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E-LEARNING AS MEANS TO FACILITATE SUCCESSFUL TRANSITION FROM AN ENGINEERING BACHELOR TO A TECHNICAL MASTER'S PROGRAM WITH ANTHROPOLOGICAL AND ETHICAL CONTENT

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ABSTRACT

The transition between BSc and MSc study programs can be challenging – especially if a student changes from one discipline to another, for example, when an engineering bachelor changes to the master's program in Techno-Anthropology (T-A) at Aalborg University, which is a technical master's program with anthropological and ethical content. To facilitate such transitions, Aalborg University allocated funding to develop and offer the e-course "Introduction to Techno-Anthropology". The e-course is a set of seven modules introducing the central concepts and methods of T-A to applicants without a bachelor degree in T-A. This paper sketches the design and provides a technology assessment of this e-course to determine how it could be improved and applied to ease the transition between different study-programmes that face similar challenges.

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1 INTRODUCTION

As a regular practice at Aalborg University, every course and semester have a feedback session where students and course coordinators reflect on the quality, content and other issues like the study environment. From 2014 until 2019, there was a repeated perception of repetition among the Techno-Anthropology (T-A) bachelor students who continued at the master's program regarding the content of the first semester. On the other hand, from the side of students who came from the outside with another study-program, university and/or country, the perception of concepts, topics and expressions, taken for granted by the T-A bachelors, generated overwhelm, frustration and sometimes desertion from the program. The confusion usually peaked when the program's problem-based learning assignments nudged the students to collaborate in group work. The new PBL context, in addition to time restrictions, interdisciplinarity and heterogenic participant's expectations, generated disappointment and uneasiness in students with both a background and a non-background in T-A. These conflictive situations overloaded the program coordinators, supervisors, career counsellors and sometimes staff from the international office and the program's study secretariat; not to mention the foggy environment among students.

1.1 Method

As researchers and teachers at T-A we often recommend students to apply Action Research (AR) as a methodology to address technological challenges. Thus, we decided to take some of our own medicine and apply AR to deal with the problem at hand. An obligation in higher education is to enhance the quality of the teaching and continuously improve the students' experiences e.g. in their on-boarding process when enrolling in a new master's program. Having recognised the challenge described above, the different involved parties, the clear need for change, and the shared vision for a collective solution let us to recognise that the preconditions were present to do a participatory action research project. The main purpose of this methodology revolves around an action group that recognizes that there is need for a change. The central element for AR projects is that transformative processes are designed collectively as a democratic practice, aiming at the community's empowerment through shared knowledge production. [1,2,5,7]

1.2 The collective purpose

In September 2019, a collective planning session took place aiming to define the research objective and a shared vision to promote change and empowerment. The action group was made up of two researchers at the Techno-Anthropology and Participation research group (TAPAR), the head of the Study Board for Techno-Anthropology and Sustainable Design, an e-learning consultant at Aalborg University and a former T-A master's student. One of the researchers and the e-learning consultant are no longer working at the university. They decided to leave the university when the project was in its final production phase. Their decision to leave did not

jeopardize the successful implementation of the project, as their final working tasks were taken over by other members of the action group.

The action group decided to address the challenge of conflicting experiences of the master's program in T-A through the setting up of an e-course with the purpose of leveraging the incoming external students' techno-anthropological knowledge. During the process of collective knowledge production, and after multiple co-creation instances, we managed to engage a selected group of teachers from the departments of Planning and Culture & Learning, aiming to contribute to the content design and production of the e-course. The teachers were selected based on their seniority and involvement in the study program of T-A in terms of course responsibility. More than half of the staff teaching at T-A participated in the formation of this e-course. In addition to the possible solution to the challenge detected, this project created an instance of collaboration between university teachers located at different campuses in Aalborg and Copenhagen, who otherwise would not discuss nor share their teaching.

2 THE CO-CREATED SOLUTION

Both the action group and the participating teachers recognized e-learning as a promising pedagogical technology that has gained more attention in the latest times [6]. Therefore, the main outcome of the co-creative sessions, was to develop an introductory digital course to prepare non-T-A applicants for the T-A master's program and level out the differences between them and the T-A bachelors (**empowerment**).

An intended effect was to create a showcase and a motor for developing film bits to be used in both the e-course and during the bachelor's program, as part of the Aalborg University's flipped approach (**change**). The flipped approach gives access to topic-related material to students in preparation for deeper discussions and reflections in class. The teacher can then perform basically as conductor and facilitator of interaction in class. In this modality, teachers use more efficiently their teaching time to enhance the student's learning experience [8].

Finally, the conceptualization and development process for the e-course enabled co-constructive sessions aiming to build coherence and consistency in the master's program between the Aalborg and Copenhagen branches (**interessement and collaboration**).

2.1 Exploring digital learning experiences

As part of the context exploration the action group was interested in understanding how scientific knowledge is disseminated, research results are shared, socio-technical content is taught, and technological innovations are communicated for a non-expert audience. That led us to explore references and cases of use of video-lectures, electronic courses (e-courses) and electronic learning platforms in topics closely related to our studies. The exploratory work allowed us to identify good and problematic elements, having consideration on two different points of view, the teachers and the students.

In Annex 1 one can find a table that shows detailed the key features that we mapped and assessed from a selection of digital training experiences. The items were identified through a internet search followed by manual assessment of the relevance of the identified resources. Overall, we find three central elements in the configuration and disposition of educational content: the technical platform, the availability of additional resources, and the layout.

In regards to the technical platforms, there are all kinds of varieties of technological solutions; one can find in-house options with highly personalised training methodologies, including features that enhance the experience of the students, i.e the possibility to see independently the powerpoint presentation that the teacher is presenting in the video-lecture. A second option includes the private and standardized solutions such as Coursera, Future Learning, etc. These providers have an exigent list of requirements, content curation to guarantee a minimum of quality for their customers. The features of the courses are standardized, and the user can enable or disable different options depending of the level of usability desired. In the third option, we include the video platforms like Vimeo, YouTube, The Royal Institution, TED talks among others, that are channels for public dissemination of knowledge, and where the quality of the audio-visual explanation and its content relies mainly in the author.

The structure and additional resources have a relation to the way authors organize the course content. There are clear narratives in the themes included in the courses that give coherence and direction to the students' learning processes. In addition to the pedagogical approaches, there are several combinations of media and other resources as images, gags, games and assessments embedded in the main lectures. These elements not only are supplements to the learning experience but also help the students to focus their attention in the lectures and are incentives to complete the course.

Finally, the layout. It includes all kinds of combinations supported by aesthetics that aims to create not only the atmosphere for learning but to engage, attract and reflect the formality, seriousness and dedication from the authors presenting the content with quality. Some of the features include, professional audio and video filming and editing, a structured and coherent use of shapes, colours, figures and effects, and the use of various ways to present ideas for instance, the alternation between videos, slides presentations and the use of the blackboard. All these elements print a special dynamics to the courses.

The caring combination of most of the elements highlighted above needs to be analysed from extant possibilities when developing an electronic course. The action group recognized and identified the boundaries connected to their current technical capabilities, the lecturers' skills, the time restrictions, the equipment limits, locations and budget. All these items had to be aligned in the course to capture and engage the desired audience - students facing a transition from a bachelor program in engineering and natural sciences to an interdisciplinary technical program with anthropological and ethical content [4,5,6] – which was quite a challenge.

2.2 Project design (approach structure):

The design of the e-course consisted of choosing the central theoretical concepts, methods and illustrative examples from the T-A bachelor program, and of deciding on features of usability from other courses explored.

The design, implementation and execution of an e-course initiative requires good practices on project management to accomplish the action groups' expectations regarding the budget approved, time limitations and teachers availability. Therefore, the planning stage established the following project structure: Agreeing and conveying project goals to all the participants, defining the course's content, gathering available material, defining the course format and layout, making the content production plan, defining the evaluation scheme, and adjusting the teaching sequence. The sequence of the content becomes central because it assures that the students can follow the narrative of the course as a coherent and cohesive experience.

2.3 Content and Modules structure

The course was distributed into **three parts**, the e-course introduction, modules with lectures, and a PBL experience module.

2.3.1 Part I.

The introductory guideline and context driven presentation of the e-course divided into sessions. a) The welcoming and explanation of the e-course, b) a second session where the students are introduced to the concept of Techno-Anthropology. They have access to some examples of how techno-anthropologist work, discuss and assess users and experts interaction with technologies. The main areas of research for the T-A master's students is presented. Finally, students have access to some good practices on how to read academic papers and what does the PBL experience means for any student at Aalborg University.

2.3.2 Part II

Central concept modules. Organized in six modules, this part has inspiration from the content that is taught during the 6 semesters of the bachelor's program in Techno-Anthropology. In the following, we will present the aim for each module. 1) Socio-technical understandings of technology (1st year). Presents, explains and provides examples of central theoretical concepts, the epistemological understandig of the techno-anthropological repertoire of theories and models, and how we use them in our projects. 2) Ethnographic and anthropological methods to support technological design (3rd semester). The module explains ethnographic and qualitative methods that we use to interpret the interaction between humans and technologies and to make design and performance improvements. 3) Digital Methods. The third module present the digital methods as an emerging field that allow researchers to make ethnography in the digital sphere, prepare the available information before going to the field. Students are introduced to why these digital methods becomes more relevant both in techno-anthropological research and contemporary society. 4) Technological

intervention through action research and participatory research (4th and 5th semester). This part presents examples and theoretical background, pertinence and relevance of participatory design and action research approaches as the finger print that characterizes the techno-anthropological work. 5) Sustainable and responsible technological innovation (all semesters – the overall objective of the program). In this module, the students are introduced to concrete examples of contributions of techno-anthropological approaches to make responsible technological innovation. And the last module 6) is an invitation to write a motivational letter taking as inspiration the explanation that some T-A graduates and the honorary professor Peter-Paul Verbeek gives around the relevance of the Techno-Anthropology for the future of humans and technologies. This module explicitly liaises the applicant's background, competencies, and future employment interests. The motivational letter must address how combining the course participants' bachelor degree plus the MSc in T-A will help them achieve their professional and academic aspirations.

2.3.3 Part III

The PBL experience is a compilation of best practices, experiences and concepts that would facilitate the way new students understand how graduates from Aalborg University performs in their projects and future work environments. The careful selection of topics in this module give tools for organizing the work, help to formulate research questions and among other tricks help the student to situate her as a key team member that enrich interdisciplinary work experiences.

2.3.4 Modules structure:

The e-course requires from the students three to four weeks of dedication with around six to nine hours of work per week. Each module follows a standard structure, as shown in the following illustration. The module configuration includes a basic description that highlights the main objectives and the learning goals of each lecture. Each teacher prepares a selective list of key references that the students are required to read, prepare and reflect upon before watching the video lectures. The video-lectures' duration depend on each topic and in average the lessons are not longer than 7 minutes each. In between video lectures, some multiple choice and true-false quizzes were set to facilitate the progression of the students with the lectures' themes. At the end of each module there is a final quizz that assesses the attention, retention and understanding of the concepts presented in the module.

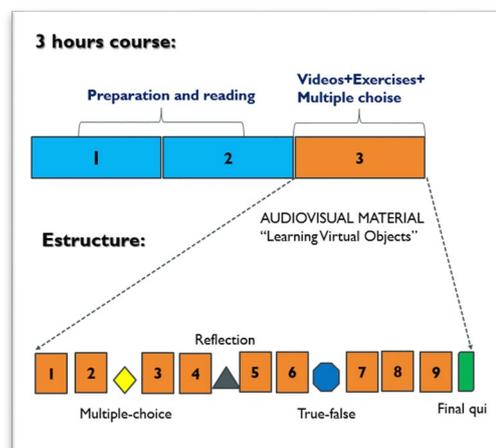


Fig 1. Configuration of each module in the e-course

The reader and other interested parties can enrol in the e-course by sending an e-mail to Introt-a@plan.aau.dk with the subject "Enrol me". Next, one will receive a link to the course and further instructions.

3 WHAT WE LEARNED

The collective knowledge production represents the essence of AR; hence we want to present some lessons learned that made the process more straightforward and significant for all parties.

3.1 Engaging teachers in the defiance of synthetizing and digitalizing their lectures.

A live-lecture involves a teacher's abilities to adapt and perform during the lecture depending of the characteristics of the audience, time limits and the specific context. The human to human interaction in class, plays an important role in the mutual feedback between students and teachers and here the experience of the teacher becomes essential to keep the students' attention. In a video film, the teacher is performing in front of a camera, there is no eye contact thus, limited feedback from the reduced audience present in a film set. After making some footage samples, video mockups and a video lecture pilot, discreet options were defined as the possibilities offered to the teachers for their digital lectures.

This was one of the most challenging tasks in the development of the e-course. The plan with teachers included classification and prioritization of the content of their lectures. All the selected material was upgraded and complimented when needed to have homogenous visual resources to include in the lectures. Some teachers felt more confident with the slides, others with some notes on paper, others supported by a script running in a teleprompter, and some more experienced with cameras act a hands-free speech lecture.

3.2 Technical and usability considerations

All the best practices for producing academic audiovisual content converge on four basic elements: quality of sound and video, natural light preferable over artificial illumination, clean cuts and edition, and dynamic elements included in the videos to call the attention of the audience. These considerations influenced the type of equipment and the editing software used. Furthermore, in the second part of the project, we incorporated a green screen to have more flexibility in the video edition and production stage. Some of the additional features embedded in the videos were various figures, graphs, gifs (micro-videos), flying words and illustrations to reinforce the messages. Considering the diversity of accents and facilitating non-native English speakers, the project included subtitles in English for all the content produced.

3.3 Minimal human support, but support

We designed and equipped the e-course with enough resources to provide the students with maximum autonomy, and knowing there were no resources to supervise students once following the course. The practice showed another reality. Very engaged students wanted to be sure that they were on the right track and nothing were

missing in their process to produce their motivational letter for applying to the master's program. Several questions reached different instances in the university with frustration. Thus, we introduced some changes and made public an email address for guidance. This simple gesture improved the perception of the rigour and professionalism at AAU and allowed the authors to have ongoing feedback from the students [3]. Some students expressed that they were not expecting a human interaction within the course and that it turns out as an incentive to consider applying to the program strongly.

4 ASSESSMENT AND PILOT

The first experience with the e-course with a real audience was in a focus group with five students from the second semester and two graduates from the master's in techno-anthropology. Additionally three students from different master's programs also shared their impressions and interest in the e-course. Some suggestions were included in the final version of the e-course.

The public pilot was launched among new students enrolled in the master's program in fall 2020. All the students, including those who graduated from the bachelor, received an invitation to follow, voluntarily, the e-course to prepare for the semester start. A total of sixty-three students enrolled both in Aalborg and Copenhagen. As was expected, only those who came from different disciplines finalized the course, twenty-three in total. The general impression of the students was very positive. In class, it was possible to identify those who completed the course because of their reflections, the use of some concepts and their confidence in group work with students with a background in techno-anthropology.

No quantitative course evaluation was made. However, we take notice of a suggestion by an anonymous reviewer to include a quantitative course evaluation in the e-course that must be answered to complete the course.

5 RESULTS

5.1 Public release and feedback

The final release of the e-course in the public platform for e-learning at Aalborg University was in late January 2021. As part of a campaign to help student applicants to know if T-A would be the right choice for them.

The e-course was published in the master's program's official web page, its facebook page, and the official profile of T-A at LinkedIn. A total of ninety persons asked for enrolment, eightyfive effectively enrolled in the platform and more than sixty followed the e-course. In the end, twenty-nine students completed the e-course and handed in a motivational letter to apply to the master's program in fall 2021. Despite some slight technical issues that were corrected immediately, the feedback from all the students did not have critical remarks. In general, the experience of those who completed the course was very positive. This was mainly reflected in the inspiring motivation letters

sent by the applicants and in several messages of gratitude that the course's tutor received from different countries around the world.

5.2 Replication of the idea

In the last year, the sibling program of T-A, the master's program in Sustainable Design Engineering, decided to replicate the idea and implement an introductory course for their new students. In the last months, colleagues from other departments asked for guidance and support to implement the same initiative in other interdisciplinary programs that face the same challenge with students coming from different backgrounds. As part of a plan for facilitating the production and development of digitalized academic content, a business-oriented spin-off inspired by this experience was founded and is called Techno-Anthropology4U [www.TA4U.dk].

In the coming months, the initiative's next level will be creating the Open Science and Responsible Innovation Teachers' Academy. This project pretends to incorporate the experiences with this e-course into a hybrid course that will help and prepare higher education teachers to communicate their research in the framework of Responsible Research and Innovation (RRI). This initiative is supported by the COST Action EuroScitizen: CA17127 - Building on scientific literacy in evolution towards scientifically responsible Europeans.

6 CONCLUSIONS

In this paper we have shown how the problem with transition of students from specialized engineering or natural scientific bachelor degrees to a technical master's program with anthropological and ethical content can be addressed through action research and e-learning. We have presented our inclusive co-creation action research process and the resulting e-course "Introduction to Techno-Anthropology".

During the process we learned that engaging university teachers is key in digitalization of higher education. You can produce e-learning solutions almost from scratch if you have engaged teachers and some institutional support. We experienced that our e-learning project was easily accepted by both students and teachers because it solved the problem that conventional teaching did not address, and did not substitute existing conventional teaching.

We could not create an e-course that was 100% automated. It requires a minimal effort of human support and feedback to overcome students' misconceptions and technical barriers. Still, the e-learning solution turned into an effective use of resources. For instance, teachers' time to assess applications to the program decreased.

The e-course made the students focus and align their expectations, which enabled better reflections and coherent group discussions once enrolled in the master's program.

Starting almost from a low level, it was possible to build up to pedagogical, didactical and technical e-learning expertise within an action group, whose competences are now in high demands in other programs.

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Annex 1

Name and host institution	Key features	Good	Problematic
Course in philosophy of Technology / University of Twente.	<ul style="list-style-type: none"> The course is allocated in a stable learning platform (Future Learning) Very well explained content supported by visual resources The course allows human-based feedback and peer interaction Professional edition and production The content follows a structure and clear script. 	<ul style="list-style-type: none"> Attractiveness Clear message Short and concrete Clear language 	<ul style="list-style-type: none"> Performance depends on the presentation skills of the teacher High demand of resources (time and money) for audiovisual production The course demands human assistance for the reflection parts
Interview with Peter Paul Verbeek: blurring boundaries between man and technology / FastFacts Sciencetube.	<ul style="list-style-type: none"> The material is a complete interview that present concepts and exemplarity cases The interview is oriented to present areas of research and intriguing findings Combines different academic, scientific and commercial contents 	<ul style="list-style-type: none"> The interview is structured and has a clear take-home message The complementary content is illustrative The time frame is short 	<ul style="list-style-type: none"> Requires video edition and production Five minutes presentation can be enough. Depending on the topic it might be too short The quality is relying on the fluency of the lecturer
Reinforcement Learning Winter 2019 Lecture 1 – Introduction / Stanford Engineering.	<ul style="list-style-type: none"> Hybrid course: Virtual content combined with presence presentations The lecture is recorded in the classroom with the support of a <i>powerpoint</i> presentation. The presentation is complemented with closed-captions 	<ul style="list-style-type: none"> The changeable screen between the lecturer and power-point presentation helps with the dynamic of the presentation. The resource of the whiteboard is very useful for improvisation during the class. 	<ul style="list-style-type: none"> The teacher gives the pace of the class; there is not enough room for interaction with students, or other dynamics. A 1-hour lecture requires lots of time for edition. After 20 minutes, despite the interesting topic the presentation turned monotonic. The presentation is flat and with no design at all. The language tends to be for a specialized audience.
Internet of the Things / Stanford Online.	<ul style="list-style-type: none"> The online platform allows the participant to see the progression and the time spend in the course. The platform has a feature to make a short tour through the basics of the platform before starting the e-course. The course has not only video-lectures but also <i>powerpoint</i> presentations, literature and other tools. The communication style is very clear and the language is very accessible for a non-expert audience. 	<ul style="list-style-type: none"> The features are very user-oriented and intuitive. The same topic is presented and supported by different speakers. Once the student open the video, the slides of the session appears in a pop up window. The personalization of the speed to reproduce the video is enabled. The course includes assignments to foster the learning process. The teachers are very fluent in their presentation. The presentations are very well-designed following coherence and standardization. 	<ul style="list-style-type: none"> The presentation tends to be very formal but maybe less attractive for young audience (standardized). The background is white with only one camera, it turns into a static and flat presentation

Name and host institution	Key features	Good	Problematic
MIT open Course: Introduction to Machine Learning / MIT	<ul style="list-style-type: none"> This is a lecture recorded in the classroom with the support of a <i>powerpoint</i> presentation. It is allowed to have students' interventions and question The presentation is complemented with closed-captions. 	<ul style="list-style-type: none"> The changeable screen between the lecturer and <i>powerpoint</i> presentation helps with the dynamic of the presentation. The resource of the whiteboard is very useful for improvisation during the class. The <i>powerpoint</i> presentation is more structured and include design features. 	<ul style="list-style-type: none"> The teacher gives the pace of the class. 50 minutes lecture requires lots of time for edition.
SCRUM- Introduction Course. / Scrumstudy.	<ul style="list-style-type: none"> The course is allocated in an in-house platform. All the content and material is available in the sharing resources platform. The evaluation takes place both during some parts of the lecture and in a special session. The course allows participants to have access to complementary material The interaction to peers is enabled in the collaborative platform. 	<ul style="list-style-type: none"> Allows discussions between peers. Allows Q&A session with the facilitator of the course (it is a live session). There is time for individual feedback at the end of the course. 	<ul style="list-style-type: none"> The time is very limited for Q&A and vary depending on number of participants. A next level of supervision is not included in the price of the basic course; the provider offers additional levels where they have more specialized guidance. It becomes evident that the course has economic prevalence (cross-selling courses are related). The limited access to additional material generates frustration and lead you to buy another level of the course. The material lacks of design and a coherent visual structure.
Artificial Intelligence, the History and Future - with Chris Bishop. / RI (the Royal Institution).	<ul style="list-style-type: none"> Lecture are recorded in an iconic theater The conference involve a high film production that includes more than three cameras and full edition The audience have access to a big screen with the presentation The presenter has evident skills to perform in from of the camera and simultaneously in front of a big audience. The production includes a selection of videos embedded in the presentation. The lecture is full of smart jokes and engaging side stories connected with previous RI presentations 	<ul style="list-style-type: none"> The lecture format is very attractive and engaging. The management and production of the images and change of camera is clean a very professional. Usually the format of the lectures include experiments and some interactions with the public. The tradition of the lectures transcends centuries, it started in 1825 with the inaugural lecture with Michael Faraday. 	<ul style="list-style-type: none"> The lecture demands many resources (filming, edition and production). The quality of the presentation rely in the expert is not in the learning platform.