessary for residents to address and handle anxiety<sup>16,23,27,32,44</sup> and panic<sup>32</sup> in stressful<sup>20,22,25,27,31,32,34,41,45</sup> and complex<sup>19-22,35,39,41</sup> situations. Therefore, in order to provide good and convincing leadership, residents must learn to be confident<sup>1,16,23,27,32,36,37,39,41,42,44,46,47</sup> and calm<sup>16,30,32,44</sup> when assuming the leadership in emergencies.

However, 'something' is apparently still missing, and the reason why 'residents feel unprepared and unsupervised as leaders'<sup>27</sup> should be explored.

The parallel between the conductor and the team leader in emergencies in this context is the highly intense situations they work in: both situations require clear and convincing leadership and there is no time or room for discussions. Neither the concert nor the cardiac arrest can be interrupted. The leader's guidance and instructions must be carried out immediately.

One year prior to the start of the PhD study, a pilot project was conducted. A consultant who also was an amateur trombone player realized the parallel between the teamleader and the conductor when her concert band received a new skilled conductor. The consultant and the conductor designed a course for medical students who participated in a program introducing non-verbal communication and team leadership. The results from the course is described in the article "Team Management - Can music contribute to better understanding?"<sup>48</sup>. (Abstract is presented in the appendix section).

Many initiatives have sought to address leadership training in emergencies: in particular leadership is part of the Scottish initiative Anaesthetists' Nontechnical Skills (ANTS)<sup>49</sup>, adapted to 'Non-Technical Skills for Surgeons' (NOTSS)<sup>38</sup>, and to 'Scrub Practitioners' List of Intra-operative Non-

Technical Skills' (SPLINTS)<sup>50</sup>. The latter replaced NOTECHS for nurses<sup>51</sup> – which was also modified to: Oxford NOTECHS<sup>52</sup> and among other things: T-NOTECHS<sup>53</sup>, as well as the Swiss leadership training programme based on the Leadership Behaviour Description Questionnaire (LBDQ)<sup>1</sup>. These programmes focus on developing formative assessment tools<sup>54</sup>, behavioural markers<sup>55</sup> and taxonomies in order to measure<sup>15,22,33,38</sup> leadership skills. Since 2015 the literature has begun to question the number of tools – and methods used – in the taxonomies<sup>34</sup>.

Handling negative feelings is not a part of existing programmes. Leadership during an emergency situation involves knowledge and skills, but also implies dealing with the pressure<sup>16,25,28,34,38,56</sup> of being the decision-maker and taking the ultimate responsibility for what happens (or does not).

## **THE CONDUCTOR**

The conductor works purposefully with his posture and appearance in order to eliminate anything that could possibly prevent the message from being interpreted as intended. The conductor's main focus to achieve the authority to lead an orchestra, it is important to appear calm, balanced, competent, authentic, and credible. This is the basic starting point for the conductor, when recognised, he is able begin to work and choose his style of leadership<sup>57</sup>.

This views expressing the conductor's reflections on his work with the orchestra's musicians are general and do not reflect the opinions of a single conductor. The above description of the conductor's focus is read by two symphonic conductors, and discussed thoroughly. Both conductors could endorse the reflections and opinions that were presented.

No literature addresses these competencies equally in health care.

## **EMERGENCY IN HEALTHCARE**

“Emergency medical care teams have [...] little time for deliberate planning and elaborate communication while providing care. Second, such teams are generally ad hoc, that is, assigned to work together in ever changing compositions”<sup>40</sup>. ‘Ad hoc’ teams are also referred to as ‘crash’ teams<sup>23</sup>.

This situation is complex<sup>16,19-22,24,25,29,30,33,35,39,41,44,56,58</sup> and stressful<sup>16,20,22,23,25,27,29-34,41,45,47,59</sup> and has been referred to as a chaotic situation<sup>1,32,34,41,44,46,60</sup> perceived as with anxiety<sup>1,14,16,23,27,32,36,44</sup>. In this framework, the emergency team leader should rise to the occasion when called upon, mark

leadership and identify competencies and resources of the team for the purpose of ensuring the best treatment of the patient.

The problem has been to define these issues and subsequently find a way to train these objectives in healthcare.

## **AIMS**

The overall objective of this thesis was to explore a different approach to train the leader of the emergency team with help from another domain. Furthermore to investigate existing aspects of training of the team leader in emergencies in healthcare using different methods in three studies with the following aims:

Study 1: To describe how literature addresses workable and operational leadership training for the emergency medical team-leader and to enhance understanding of leadership training in the medical environment.

Study 2: An investigation to determine any consensus in opinions and views about challenges or barriers in training leadership in emergencies.

Study 3: The overall aim of the course is to investigate whether, in an emergency, a clinical team leader could apply a conductor's leadership skills. A description of a course held for residents, medical students and emergency room nurses.

## **CONCEPTUAL FRAMEWORK**

### **DIFFERENT ONTOLOGIES**

Ontology: Ontos is Greek for being, logos means study i.e. 'the study of being'. What can be said to really be, or exist? Epistemology: Episteme means knowledge and logos study i.e. 'the study of knowledge'. Even if something really exists, how can I know?

The researcher, who is a conductor, is influenced by a constructivist's ontology, stating that reality is a social construction and must be seen in the context of individuals, and therefore many (interpreted and constructed) realities are present. His epistemology is inductive and interpretative.

Qualitative research methods are “used in the exploration of meanings of social phenomena as experienced by individuals themselves, in their natural context” <sup>7</sup> .

A typical surgeon is working in a positivistic research tradition, believing that the world is objective and can be measured, that there are universal concepts, and that these can be objectively verified by statistical manoeuvres. There is only one reality. His epistemology is as an empiricist, that is, he is *testing*. “Medical doctors believe that their field is founded on scientific knowledge; where knowledge is defined as facts that can be empirically verified by the biomedical method”, as stated by Malterud <sup>6</sup> .

### **QUALITATIVE METHODOLOGY CONSIDERATIONS**

The following research approaches have served as sources of inspiration in this thesis: Grounded theory (GT) <sup>61,62</sup> , qualitative content analysis (QCA) <sup>8,63</sup> , and hermeneutics <sup>5</sup> . Central to these approaches is that they all rely on a continuous movement between pre-understanding and analysis, ‘moving to and from’ <sup>64</sup> .

The following features are common to GT and QCA: The researcher looks at phenomena with fresh eyes and from new perspectives without restriction within already existing hypotheses – and based on the findings, ideas are developed – and the researcher takes another look at the phenomena <sup>8,63</sup> . In hermeneutics it is stated that to understand a part of a text, one must understand the whole. At the same time, however, one can only understand the whole when understanding the individual parts <sup>5</sup> . All three approaches to interpretation bring the importance of the interpreter into focus. Hans-Georg *Gadamer* argued that knowledge is not something that we acquire and control as a possession. Rather knowledge is to be understood as something in which we are always already situated. The reason we understand anything at all is because we already stand in it <sup>65</sup> . It has been argued in hermeneutics that pure description is impossible because description always involves interpretation <sup>5</sup> . Data can be collected from multiple channels in all three methods, such as interviews, observations, documents, and visual materials <sup>5</sup> .

Originally QCA was developed within the field of communication and linguistics as a means to understand the meaning of text and context <sup>8</sup> in order to challenge/supplement a tendency to focus on the quantitative content. GT methodology emerged from the field of sociology <sup>66</sup> . GT is a reaction to positivistic perspectives on science <sup>8</sup> . Hermeneutics is a methodology working with semiotics, presumptions, and pre-understandings <sup>5</sup> .

### Major Coding Differences Among Three Approaches to Content Analysis

Type of Content Analysis	Study Starts With	Timing of Defining Codes or Keywords	Sources of Codes or Keywords
Conventional content analysis	Observation	Codes are defined during data analysis	Codes are derived from data
Directed content analysis	Theory	Codes are defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative content analysis	Keywords	Keywords are identified before and during data analysis	Keywords are derived from interest of researchers or review of Literature

Table 1. Hsieh: Three Approaches to Qualitative Content Analysis <sup>63</sup> .

As presented in Table 1, an *inductive approach* (conventional <sup>63</sup> ) is appropriate when prior knowledge regarding the phenomenon under investigation is limited or fragmented <sup>8</sup> . In an inductive approach, codes, categories, or themes are directly drawn from the data <sup>8</sup> . A *deductive approach* (directed <sup>63</sup> ) starts with preconceived codes or categories derived from prior relevant theory, research, or literature <sup>8</sup> . A *summative approach* identifies and quantifies certain words in an attempt not to infer meaning but, rather, to explore the extent to which a certain word is being used, thus it is a *quantitative analysis*: the researcher codes the visible and surface content of text (manifest content <sup>8</sup> ) and count words. But if the researcher codes the underlying meaning of the text (latent content analysis <sup>8</sup> ) it is a summative approach to QCA <sup>63</sup> .

In qualitative studies the researcher brings himself in to the investigation, and consequently attention should be drawn to the objectivity and scientific quality of the study. ‘Subjectivity’ arises when the effect of the researcher is ignored <sup>7</sup> .

However, the effect of the researcher is highly implemented in these approaches. In GT and QCA the findings can influence data collection, that is, an interpretation is taking place *before* examining the findings second time. In hermeneutics it is argued that understanding and pre-understanding are fundamental conditions to each other.

The origin of these approaches is related to ‘abduction’ as defined by Charles Sanders Peirce (1839–1914). An abductive approach to research makes it possible for the researcher to present a qualified presumption (*educated guess or inference*) <sup>67</sup> when commencing his investigation. Based on his findings, he acquires new knowledge, he might alter / adapt this new knowledge to the presumption and the process starts over.

## LEARNING THEORY CONSIDERATIONS

### THEORIES SUPPORTING CONCEPTUAL CHANGE OR TRANSFORMATION

This section explains how the learning environment can support conceptual change and transformation.

#### EMBODIED COGNITION

“Cognition is embodied when it is deeply dependent upon features of the physical body of an agent, that is, when aspects of the agent’s body beyond the brain play a significant causal or physically constitutive role in cognitive processing”<sup>68</sup>. The theory might be used in the design of effective learning environments, especially those targeting conceptual change<sup>69</sup>. The course described in this thesis assumes that one has to experience the pressure as a conductor by *practice* to understand it as described in *Embodied Cognition*.

#### TRANSFORMATIVE LEARNING THEORY

In *Transformative Learning Theory*<sup>70</sup> it is stated that one prerequisite for creating a real transformation is being faced with a ‘disorienting dilemma’ defined as an acute personal or social crisis and through 10 phases (Table 2) of ‘perspective transformation’ leading to ‘a reintegration into one’s life on the basis of conditions dictated by one’s new perspective’<sup>71</sup>.

1	A disorienting dilemma
2	Self-examination with feelings of guilt or shame
3	A critical assessment of assumptions
4	Recognition that one’s discontent and process of transformation are shared and that others have negotiated a similar change
5	Exploration of options for new roles, relationships, and actions
6	Planning of a course of action
7	Acquisition of knowledge and skills for implementing one’s plans
8	Provisionally trying out new roles
9	Building of competence and self-confidence in new roles and relationships
10	A reintegration into one’s life on the basis of conditions dictated by one’s new perspective

Table 2. 10 phases of perspective transformation, Transformative Learning Theory<sup>70</sup>

In the course mentioned, participants were presented for a ‘Disorienting Dilemma’ at a personal level as in this course: the participants were given assignments almost impossible to solve.

#### APPRENTICESHIP

Apprenticeship is practice, the student learns from senior master who acts as role model. The master furthermore allows himself to be subjective and bases feedback on his own experiences

from his profession. In short, the learning mechanisms and processes are defined as: Imitation, identification with role models, feedback on specific work solutions, in depth professional focus and peer-to-peer learning<sup>72</sup> (TL's translation from Danish).

In addition, regarding apprenticeship and leadership, it is stated by Mintzberg that leadership "is a *practice*. It is not a profession, not a science. You can't learn it the way you learn surgery or engineering"<sup>73</sup>. This is relevant to the course described in this thesis, because the conductor has acquired his skills mainly through *practicing* leadership.

### **FLOW THEORY – A PEDAGOGIC IDEAL**

This section explains how a learning environment can support the intensity in a student's focus in a learning situation.

"Flow" is defined by the psychologist Csikszentmihályi as: "the creative moment when a person is completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one..."<sup>74</sup>. "The flow state must be a general pedagogical ideal because it is often extremely good learning, as you are optimally challenged, fully focused and emotionally involved so you tend to remember very much of what you are dealing with"<sup>75</sup> (TL's translation from Danish). The conductor knows that when collaboration works optimally with the orchestra, a state can occur where time and place is dissolved as described in *Flow-Psychology*<sup>76</sup>, and wants to give the participants an opportunity to experience the *feeling* of flow at the course described.

### **ANXIETY COUNTERACTS LEARNING**

Anxiety causes the body to prepare itself for fight or flight. Chris Williams, professor of psychosocial psychiatry states "If you are in a situation of imminent actual threat, then the increased alertness and body response can be lifesaving, [...] but if it occurs when trying to revise, or present a talk, or at such a high level that it paralyses or causes errors, it can interfere with what we want to do." [...] Consultant psychiatrist Rajeev Krishnadas states: "Under normal circumstances the amygdala is under tight control from the prefrontal cortex, which evaluates the threat associated with the stimulus. [...] If it is threatening, the amygdala fear response is maintained." This is clearly not a state conducive to learning or concentrating in a seminar, says clinical psychologist Dr Angharad Rudkin. "Even if you manage to take in what is being said, the information is likely to bounce around [in your brain], not being processed properly or stored in your long-term memory"<sup>77</sup>.

It is important to address fear; a conductor who is afraid in front of an orchestra has been deprived of the opportunity to work. However, anxiety is used as a foundation for creating the disorienting dilemma described above.

## **THINKING, FAST AND SLOW**

Psychologist Daniel Kahneman discusses three topics relevant to this thesis: System 1 and system 2, the intuitive expert, and substitution.

### *System 1 and system 2*

Kahneman describes two ways of thinking. System 1 is fast and intuitive and automatic: associative memory continually constructs a coherent interpretation of what is going on in our world at any instant. System 2 is slower, deliberate and logical: consisting of controlled operations representing an effortful mental activity. The highly diverse operations of System 2 have one feature in common: they require attention and are disrupted when attention is drawn away. Intense focusing on a task in system 2 can make people effectively blind, even to stimuli that normally attract attention. System 1 runs automatically and System 2 is normally in a comfortable low-effort mode, in which only a fraction of its capacity is engaged. System 1 continuously generates suggestions for System 2: impressions, intuitions, intentions, and feelings. If endorsed by System 2, impressions and intuitions turn into beliefs, and impulses turn into voluntary actions <sup>78</sup>.

### *The intuitive expert*

The intuitive expert is a term introduced by Kahneman, and he explains: “The chess master who walks past a street game and announces “white mates in three” without stopping, or the physician who makes a complex diagnosis after a single glance at a patient. Expert intuition strikes us as magical, but it is not.” It also occurs in our daily lives: “Most of us are pitch-perfect in detecting anger in the first word of a phone call, recognizing as we enter a room that we were the subject of the conversation, and quickly responded to subtle signs that the driver of the car in the next lane is dangerous. Our everyday intuitive abilities are no less marvellous than the striking insights of an experienced firefighter or physician – only more common” <sup>78</sup>.

### *Substitution*

The mechanism of replacing a difficult question with a simpler one is extensively described by Kahneman: “when faced with a difficult question, we often answer an easier one instead, usually without noticing the substitution [...] The target question is the assessment you intend to produce.

The heuristic question is the simpler question that you answer instead. The technical definition of *heuristic* is a simple procedure that helps find adequate, though often imperfect, answers to difficult questions”<sup>78</sup> .

Kahnemans objectives have an impact on the existing taxonomy based training as well as the substitution found in the literature, but, furthermore, at the course described in the thesis; the master / apprenticeship relationship and achievement of learning goals for the participants.

### LEARNING PYRAMID, NTL

The National Training Laboratories has found the following average retention rates for different training and teaching methods. This is included in the thesis in order to discuss at which level the learning in the described course is, according to NTL.

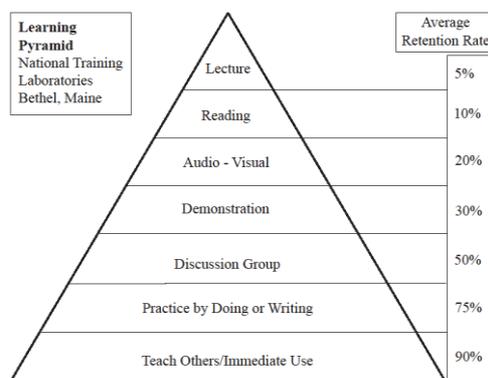


Figure 1. The Learning Pyramid

### ANALYSIS CONSIDERATIONS ON EXTRA LINGUISTIC DATA

When two people are present, communication will always take place. It is impossible not to communicate<sup>79</sup> .

This thesis aims at investigating and exploring the conductor’s non-verbal skills. Therefore, the following theories and methods of analysis are included to illustrate evidence on non-linguistic communication, including the use of video for research purposes.

### INCONGRUENCE BETWEEN ORAL AND EXTRA LINGUISTIC COMMUNICATION

In the 1960s, Mehrabian became aware that there were other factors than linguistics that were important in face to face communication. Mehrabian performed simple interventions where he

demonstrated his findings on inconsistent messages of feelings and attitudes (and the relative importance of words vs. nonverbal cues). When there is incongruence between words, voice and facial expression in communication, our attention will be drawn from the words and their meaning to non-verbal communication. That is, where the words did not match the facial expression specifically in Mehrabian's research people tended to believe the expression they saw, not the words spoken<sup>80,81</sup>.

## **SEMIOTICS**

A pioneer in semiotics was Charles Sanders Peirce (1839-1914) and today his thoughts are among the foundations for Multimodal Analysis. At the centre of his philosophy was a model of the way human beings think, he challenged traditional models by describing thoughts not as 'ideas' but as 'signs,' external to the self and without meaning unless interpreted by a subsequent thought. His general theory of signs – or semiotic – is especially pertinent to methodologies currently being debated<sup>11</sup>. He pioneered approaches to studying visual semiotics, and was interested in the range of different kinds of signs that can be found as compared to language that comprises abstract symbols<sup>10</sup>.

Pierce's work about symbolization and to the conscious control and awareness of signs became known to Susann K Langer (1895-1985). Langer is important for this thesis when she states: "The limits of language are not the last limits of experience, and things inaccessible to language may have their own forms of conception, that is to say, their own symbolic devices"<sup>82</sup>.

## **MULTIMODALITY (EXTRA LINGUISTIC COMMUNICATION)**

Gunther Kress (Professor of Semiotics) emphasises that in linguistics there is always something that is *paralinguistic* or *extra linguistic* existing together<sup>9</sup>. Multimodality is describing other meanings than based on language and linguistics. There is visual language, gestural language, and so forth. It is socially produced, cultural resources for making meaning. Situations are given where text only gives a partial account of what is going on<sup>12</sup>. Though it is important we should not throw knowledge overboard: linguistics has shown us how language works and sociolinguistics shows how it is used<sup>9</sup>. Multimodal discourse analysis opens the possibility of moving against the "reductiveness of twentieth-century generalizations and abstractions [...] and toward a full account [...] of the impact of the fact that, as humans, we are physical, material bodies and that meaning cannot be understood outside the recognition of this materiality"<sup>83</sup>. "Gaze, gesture and posture,

for instance, tend to be considered a *support* to speech; reinforcing or otherwise modifying speech but not providing communication in its own right, and image is often thought to be in a *supportive* relation to writing. Multimodal research across a range of social settings cast doubts on this assumption”<sup>84</sup> .

## **VIDEO ANALYSIS**

It was stated in 2000 that when transcribing ‘visual phenomena’ we are only at the beginning of this process<sup>85</sup> . And it was considered a challenge associated with enormous methodological and theoretical problems<sup>85</sup> . Furthermore, video as data collection was extensively discussed by researchers<sup>86</sup> .

Xiao et al. stated in 2004 that video recordings are a rich source of data for such research because, in comparison to observational notes and audio recording, video recordings capture much of the richness of human interactions and of the context in which activities are studied<sup>66</sup> . However, Xiao does not take the consequence when he decides to limit the use of videos to *verbal* analysis of what’s going on in his study. One possible explanation could be that Xiao did not have methods or toolkits to describe / analyse this “*richness of human interaction*” which he emphasizes. In 2010 Raudaskoski stated that visual data material has no established transcription standards<sup>87</sup> .

The availability and use of video has evolved exponentially over the last decade, and production of High Definition video is now available to everybody at their daily life especially via mobile phones camcorder. It is today a natural mean of communication and videos are shared on all social media. It might be argued that video has evolved into being an independent form of communication on its own. According to Statistic Brain Research Institute it is interesting to ascertain that in 2016 300 hours of video was uploaded to YouTube every minute, total number of people who use Youtube 1.325.000.000, and the number of videos viewed everyday was 4.950.000.000.

## **CONDUCTORS AND VIDEO**

In recent years, the use of video recordings has been a natural and integral part of conductor teaching at the conservatories around the world. For example, at the Sibelius Academy in Helsinki, Finland, a camera is mounted in the rehearsal room for the purpose of recording the conductor in close-up as he conducts the orchestra. A video room has been built where students receive and provide feedback on the performance together with the lecturer after the rehearsal with the orchestra.

## **VIDEO AND SIMULATION IN HEALTHCARE**

Video is widely used in simulation training in healthcare, hence the students are highly accustomed to the presence of a camera during the training. Video recordings in the emergency department are used in USA and are regarded as an effective tool for improving trauma team performance by educating clinical staff regarding roles and responsibilities<sup>88</sup>. The use of a surgical black box [integrating video recordings] has been researched<sup>89</sup>. Delivery situations, that represent complications, are video recorded at Aarhus University Hospital in Denmark in a PhD research project in 2017 managed by Lise Brogaard, PhD-student.

## **PRE-UNDERSTANDING**

In accordance with qualitative research traditions, the PhD student's preconceptions are accounted for. Being an orchestral conductor, I find the social mechanisms that take place in the interaction between conductor and musicians extremely interesting, both to observe as well as to influence in my position as conductor. Furthermore, I have been a professional musician and have thus the other perspective on this cooperation seen from the team's point of view, and have thus experienced the huge distance between those highly different viewpoints. In addition I am a composer and as such I have created and have detailed orchestrated complex actions and events at a long time distance, as all composers do. Those are the pre-understandings I bring into this project.

## **METHOD**

### **SYSTEMATIC REVIEW**

In the first study, we systematically reviewed the literature. Quantitative studies were classed according to PRISMA <sup>3</sup>, Cochrane <sup>90</sup>, and GRADE <sup>91</sup>. PRISMA focuses on the reporting of reviews evaluating randomized trials, but can also be used as a basis for reporting systematic reviews of other types of research, particularly evaluations of interventions. GRADE's approach to rating the quality of evidence is used in this study. With GRADE, the quality of evidence was assessed, as well study design / method as risk of bias, inconsistency, indirectness, imprecision and publication bias. In addition Cochrane's recommendations for the risk of specific bias have been assessed: selection, performance, attrition, detection and reporting bias. There has been attention to internal validity and external validity in the assessments. Qualitative studies were classed according to CASP (Critical Appraisal Skills Programme) <sup>4</sup>.

A number of presumptions were included in the search in the systematic review for the purpose of narrowing the number of articles in this search. One presumption was that operational leadership training is related to non-verbal communication. Another presumption was that NTS or NOTSS might turn out to address the topic. A third presumption was that specific words about leadership were necessary (authority, respect, management, leader, lead, etc.). The literature was searched for the words describing the conductor's competencies (conductor, orchestra, symphon\*). Education was added in the search (teach, educa \*, train \*, learn \*). Various emergencies (CPR, intensive, acute etc.) were added. 'Mesh terms' was searched in the Pubmed database: 'leadership' and 'education, medical'. Combinations of the above were tested to find the connection with the clinical team leader. Supplementary search was inspired by articles found in Pubmed's 'similar articles'. Inspired by the new articles new keywords emerged (training leaders, team learning, urgency, situation, task performance, resuscitation, cardiac arrest, human factors, performance, advanced life support, etc.) combinations of these were added to the search.

### **QUALITATIVE CONTENT ANALYSIS AS A METHOD**

After conducting the conventional systematic review it was decided to examine the articles in another perspective abductive - inductive QCA.

### *Strategy for qualitative content analysis*

In the systematic review, all articles included were grouped together in a single PDF document and searched several times for keywords, their synonyms and, if available, their meaningful similar positive and negative analogies, phrases and sentences. The quotes were grouped into themes in an iterative process, and sorted chronologically. The most important/significant quotes chosen on basis of the authors' interpretation are presented in this thesis.

At the beginning of the QCA the method was 'conventional', abductive – inductive. When codes became established, the search and analysis became directed by those findings. By using a directed, summative approach on 'quantitative manifest content analysis' <sup>63</sup> in order to explore usage of the visible and surface content of the text it was possible to identify consensus on selected words from a quantitative approach. By using 'qualitative latent content analysis' <sup>8</sup> it is possible to interpret the underlying meaning of the words and thus, rather, interpret a qualitative approach.

The preconceived categories in the search conducted in the second paper were guided by the content of an article <sup>44</sup>. Directed (deductive) qualitative content analysis starts with preconceived codes or categories derived from prior relevant theory, research, or literature <sup>63</sup>. Introducing a different perspective on the articles found in the systematic review, the inclusion criteria were expanded to cover experience, perceptions and emotions relating to leadership training in emergency situations, and therefore primary as well as secondary articles became relevant.

QCA was finally used to analyse a course for residents, 3<sup>rd</sup> semester medical students and nurses, as presented in the third paper as well: All text-based data were gathered into one single PDF document and searched for keywords and sentences describing the content of the course, and the words were interpreted in a meaningful context. The method was Qualitative Content Analysis, conventional, and inductive: Themes emerged in an abductive – inductive process, abductive because the conductor had his presumptions for the course – inductive because the findings adjusted the presumptions. When themes based on keywords were established, the process became directed by the themes, thus the process became deductive. Three keywords were present at the course though rarely verbalized, but showed up on the video footage. The words were grouped into three themes according to the presumptions as well as the findings in the data set.

## **VIDEO**

Video footage was reviewed several times, and edited with the aim of exemplifying the themes described above. Integrated video and audio recordings representing 22:12 hours of observation of all the courses for the residents and students were made. One camera focused on the 'leader' and another on the 'team'. The first four course days were recorded on the GoPro Silver edition, and these cameras were replaced by the GoPro HERO 4 Black edition, which has high definition resolution (4K), allowing zooming in on the details of the footage in the editing process. The HD footage was edited on a MacBook Pro with two external two TB hard drives (one for backup). Recordings from a single course day took up between 40 and 60 GB of disk space: all 22:12 hours of recordings filled approximately one TB of hard drive space. The videos were edited in Adobe Premiere Pro CC, release 2017.1.2.

## **TRANSCRIPTIONS**

Written field notes were compiled for all the courses. Complete dialogues were transcribed from six courses (the final course design). Transcription made partly by TL and partly by two medical students who were not attending or informed about the course ('blinded' as to the background, method and assumptions for the course). Throughout the project, TL kept a research diary, where observations and thoughts deemed to be relevant for the project were recorded (Online log available in Appendix).

## **EVALUATIONS**

All the participants (students, residents and nurses) evaluated the course immediately after. They gave written quantitative evaluations and responded to a short survey of four quantitative questions plus an option for a free assessment comment (Appendix). The students and residents were encouraged to reflect on the course in written evaluations after the course. After receiving edited video clips showing their personal performance during the two course days, the students and residents were sent a survey with 14 questions. The 'blinded' students wrote a qualitative non-guided reflection from the videos transcribed.

## **ETHICAL CONSIDERATIONS**

The Committees on Health Research Ethics for the Capital Region of Denmark was asked to give ethical approval but a formal review was waived for this study (H-4-2015-FSP). All participants gave written consent for their videos to be displayed / published here.

## DISCUSSION

The overall objective of this thesis was to explore a different approach to train the emergency team leader with help from another profession. Furthermore, to investigate existing aspects of training of the team leader in emergencies in healthcare. This chapter will summarize the main findings and discuss the strength and weaknesses of the studies.

No defined and workable leadership training was identified in the systematic review and no clear definition of leadership has been found. In addition the literature on this subject are dominated by 'significant variability in terminology, training modalities and evaluation' in this field<sup>15,41,43</sup>. Nevertheless, scientists agree that leadership training has an impact, improves behaviour and changes clinical outcome. Despite this, the literature demonstrated that formal leadership training has been inadequate or that education is insufficient. This thesis demonstrated a gap – or at least lack of consequence – in between what medical educators knows and what action they do take.

An explanation could be that research in healthcare has a tradition for applying the positivistic clinical research tradition, the need to *measure*. In accordance with this explanation: most of the articles found in the systematic review in this thesis (23 of 27) revealed a positivistic ontology aiming to make qualitative findings quantitative and measurable – and used statistics to prove the result<sup>1,13-15,17,21-23,26,27,29,33-37,39-43,56,59</sup>. The enthusiasm of the researchers is noticeable when they consider solving the problem as stated by Prof. Yule in 2006 “this study has taken the additional step of identifying explicitly the particular non-technical skills which might be both taught and observed – and therefore measured”<sup>38</sup>. Here it seems to become a goal in itself to be able to measure.

But when no definition of leadership is found, as stated above, it will subsequently not be possible to try to measure anything concerning leadership. An explanation to this dilemma could be that the social and communicative qualities the team leader needs is *not* measurable, but nevertheless represents very real interpretations and constructions of reality in between humans. This is in accordance with the ontology of a constructivist approach and not the ontology of a positivistic approach.

Another explanation to this change of focus could also be explained by 'substitution'. The mechanism of replacing a difficult question with a simpler one is extensively described by psychologist Daniel Kahneman: “when faced with a difficult question, we often answer an easier

one instead, usually without noticing the substitution [...] The target question is the assessment you intend to produce. The heuristic question is the simpler question that you answer instead”<sup>78</sup> .

The predominant training found involves taxonomies and algorithm training as demonstrated in the Systematic Review. This is dominated by two schools of medical educational research, one inspired by the military, the LBDQ, and the other one inspired by aviation, NOTECHS. It is not within the scope of this thesis to discuss why there is very sparse communication between the two research groups, but it is a surprising finding that may be important. The weakness of using military and aviation models is that they are aimed at people who have leadership as a full-time employment, while doctors also have to cope with several other roles in their profession, in accordance with CanMEDS definition of the seven roles of the doctor<sup>92</sup> .

As described above, literature revealed a large number of taxonomies aiming at measuring the ability of residents to implement various professional algorithms without specific focus on the leadership role. It can be argued that this relationship expresses more about an actual clinical skill and basically nothing about the quality of leadership. Again, in accordance with Kahneman<sup>78</sup> , it is possible to argue that training in clinical skills and memorizing algorithms addresses the effortful, slow and rational operations of system 2 while interaction between people (leadership) takes place in the automatic, fast and intuitive system 1. It is difficult to operate in both systems simultaneously and errors can occur if the two systems conflict with each other.

This thesis describes that it is appropriate to train clinical knowledge and leadership separately. Evidence from evaluations and videos in this study demonstrates that the participants are very excited to have the opportunity to focus explicitly on their personal leadership skills as well as stated in the literature<sup>14,17,23,27,33,36,41</sup> .

In study 2, it has been described that there is a need to address the young physician’s strong negative feelings associated with the leadership role. Anxiety can block learning (amygdala hijack) and anxiety can block performance, ‘paralyses or causes errors, it can interfere with what we want to do’ as stated by Prof. Williams<sup>77</sup> . It is not found in the existing training that the researchers have considered – or even managed – to address the fear that young doctors can experience in a stressful situation.

### *Development and conduction of a course addressing leadership*

This project developed an unconventional course focusing on training leadership for the clinical teamleader in emergencies in an effective way that seems to address what the literature has sought for 30 years.

In this regard, it is important not to threaten the young doctors professionally. On this course they are not assessed on clinical competencies, participants do not compete with their professional knowledge. The focus is solely on the leadership aspect in the musical exercises that address the intuitive system 1, in accordance with Kahneman, addresses creativity also and, in fact, are fun challenges as evidenced by the data. Common to all participants, however, is the total lack of knowledge and prerequisites for solving the exercises. All participants, in this regard starts on a shared baseline close to zero. This is an important point that is in line with the phases of transformational learning theory<sup>70,71</sup>. Participants are given an impossible task to be performed in a stressful situation where they are highly vulnerable in front of everyone. This is described as 'a disorienting dilemma', which provides an excellent starting point for later transformation in accordance with transformational learning theory. As described in the data, as well as clearly visible on the videos, cohesion is created when the participants discover that this recognition of inadequacy is shared by all. This phase is also expressed as an important part of the transformative learning process, which describes a phase four, where it is pronounced as follows: 'Recognition that one's discontent and process of transformation are shared and that others have negotiated a similar change'<sup>70,71</sup>. Many participants expressed that they discovered new characteristics of themselves from the course.

Previously it has been claimed that anxiety can block learning. Nevertheless, as demonstrated, it is possible to process the anxiety created on this course because the challenge is almost impossible and therefore ridiculously unfair, creating cohesion among the participants and lots of laughter. Furthermore, the exercises are fun itself when dealing with music and creativity, not algorithms and clinical knowledge.

It was an important objective to give the participants a feeling of the intense communication when leading an orchestra non-verbally. This was as much 'learning by feeling' as 'learning by doing'. With the intention of giving the participants this deep understanding and experience of being in control, creating confidence in the leadership, focus on the work at hand and creating calmness in the team, it was considered desirable that the participants in their own body experienced that it

was possible in *practice*. The feedback was dependent upon features of the physical body of the participant, that is, aspects of the body beyond the brain and therefore the cognition of the participant is embodied, as described in *embodied cognition*<sup>68</sup>. This phenomena is described as important for effective learning especially promoting learning targeting conceptual change, in accordance with *embodied cognition*<sup>69</sup>.

It is described in the literature that there is a need to address the strong negative feelings of young doctors associated with the role. Therefore, conscious work is to integrate the fear into the design of the course. It may seem paradoxical that it should be possible to create a safe learning environment while introducing anxiety-inducing exercises, but it is nevertheless what happens and this paradox is emphasized by the participants' evaluations. Everybody laughs very often and everyone is speaking freely, as is evident from transcriptions of the course and of the videos. Discussions among the students promote a high level of learning, with a retention rate of 50%, according to NTL's average retention rates for different training and teaching methods.

For a short while, the participant gets the opportunity to work as a conductor and actually influence others to act and respond to their intuition – no questions are asked – and especially when conducting the Ghetto Blaster session a state can occur where time and place is dissolved, the participants are optimally challenged, fully focused and emotionally involved – described as learning by feeling – as can be observed at the videos ([youtu.be/KcyZf3\\_QfMk](https://youtu.be/KcyZf3_QfMk)). This condition is described in *Flow-Psychology* as a general pedagogic ideal<sup>74-76</sup>. Furthermore, this is also 'learning by doing' (by practice), which promotes a higher level of learning, with a retention rate at 75%, according to NTL.

The teaching method at the course is apprenticeship. The conductor acts as a role model and provides feedback. The participants imitate the conductor and receive feedback on their own performance, which guarantees in depth professional focus according to the qualities of apprenticeship<sup>72</sup>. Participants chose to call this feedback 'straight on', and this gave them the opportunity to gain direct insight into their own weaknesses as experienced by the conductor.

One factor that is unusual in relation to medical education is that the conductor allows himself to have an opinion and be subjective when giving feedback. In accordance with the principles of hermeneutics, it is possible to recognize and observe reality when present in it and being able to interpret on the basis of presumptions<sup>5,65</sup>. The conductor is capable because he is an 'intuitive expert', according to Kahneman<sup>78</sup>.

A benefit of this method is that the participants realise that it is acceptable to trust an intuition and be subjective in their interpretation as the conductor does. This is emphasized on the joint discussions and reflections where participants discover that this ability is not a talent or a competence reserved to the conductor. These personal subjective interpretations are shared by everyone and thus *generally* applicable. It should be emphasised that the participants do not learn to interpret at this course, they already know; we believe it is deep within us to seek to understand and find explanations, that is, to interpret. The course teaches the participants to trust their own intuitive, subjective interpretation and consequently; that it is possible to be interpreted or 'read' as desired. Therefore, reality is a non-measurable construction, but nevertheless real construction of what takes place in people's minds when they are together. Reality becomes a social construction of (intuitive) interpretations and must be seen in the context of individuals interacting, as also described in constructivism.

The study is to be seen in a context of allowing experiences and perceptions to exist beyond the limits of language, according to semiotics and multimodality<sup>9-12,83,84,86,93</sup>. The course deals with non-verbal communication on multiple levels. 1) One level deals with bodily expression and gesture. 2) Another more intangible, but still shared, recognised level dealing with 'presence to the moment', 'credibility', 'responsiveness' and 'authority'. 3) Finally there's music, which, according to Langer, deals with experiences inaccessible to language<sup>82</sup>. Especially in the Ghetto-Blaster exercises, the participant gets acquainted with an exercise in which they are playing creatively with a music-aesthetic they have not experienced before. The (spoken) focus at the above mentioned level 1 and 2, but the language in the exercises is the music – level 3. The music and the interpretation of the music is a topic that is rarely mentioned in the text material representing data from the course, but it may be important for a non-verbal course to work with this creative and wordless communicative media where the outcome only exists in the moment it is created – and only in the cognition and interpretation in the minds of the participants.

### *Feedback*

As documented in the evaluations and in the video footage, the participants are most excited about the personal and clear feedback. This is considered – by the participants – as a very useful and completely unique strength of the course as described in the evaluations after the courses. Obviously, this is not a surprising reaction, it's highly unusual for adults to comment on each other's appearance and non-verbal communication, but this is highly appreciated in this context.

It is a delicate balance for the faculty when feedback is given to the participant; it is important to 'get under the skin' of the participant, but crucial that the feedback is safe; this is the decisive challenge for the course. Participants stated that they felt that the faculty fully understood the challenges they faced.

An important factor is that feedback is given immediately the moment a problem arises. Common practice in simulation training is to provide feedback after the simulation is completed; i.e. with a certain distance of time. As demonstrated on the videos, the conductor immediately pinpoints an inappropriate behaviour, is able to imitate it and thereby demonstrate the disadvantage of this behaviour and he is able to demonstrate what a more appropriate behaviour would look like in the situation, in accordance with apprenticeship <sup>72</sup> .

Initially, it is the conductor who gives feedback, then it is the clinical teacher for clinical relevance but soon during the course the feedback is handed to the course participants. There are on-going discussions and reflections on the lessons learned and about the interpretation of the non-verbal expressions that are the subjects of the course, and equipped with this new awareness and vocabulary, the participants gradually give each other feedback on each other's behaviour and appearance as leaders. When the participants comment on each other's development, it is considered as the most optimal learning setting, with a retention rate at 90%, according to NTL.

Another important learning takes place when participants *observe* how and why personal feedback is given, and experience how this feedback immediately influences, transforms and strengthens the 'leader's' credibility in front of the team.

### *Faculty*

The participants learn from the conductor, who is a master in non-verbal communication and leadership of the orchestra. He himself has acquired his leadership competencies through apprenticeship, and these skills have evolved not through theoretical learning, but, in accordance with Mintzberg through many years of *practise* <sup>73</sup> . This gives him a high level of credibility among the participants.

As demonstrated in the data, the course works explicitly and is highly targeted with intangible topics such as non-verbal communication, appearance, presence and authority. It is possible to work with these subjects because the course draws on the experience of a conductor who works

consciously (deliberately) with these subjects in his profession when he stands in front of the orchestra.

One can say that the entire argument for this thesis about the conductor's communication is that the conductor can work to be interpreted unambiguously – without using words, and this skill is valuable knowledge for the clinical team leader.

Participants acknowledge his expertise and experience how much he can 'speak' without words and acquire a clear understanding of this possibility of communication, which, according to Mehrabian's research, is a very strong element in 'face to face' communication; people tends to believe the expression they see <sup>80,81</sup> .

This conductor seems to claim that there is only one way of conducting an orchestra: keep calm, raised sternum, in control of arms and body. But there are evidently many, different and often extremely passionate and expressive conductors, and furthermore their leadership style is very different as well. Riccardo Muti = commanding style centred around 'I, the conductor'. Richard Strauss = only execution of the written music – no interpretation. Herbert von Karajan = closed eyes and no clear instructions, all about interpretation and listening. Carlos Kleiber = creates conditions, motivation and partnership – but authoritative leadership. Leonard Bernstein = demonstrating the *feelings* of the music <sup>57</sup> . What is the same for all conductors is that the *basic* knowledge and ability are shared. Only when this is acquired it is possible to add personality to the leadership style.

However, it was important that the other teacher on the course is clinical lecturer and consultant and set the framework for the course. By consultants presence, the clinical relevance is visualized and guaranteed in the dialogues and discussions on the course. The lecturer draws parallels from the learned to the clinic and the clinical team leader.

It is interesting to ascertain that the skills and competences addressed in the course are situated on a meta-level and are a prerequisite for the teaching: the faculty has to be able to assume the leadership role as educators who are able to *improvise* when teaching, which is a skill requiring a high level of experience and knowledge according to Koivunen and Barrett <sup>94,95</sup> . It is very important for the faculty to be able to demonstrate 'presence at the moment' and 'responsiveness' in order to appear credible as teachers and role models. If the teaching in leadership was based on theories and the teacher was unable to demonstrate leadership, the teaching would not have the impact it had. It would not be experienced as authentic but rather as an assertion or an abstraction.

### *Assessment of the impact of the course*

According to the results of the course, participants reported to gain self-confidence, calmness and overview when called upon to act as conductors. Video recordings from the course have shown that the course strengthened the participant's credibility, and the participants received tools for dealing with personal anxiety as demonstrated in the qualitative content analysis of the transcriptions from the course, the evaluations as well as shown in the video footage.

The Kirkpatrick Model is a highly recognized way of assessing learning <sup>96</sup>. On a questionnaire designed according to this model, the participants themselves assessed how the learning will change their behavior and how they will implement the learned in their professional work. The quality of this assessment may be challenged. It would have been better if a third part had evaluated the change in behaviour. This is not an option in this thesis. However, many evaluations, after the course, described that the course had an impact on their professional activities as well as in their daily lives.

One video sequence summarizes in a very convincing way one of the core objectives of the course and documents the transformation of a participant. This video demonstrates how the trainers 'gets under the skin' of the participants, shows the reflection on the learning and the support from the other participants. The participant in focus goes from saying "My palms are totally sweaty" and "I think it's horrible" to say: "I wish everyone could try this" and "It is most impressive".  
[youtu.be/GW7XPdnf-EU](https://youtu.be/GW7XPdnf-EU).

We allow ourselves to *interpret* that we change the participants' behavior as team leaders, measured by their own experience on their own body as well as by observing the other participants in the situation. However, we think it is necessary to *interpret* because we are discussing things that have no definite definition. There is no fixed definition of the quality of leadership and it is not possible to assess 'charisma' or assess the quality of non-verbal communication and leadership, only qualitative and interpretative approaches exist.

## **STRENGTHS AND LIMITATIONS**

The search in the systematic review has been systematic, objective and reproducible. But the search string produced can be criticized for involving non-verbal communication in the search. It is the researchers' conviction that it is necessary to address this topic in the training. The search can

be criticized for not incorporating the theoretical aspect of leadership, but it has not been the purpose of the study, which has explicitly focused on finding an operational and workable training.

It could be a limitation that the search string used focused on leadership training in a variety of emergencies. It could be argued that other leader development programmes might have been ignored, by doing so.

It can be discussed whether it is reasonable to examine texts in articles written in positivist ontology with an interpretative epistemology. It could be argued that it is irrelevant to emphasize and interpret what the article states based on experience in a scientific study. The scientific premise for their study must be discussed on the basis of their scientific approach, design, method, and analysis. It can be considered inappropriate to make the articles accountable for statements as it is expressed in the articles. However, this interpretative method tells where the focus has been. The method reveals whether leadership is needed and that leadership is important. The interpretative method makes us look through the literature, in terms of consensus on opinions as well as behind the aims of the articles.

A strength of this thesis is the latent content analysis by which it is possible to include the underlying meaning of a text, and the study as well searched synonyms and, if available, meaningful similar positive and negative analogies, phrases and sentences. This analysis is broader than persons words, which was used as the objectives in the QCA.

It can be discussed if the population who attended the course was representative, if there was any selection bias. The residents and the medical students were offered a course in leadership training, and maybe those who enrolled in the course were participants who had difficulty taking the authority in this role. If there had been more attendees who already had high self-confidence as leaders, there would not be so much improvement of the participants, and eventually, the evaluations would have been more moderate. Nurses participated in other terms, they were not offered a course but were told to attend. They found the course most valuable.

It has been in accordance with this general practice in conductor teaching to integrate video at the course. One basic idea for the project is to place a participant in a stressful and vulnerable situation in front of the other participants, giving him difficult tasks to solve in the situation for the purpose of provoking discomfort and anxiety. If the camera is experienced as an additional stress factor, it will only add beneficial challenges to the idea of the intervention itself.

It has been repeatedly shown that there are communicative terms which are not verbal in accordance with Mehrabian, Peirce, Multimodal Analysis and Langer<sup>11,67,80,82,83,97</sup>. It has been demonstrated that video has evolved to an independent communication tool suitable for showing the diversity of social interaction in accordance with Xiao<sup>66</sup>. It has been demonstrated several times in this study that interpretation and intuition can be shared, and thus general. In some situations, we recognise that there is only one reality, the measurable reality. In other situations, and especially in the context of human interaction, we must acknowledge that there are several realities, and these are constructed and interpreted among people who interact. In accordance with this, we allow ourselves to present the edited videos that are not interpreted with words as evidence. It should be mentioned that all the videos presented in the appendix are in fact more *explanatory* when documenting the diversity and nuances in the content of the course.

In order to underline which objectives were addressed during the course, this is demonstrated primarily by words in the form of quotes. It is stated that the more participants who say the same independently of each other, the greater the possibility that the statement is generally applicable. This can be criticized for using positivist statistics in a study based on an interpretative approach. The challenge inherent in this thesis is to document the conductor's highly qualitative approach when introducing non-verbal communication in a clinical research tradition. Moreover, it is not considered that one ontology exclude the other.

What can be documented can be seen from the available data: It is estimated that 1) the participants' reflections at the course reflect their immediate experience. 2) Their evaluations after the course reflect what they took home from the course. These answers are available one week after, ten months after and up to two years after the course was conducted. 3) The two 'blinded' students commented the course impact on course participants independently, based on their own interpretation of the videos. 4) Videos are edited and categorized according to the encoded themes. The content of this data presents a triangulation of the course's impact.

A strength for the course was the diverse ontologies represented by the researchers in the study. The PhD student, the conductor, and the main supervisor, the consultant, constituted a unique research team in the constellation between two very different ontologies acquired through their very different professions. This represented a different approach in relation to the conventional approach in medical-pedagogical research in this field. They looked at the phenomena with fresh eyes and from new perspectives without restriction within already existing hypotheses, but had an

idea based on intuition. From the findings, new knowledge was acquired, this new knowledge was adapted to the original idea and the process was restarted, according to the abductive-inductive methodology introduced by Pierce<sup>67</sup>, and found in the hermeneutics<sup>5</sup>, GT<sup>62,63</sup>, and QCA<sup>8,63</sup>. Through those various ontologies and thus the following discussions on epistemology, the subject has been studied and elucidated from several angles. Consequently this led to new findings on leadership in the clinic through understanding of what a conductor does in front of the orchestra.

## CONCLUSION

No consistent and targeted leadership training for the emergency medical team leader was identified. For many years multiple taxonomies and assessment tools have been developed but failed to come to address leadership training. A need for explicit targeted team leadership training in healthcare was identified. The authors recommend training of leadership take another turn to investigate if it is possible to find other and more efficient ways to train the team leader in emergencies.

Barriers for acquiring leadership competencies required when managing emergency teams were identified. Learning goals were identified. Strong negative emotions such as stress, anxiety and panic were found when working in emergencies. We developed a course that addressed those barriers.

The participants noted and commented on each other's development on the course. According to their self-reporting after the course the transfer of a conductor's skills changed the participating students', nurses' and residents' behaviour, and introduced a method to handle anxiety and show calmness and authority. This course clearly seems to accommodate the need for an operational and targeted training of the team leader in emergencies, addressing a way to achieve confidence in a stressful, but safe learning environment. In addition the outcome turned out to be a profound transformation of participants' self-understanding.

The thesis illustrated that it was beneficial to involve another profession to healthcare. This thesis demonstrated a gap – or at least lack of consequence – in between what is known and what action is taken.

## **PERSPECTIVES**

### *Implications for future practice*

The thesis describes how it is possible to achieve leadership skills by using musical exercises. It is therefore recommended to continue the development of courses in medical unchallenging, harmless environments that allow each resident / student to gain insight into their own personal challenges and guidance in how to work with these. This thesis has shown a context where this is possible.

### *Educational implications*

We recommend: If this course is to be introduced as a compulsory part of the educating of doctors, the ideal time would be after clinical skills have been acquired, experience gained and routines understood in the clinic. The course will be an important supplement to existing educational programs for residents.

### *Further research*

It is recommended to evaluate whether the learning can be transferred to clinical practice and whether they have a positive impact on the treatment of patients.

Research is needed to examine if it is possible to train these skills in mixed clinical teams.

Research is needed to develop and validate a score to assess the quality of non-verbal communication and leadership. This could be measured at conductor students at a conservatory.

In this connection, another study could be conducted to investigate the emotional response of conductor students when conducting. Measured on pulse, or hormonal changes in norepinephrine or cortisol level if possible.

It is recommended to develop a 'train the trainer' programme aiming to educate more trainers and involve them in the further development of the course. In this context, it is recommended to develop a certification method for a 'train the trainer' education programme.

## REFERENCES

1. Cooper S, Wakelam A. Leadership of resuscitation teams: 'Lighthouse leadership'. *Resuscitation*. 1999;42(1):27-45.
2. Flin R, Maran N. Identifying and training non-technical skills for teams in acute medicine. *Qual Saf Health Care*. 2004;13(suppl 1):i80-i84. doi: 10.1136/qshc.2004.009993.
3. PRISMA (preferred reporting items for systematic reviews and meta-analyses ). prisma-statement.org/. Updated 2015.
4. Singh J. Critical appraisal skills programme. *Journal of Pharmacology and Pharmacotherapeutics*. 2013;4(1):76-77.
5. Rennie DL. Qualitative research as methodical hermeneutics. *Psychol Methods*. 2012;17(3):385-398.
6. Malterud K. The art and science of clinical knowledge: Evidence beyond measures and numbers. *The Lancet*. 2001;358(9279):397.
7. Malterud K. Qualitative research: Standards, challenges, and guidelines. *Lancet*. 2001;358(9280):483-488.
8. Cho J, Lee E. Reducing confusion about grounded theory and qualitative content analysis: Similarities and differences. *The Qualitative Report*. 2014;19(32):1-20.
9. Kress G. Multimodality: Key concepts. conversation with gunther kress. . 2012 - <https://youtu.be/rZ4rMVCWkQs>;MODE, Institution of Education, University of London.
10. Jewitt C. The routledge handbook of multimodal analysis. In: Jewitt C, ed. 2. ed. ed. Milton Park, Abingdon, Oxon: Routledge; 2014:468.
11. Peirce CS. *Peirce on signs - writings on semiotic by charles sanders peirce*. Chapel Hill; London: The University of North Carolina Press; 2014.
12. Bezemer J, Diamantopoulou S, Jewitt C, Kress G, Mavers D. Using a social semiotic approach to multimodality: Researching learning in schools, museums and hospitals. . 2012, March;01 National Centre for Research Methods.
13. Wisborg T, Ronning TH, Beck VB, Brattebo G. Preparing teams for low-frequency emergencies in norwegian hospitals. *Acta Anaesthesiol Scand*. 2003;47(10):1248-1250.
14. Marsch SC, Muller C, Marquardt K, Conrad G, Tschan F, Hunziker PR. Human factors affect the quality of cardiopulmonary resuscitation in simulated cardiac arrests. *Resuscitation*. 2004;60(1):51-56.
15. Makinen M, Aune S, Niemi-Murola L, et al. Assessment of CPR-D skills of nurses in goteborg, sweden and espoo, finland: Teaching leadership makes a difference. *Resuscitation*. 2007;72(2):264-269.
16. Hjortdahl M, Ringen AH, Naess AC, Wisborg T. Leadership is the essential non-technical skill in the trauma team--results of a qualitative study. *Scand J Trauma Resusc Emerg Med*. 2009;17:48-7241-17-48.
17. Hunziker S, Buhlmann C, Tschan F, et al. Brief leadership instructions improve cardiopulmonary resuscitation in a high-fidelity simulation: A randomized controlled trial. *Crit Care Med*. 2010;38(4):1086-1091.

18. Georgiou A, Lockey DJ. The performance and assessment of hospital trauma teams. *Scand J Trauma Resusc Emerg Med*. 2010;18:66-7241-18-66.
19. Hunziker S, Tschan F, Semmer NK, Howell MD, Marsch S. Human factors in resuscitation: Lessons learned from simulator studies. *J Emerg Trauma Shock*. 2010;3(4):389-394.
20. Hunziker S, Johansson AC, Tschan F, et al. Teamwork and leadership in cardiopulmonary resuscitation. *J Am Coll Cardiol*. 2011;57(24):2381-2388.
21. Briggs A, Raja AS, Joyce MF, et al. The role of nontechnical skills in simulated trauma resuscitation. *J Surg Educ*. 2015;72(4):732-739.
22. Leenstra NF, Jung OC, Johnson A, Wendt KW, Tulleken JE. Taxonomy of trauma leadership skills: A framework for leadership training and assessment. *Acad Med*. 2016;91(2):272-281.
23. Robinson PS, Shall E, Rakhit R. Cardiac arrest leadership: In need of resuscitation? *Postgrad Med J*. 2016.
24. Ford K, Menchine M, Burner E, et al. Leadership and teamwork in trauma and resuscitation. *West J Emerg Med*. 2016;17(5):549-556.
25. Yule S, Flin R, Paterson-Brown S, Maran N. Non-technical skills for surgeons in the operating room: A review of the literature. *Surgery*. 2006;139(2):140-149.
26. Gilfoyle E, Gottesman R, Razack S. Development of a leadership skills workshop in paediatric advanced resuscitation. *Med Teach*. 2007;29(9):e276-83.
27. Hayes CW, Rhee A, Detsky ME, Leblanc VR, Wax RS. Residents feel unprepared and unsupervised as leaders of cardiac arrest teams in teaching hospitals: A survey of internal medicine residents. *Crit Care Med*. 2007;35(7):1668-1672.
28. Flin R, Yule S, Paterson-Brown S, Maran N, Rowley D, Youngson G. Teaching surgeons about non-technical skills. *Surgeon*. 2007;5(2):86-89.
29. Ringen AH, Hjortdahl M, Wisborg T. Norwegian trauma team leaders--training and experience: A national point prevalence study. *Scand J Trauma Resusc Emerg Med*. 2011;19:54-7241-19-54.
30. Jacobsson M, Hargestam M, Hultin M, Brulin C. Flexible knowledge repertoires: Communication by leaders in trauma teams. *Scand J Trauma Resusc Emerg Med*. 2012;20:44-7241-20-44.
31. Hunziker S, Tschan F, Semmer NK, Marsch S. Importance of leadership in cardiac arrest situations: From simulation to real life and back. *Swiss Med Wkly*. 2013;143:w13774.
32. Kolehmainen C, Brennan M, Filut A, Isaac C, Carnes M. Afraid of being "witchy with a 'b'": A qualitative study of how gender influences residents' experiences leading cardiopulmonary resuscitation. *Acad Med*. 2014;89(9):1276-1281.
33. Fernandez Castela E, Boos M, Ringer C, Eich C, Russo SG. Effect of CRM team leader training on team performance and leadership behavior in simulated cardiac arrest scenarios: A prospective, randomized, controlled study. *BMC Med Educ*. 2015;15:116-015-0389-z.
34. Yule S, Parker SH, Wilkinson J, et al. Coaching non-technical skills improves surgical residents' performance in a simulated operating room. *J Surg Educ*. 2015;72(6):1124-1130.

35. Hargestam M, Hultin M, Brulin C, Jacobsson M. Trauma team leaders' non-verbal communication: Video registration during trauma team training. *Scand J Trauma Resusc Emerg Med*. 2016;24:37-016-0230-7.
36. McCue JD, Magrinat G, Hansen CJ, Bailey RS. Residents' leadership styles and effectiveness as perceived by nurses. *J Med Educ*. Jan 1986;61(1):53-58.
37. Itani KM, Liscum K, Brunnicardi FC. Physician leadership is a new mandate in surgical training. *Am J Surg*. 2004;187(3):328-331.
38. Yule S, Flin R, Paterson-Brown S, Maran N, Rowley D. Development of a rating system for surgeons' non-technical skills. *Med Educ*. 2006;40(11):1098-1104.
39. Nicksa GA, Anderson C, Fidler R, Stewart L. Innovative approach using interprofessional simulation to educate surgical residents in technical and nontechnical skills in high-risk clinical scenarios. *JAMA Surg*. 2015;150(3):201-207.
40. Roberts NK, Williams RG, Schwind CJ, et al. The impact of brief team communication, leadership and team behavior training on ad hoc team performance in trauma care settings. *Am J Surg*. 2014;207(2):170-178.
41. Mantha A, Coggins NL, Mahadevan A, Strehlow RN, Strehlow MC, Mahadevan SV. Adaptive leadership curriculum for indian paramedic trainees. *Int J Emerg Med*. 2016;9(1):9-016-0103-x. Epub 2016 Feb 20.
42. Cooper S. Developing leaders for advanced life support: Evaluation of a training programme. *Resuscitation*. 2001;49(1):33-38.
43. Carlson J, Min E, Bridges D. The impact of leadership and team behavior on standard of care delivered during human patient simulation: A pilot study for undergraduate medical students. *Teach Learn Med*. 2009;21(1):24-32.
44. Iserson KV. Critical leadership. *J Emerg Med*. 1986;4(4):335-340.
45. Sommer KJ. Pilot training: What can surgeons learn from it? *Arab J Urol*. 2014;12(1):32-35.
46. Fond G, Ducasse D, Attal J, et al. Charisma and leadership: New challenges for psychiatry. *Encephale*. 2013;39(6):445-451.
47. Stoller JK, Taylor CA, Farver CF. Emotional intelligence competencies provide a developmental curriculum for medical training. *Med Teach*. 2013;35(3):243-247.
48. Larsen T, Beier-Holgersen R. **Team management - can music contribute to better understanding?** . *MedEd Publish*. 2014.
49. Fletcher G, Flin R, McGeorge P, Glavin R, Maran N, Patey R. Anaesthetists' non-technical skills (ANTS): Evaluation of a behavioural marker system. *Br J Anaesth*. 2003;90(5):580-588.
50. Mitchell L, Flin R, Yule S, Mitchell J, Coutts K, Youngson G. Development of a behavioural marker system for scrub practitioners' non-technical skills (SPLINTS system). *J Eval Clin Pract*. 2013;19(2):317-323.
51. Flin RH, Mitchell L. *Safer surgery : Analysing behaviour in the operating theatre*. Farnham: Ashgate; 2009:xxvi, 456 s., illustreret.

52. Mishra A, Catchpole K, McCulloch P. The oxford NOTECHS system: Reliability and validity of a tool for measuring teamwork behaviour in the operating theatre. *Qual Saf Health Care*. 2009;18(2):104-108.
53. Steinemann S, Berg B, DiTullio A, et al. Assessing teamwork in the trauma bay: Introduction of a modified "NOTECHS" scale for trauma. *Am J Surg*. 2012;203(1):69-75.
54. Spanager L, Konge L, Dieckmann P, Beier-Holgersen R, Rosenberg J, Oestergaard D. Assessing trainee surgeons' nontechnical skills: Five cases are sufficient for reliable assessments. *J Surg Educ*. 2015;72(1):16-22.
55. Klampfer B, Flin R, Helmreich R, et al. Group interaction in high risk environments: Enhancing performance in high risk environments, recommendations for the use of behavioural markers. . 2001.
56. Sadideen H, Weldon SM, Saadeddin M, Loon M, Kneebone R. A video analysis of intra- and interprofessional leadership behaviors within "the burns suite": Identifying key leadership models. *J Surg Educ*. 2016;73(1):31-39.
57. Talgam I. Lead like the great conductors: A TED-talk. [youtube.com/watch?v=R9g3Q-qvtss](https://www.youtube.com/watch?v=R9g3Q-qvtss). Updated 2009.
58. Mercer S, Arul GS, Pugh HE. Performance improvement through best practice team management: Human factors in complex trauma. *J R Army Med Corps*. 2014;160(2):105-108.
59. Krage R, Tjon Soei Len L, Schober P, et al. Does individual experience affect performance during cardiopulmonary resuscitation with additional external distractors? *Anaesthesia*. 2014;69(9):983-989.
60. Willems A, Waxman B, Bacon AK, Smith J, Kitto S. Interprofessional non-technical skills for surgeons in disaster response: A literature review. *J Interprof Care*. 2013;27(5):380-386.
61. Strauss A, Corbin J. *Basics of qualitative research: Grounded theory, procedures, and techniques*. Newbury Park: Sage Publications; 1990.
62. Glaser BG, Strauss AL. *The discovery of grounded theory, strategies for qualitative research*. New York: Aldine de Gruyter; 1967.
63. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res*. 2005;15(9):1277-1288.
64. Reichertz J. Abduction: The logic of discovery of grounded theory. *Forum: Qualitative Social Research*. 2009;11(1).
65. Zimmerman J. *Hermeneutics: A very short introduction*. Oxford University Press; 2015. 10.1093/actrade/9780199685356.001.0001.
66. Xiao Y, Seagull FJ, Mackenzie CF, Klein K. Adaptive leadership in trauma resuscitation teams: A grounded theory approach to video analysis. *Cognition, Technology & Work*. 2004;6(3):158-164.
67. Burch R. **Charles sanders peirce**. <https://plato.stanford.edu/entries/peirce/>. Updated Wed Nov 12, 2014.
68. Wilson RA, Foglia L. Embodied cognition. In: Edward N. Zalta, ed. *The stanford encyclopedia of philosophy*. Spring 2017 ed. Metaphysics Research Lab, Stanford University; 2017.
69. Holton DL. Constructivism + embodied cognition = enactivism: Theoretical and practical implications for conceptual change. . AERA 2010 Conference.

70. Jones LC. You learn it in your heart: Transformative learning theory and clinical pastoral education. *J Pastoral Care Counsel.* 2010;64(4):7.1-10.
71. Mezirow J. Transformation theory of adult learning. In: Welton M, R., ed. *In defense of the lifeworld. critical perspectives on adult learning.* State University of New York Press; 1995:39-50.
72. Nielsen K. *Mesterlære. læring som social praksis.* Kbh: Hans Ritzels Forlag; 1999.
73. Mintzberg H. **Rethinking the MBA.** <https://hbr.org/2009/03/rethinking-the-mba.html>. Updated Visited Nov. 2017.
74. Csikszentmihályi M. Interview . *Wired magazine.* 2006:p. 21.
75. Knopp HH. Om kunsten at finde flow i en verden, der ofte forhindrer det. *Kognition og Pædagogik - tidsskrift om tænkning og læring.* 2004;14(52):66-82.
76. Csikszentmihályi M, Nakamura J. Flow theory and research. In: Snyder CR, Shane JL, eds. *Oxford handbook of POSITIVE PSYCHOLOGY.* Second Edition ed. New York: Oxford University Press; 2009:195.
77. Rix J. **How anxiety scrambles your brain and makes it hard to learn.** [theguardian.com/education/2015/nov/21/how-anxiety-scrambles-your-brain-and-makes-it-hard-to-learn.](http://theguardian.com/education/2015/nov/21/how-anxiety-scrambles-your-brain-and-makes-it-hard-to-learn) Updated 21 Nov. 2015.
78. Kahneman D. Thinking, fast and slow. (2011). *Thinking, fast and slow.* 499 pp. New York, NY, US: Farrar, Straus and Giroux. US.
79. Watzlawick P. *Pragmatics of human communication, a study of interactional patterns, pathologies, and paradoxes.* [1. Norton paperback ed.] ed. New York: W.W. Norton; 2011.
80. Mehrabian A, Ferris SR. Inference of attitudes from nonverbal communication in two channels. *J Consult Psychol.* 1967;31(3):248-252.
81. Mehrabian A. Silent messages. In: Belmont: Wadsworth; 1971:75-80.
82. Langer SK. *Philosophy in a new key, a study in the symbolism of reason, rite, and art.* Cambridge, Mass.; 1942.
83. Kress G. Multimodal discourse analysis. In: Gee J, P., Handford M, eds. *The routledge handbook of discourse analyses.* London: Routledge; 2012:35.
84. Jewitt C. An introduction to multimodality. In: Jewitt C, ed. *The routledge handbook of multimodal analysis.* 2. ed. ed. London: Routledge; 2014:15-30.
85. Goodwin C. The handbook of visual analysis; pages 157-182. In: London: SAGE Publications Ltd; 2017. <http://methods.sagepub.com/book/the-handbook-of-visual-analysis>. 10.4135/9780857020062.
86. Jewitt C. An introduction to using video for research. . 2012, March;03 National Centre for Research Methods Working Paper.
87. Raudaskoski PL. Observationsmetoder (herunder videoobservation). In: *Kvalitative metoder.* Hans Reitzel; 2015:97-112.

88. Brown DM. Video recording of emergency department trauma resuscitations. *J Trauma Nurs.* 2003;10(3):79-80.
89. Moulton D. Surgical black box may sew up malpractice cases. *CMAJ : Canadian Medical Association Journal.* 2015;187(11):794-794.
90. Rosenberg J. *Systematisk review og meta-analyse.* 2. udg. ed. S.l.: CreateSpace Independent Publishing Platform; 2016.
91. Balshem H, Helfand M, Schunemann HJ, et al. GRADE guidelines: 3. rating the quality of evidence. *J Clin Epidemiol.* 2011;64(4):401-406.
92. CanMEDS flower. <http://canmeds.royalcollege.ca/en/about>. Updated 2017.
93. Bezemer J, Kress G, Cope A, Kneebone R. Learning in the operating theatre: A social semiotic perspective. In: Cook C, Newman M, eds. *Work--based learning in clinical settings: Insights from socio--cultural perspectives.* Abingdon: Radcliffe; 2012:125.
94. Koivunen N, Wennes G. Show us the sound! aesthetic leadership of symphony orchestra conductors. *Leadership.* 2011;7(1):51-71.
95. Barrett F. *Yes to the mess : Surprising leadership lessons from jazz.* Boston, MA: Harvard Business Press; 2012:2002 pages.
96. The official site of the kirkpatrick model. [kirkpatrickpartners.com/Our-Philosophy/The-Kirkpatrick-Model](http://kirkpatrickpartners.com/Our-Philosophy/The-Kirkpatrick-Model). Updated Nov. 30, 2017.
97. Ma J. The synergy of peirce and vygotsky as an analytical approach to the multimodality of semiotic mediation. *Mind, Culture, and Activity.* 2014;21(4).
98. Yukl G. *Leadership in organizations.* Seventh Edition ed. New Jersey: Pearson; 2010.
99. Stogdill RM. Handbook of leadership : A survey of theory and research. In: New York-London: ; 1974:259.
100. Larsen T, Beier-Holgersen R, Dieckmann P, Østergaard D. Training residents to lead emergency teams: A systematic review [part one]. *Under review.* 2018.
101. Larsen T, Beier-Holgersen R, Østergaard D, Dieckmann P. Training residents to lead emergency teams [part two]. barriers, challenges and learning goals: A qualitative review. *Under review.* 2018.
102. Edmondson, Amy. Psychological safety and learning behavior in work teams. *Adm Sci Q.* 1999;44:350-383.
103. Rudolph JW, Raemer DB, Simon R. Establishing a safe container for learning in simulation: The role of the presimulation briefing. *Simul Healthc.* 2014;9(6):339-349.