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Mapping what matters – an approach to determine curriculum content of in-service teacher training

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Abstract

Denne artikel studerer paradokset i, at mere end halvdelen af lærere oplever et misforhold mellem den efteruddannelse, de får, og deres oplevede behov, selvom der er konsensus om, at det er vigtigt at tilpasse indholdet til lokal praksis. Vi hævder, at dette paradoks fortsat eksisterer på grund af mangel på metoder til at indsamle og aggregere behov udtrykt af mange lærere. Artiklen adresserer dette paradoks ved at bruge directed acyclic graphs (DAG's) til at repræsentere 17 danske læreres efterspurgte indhold til efteruddannelse i digital underviserkompetencer. Vi undersøger, hvordan DAG'en blev brugt og opfattet som redskab til kursusdesignere i udvikling af et konkret efteruddannelsestilbud. Undersøgelsen viser, at DAG'en tilvejebragte vigtige indsigter ved deres valg af indhold, der skulle inkluderes i efteruddannelsestilbudet. Begrænsninger omfattede en opfattet forpligtelse til at bruge al information i DAG'en og en følelse af ikke at have indsigt i lærernes affektive forholdemåder til indholdet i DAG'en.

English abstract

This paper studies the paradox that more than half of teachers experience a mismatch between the in-service training they are provided and their experienced needs, while there is consensus that aligning content to local practices is important. We argue that this paradox remains due to a lack of methods to collect and aggregate needs expressed by many teachers. The paper addresses this by using directed acyclic graphs (DAG) to represent 17 Danish teachers' requested content for in-service training in digital teaching practices. The paper investigates how the DAG was used and perceived by course designers when developing the course. The study finds that the DAG provided appreciated insights when choosing content to include. Limitations include a perceived obligation to use all information in the DAG and a feeling of not having insights into teachers' affective relation to the content included in the DAG.

Introduction

In-service training of teachers is generally acknowledged as a necessity, as new pedagogical approaches, digital tools and curriculum continue to emerge and evolve. New technology and digitization require that teachers build competencies beyond those they have acquired during their formal teacher education (UFM, 2019). In spite of this, the number of teachers doing formal in-service training is steadily dropping (UFM, 2020), and teachers report an experienced mismatch between what is offered and what they need (Epinion, 2016). International research on in-service training of teachers is a comprehensive field of study, which has developed new formats and better understandings of the challenges of building sustainable change. Yet, remarkably few studies focus on the difficult task of choosing subject-matter content that aligns with what is requested by teachers.

From late March 2020 and 18 months onwards, the need for digital teaching competencies has stood out as one of the most relevant content areas to offer teachers. On the one hand, teaching during the pandemic has led to an unusually extensive accumulation of teachers' experience with digital teaching, who currently are likely to have much better insights into what works and what does not, and into their level of ability to pedagogically harness and exploit digital tools and formats in educational contexts. On the other hand, there is little guidance to retrieve from research in terms of how these accumulated experiences can be collected and aggregated to inform decisions of what to include in training programs despite there being consensus that this is important (Martin and Umland, 2008; Selter, 2015). It is this paradox that this paper seeks to address. Although the current pandemic situation arguably has increased the need to act upon or resolve this dilemma, its existence is however by no means dependent on it.

Our paper reports from a project funded by the Ministry of Higher Education and Science seeking to apply an approach that collects, represents and integrates requests for digital teaching among teachers by using a visual mapping technique based on directed acyclic graphs (DAGs). The purpose of this approach is to offer in-service training providers a highly disambiguated, visual overview of what is requested by the target group to ensure that the content of the course addresses what is perceived as relevant. This DAG was used by course designers to plan an in-service training course for teachers on digital teaching, and the paper sets out to investigate the potentials and limitations of this approach using design based research (DBR). We thus aim to address the following research question:

To what extent can DAG-representations support or hinder course design when choosing content for in-service teacher training in digital teaching?

Related work

We consider the following two areas of existing research to be most relevant for this study: literature on how to choose adequate content for professional development of teachers and visuospatial approaches to capturing curriculum content.

Literature on how to choose adequate content for professional development of teachers

Although vast resources are spent on in-service training (Yoon et al., 2007), such efforts seldom succeed in changing teachers' practices (Maurer, 2010). The comprehensive body of literature on in-service training of teachers has addressed this issue from different approaches, here among how to anchor initiatives and support sustainable change. These studies have emphasized the potentials of establishing collaborations among practitioners and between practitioners and researchers (Jackson & Cobb, 2021; Jawoski, 2003; Krainer, 2014; Lewis, Perry & Murata, 2006; Pang, 2016; Stigler, 1998). Approaches such as Lesson Studies (Stigler, 1998), co-learning inquiry between researchers and teachers (Jaworski, 2003), and teachers' development of their own practices (Postholm, 2009) are examples of formats that focus on this problem. However, despite the continuously growing body of literature, little attention seems to be given to the issue of choosing adequate curriculum content (Besser & Leiss, 2014). This seems particularly important, since teachers report subject content as the most significant factor for effective professional development programs (Martin and Umland, 2008; Garet et. al, 2016).

Selter (2015) and Borko (2004) emphasize the need of choosing adequate content by respecting local ideas, and argue that the content of in-service training needs to be based on a refined understanding of teachers' existing practices. Despite our efforts in searching for literature on this matter, we have only succeded in finding few studies. In addition, these studies have not been published recently, but are typically 10 years old or more. A possible explanation for the lack of newer research on how to choose

content for in-service training is that the discourse in education has been dominated by learning objectives during the last decade or so. As noted by several researchers, this discourse is characterized by a distinct absence of content in favour of objectives or goals (e.g. Rømer, 2019). This is particularly problematic when we are dealing with subjects without well established traditions such as digital teaching. However, the existing research literature offers little concrete advice on how to gain insights into local ideas and practices, and specifically how to do this economically when the course is intended to reach many teachers from diverse schools. Achieving these goals seems to involve important challenges. How do we capture, integrate and overview understandings about the subject from many teachers with diverse backgrounds and teaching obligations?

Of particular concern is how teachers refer to desired content. In the field of education, concepts often are defined and interpreted in a multitude of ways. For example, although there is widespread consensus of the importance of digital literacy and computational thinking, these concepts have dramatically different meanings depending on the source (see e.g. Tamborg & Allsopp, 2018, 2018; Kallia et al. 2021). This is problematic since teachers can both use the same labels to refer to different content, and different labels to refer to the same content, ultimately leaving course designers with only a vague understanding of what is needed.

Visuospatial approaches to capturing curriculum content

The above concerns call for approaches that heighten precision and disambiguation, but not at the cost of overview of the subject. Detailed insights into what teachers who are to participate in in-service training find important are only valuable for course designers or in-service training to the extent that it is communicated in a manageable overview. In our view, visualizations are more likely to meet this need than conventional linear text. Two of the authors of this paper have previously reviewed 26 papers relevant to structures for mapping curriculum content (Tamborg et al., 2019). From this work, five types of visual structures for mapping curriculum content were identified: lists, tables, trees, DAGs and directed graphs. Below, we summarize the affordances of these structures for mapping learning content.

Lists are used to say what learning content should be included in a given context. One study (Sitlington & Coetzer 2015) shows experts ranking of knowledge, skills and attitudes relevant for strategic human resource management in lists. Lists can also rank or order elements, but otherwise do not show how different elements relate directly to each other. Tables consist of a number of rows and columns for differentiating content. Ullmann (1982) uses tables to show how each part of a second language curriculum belongs to one category from one group of categories (the rows), and one category from another group of categories (the columns). This relates parts of the curriculum, but only along two dimensions. Trees are a simple graph structure. They have only one edge pointing to any one node, but can have any number of edges leaving a node. Komenda et al. (2015) describes MeSH (Medical Subject Headings) — a standardized catalogue of medical subjects divided and subdivided up many times in a tree. Trees are not good at showing if one subject area is included in multiple other areas. DAGs resemble trees in that they can have any number of edges pointing from nodes, but a critical difference is that they also allow multiple edges to point to the same node. They are “acyclic” in that they do not allow edges that point higher up in the structure. Chrysostomou (2004) describes a way of organizing learning units in a DAG structure. The paper describes the relations of learning content for an interdisciplinary curriculum in a DAG structure. Directed graphs allow any edge that a tree or a DAG would allow but differ from DAGs by allowing cycles. Martínez-Zarzuelo, Roanes-Lozano & Fernández-Díaz (2016) describe a way of organizing mathematical skills in a directed graph structure. Trees, DAGs and Directed Graphs are all types of graphs and are exemplified in Figure 1.

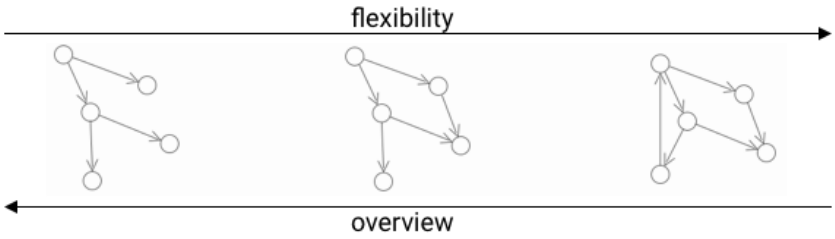

Figure 1: Three types of graph: tree, DAG, and directed graph. They are arranged in that order to show the trade-off between flexibility of graph structures and the overview they provide

Figure 1 also illustrates the main point argued in (Tamborg et al., 2019) that DAGs are more flexible than trees and directed graphs are more flexible than DAGs. This flexibility can be seen as a form of expressiveness where we are not limited to only showing relations that meet specific structural requirements. However, flexibility comes at a price. As our structures become more flexible, they also become harder to overview. Trees are easy to layout and visualize while DAGs and directed graphs quickly become crowded with crisscrossing edges, and when they reach a certain size, require special software to visualize.

This paper adds to the existing knowledge described above by investigating the use of a DAG representation to map teachers' requests for content for a course on digital teaching. It also investigates how the DAG was used and perceived by course designers when developing the course. We thereby seek to contribute by developing an approach that supports course designers in developing curriculum content that reflect the current practices of the teachers attending the course and what they find important. Below, we describe the method we applied to conduct this study.

Method

The project reported in this paper is based on design-based research (DBR). DBR is a form of research where new knowledge is generated by iteratively developing, implementing, evaluating and improving a design (Amiel & Reeves, 2008). A design can take various forms, but always address a concrete practical problem, which is identified and analyzed collaboratively between practitioners and researchers. DBR is an iterative approach where design interventions produce observations that are evaluated to inform modifications to both the design and further interventions. Each iteration does not need to provide exhaustive evidence towards a conclusion, but merely inform the next iteration. The idea is that greater leniency in each iteration is more than compensated for by assumptions being challenged continuously.

A key concept in DBR is that of a hypothetical learning trajectory (HLT) (Doorman et al., 2013). A HLT seeks to make explicit what is expected to happen when the design is brought into the hands of the practitioner in the real-world problem it aims to address. An HTL should be informed by theory and be sufficiently exhaustive so that its assumptions can be challenged by a real-world enactment of the design (Cobb & Gravemeijer, 2008). The HLT enables us to expose unforeseen interplays between intention, design and reality and thereby challenge and qualify our theoretical assumptions. After an intervention, we are thereby able to not only consider whether it led to the desired outcome or not, but also to point specifically to where our understanding of the design was supported or challenged, and what should be modified (Misfeldt, 2010; Doorman et al., 2013). In the following, we describe the real-world problem we address in this paper, and how this, alongside theory on structure and structure for mapping learning content, informed the design reported in this paper and its underlying HLT.

Real-world problem: Matching offerings of in-service training content with needs of the target group

The project reported on here was conducted at University College Northern Denmark (UCN). UCN provides education, research, development and innovation within business, social education, health and technology. One of their offerings is in-service training courses to compulsory teachers in several subjects - both formalized modules and on-demand courses of either shorter or longer duration. UCN generally works from a principle that good quality in-service training is not an off-the-shelf-product, but an offering that should be based on an understanding of and knowledge about the practitioners' needs and existing practices (Andersen et al. 2020). When new courses are developed, UCN uses different approaches to determine the course content, which can be more or less formalized and systematic. One example of a comprehensive mapping took place during an in-service initiative on inclusion developed on request from a municipality in Northern Jutland. Prior to developing this specific course, UCN wanted to gain insights into the existing practices among the schools in the project and identify potential areas for development among the pedagogical staff regarding inclusion (Andersen et al., 2020). To do so, UCN collected data via a survey, student interviews, classroom observations and workshops at all 10 schools involved in the project. This data was condensed during analysis and summarized in a report, which was sent to the management teams at the schools in the project to lay the foundation for a number of workshop meetings at the schools to agree upon content for the course. UCN describes very positive experiences when conducting such mappings to inform the decision of content for in-service training. Most importantly, it laid the foundation for reaching a shared understanding of the professional practices of the teachers participating in the course (Andersen et al., 2020). The problem in this approach is not that it fails to produce better courses — the courses appear to be well received. Neither is it necessarily a problem that the process itself is very time consuming both on the part of course designers doing the research and on the teachers that are consulted — the immersion of the course designers in the teachers' perspectives is time well spent, and letting teachers be heard is undoubtedly beneficial. Rather, the problem with this approach has to do with the related issues of traceability and transferability of the knowledge produced in this way.

By traceability, we mean the opportunities of tracking direct quotes in general recommendations. While the researchers undoubtedly develop deep insights into the needs and perspectives of the teachers, it can be difficult to reconsider what the teachers said in new ways. The researchers' focus tends to move from information comprising individual utterances to information comprising categories and on to aggregations of categories. In practice, much information is lost in the continued process of consolidation. While we may keep critical quotes at hand, the analysis is unlikely to be redone, and the wealth of observational information is likely to fade into the background. Then, when the researcher becomes the course designer, they need to work from broad categories to specific issues and examples. As memory of the actual observations fade, the course designers need to work with categories that may seem empty of details or without vitality.

By transferability, we mean the ability to use the research when one has not partaken in the research. It is not always practical to have the same people do the research and design the course, which means that the course designers are dependent on a transferal of knowledge from the researchers. This relates to traceability, but here we have the added obstacle that the information needs to be transferred between minds. While the course designers are handed over recommendations for curriculum content to include, they are likely to be more in the dark about the details that have justified those categories.

Both of these issues are of crucial importance in the particular situation that this paper explores. In this situation, UCN had decided to offer a course with the name "digital teaching". As usual, the instructors were to be the course designers, however, unlike in the practice of comprehensive mapping described above, UCN wanted to outsource the research process. This provided an opportunity for both the application of learnings from earlier research on representing competencies in DAGs and for evaluating the process of developing those DAGs and their application in course design with DBR.

HLT and initial design: Mapping digital teaching competency using DAGs

In order to address the agreed upon challenge described above, we developed a HLT informed by theoretical insights described in the related work section, which served the purpose of informing the design of the intervention. The HLT consisted of three main hypotheses:

1. Teachers' view of which aspects of digital teaching competencies that are important can be helpful information for course designers to decide what to include. This is both supported by previous research (Martin and Umland, 2008; Garet et. al, 2016) and aligns with UCN's previous experiences described above.
2. DAG representations can visualize potential curriculum objectives in a way that encourages precision and detail while maintaining overview. This hypothesis is based on results from our own previous research on structures for mapping curriculum content, especially (Tamborg et al., 2019). As this approach preserves both detail and overview, it can benefit both traceability and transferability.
3. Finally, we believed that an aggregated DAG representation of what digital teaching competencies teachers found important would support course designers in developing a course on this subject. This hypothesisis is informed by Komenda et al. (2015) who found that tree-like visual overviews can help curriculum designers navigate multidimensional and extensive data.

Below we describe the design we developed on the foundation of this HLT.

Eliciting, processing and visualizing digital teaching competencies

To elicit what digital teaching competencies the teachers' attending the course found important, we conducted two conversations with each of the 17 teachers who had signed up for participating in the course on digital teaching competencies. All conversations lasted between 15 and 25 minutes and were held online using a video conference tool. Prior to the interview, we had sent the teachers a video, in which they were encouraged to think of 3-5 digital teaching competencies they thought of as important. We began the first conversation by asking the teacher to name competencies they had thought of. To capture the competencies viewed as important by the teacher, we added them as labeled nodes in the graph drawing software we would use throughout the project. We call all nodes for competency areas (CA). The 17 teachers had volunteered for the course and were not recruited based on their specific subject specialization, level of proficiency or perceived needs.

We shared our screen in the video conference system for the teachers to see as we added content. Then for each CA we asked the teacher 1) what elements this specific competency included and 2) why this competency was important. Answers to 1) were added as children to the competency, and answers to 2) were added as parents. As children and parents were added, the questions were repeated to add grandparents and grandchildren and so on. We repeatedly asked for clarification on how an element was important for a parent or how it included a child and were often forced to add clarifying intermediary nodes. Likewise, labels were modified repeatedly until we were confident that we shared an understanding with the teacher of what the competency was. Since we shared our screen, the teacher could follow how the map of the competencies they found important evolved.

These conversations led to a single map for the first conversation with each of the 17 teachers. After the first conversation, we went through the map, corrected for typographical errors, and ensured that we understood it ourselves. If elements were ambiguous, we either adjusted these based on memory or tagged them to be revisited with the teacher in the second conversation.

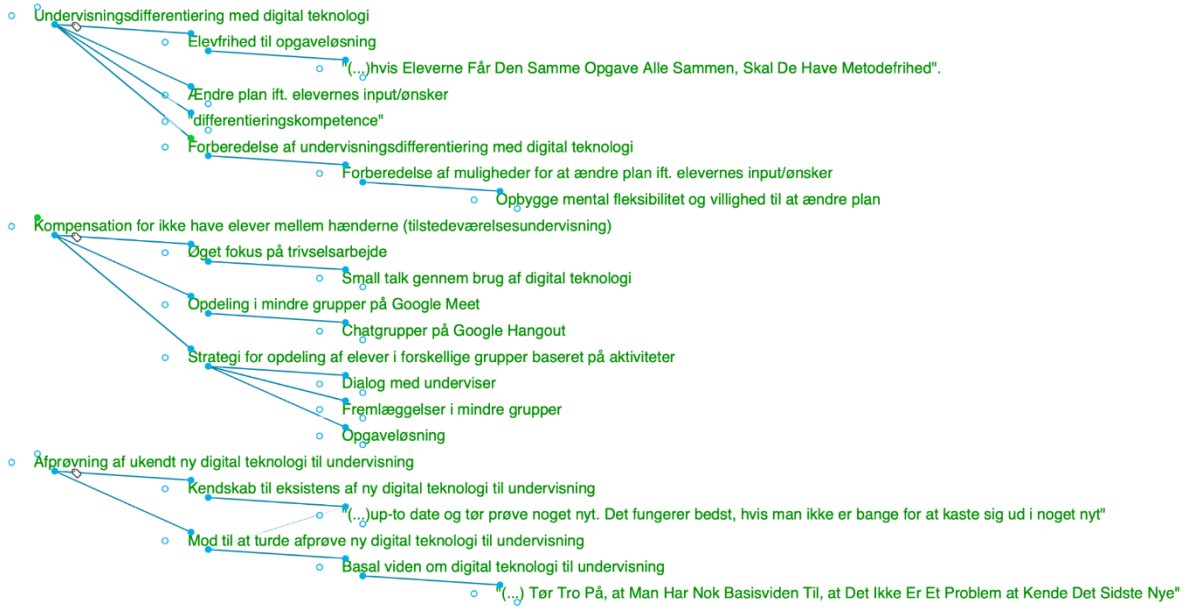

Figure 2. An example of a map created from conversations with one teacher.

At the same time, we did initial integration work (see below) on identifying aggregation CA (ACA) that could include many of the high level CA already identified through the conversations. Links were drawn from the AGA to include CA in the individual maps.

The aim of the second interview with each of the teachers was to ensure:

1. That the teacher's contributed CA still made sense to them after a few days had passed.
2. That they made sense to the teachers in the context of parent CA that had been identified during the first conversation.
3. That the disambiguation work that we had done since the first conversation made sense to the teachers and they could comment on flagged ambiguity.
4. That the addition of our ACA above the highest level CA that they had identified made sense to the teachers.

When these issues were discussed with the teachers, we achieved a high level of confidence that we had a fair representation of what competencies the teachers thought were important for digital teaching and why.

Already after the earliest interviews, we started work with identifying ACA that could act as parents to the highest-level CA identified in the conversations. These ACA were made children of the project's global CA: digital teaching and sometimes multiple levels of ACA were added before they could act as parents to the highest-level CA provided by the teachers. The graph drawing software we used allowed us to color code which areas we had added, and which areas came from an interview map. The software also allowed us to filter all but one teacher's sub DAG. This allowed us to exclusively show each teacher during the second interview their DAG in the context of our DAG of ACA.

After all first and second conversations were complete, we were still far from having a map of the subject. There were massive redundancies between the individual teachers' sub-DAGs; especially with their higher level CA. Furthermore, although we had confirmation that the individual ACA we had added did encompass CA identified during the initial conversation, it was not always clear if we were missing intermediary ACA.

Completing the conversations initiated a phase of pure integration work. This process was guided by a metric we developed for the popularity or importance of the ACA we identified. This was done by treating each CA identified in each of the conversations as a single data point with a weighting. CA without children (leaves) were given a weighting of one. The parent CA of these leaves aggregated the

ratings of all of their children. With the help of the graph-drawing tool, this was repeated for their parents and so on upwards to give every CA, and then every ACA, a weighting. Then began a recursive process extending our AGA DAG downwards. Wherever there was one of our ACA with a high weighting and many immediate children contributed by teachers, we used this as indication that the granularity of our DAG was too coarse. We needed to examine the children to see if they supported division into smaller collections. When it was possible to give names for these smaller collections, an intermediary CA was added, and the teacher CA were moved to belong to one of our new ACA that more precisely represented why it was important. This was initially done to the point where all of our ACA directly contained less than 50 teacher CA, but when this was achieved, we repeated the process again with a threshold of 35 and eventually with a threshold of 20. At this point, the part of the DAG identified by us consisted of 108 unique ACA nodes. This part of the DAG viewed separately from the teacher DAG constitutes our map of the area.

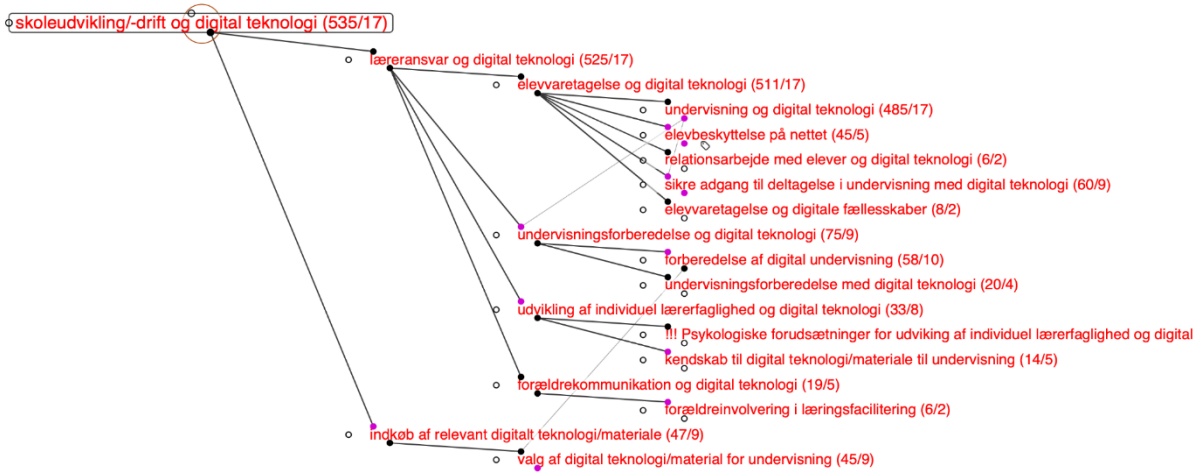

Figure 3. The first few levels of the aggregated DAG.

After we had completed our DAG, we held a two-hour workshop with the course designers to communicate the results of the mapping, namely what competencies the course attendees found important. We also communicated different ways of using the map for designing the course and showed how the course designers could explore below our ACA to the specific CA contributed by the teachers. After the workshop, we handed over the map as a PowerPoint presentation, where we enabled navigation of different areas of the map through links. From here, it was then left to the course designers to design the course.

Collecting, processing and analyzing data

In order to investigate the HLT described and our research question, we interviewed the two UCN course designers responsible for designing the course after they had completed designing the course using the map. The interview followed a semi-structured protocol (Kvale & Brinkmann, 2008) and was organized into the following main categories:

* Experiences of using the map to plan course
* Experiences of viewing and navigating competencies brought up as important by teachers participating in the course
* Suggestions from improvement

Through the semi-structured format, we sought to provide data that would allow us to answer our overall research question while not neglecting informant perspectives our pre-made interview guide had not accounted for. We conducted the interview using a video conference tool, which also recorded the interview.

Each category consisted of 3-7 open questions, which we posed for both informants to answer, supplement each other's answers and articulate their different opinions. We transcribed the interview as close to the spoken word as possible and coded it using an open coding approach (Creswell & Creswell, 2018). We initially grouped the informants' utterances as either limiting or supporting decisions on what content to include. Next, we explored whether two or more analytical categories could be merged to specify a broader analytical theme. We then carefully read the quotes to identify types of limitations and support, which led to two types of each. Below we describe and elaborate these results, their implications for the course designers' development of the course and their relation to our HLT. We do so by addressing our research question, namely to what extent DAG-representations can support or hinder course design when choosing content for in-service teacher training in digital teaching.

Analysis: support and limitations of using inclusion DAG representations to choose curriculum content

Support - direct insights into the teachers' practices

Similar to their previous experiences of mapping, the course designers thought of the approach as interesting since they believed it was valuable to learn what teachers themselves found to be important. This is illustrated in the quote below:

> Course designer 1: "When I was introduced to the project, I thought: great to have the teachers themselves directly involved and hear what they want, not only what people representing them find important. I really believe that there is a potential to heighten their motivation and I was keen on exploring that."

An aspect of our HLT was that teachers' view of which aspects of digital teaching competencies that are important can be helpful information for course designers to decide what to include. This assumption was in part already validated by UCN's previous experiences as described in Andersen et al. (2020). The design reported on here was however different from previous approaches in that it sought to maintain direct quotes from teachers while providing an overview of what the collective group of teachers found important (traceability). On several occasions during the interview, the course designers mentioned that our DAG containing both our ACA and the teachers CA had succeeded in achieving this. This is illustrated in the following quote:

> Course designer 1: "The map really made something highly complex much more tangible. We were able to see the actual quotes uttered by the teachers and explore how we can meet the expectations of the individual teacher".

Usually, UCN's research process provided highly summarized recommendations, which lay a more manageable foundation for decision making at the expense of access to the raw data. The quote above however indicates that the information in direct teacher quotes was easy to find and was appreciated when designing the course. While the aggregated DAG and raw data in principle contains the same information, the DAG provides a map-like infrastructure where course designers are able to zoom in and explore areas of a teacher's DAG on demand. In raw data on the other hand, individual teacher's quotes often are difficult to extract, to locate and to situate within the larger understanding that it informs. In this respect, the quote also suggests that the DAG representation encouraged precision and detail while maintaining overview, which also was an assumption in our HLT.

As the interview progressed, we inquired deeper into how the course designers had used the map to choose and distribute content across the lessons in the in-service program. We found this interesting

since the mapping process did not take the practical organization of the course into account. The content suggested by the DAG could by no means fit into the five days dedicated to the course. It was therefore the task of the course designers to exclude areas, categorize, and merge others into content themes to address in individual lessons. The quote below shows how the course designers experienced using the DAG in this process:

> Course designer 2: "The map enabled us to very precisely merge some of the map areas into headlines, group these headlines together and ultimately distribute the ones we thought as most important among the five days the course consists of."

The DAG allows users to zoom in and out between overview and detail. The excerpt above exemplifies that the DAG's aggregated overview was highly helpful in converting the overall areas of the map into separate themes fit for being distributed across the five days. It also illustrates the map supporting them in prioritizing which areas to include and which to leave out. This indicates that the course designers thought of the overview as a space of possible areas to include rather than as a blueprint of content that they needed to cover.

Support - beyond faster horses

During the interview, the course designers brought up a reflection of the limitations of the information in the DAG for course design. In their interaction and interpretation of the map, they had observed a remarkable absence of pedagogical theories and frameworks such as SAMR (Puentedura, 2013) and SMTTE (Andersen, 2000). They thought of this absence as remarkable since they themselves experienced such frameworks as necessary to engage in professional discussions about the different roles digital tools could play in teaching. This observation is described in the quote below.

> Course designer 2: "They did not mention models such as SAMR and SMTTE, which nonetheless are important in discussions of when and where it makes sense to use technology, and how digitalization goes beyond a digital textbook. But they are of course not able to see that the ability to distinguish between types of files, JPG, PDF is perhaps related to a more general competency that they do not know about."

This comment refers directly to one teacher's CA, "distinguish between types of files, JPG, PDF" and relates it to a larger area, which has to do with substituting traditional material on paper with digital resources, which is a topic explored in SAMR. This comment was immediately followed up on by course designer 1 who argued that a constraint of the map was that the information it comprised was limited by what the teachers knew:

Course designer 1: "Well, you don't know what you don't know. The balance here is both to give them what they want and simultaneously push them by presenting them to knowledge they are not aware of.

The course designers were thus left with information of only what the teachers already knew and found to be important. Since they knew what was in the map, how was this information to inform what to include in the course? To be fair, the integrated DAG represented the sum of what the teachers together knew and found important, which naturally exceeded what was represented in the separate DAGs developed with the individual teachers. Some teachers could therefore likely benefit from learning what some of their peers already knew. One of the course designers however voiced the principle that their role as representatives of a public research and training institution amounts to a greater responsibility than giving the customers what they want. This is illustrated in the dialogue below:

> Course designer 1: "After all, we are a knowledge institution. If we were a private company, we could easily settle with giving them exactly what they want."

> Course designer 2: "Yes, we have a more formative obligation to not only teach them content, but also to develop them professionally as teachers. We easily find ourselves in a situation where someone comes up to us and says: this content was not what I signed up for. In those situations, we have to explain transparently that we acknowledge that view, but that we made these specific choices based on these considerations".

Firstly, this excerpt shows that the course designers perceive their role as providers of in-service training as having a responsibility of formative development, which exceeds that of private providers of in-service training. Their obligation includes exposing teachers participating in the course to knowledge beyond what the teachers themselves declare as important, even if this implies that they purposely do not accommodate what the teachers have articulated as being important. Secondly, the quote indicates that having the DAG at hand made them aware of what they choose to include and leave out and gave them the opportunity to prepare arguments for such priorities. As illustrated below, they saw this role as similar to being a translator:

> Course designer 2: "We are a kind of translator. The content in the map was very practical, and our role was to connect these needs to theory and literature. "

The practical nature of the map referred to by course designer 2 particularly regarded that the teachers mentioned competencies close to their daily classroom practices e.g. "searching for information to inform the planning of digital teaching". The course designers thought of their role as connecting these practical competencies with theory and literature. In this respect, they made decisions on where to go during the course based on information about the teachers' current location. We can interpret course designer 2's utterance as that the map showed the current location of the teachers attending the in-service program and the course similar to a competency route to travel. Viewed through this lens, it is obvious that information of a group's current location is insufficient to plan a route: this would imply the group would stand still. Knowing the location of course attendees however play an important role in ensuring that the route starts at places familiar to the group, and that route it travels align with the groups' proficiency. The quote above suggests that the course designers managed to use the map in a way where such competency route planning was possible.

It is worth noticing that although the map provided detailed insights into what the teacher found important, the course designers avoided the temptation to give the teachers participating in the course exactly what they expected. From a shortsighted perspective, such avoidance is a safe way to happy customers, which undoubtedly is important to maintain a position as an attractive provider of in-service training. The course designers' interpretation and use of the map however seemed to be subordinated to their view of public in-service training as formative and as challenging teachers' perspectives in accordance with the course designers' professional ethos.

Limitations - perceived obligations of addressing all details in the map

A recurrent theme brought up by the course designers during the interview was their experience that while they considered the detailed insights into what teachers found important valuable, their possession of this knowledge came with a perceived obligation to accommodate all details of the map. One of the course designers phrased the challenge as follows:

> Course designer 2: "How can we make sure that all feel seen and heard? We have been sweating much more than we have been for a long time."

This statement was followed by the other course designer, who emphasized her view of the importance of going into every detail of the map illustrated in the following quote:

> Course designer 1: "Yeahh, and I think that it's really important that we cover every detail of the map, which can be difficult."

The DAG intended to function as a navigation tool by assisting the course designers in navigating the landscape and deciding what content to include and what to leave out. While the course designers understood this, knowing so much about what the teachers expected often gave rise to a temptation to ensure that everything included in the map be included in the course. This temptation led the course designers to spend longer time planning the course. One of the course designers explained that they alternated several times between developing the course and looking into the map to ensure alignment between DAG and the course.

> Course designer 1: "Today, we have been very much back and forth between the map and the course design because we wanted to be absolutely sure that we covered the things we wanted. I do not think we would ever have done that in a regular course. "

One of the ways they handled this in the course was to introduce a distinction between personal and collective learning goals, which is illustrated below:

> Course designer 2: "We also made some interesting slides today about our different areas of responsibility. There are some things in the map that we take joint responsibilities of - those are the areas that we as course designers have chosen to focus on - and then each individual course participant may have their own personal learning goals, which they can focus on."

An example of such a situation was that a single teacher had mentioned the use of interactive whiteboards as important. The course attendees however did not think of whiteboards as significant enough to include in the course. As illustrated in the following quote, the course designers however still ended up making it possible for this one teacher to work with whiteboards if he desired:

> Course designer 2: "And even though we agreed that interactive whiteboards were not interesting, I ended up asking: Don't we have a room here at campus with interactive whiteboards so that we at least can offer him the chance of experimenting with them? We really want to design the course so that everyone is happy, but it all comes down to the art of balance."

Thus, the map seemed to burden course designers with a perceived obligation of making sure that when course attendees have spent time expressing what they want, that these requests indeed are accommodated. Beyond this, there was another limitation of the map, which concerned the lack of information about the persons who had articulated a competency included in the map.

Limitations - insights into competencies, but not emotions

As stated, the reported project aimed to increase the transferability of research to the course designers. As suggested in the previous sections, this was often achieved. However, the course designers voiced a shortcoming, when using the map, related to transferability. In the project, the course designers were not present during the elicitation conversations with the teachers, but were handed over the DAG at a workshop after the individual teacher maps had been integrated into one map. While this DAG maintained the utterances from individual teachers, the course designers still felt that not having participated in the teacher conversations had limitations. This is illustrated below.

> Course designer 2: "I have an interesting reflection about the aspect that we are reading something that we have to interpret without having been in the situation to sense it ourselves. There definitely is something relational missing."

Shortly after this statement, the course designer elaborated by referring to prior experiences of engaging in dialogue with teachers to discuss what content they would like included in a given course.

> Course designer 2: "Here, we are almost hermeneutically interpreting texts, whereas… When we usually have conversations with teachers about what they would like at the course, we see mimicry [sic], we see what they are interested in, we see where there is energy. I think that matters, now that we miss the human aspect. We feel a bit envious of you that you have had these minutes with them."

Conventional research approaches conducted by third parties often process large amounts of data to end out with manageable guidelines that recommend specific content areas to focus on in in-service training. In such guidelines, individual teachers and their concrete utterances are often absent since their purpose is to condense and synthesize the needs expressed by a large group into general guidelines that by and large apply to the groups as a whole. This makes it difficult to trace the original data sources leading to the general guidelines. In our approach, the DAGs sought to maintain individual utterances and enable course designers to explore them, identify nuances and develop their own interpretation, which indeed were experienced as valuable. The excerpt above however points to an interesting paradox; although the DAG has more information than what is available in general guidelines, this might open up for the perception that still more is missing. To interpret the utterances in their full extent, they express a need for knowing more about how the teachers expressed themselves. When were they energetic? What awakened their interest?
In what follows, we will engage in a discussion about how the results above could inform a future iteration of the design in a similar context, and how our study contributes to existing research on in-service training of teachers.

Discussion

There is little advice to be found in the research literature on how to align the choice of content for in-service training with teachers' requests, although the importance of doing so is agreed upon. Especially in the subject of digital teaching, this confronts us with a paradox in that teachers both need in-service training and at this point have extensive experiences about digital teaching practices in fresh memory, but no methods are available that enable aggregating these in a manageable overview while preserving details. This study has investigated ways to align decisions of content with teachers' view of what is important in complex situations involving diverse teachers from different schools. Our approach to this was informed by research on visual representations of curriculum content and indicates strong potential in this path. The course designers expressed that the DAG provided highly meaningful insights into the current viewpoints of the teachers attending the course. The combination of overview and detail in the map offered the possibility of consulting, in verbatim, the teachers' utterances, thus ensuring that choice of content to include in the program was in continuity with existing practices.

Although the insights developed in this paper stem from a limited number of informants, the results indicate nuances of the existing knowledge on the importance of accommodating teachers' needs (e.g. Martin and Umland, 2008; Garet et al., 2016). This especially regarded the course designers' reflections on the role of in-service offered by knowledge institutions as exceeding what teachers find important. Insights into what teachers view as important can provide a starting point for decisions on what content to include. As indicated in the results of this paper, mapping of teachers' current practices and views on what is important can also act as insights into what they do not know or what is not part of their practices. For the course designers in this study, these insights informed decisions allowed knowing how to broaden the teachers' professional horizons by presenting them content they were not aware of, but which were in continuation with their current practices. An important principle in our mapping process was that it was highly inclusive. Thus, we did not require that the teachers' contribution to the DAG had to fit into a specific definition of what a competency is. The responsibility of converting the versatile information in the DAG into concrete competency goals, which typically is required for formalized in-service training, were exclusively handed over to the course designers. Being well aware of this, we maintained the principle from the consideration that teachers' requests should be mapped as authentically and close to how it was articulated as possible. Because the course designers valued direct insights into teachers' practices, we consider this principle of maximal inclusiveness to be reasonable.

Our results however also point to limitations of using DAGs to inform decisions on curriculum content. In particular, our analyses show that the high level of detail about what the teachers found important seemed to impose a perceived obligation to accommodate every corner of the map in the course. While our intention was to enable the course designers to develop better courses, this indicates a risk of imposing a higher pressure on the course designers. This issue boils down to a more principled question, whether one prefers choosing on a foundation that is knowingly not entirely representative or having a more representative representation available and use it to make decisions that intentionally do not accommodate all requests. As evidenced in our analysis, it is clear that the price of the latter can be psychologically stressful. In light of the benefits of our approach as described in the analyses, we however maintain that a fruitful way forward is to consider how such unanticipated implications can be accounted for and avoided. We see several ways of addressing this. Firstly, it is important to communicate this to course designers when a map is handed over. Although we stressed that the DAG be used as the course designers found fit, this must be communicated in very clear terms from the beginning. Secondly, we find it appropriate to clearly communicate to the teacher who informed the final DAG and make it clear the conversation did not aim to provide a blueprint of curriculum content, which the course designers are required to address.

The second limitation of using the DAG to decide curriculum content regarded that the course designers urged a deeper insight into the teachers' affective relation to the CA's they mentioned. The DAG described in this study provided the course designers more information than most alternatives, especially due to the high traceability of individual teachers' utterances. Nonetheless, there is a limit to how much information text about competencies can carry, and course designers were thus left with less information than those who had conducted the teacher conversations. An obvious way to address this is by having the course informants themselves conduct the conversations and the mapping. At this point, this possibility is limited by the fact that the process of integrating many individual teacher DAGs into a single DAG is technically demanding. The current version of the aggregated DAG includes a weighting system added by us and based on frequency of related CA. An opportunity is to revise or supplement this weighting system to be based on what the teachers' find interesting, which possibly could be a step towards what the course designers' request.

Conclusion

This paper investigated to what extent DAG representations of teachers' expressions of what they found important in digital teaching could support or hinder course designers' decisions on what content to include in an in-service program. We found existing literature offers little advice on how to represent overview and detail such experienced needs, and that DAG representations are likely to be a well-suited approach to achieve this goal. To investigate this, we developed a design involving a DAG based on conversations with 17 teachers, which was guided by an HLT assuming that what teachers find to be important competencies are helpful to choose content, that DAG representations can allow detail while maintaining overview, and that the DAG would be helpful in developing the course.

To a large extent, our analyses confirmed this HLT: the course designers thought of the information in the DAG as useful, the DAG did indeed provide overview and detail, which supported them in choosing content to include in the course. The identified limitations concerned that the course designers were tempted to address every detail in the map, and that they experienced a need for information of how the teachers affectively related to the competencies in the DAG. These aspects were not accounted for in our HLT, but taught us important aspects of our design. A key dimension of DRB is its iterative nature. This project was iterative with respect to the process of integrating teacher DAG into the aggregated DAGs, but not iterative with respect to the entire process of the project. The identified limitations are thus valuable in a future iteration in similar contexts, and we have great faith that they can enable better approaches to using DAGs to ensure high quality in-service training of teaching in the future. Lastly, this study showed no indications that the usefulness of DAGs were limited to either in-service training or the subject of digital teaching competencies. We are therefore confident that our approach can generate valuable and cost-effective results in other settings in the future.

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