TRANSLATION OF AN INTERDISCIPLINARY PBL STRATEGY TO THE FORMATION OF INTERDISCIPLINARY COMPETENCES:

A REPORT

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LIST OF CONTENT

1 Purpose and project overview 1

1.1 Literature review 2

1.2 Analysis of the student reports from 7th semester TANT MSc 3

1.3 Evaluation and idea development Workshops with faculty and students 5

1.4 Catalogue: ideas and challenges on how to improve interdisciplinary skills in the MSc program 8

1.5 Implementation of selected ideas 9

1.6 Evaluation, next step and recommendations 11

1.7 Communication 12

1.8 Acknowledgement 13

2 Appendices 14

2.1 Literature review – 10 selected papers 14

2.2 Summary of student report analysis 16

2.3 Catalogue of ideas and challenges 19

1 PURPOSE AND PROJECT OVERVIEW

A range of Master's Programs at Aalborg University admit students with many different backgrounds, further many of these programs are interdisciplinary in some way. This poses a challenge of integration and gaining a shared professional profile and community between students of the study. Additionally, these differences can lead to poor wellbeing and even in some cases a high dropout rate.

This project explores how a strengthened PBL effort can improve the community of students and create a clear interdisciplinary professional profile. This exploration is done by arranging a range of activities focused on improving the community of students and creating a clear interdisciplinary professional profile, or taken together, on initiatives aiming at developing the students' interdisciplinary competencies.

The MSc program in Techno-Anthropology is the focus of this project because it is a highly interdisciplinary study-program that over the years has faced some of the above mentioned interdisciplinary challenges.

The interdisciplinary challenge at Techno-Anthropology is due to high complexity in the study-program. The program is offered at two campuses: Aalborg, Copenhagen. It enrolls many nationalities: Danish, Foreign. Enrolled students have different backgrounds: The Master's program is populated by interdisciplinary bachelors in Techno-Anthropology, Art and Technology, Communication and Digital Media etc., bachelors in Technical Science (engineering), students with a degree drawing on ethnographic methods, professional bachelors e.g. nursing, bioinformatics etc., interdisciplinary bachelors BSc. e.g. The teachers are employed at different departments: Department of Planning, Department of Learning and Philosophy, Department of Energy Technology, Department of Chemistry and Bioscience.

Project activities were:

1. Literature review
2. Analysis of project reports
3. Workshops with students and faculty members
4. Catalogue of ideas
5. Implementation of selected ideas
6. Next steps
7. Communication

Following is a description of the activities of the project and further reflections.

1.1 LITERATURE REVIEW

As part of the literature review, an initial corpus of 71 articles was put together according to specific keywords used in available and appropriate educational databases.

Three blocks of keywords were used: 1) "university teaching", made up of "university", "teaching", and "academic" 2) "PBL", made up of "problem-based", "learning", and "PBL", and 3) "interdisciplinary and transdisciplinary", made up of both words and "interdisciplin*" and "transdisiplin*" versions to cover for inter-/transdisciplinarity as well.

A list of criteria – i.e. partial or full answer to the question *How PBL supports inter- and transdisciplinary university teaching*, and a stated focus on PBL – was applied on this initial corpus, which resulted in a list of 10 core articles addressing state-of-the-art research on PBL and interdisciplinarity. (See Appendix 2.1. Literature review – 10 selected papers).

Out of these 10, one paper was found to be particular useful and insightful as a theoretical framework for working with interdisciplinarity in PBL. This was the paper "Impact of Transdisciplinary Threshold Concepts on Student Engagement in Problem-Based Learning" by Maggie Savin-Baden. The central concept in this paper is the *Transdisciplinary Threshold Concept* (TTC). Savin-Baden defines "Transdisciplinary threshold concepts [...] as: concepts which transcends disciplines and subject boundaries but which are challenging and complex to understand, but once understood, the student experiences a transformed way of understanding" (Savin-Baden, 2016: 10).

Characteristics of Transdisciplinary Threshold Concepts are:

1. *Transformative*; change the way students view the discipline,
2. *Troublesome*; pose a challenge, Irreversible; cannot be unlearn,
3. *Integrative*; bring together different elements,
4. *Bounded* or *Located*; delineate a particular conceptual space.

Savin-Baden identifies four Transdisciplinary Threshold Concepts, which are required for an enhanced student engagement in a PBL context:

1. *Liminality*; crossing into a new way of being,
2. *Scaffolding*; the way students are supported in learning,
3. *Pedagogical content knowledge*; dissemination of key conceptions of the domain,
4. *Pedagogical stance*; ways of viewing oneself as learner.

Transdisciplinary threshold concepts are used in this study to consider and frame activities to enhance interdisciplinary competencies among students. The choice of concept reflects an issue visible through students' engagement. The enrolled students who graduated from the Techno-Anthropology Bachelor's program did according to the semester evaluations in 2014 and 2015 not appear to conceptualize the content of the Masters' program in line with a TTC understanding; instead, they appear to see the program as a continuation of their Bachelor's experience, not as something new and challenging. On the other hand, the students who did not graduated from the Techno-Anthropology Bachelor's program were challenged by the new study content, as the general theoretical and methodological framework is something they were not familiar with. The students in this group saw a threshold, which some of them did not manage to overcome. The potential for learning, thus, suffers in both groups.

1.2 ANALYSIS OF THE STUDENT REPORTS FROM 7TH SEMESTER TANT MSC

A total of 26 project reports from 7th semester on the Master's program of Techno-Anthropology from 2014 and 2016 in both Aalborg and Copenhagen campuses were analyzed and compared (See appendix 2.2. Student report analysis). This analysis gave an overview of how inter-/ transdisciplinary qualifications have already established themselves on the Master's program and how targeted development initiatives can help to support this practice.

Project groups:

The project groups were in general mixed and populated with students with different backgrounds.

Theories and problems:

In all of the reports one or more of the six central Techno-Anthropological theories (theories addressed in the TANT Bachelor program and/or in the so-called signature course "Techno-Anthropological Problems and Theories") were applied to problems often taken from areas related to the backgrounds of the students with a non-Techno-Anthropological background. This indicates that theories taught at the study are preferred above the theories that non-TANT students are familiar with.

Theories from other disciplines were rarely by the project groups considered relevant to include in project reports. We find this is remarkable at an interdisciplinary MSc program, as the two types of theories do not exclude each other.

Methods and other case-studies:

The applied methods were those taught at the Bachelor program of Techno- Anthropology: Interviews, observations, workshops and literature reviews. Interviews are the dominating method in these papers. Even though the workshops seem very reflective, they were not based on any literature on the matter, which is interesting as we then do not know if the facilitation is based on personal experience, identified literature or the courses at the semester. The reports did not draw parallels to other case studies.

Problem statements:

At the Aalborg campus most of the problem statements were two-part, one being an explorative question of what or how something is, and the latter part being about in what way this knowledge can be mobilized to create a solution: "Why do people miss their appointments at the AUH and can we, with this knowledge, contribute to a solution to the problem?"

The problem statements of the Copenhagen campus reports contain "how" questions that aims at portraying existing and imagined relationships between group(s) and technology: "How do different institutions conceptualize drones, and how do they imagine the potential for drone technology?"

1.2.1 SUMMARY

The overall conclusion is that core TANT theories and methods were applied in project reports. Problem formulation were often taken from non-TANT BSc background field. This hints an asymmetry between TANT and non-TANT students that could have been removed if the TANT core theories and methods were complemented by theories and methods from other disciplines, and hence, could have served as a TTC for the enrolled TANT bachelors. Few analogies to other – similar or different -- cases were made. One interpretation

of this is that the project reports did not demonstrate an overview of existing Techno-Anthropological case-studies. Establishing such an overview could have constituted a TTC shared by all enrolled students.

1.3 EVALUATION AND IDEA DEVELOPMENT WORKSHOPS WITH FACULTY AND STUDENTS

The workshops with students and faculty member (coordinators, teachers and supervisors) were focused on defining current challenges and positive activities, then generating new ideas and lastly rating the most important ones. The activities of the workshops were:

- Discussion of what interdisciplinarity is
- Evaluation of current activities: positive ideas (green) and challenges (orange)
- Generate new ideas (purple)
- Rate ideas (mark for most important)

In the following the key results from the workshops will be presented. First the two workshops done with faculty from Aalborg and Copenhagen and second the workshop done with students in Copenhagen.

1.3.1 WORKSHOP WITH TANT MSC STUDENTS FROM COPENHAGEN

Below are the best rated ideas generated at the student's workshop in Copenhagen. The students focused mostly on challenges when rating the ideas generated in the workshops:

- Focus on challenges of the study program. In contrast to the teachers, they emphasized the social elements of developing the study program.
- Cutting edge technology has to go. Cases were too simple and we could have read the same on wiki. Take courses elsewhere. Possibilities to specialize by taking classes on other uni's instead.
- It was a problem that teachers constantly enforced a difference between TANTs and non-TANTs
- Some courses on 7th and 8th semester was too repetitious for TANTs
- More focus on facilitating social events through the tutor-corp. This has to be funded and prioritized.
- Field trips to blend better (social and in class). Trips to places that are interested in employing TANTs. Make case competitions
- Techno-Anthropological Friday bar
- Tek-Ant Bachelors could be used actively in the course. As it was a lot of repetition for them, they became very passive. They could present their bachelor where the theories are used in practice - Both good for new and activate "old".
- Introduction of theories to non-tan before the start of the studies. In order to have higher quality of teaching from study start.
- Electives have been really good! - Better access to subjects on other lines
- We must learn to write articles
- There was no mix across groups <-> Missing social events at the start of the masters.
- Danger of a heterogeneous supervisor group - competence problems

The students felt that the workshop was a good way of evaluating the study program. There were discussions across semesters both about defining themselves as techno-anthropologists, how to integrate students from different backgrounds and how to make a better student environment. This format of evaluation and generating ideas for the development of a study program can potentially both provide a forum for students to assess the study across semesters and develop a shared understanding and sharing of knowledge.

1.3.2 WORKSHOP WITH TANT BSC STUDENTS FROM AALBORG

It was decided not to initiate didactical initiatives at the MSc program offered in Aalborg campus of the reason that very few bachelors with a TANT bachelor degree enrolled in the TANT MSc program. Instead a workshop was conducted with BSc students of Techno-Anthropology that could enroll into the MSc program in TANT in 2018. The workshop aimed at explaining why the TANT bachelor students did not find the MSc program in TANT attractive, and secondly to ask the students to give inputs as to what could be changed so that the program would gain popularity among TANT bachelors. It remains to be seen whether this will increase the numbers of enrolled bachelors with a background in Techno-Anthropology.

The workshop showed that the TANT bachelors perceived the MSc program as lacking electives, low degree of progression, too little use of external censors. Further the students feared that they had to "tutor" the non-TANT-bachelors. They also felt that the programs' professional profile was unclear, and should be clarified by a stronger integration with researchers and potential employers.

1.3.3 WORKSHOP WITH FACULTY IN COPENHAGEN AND AALBORG

The best rated ideas generated at the workshops in Copenhagen and Aalborg are presented here. Some are things that are already done, others are new ideas, which will be elaborated on in sections 1.4. and 1.5. The best rated ideas follow:

Building a Professional Techno-Anthropological profile for employability:

- More presentation with people who work – Idea of future profile.
- Organize an event with companies where TAN can potentially be employed.
- Connection with profession - identity
- Understand the carrier path

Ideas for development of the study program:

- How is the academic code broken, what is a good solid project?
- SDC (SUS) conversations (student development talks) to develop understanding of competence and what profile the student would like to pursue.
- Examples of good / exemplary projects from the MSc.
- Focus on employability e.g. collaboration with companies and internship.
- Courses where all the students are new to the methods and theories (e.g. digital methods).
- Making mixed groups
- Emphasize the PBL method of Problem analysis prior to PF
- Teachers need to know what has been taught in other courses.
- Less bureaucracy
- Address the challenges in writing academic and in English
- The students need to be introduced to humility in relation to their TAN competencies and identity.
- The non-tan students need to have developed a vocabulary before they start on the masters.

Ideas in relation to the technology domains:

- Better interaction with the development and use of specific technology
- The students need to develop their knowledge about technology practices
- Need to develop a language to understand the research-'world'.

- The students should develop a sense of the value of different domains knowledge. Respect for professionalism.
- Clearer mono-professional course
- Need to consider how the technology domain becomes more than a field of study?

Ideas about interdisciplinarity:

- Interdisciplinarity - More teaching and texts (PBL / STS course)
- Prejudice about both Anthropology and Natural Sciences
- Teachers do not frame interdisciplinarity - Missing resources and Didactic focus. Teacher / supervisor need to acknowledge the need for interdisciplinary work.
- Interdisciplinary groups: challenge / opportunity -> different backgrounds = the basis for initiating an interdisciplinary understanding and discourse
- To work with their DNA. They must understand that their strength is to access things that way
- Messy science = cross-disciplinary research
- There is a need for continuous discussion between research groups
- Interdisciplinary semesters / projects
- There is a challenge regarding specialization vs interdisciplinarity
- Interdisciplinary communication is challenging. Respect for professionalism, but as teachers we must have better mutual understanding
- The students work to define themselves as "TAN"

The ideas generated at the workshop were diverse and sometimes contradicting. Both workshops did, however, generate many relevant discussions between the teachers. Along with the ideas this discussion can be seen as a main outcome of the activity. When dealing with a study that works across many different faculties – facilitating a discussion does not provide a shared understanding, but a shared vocabulary and understanding of the contrasts inherent in the study program. This is a needed basis for development of any interdisciplinary or cross-disciplinary study program.

1.3.4 SUMMARY

Doing workshops on evaluation can be an alternative to more traditional forms of evaluation meetings where students and faculty can discuss the challenges and opportunities for development of a study program. This project found these workshops extremely fruitful in the sense that they 1) identified possible solutions to identified problems, and 2) engaged both students and faculty members.

1.4 CATALOGUE: IDEAS AND CHALLENGES ON HOW TO IMPROVE INTERDISCIPLINARY SKILLS IN THE MSC PROGRAM

The three workshops produced a list of 226 ideas. The general goal of the workshops had been "*to support and develop the Techno-Anthropological study in relation to cross-disciplinary competencies*." This was translated into a direct question to the workshop participants: "*How do we as teachers and students develop and support the crossdisciplinary competencies in the Techno-Anthropological study?*" Answering this question was part of a two-step analysis, which was performed on the 226 ideas.

The first step of the analysis thematically divided the list of ideas into five groups, which are generally applicable to all ideas. The first three groups displayed a higher diversity in thematic nuance in their content, which demanded they be further broken down into sub-categories. Thus, the full breakdown of the ideas is as follows:

1. CURRICULUM:
    a) Planning of study courses and activities,
    b) What to include (texts, theories, methodologies, etc.),
    c) Bureaucracy,
    d) Miscellaneous
2. TECHNOLOGY:
    a) Weak focus on technology,
    b) Practice focus on technology,
    c) Socio-technical approach
3. INTERDISCIPLINARITY:
    a) Theoretical foundation of interdisciplinarity,
    b) Identification of interdisciplinary research questions, problems and cases,
    c) Collaboration between students with different backgrounds,
    d) Collaboration between different perspectives in research and teaching.
4. PROFESSIONAL ACTIVITIES
5. MISCELLANEOUS

The second step of the analysis was performed during the Teachers' workshops in Copenhagen and Aalborg. There, participants marked ideas with a [positive idea] and [challenge] tags to indicate the type of change needed. The positive ideas are marked with light green, whereas the challenges are marked with light orange.

Both steps are present on this catalogue of ideas – Appendix 2.3. Catalogue of Ideas and Challenges.

1.4.1 SUMMARY

Compiling a catalogue of ideas and challenges can serve as a structuring tool to both see the specific ideas and the broader topics that emerge from them. These structures – presented in a rudimentary form in Appendix 2.3. Catalogue of Ideas and Challenges. – indicate where teachers' and students' opinions overlap and give a sense of the perceived positive effects of the Techno-Anthropology program and some of the challenges it's facing.

1.5 IMPLEMENTATION OF SELECTED IDEAS

As part of the project, nine ideas on how to support inter- and transdisciplinary in a PBL environment have been implemented and three have been made ready for implementation. The full list follows:

Poster presentation:

Newly admitted Techno-Anthropology Master students participate in an event where they craft a poster, which showcases their Bachelor's thesis. The students then have to present the poster to their colleagues and attempt to exemplify how their existing experience can benefit from and even support the Techno-Anthropology field.

Film discussions:

Students are invited to watch TV shows and movies, which have a visible thematic relationship with the Techno-Anthropology field (i.e. BBC/Netflix's *Black Mirror*). They are encouraged to be engaged with a non-textual/non-academic medium, which is related to their studies, and demands interdisciplinary perspective(s).

Food events:

A social event meant to offer students an outlet for discussion and bonding outside the classroom, where they are encouraged to cook traditional meals or bring whatever food they prefer and share it with the class. These events grew out organically from the film discussions where students brought food unprompted and assisted in addressing previously voiced concerns of a troubled social atmosphere among the Techno-Anthropology Master students.

Academic reading seminar:

This initiative was to address the different or nonexistent ways students had been taught about academic reading prior to their signing up for the Techno-Anthropology Master's program. The seminar brought together students and offered them a unified view of what are the parts of an academic text and what are good practices in reading, deconstructing, deciphering the information, which will be helpful throughout their Master's studies.

Case analysis:

An exercise aimed at practicing the main theoretical frameworks taught to the Master students. They were presented with a specific case, which then had to be analyzed from a variety of theoretical standpoints to illustrate their strengths and weaknesses.

P0 literature search:

This effort provided the new Master students with practical tools and strategies for searching literature sources online through Aalborg University Library's portals. These skills play an important role in their future projects.

Updated language:

This implemented idea addressed a specific issue raised by previous Techno-Anthropology Master students. Namely the highlighted distinction between a predominantly Danish segment of the Master students who have graduated from the Bachelor's program in Techno-Anthropology, and a predominantly non-Danish

segment of students coming from abroad, who have graduated from different Bachelor's programs. Not using the short "TANT and non-TANT students" made for a positive social difference. Some faculty members also mentioned this as an issue.

As a consequence, a formulation in the 2018 curriculum was changed so it no longer makes a distinction between TANT and non-TANT.

Company visit:

A professionally-oriented event, which meant to introduce the Master students to a company – their product via demo (in this case iMotion's biometric software solutions), their team (Lead Product Specialists, Software Developers, Support Staff and others), and the general atmosphere of being in a business environment. Additionally, this event was meant as a way to potentially offer students opportunities for internship or a full-time job, and the company – a look at skills they would potentially need.

1.5.1 PROPOSED IDEAS AND SUMMARY

PBL for everyone:

Currently, the Problem-Based Learning approach is a mandatory class for all new non-Aalborg University Master students, which contributes to a division inside the classes. This proposed idea will bring all students together by offering Aalborg University students practical reasons to join the class and participate in the activities, namely by a more tight and explicit integration between the PBL class and their semester project, through increased cooperation amongst teachers and semester coordinators.

Theoretical refocus:

A proposed restructuring of the current theoretical framework, presented to the Master students. This refocus would put in a different context the current six main theories (Social Construction of Technology, Actor-Network Theory, Post-phenomenology, Critical Theory of Technology, Feminist Techno Science, and Co-production). Instead of only presenting these to the students, these theories would become one part of a three-pillar structure. The other two pillars would include: 1) a focus on theories more closely related to the academic background of students with engineering degrees, health degrees, etc., and 2) a focus on exemplary cases, which showcase the practical application of theories and highlight the need for interdisciplinary academic approach.

New texts:

Keeping in line with the idea of renewed student engagement, this proposition would incentivize professors to focus on newer academic literature. This would address three main points: 1) engage in current academic debates, 2) provide recent examples to students, which they are likely to be more familiar with, thus be more interested in, and 3) address a concern by the students who have completed the Techno-Anthropology Bachelor's program, that the Master's program does not offer too many newer texts, rather it recycles some of what they have been taught throughout their BSc.

The implemented and proposed ideas appear to suggest a need for recognizing the social specifics of the Techno-Anthropology program and their importance. Additionally, they indicate a need for partial methodological refocusing of the program (i.e. offering exercises and classes that develop the students' academic English; incorporating additional theories and cases, which are reflective of a broader student base).

1.6 EVALUATION, NEXT STEP AND RECOMMENDATIONS

Focus group interviews were conducted with students to evaluate the implemented ideas. The students generally appreciated the implemented ideas. The project owners tried to involve the students in the planning of ideas. However, some students called for more teacher controlled planning of the implementation of ideas. This points to a central concern: to which extend should students be involved to the planning of teaching activities?

The students asked for additional scaffolding items. The offered scaffolding items -- socio-technical concept of technology and the PBL pixi – were not used very much in the project reports. Rather than developing new scaffolding items, the project owners suggest to develop and improve the existing scaffolding items.

Not all teachers took ownership over the ideas generated during this project, because it takes time to implement educational changes. Initiatives that can root the ideas in the core group of teachers must continue to be organized. It is proposed that the ideas generated in this project are further addressed at a yearly meeting for all faculty members, teacher's meetings at each campus every semester, semester planning meetings.

On the basis of this development project's findings it is recommended that:

1. the transdisciplinary threshold concepts are used to theoretically frame the interdisciplinary PBL activities at the MSc program of Techno-Anthropology and at other interdisciplinary study programs at AAU
2. workshops with students and faculty members are conducted on a regular basis to complement other evaluation tools
3. the study board responsible for the Techno-Anthropology Master's program discusses – and in conjunction with the involved semester coordinators, module coordinators and supervisors – decides which of implemented and suggested ideas it want to continue and/or revise
4. a follow up analysis of project reports are conducted in 2019 to see if the project reports have developed.

1.7 COMMUNICATION

The nature of the current project necessitates open discussion and debates with all parties involved. A number of events testifies to the efforts put in facilitating this open process.

- *03 May 2017 - Day of Teaching*. Discussion with teachers
- *10 May 2017 – Presentation at research conference: Intercultural challenges in PBL education.* Presentation of preliminary findings.
- *19 July 2017 – Presentation at international workshop on Education and Philosophy of Engineering*. Overview of the project given to Chinese scholars.
- *08 June 2017 - Workshop with teachers in the Aalborg campus*.
- *09 June 2017 - Workshop with teachers in the Copenhagen campus*.
- *01 November 2017 - Meeting with semester coordinators in the Copenhagen campus*.
- *03 November 2017 - Meeting and workshop with semester coordinators in the Copenhagen campus*.
- *14 November 2017 – Meeting with students in the Aalborg campus*
- *27 November 2017 – Meeting with students in the Copenhagen campus*.
- *08 January 2018 – Presentation at research conference: Interdisciplinary educational collaborative initiatives in Techno-Anthropology*. Presentation of preliminary findings.
- *17 April 2018 – Presentation at research conference: Beyond complex*. Presentation of project outcomes.
- Upcoming: *2 and 3 May 2018 - Poster presentation of the project at Day of Teaching*.
- Upcoming: *Discussion at an up-coming TBI study board meeting in June 2018.*

Additionally, other communication efforts worth mentioning are 1) the current report, 2) the poster that it elaborates on, 3) the PowerPoint slides from the events mentioned above, and 4) draft to a book that will be published by an academic publishing house.

1.8 ACKNOWLEDGEMENT

This PBL development project was funded by the Strategical Educational Council at Aalborg University (Det Strategiske Uddannelsesråd ved Aalborg Universitet). The support is acknowledged with gratitude.

2 APPENDICES

2.1 LITERATURE REVIEW – 10 SELECTED PAPERS

Author	Description	Title
Edler, 2015	A truncated approach to PBL presented via a case development process in an undergraduate research methods class. Edler presents the method's implementation reflectively and collecting students' feedback from the experience.	Using a Brief Form of Problem-Based Learning in a Research Methods Class: Perspectives of Instructor and Students
Kolmos & Graaff, 2003	A comparative presentation of PBL characteristics from the McMaster-Maastricht and Aalborg PBL models. An important cautionary point for both models, perhaps PBL as a whole, is a PBL "inherent risk" of the lack of sufficiently broad subject overview. This necessitates a constantly improving ability of knowledge, theory and methods transfer from both students and practitioners' backgrounds.	Characteristics of Problem-Based Learning
Franks, Dale, Hindmarsh, Fellows, Buckridge & Cybinski, 2007	Examination of three decades of interdisciplinary teaching and learning at an Australian university, with a focus on the 1) foundations of interdisciplinarity at the university, and within a broader global innovations context, 2) relevant literature and terminology, 3) Griffith University's implementation model, and 4) likely outcomes of currently implemented methods, designed to improve interdisciplinary practice. Key insight in the paper is the intentional integration of teaching and research, the learning outcomes of which informs final year and postgraduate studies.	Interdisciplinary foundations: reflecting on interdisciplinarity and three decades of teaching and research at Griffith University, Australia
Murray & Summerlee, 2007	Evaluation of an interdisciplinary first-year PBL program on student behavior, which generally concludes that knowledge, skills and competences gained through a PBL approach are 1) transferable to various learning environments, and that they 2) persist throughout subsequent study years.	The Impact of Problem-Based Learning in an Interdisciplinary First-Year Program on Student Learning Behavior
Stauffacher, Walter, Lang, Wiek & Scholtz, 2006	Using a transdisciplinary case study (TCS) learning framework based on socio-cultural constructvisim and PBL to address wide-ranging mistrust of society toward universities, and the necessity for a new contract between society and research. Main points of this new contract include students taking more responsibility in societal contexts, tackling complex, real-world problems, and developing an ability to communicate beyond the "ivory tower".	Learning to research environmental problems from a functional socio-cultural constructivism perspective: The transdisciplinary case study approach
Czabanowska, Moust, Meijer, Schröder-Bäck & Roebertsen, 2012	The article identifies "PBL fatigue" (i.e. not contributing to the PBL work process) and addresses it via Active Self-Directed Learning (ASDL), which offers additional attention to higher cognitive skills that young adults seem to develop at the start of their academic studies. ASDL consists of 1) a learning cycle (sensitization, exploration, integration, application) and 2) an instructional design (a behavioral approach towards enhancing student proactivity with 8 key features addressing the learning process, which has to be rich, challenging, extended, relevant, requiring responsibility, real, unknown, and collaborative).	Problem-based Learning Revisited, introduction of Active and Self-directed Learning to reduce fatigue among students
Newell & Green, 1982	Newell and Green identify four main issues (1. definitional, 2. vague liberal arts objectives, 3. lack of widely accepted interdisciplinary scholarly canons, and 4. appropriate relationship between interdisciplinary studies and the academic disciplines), which have a negative status effect on the idea of interdisciplinary studies in 1980s American higher education. The authors argue that 1) adopting other disciplines' assumptions and world views temporarily, and 2) deductive reasoning and synthetic thinking are critical factors in successful interdisciplinary teaching.	Defining and Teaching Interdisciplinary Studies

Maggi Savin-Baden, 2016	The author introduces four transdisciplinary threshold concepts – liminality, scaffolding, pedagogical content knowledge, and pedagogical stance, - which address student engagement in a PBL process. Savin-Baden makes the case that implementing these concepts will have a positive impact on everyone involved in the PBL process.	The Impact of Transdisciplinary Threshold Concepts on Student Engagement in Problem-Based Learning: A Conceptual Synthesis
Benson, 2012	Discussing two examples – remote PBL, i.e. "for online education" and traditional, i.e. "real time" PBL - of PBL implementation, with a specific focus on simulation techniques (role/game-playing in a realistic context), meant to address student engagement. The author provides two main contributions: 1) a list of recommendations, based on the local and remote PBL simulations, to academics who might be interested in applying similar techniques; and 2) making a "for and against" case for the use of PBL, contextualizing both scenarios for said academics.	The Relative Merits of PBL (Problem-Based Learning) in University Education
Hay, 2017	Using global health as a field of interest and students with focused, narrow disciplinary expertise, the author addresses learning environment issues related to transdisciplinarity in a complex working conditions that demand holistic approaches from collaborative teams. Hay proposes a single instructor, problem-based transdisciplinary course where expertise from one domain are translated and communicated within diverse teams, promoting student collaboration and transdisciplinary thinking.	Can Undergraduates Be Transdisciplinary? Promoting Transdisciplinary Engagement Through Global Health Problem-Based Learning

2.2 SUMMARY OF STUDENT REPORT ANALYSIS

This section contains an overview of the theories expressively used at Copenhagen campus.

The graph below illustrates the different theories used and the number of groups that used them.

- The dark blue color are the theories that were taught in the course "Techno-anthropological problems and theories".
- The light blue are the theories that were taught at the Techno-anthropology bachelor.
- Green is representing theories from the health care area.
- Dark red is technology or innovation related theories.
- The yellow are social theories.

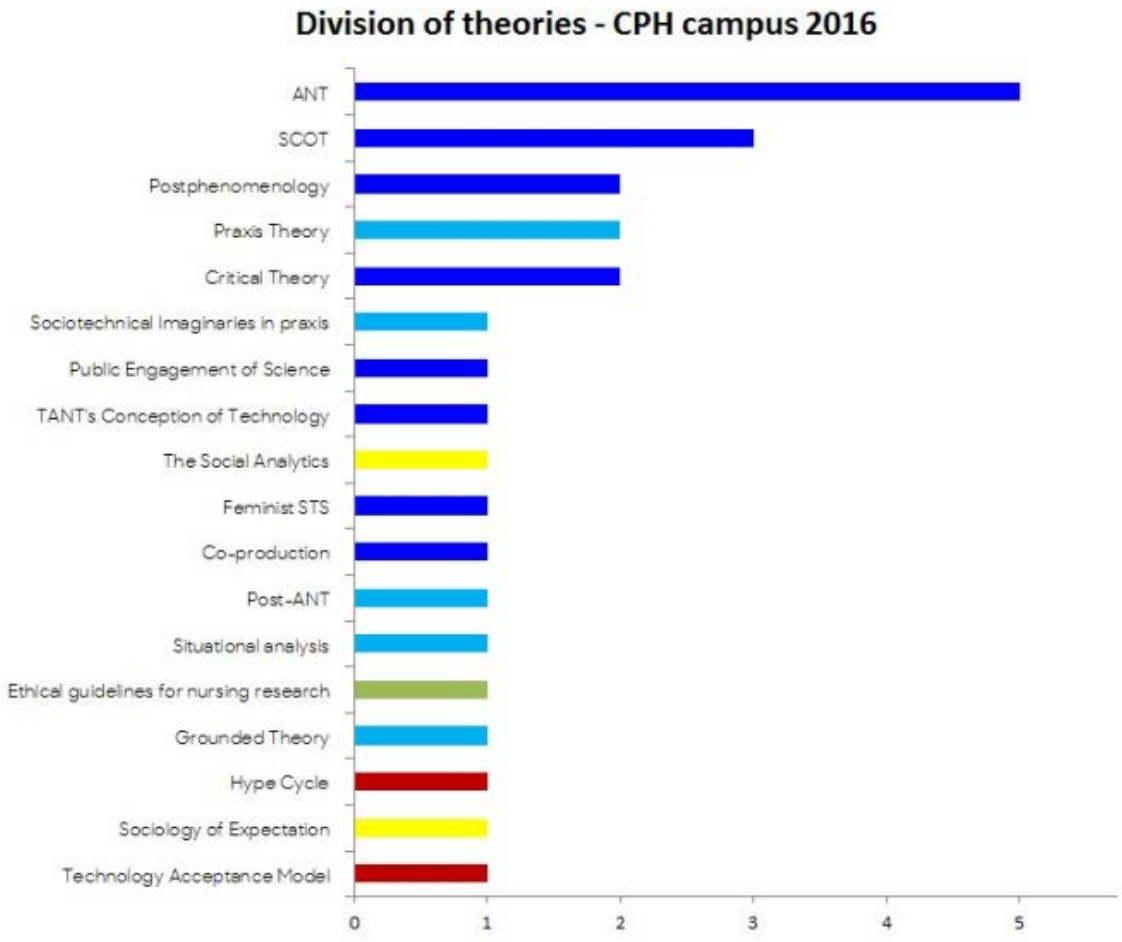

Figure 1: Theories used in the semester project of TANT Master Students in the Copenhagen campus, 2016.

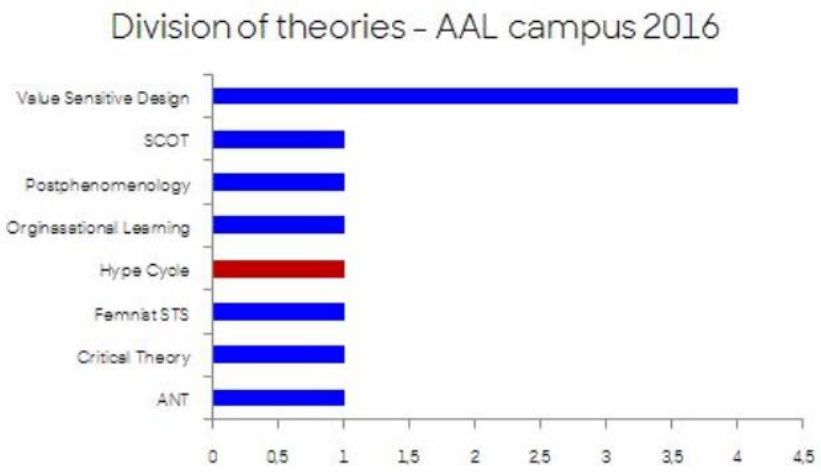

Figure 2: Theories used in the semester project of TANT Master Students in the Aalborg campus, 2016.

The categories in the 'Division of methods' graph consist of the following:

- Interviews represents all types of interviews.
- Ethnographic represents observation of different kinds, as well as situational analysis and thick descriptions.
- Literature represents literature search and reviews.
- Other contains those methods that does not fit into the other categories, in the case of Copenhagen campus it is digital methods and sampling.

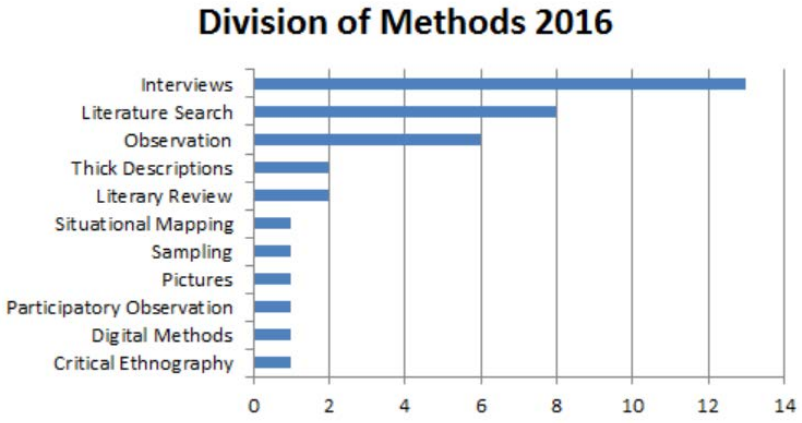

Figure 3: Methods used in the semester project of TANT Master Students in the Copenhagen campus, 2016.

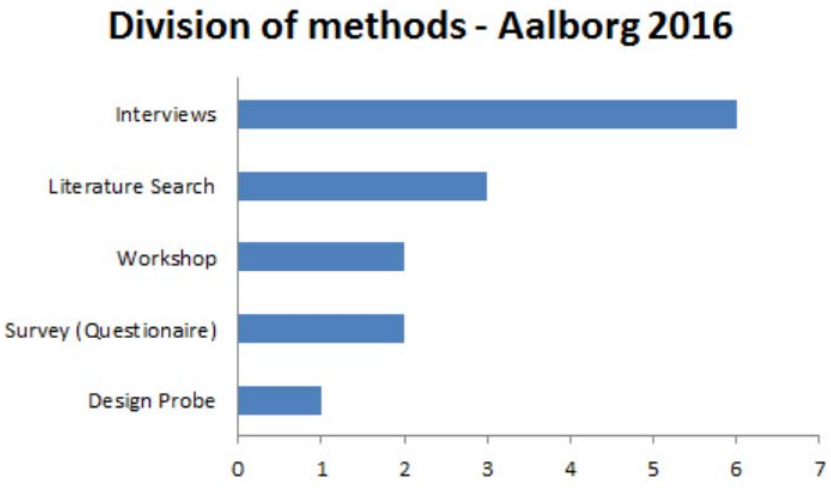

Figure 4: Methods used in the semester project of TANT Master Students in the Aalborg campus, 2016

Curriculum				Technology			Interdisciplinarity					
Planning of study courses and activities	What to include (texts, theories, methodologies, etc.)	Bureaucracy	Miscellaneous	Weak focus on technology	Practice focus on technology	Socio-technical approach	Theoretical foundation of interdisciplinarity	Identification of interdisciplinary research questions, problems and cases	Collaboration between students with different backgrounds	Collaboration between different perspectives in research and teaching	Professional	Miscellaneous
More presentations by people working with techno-anthropology skills, to statuate an example of the usage of skills - Role models	Peer/tutoring	Debureaucratisation	The Tek-ant education is not like other university programs. It is not box thinking	Not enough knowledge about technology-practices, because the students aren't from one department (food studies, urban planning)	All teachers etc. are too focused on interdisciplinarity - -- lack of foundational in-depth technical and/or social knowledge	The basic socio-technological understanding is strong	The combination of field knowledge with STS theory in specific projects	Problem-based instead of interdisciplinary	It is tempting to give TANT the responsibility to continue the "usual"	Teachers/Counsellors acknowledge the need for interdisciplinarity work -> Curious	Illustrate the possible career path	Student prepare according to a form (Kaid) study the ba/ma form before the meeting
First project on the 7. Semester	Double supervision (socio-tech)	Bureaucracy	Humility/respect for the disciplines	Design workshops - Specific and tangible technologies	Clearer mono-technical progress	Socio-technical perspetive	TAN - it is not a discipline or do we need affiliation to specific domains?	Problem formulation and project is able to bind a cross-disciplinary framework	"Interdisciplinary groups: challenge/opportunity -> different backgrounds = the basis for initiating an interdisciplinary understanding and discourse	Prejudices about Anthropology and science. Work method -> they are curious about other disciplines	What profile would you like to pursue?	User perspective
Difficulties in group dynamics due to unproductive expectations (internal)	Literature and state of the art often ignored in project scoping	SUS-partners can't be the examiner	The confidence with Techno-anthropology/science increased through tuition in these fields	No forced direct interaction with development and usage of specific technology	How do we internalize the technical in the perspective of theory and method?	Socio-technical technology understanding	STS is important but not unique	Integrate interdisciplinarity in teaching to stimulate student interdisciplinarity. Eg. -> interdisciplinary student case as part of lectures	Three groups of students on the MSc. 1) Tek-Ant BSc, 2) Other universities, 3) Bachelors of Science. Interdisciplinary thinking is based in the problem	Respect for other disciplines as teachers and mutual understanding	Clearer career path	Better opportunity to get interdisciplinary subjects - please listen to courses
English writing course offered by AAU	Focus on Academic practise when counseling source-criticism + the serach for literature, Peer-review		To work with their DNA. They have to understand that the strength in the education lies within the way they approach challenges	Students well-skilled to interact directly in innovation processes in design + technology implementation	Lack of knowledge in the domain to recognize and solve the challenges	Focus on socio-technical matters	"""Messy science = cross-disciplinary research	A presentation with good/exemplary project by MSc. students	Non-TAN BA's uptake of core TANT sensitivities in project within their home area	FINAL: video clip 5 min. Possibilities -> clear structure. Intergroup exchangees -> findings of projects (from different technical domains + signature pedagogies)	Where do you go	A more superficial understanding and core competences
Difficulties with writing	Some BSc student from other universities, isn't academically prepared for the master		Develop confidence to contribute our insights	How can technology become something more than a subject field?	DNA in technical/professional domain -> Understanding the disciplines		ANT as an approach that requires some knowledge about socio-technological interdisciplinarity	The research question has to be interdisciplinary	What are the TAN-BSc. Educational profile compared to profession bachelors?	The ability to gain a different perspective - Helicopter view	Professional knowledge is fundamental	Experiment and constructive - workshop as workshop
Networking skills with practice (customer board)	Reflexive use of theory of methods for user involvement aided to qualify researcher user- XXX		Putting yourself into the role of the learner	Practice-sight on technologies	Knowledge about the correct technical terms for a starter				The students are not aware of the complexity in choosing another interdisciplinary MSc.	The challenge in interdisciplinary communication	Ability to communicate interdisciplinary, with respect for other professionalisms	Becoming interested in "otherness"
Outsiders to part of PBL project	Teachers doesn't articulate the challenges - lack of ressources and didactic focus		Techno-anthropology BSc feels the need to/busy with portraying themselves as special in the beginning	The ambition to contribute to the technological development					People that know the techno-anthropology background are positive and curious about new perspectives eg. Social	Interdisciplinary skills aren't talked about activey -> aren't used	Lack of confidence and reduced effort due to bad "edu. Background" & motivation to digital methods. Connection between profession - identity	1) good students, 2) projects, 3) Teknoant
Difficulties in making use of non-tant knowledge	Stud. problems in parting from collaborators interest to form professionaly equivalent groups		Experiencing new students quickly adapt the new terminology with the other students						Combination of TAN bc, profession Bc and AAU bc	Great teacher teamwork regarding new courses	Various professional traditions that are not explicitly reflected	Better intercultural skills
Without the social-personal silence	How to understand the academic challenges, and how do you craft a solid academic project		Continue work on TAN 7, TAN 8						Strong condensing/translating of technology + user-perspectives among students in interdisciplinary groups	How does interdisciplinary occur VS. mono can be airgint too	The professional identity has to be clarified with external censors before examination	Who's good at what? -> share tasks according to interest
XXX access to knowledge through crafts	Connection to sociological problems		"Multiverse" creates very strong stakeholder analysis in projects						PBL - and after. Introduce the professional background and experience	The language to understand different "worlds"	Additional presentations fromk people working, to statue an example of what they do - role models	More thorough understanding of a given problem
Integrate between course and project	PBL skills for students		"Lack of confidence and reduced effort due to bad "edu. Background" & motivation to digital							The BSc. students are working with defining us as "TAN"	Create professional initiatives among student	

Figure 5: Extract of the 226 total ideas from three workshops – two with teachers from Aalborg and Copenhagen campuses, one with students from the Copenhagen campus. The catalogue is divided thematically and sub-thematically, and marked with positive ideas (green) and challenges (orange).