Stakeholder attitudes towards digitalization in higher education institutions

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Abstract: We report the results of a group concept mapping study on the topic of digital transformation in German higher education. Students, teachers and administrative employees participated in the study where they first gathered statements which were then clustered and ranked according to importance and feasibility. The results show agreement between all groups that matters of culture and mentality remain the biggest factors for a successful digitalization of higher education. While we found agreement between groups on the importance of topics, those working at the institution are more pessimistic of cultural changes than students. The unification of service platforms and the development of validated didactical concepts for digital learning offerings are also seen as open challenges.

Keywords: Digital Transformation, Group Concept Mapping, Digitalization

1 Introduction

Major changes in education are often slow and face resistance. The stakes are high, stakeholders vary in their backgrounds and may have different and competing interests. There are usually few, if any, absolute truths. An area that is currently transforming education on a large scale is the digitalization of educational institutions. Digitalization touches several sensitive areas, such as automatization and privacy. This sensitivity is especially high in Germany [TM07]. The population is historically very wary of issues regarding privacy, and the GDPR, as well as several privacy scandals have recently made the public even more aware of this topic [TM07].

Thus, to advance digitalization of educational institutions, it is important to be able to advance sensibly, and to know about the attitudes and expectations towards this topic from all the stakeholders that are involved in the process. Stakeholders are the students, the teachers, the administration and - in higher education - the researchers. The attitudes and expectations of all those groups must be considered to successfully commence changes on a large scale. Without knowing what the actual problems are, those that try to push digitalization may not receive all the support that they require. Groups that feel left behind because their issues are not considered could resist change and maybe rightfully so. It is therefore of central importance to obtain as comprehensive an image as possible of the attitudes towards digitalization and e-learning at educational institutions.

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Previous works have used primarily surveys to obtain the attitudes towards specific topics. Ifenthaler et al. have asked students at the University of Mannheim about their attitudes towards Learning Analytics (LA) [IS16]. They have found that students expect personalized systems but are at the same time rather conservative towards data sharing. This slightly contradictory expectation shows that it is important to know the exact conditions that are acceptable for learners. They complemented their survey with a qualitative study on 20 students where they validated their results [SI18]. Schmid et al. performed a large survey in 34 German universities and asked 2759 students, 542 teachers and 84 administrative employees about the state of digitalization in their higher education institution [Sc17]. They asked questions about how widespread digital learning technologies are implemented and about the stakeholders' attitudes towards those technologies. They found that while there appears to be already solid well-rated infrastructure and technology in place, that "...the educational potential of digitalization often remains untapped". In terms of strategic considerations, they identified two major camps that they call "digital advocates", as well as "analog skeptics", with quite opposing views on the furthering of e-learning. Major challenges that remain are legal issues as well as cost [Sc17]. For the student body, they note that students are not necessarily overly competent nor particularly well-versed in utilization of e-learning resources. They seem to primarily use the resources which are made available by the teaching personnel, which in turn seems very heterogeneous in their use of digital learning materials [Sc17].

While surveys offer a good overview, they may not be enough to adequately reflect the differentiated opinions of those involved. There are ideas and desires that may fly under the radar and thus if it is not asked, there will be no response to it. A way to get a perspective that is generated by participants themselves, while still quantifiable is the mixed methods Group Concept Mapping (GCM) methodology. The GCM methodology has previously been used in other studies to get opinions about digital transformations in other regions. A study by Wopereis et al. has investigated failure and success factors for the use of information and communication technologies in the Netherlands [Wo05]. They have found that "people-issues", i.e. participation, information, communication and stakeholder involvement are the most important factors. In another Dutch study, Drachsler et al. have performed a GCM study with 39 participants to get perspectives on Learning Analytics (LA) [Dr14]. While they also captured statements regarding stakeholder attitude, they also found several areas that are more concerned with concrete technologies that should be utilized. Similar was found in an Australian study [Co16], which observed a both attitudes and specific technology instances as relevant.

For our study, we performed a GCM at a German higher education institution to get attitudes and expectations towards digitalization in education. We recruited students, teachers, administrative staff, as well as researchers to obtain their statements regarding the success factors for digital transformation. Participants then grouped and ranked the statements according to importance and feasibility. In the following sections, we present

the GCM methodology and describe how we implemented it. We then reports on the results that we obtained in terms of their descriptive statistics. Finally, we discuss the results and offer our interpretation of them.

2 Method

2.1 Procedure

Group Concept Mapping (GCM) is a mixed method approach to capture results of collaborative decision-making processes. The goal is for a group to arrive at shared visions about a topic (in this case, the topic of digitalization in education). In contrast to other methods of collecting and analyzing opinions, in GCM the participants themselves generate the structure and ideas around the topic. Using multivariate statistics, the ideas of the participants are analyzed and clustered to objectively identify patterns in the data. The results of this analysis are visualized to allow further interpretation. Details and example of how GCM works and can be applied can be found at e.g. [Dr14] [RK12].

The participants were invited to take part in the study using a dedicated online GCM platform. Participants who finished all phases of the study were rewarded with 50€. Participants were asked about their position at the institution and their prior experience with learning technologies.
For the first phase, the brainstorming phase, participants were asked to complete the statement

"One success factor for digital education at the [institution] is..."

with their own ideas. This phase was active for ten days, so participants had several days to generate ideas and they could return at any time during that period to generate further ideas. Statements that were generated were cleaned up by removing duplicates and correcting spelling mistakes.
In the second phase, participants were asked to group the ideas from the first phase based on similarity and assign them a common label. For this task, all the statements were given in one large list and they could drag and drop them into containers that they created. They could create as many containers as they wanted and were requested to avoid categories such as "misc." or "other".
Finally, in the third phase, participants were asked to rate all the items on a 1-to-5 scale for their importance (1 = not important at all; 5 = very important) and feasibility (1 = not feasible at all; 5 = very feasible).

For the analysis, the ideas are represented as points on a two-dimensional plane. Points are closer on this plane if they have been put in the same group more often. The points were then clustered using hierarchical cluster analysis. Cluster suggestions are created beginning with a high number of clusters first, then reducing the number of clusters. Criterion for the quality of the clusters is the average bridging value (BR) of each

cluster. A low bridging value for an item indicates that it has been grouped with other items around it more often. The cluster coherence was furthermore inspected visually. The final number of clusters was decided on in a separate session where multiple researchers agreed on a final number of clusters based on their numerical and visual coherence.

2.2 Participants

Participants could complete only some of the steps if they chose to do so. Thus, the number of participants varied between the phases. For the brainstorming phase, 101 participants contributed. The sorting phase was started by 55 and was completed by 46 participants. The importance rating was started by 50 participants and was completed by 44 participants. The feasibility rating was started by 49 participants and completed by 43 participants. Table 1 shows the distribution regarding the position at the institution (multiple mentions were possible) and Table 2 the prior experience with digital learning technologies. The surveys were presented before the sorting phase.

Position	n	%
Student	23	28.40
Employed at Chair	16	19.75
Researcher	15	18.52
Teacher	15	18.52
Administrative Staff	10	12.35
Management	1	1.23
Other	1	1.23

Tab. 1: Participants position at the institution. Multiple mentions possible

Experience	n	%
No prior experience	2	4.44
1-3 years	18	40.00
3-6 years	7	15.56
6-9 years	9	20.00
10-13 years	3	6.67
More than 13 years	6	13.33

Tab. 2: Participants prior experience with learning technologies

3 Results

3.1 Clusters

We arrived at ten clusters. Their graphical representation can be seen in figure 1. Descriptive statistics of the clusters can be found in table 3. In this section, we report on the clusters that were created and the statements that these clusters contain. For each cluster, we report on those items which can be considered “low hanging fruit”, i.e. those items which have both a high average feasibility (FE) and as a high average importance (IM) rating. We furthermore report on statements that stick out. Wherever possible, we attempt to include the actual quotation in the text

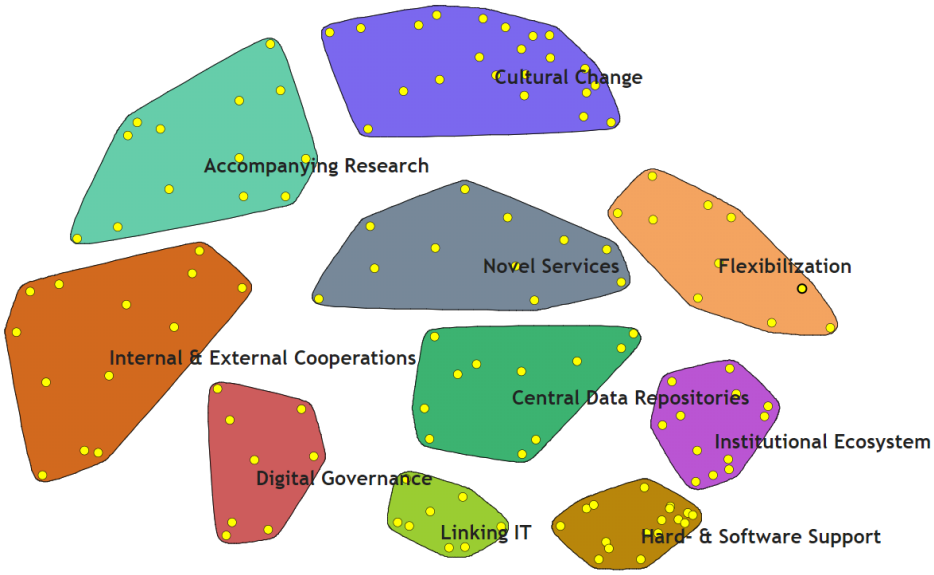

Fig. 1: The final clusters. Yellow dots are the statements within the clusters

Statements in the *Cross-linking of the IT infrastructure* cluster deal with issues and requests towards the various IT services at the institution. Requests include development of central platforms for needs such as jobs and internships (IM = 3.11; FE = 3.91), as well as having the institutional services linked to external platforms and services, such as calendars or certificates (IM = 2.95; FE = 3.14). Furthermore, "...having a central contact person for technical and didactical questions" (IM = 3.70; FE=3.60) is also requested. Ranked as important, yet perceived as not very feasible, are "...permanent positions in ALL areas of work that are responsible for educational innovations - networking and consistent change management" (IM = 3.64; FE=2.58).

Central Data Repositories contains statements for which a solution requires means of generating and storing data and making it available for the stakeholders. These include "...the comprehensive provision of literature online (e.g. e-books) also for use outside the university" (IM = 3.63; FE = 3.30) and "... that the competent support regarding legal factors (e.g. scans of literature etc.) is available." Important, yet seen as comparatively very unfeasible are statements regarding utilization of existing data for the purpose of data analytics (IM = 3.61; FE = 2.47).

The cluster *Novel Services* contains expectations and suggestions how e-learning services and platforms could improve education. While the average ratings are particularly unfavorable towards "...Establishing novel degrees, e.g. Nanodegrees, Micromaster (4-week course for a topic)" (IM = 2.50; FE = 2.19), increases in flexibility

through recordings of lectures and seminars (IM = 3.42; FE = 3.53), self-regulated structuring of the studies (IM = 3.79; 3.63,) and the option to reduce presence in lectures by means of e-learning (IM = 3.49; FE = 3.74) are received favorable. The highest ratings are for the statement "...development of didactic concepts for digital education" (IM = 4.23; FE = 3.98).

Digital Governance (BR = 0.68) contains requirements for the organization, such as creation of rulesets and the cooperation between divisions within the educational institution. The most important statement in this cluster is "...Improved cooperation of the central institutions for digital education" (IM = 4.16; FE = 3.37) and in a similar vein "...better networking of all employees involved in the IT infrastructure" (IM = 4.00; FE = 3.49), as well as "...that existing information is made transparent and easily accessible" (IM = 3.77; FE = 3.79).

In the cluster *Internal and External Cooperation* are statements which deal with topics of communication and cooperation within the institution. While this cluster has the highest bridging value of all the clusters, indicating that the items have often not been placed in the same category, inspection of the actual items reveals that they in fact mostly share this topic. The common sentiment is that different departments should communicate regularly and work towards building competencies. Training and education are mentioned as ways to achieve this, e.g. "...regular training and further education for teaching staff in the use of available media." (IM = 4.09; FE = 3.81).

In the *Critical Accompanying Research* cluster are those responses which note a need for (continuous) evaluation of the change process. Responses focus on didactics and e.g. demand that "...Lecturers (TAs and Professors) receive didactic training on how to correctly and effectively apply digital education" (IM = 4.16; FE = 3.93) and "digital education is accompanied by research questions/research projects from the areas of media didactics and educational psychology" (IM = 3.80; FE = 3.88).

Cultural Change is the cluster which contains the most items (n = 22). Items in this cluster mention attitudes and mindsets that participants see in need of (re-)evaluation for digitalization to become successful. Some statements describe worries, e.g. "...understanding eLearning as a complement for teachers instead of as a substitution" (IM = 3.95; FE = 3.79) and "...despite all enthusiasm for new technologies, do not forget to keep the people the center of attention of strategic considerations" (IM = 3.89; FE = 3.95). Meanwhile some statements take the opposite stance and demand openness "to admit ideas first, not to nip things in the bud at the very beginning because of data protection or finances" (IM = 3.84; FE = 3.65). Lastly, statements in this cluster also deal with the transition and fusion of digital and traditional means of teaching. The most important and most feasible statement is "…if digital and analogue education are combined and interlinked in a meaningful (didactically valuable) way (keyword: blended

learning)" (IM = 4.23; FE = 4.00). This cluster is also the one with the highest average importance (3.78).

In the *Flexibilization* cluster are statements that highlight some of the affordances that digitalization can bring. Those are "...greater flexibility for students by recording all lectures in a clear format" (IM = 3.61; FE = 3.77), "...if the digital material like lecture recordings, video tutorials, exercises and scripts can be made more interactive through questions/tests, quizzes, gamification...." (IM = 3.77; FE = 3.63). The cluster also contains statements about requirements for flexibility in the institutional acting. Chief among them is "...the insight: digitalization needs money." (IM = 4.36; FE = 3.91).

Institutional Ecosystem contains statements related to the existing e-learning systems and the functionalities that should be available in those. Features that are mentioned are "... Simple search functions in all systems with which you can access the desired information" (IM = 3.79; FE = 2.98), a student dashboard to monitor study progress (IM = 4.02; FE = 3.09), a "...a digital archive with all the old teaching materials (exercise sheets, exams, scripts, transcripts) which are available to students as preparation material" (IM = 3.70; FE = 3.67).
A discrepancy with high importance and low feasibility exists for the unification of the various platforms for planning and organizing the studies (IM = 3.81; FE = 2.63). The least important statement is also contained in this cluster: "...use of chatbots in consulting scenarios" (IM = 2.37; FE = 2.86).

Hard- & Software Support is concerned with technology that must be purchased, as well as support for the usage of them. Physical hardware that is requested includes PCs, tablets, video production equipment, as well as "modern systems" in general. Notable are *having sufficient power outlets* (FE = 3.44; IM = 4.09) and *reliable technical support for teachers and students* (IM = 3.98; FE = 3.49). A high difference between importance and feasibility is towards the statements "...investing in and maintaining modern hardware and software that makes digital education possible in the first place" (IM = 4.32; FE = 3.21) and "...that sufficient space is available in the [institution] in which the digital learning technologies can be used (e.g. Virtual Reality, and digital exams)" (IM = 4.00; FE = 2.51).

Cluster Name	n	BR	m(IM)	σ(IM)	m(FE)	σ(FE)
Digital Governance	8	0.68	3.70	0.08	3.37	0.16
Cross-Linking of the IT Infrastructure	8	0.40	3.06	0.27	3.27	0.14
Flexibilization	10	0.64	3.58	0.09	3.44	0.09
Central Data Repositories	11	0.36	3.60	0.01	3.30	0.10
Novel Services	11	0.38	3.34	0.18	3.50	0.29
Hard- & Software Support	17	0.08	3.62	0.18	3.05	0.13
Institutional Ecosystem	12	0.33	3.45	0.20	3.21	0.18
Internal and External Cooperation	13	0.82	3.48	0.09	3.49	0.12
Critical Accompanying Research	23	0.69	3.55	0.14	3.73	0.06

Cultural Change	22	0.31	3.78	0.06	3.53	0.13

Tab. 3: Description of the clusters with n = number of participants; BR = Average Bridging value of the statements in the cluster; IM = Average importance rating; FE = Average feasibility rating; $\sigma(\mathrm{IM})$ = Variance of the importance rating; $\sigma(\mathrm{FE})$ = Variance of the feasibility rating

3.2 Ratings

For the majority of clusters, the importance of the statements is ranked higher than their feasibility. The biggest ($\Delta = 0.57$) and most significant ($p < 0.001$) difference is in the cluster *Hard- & Software Support* where several statements are rated with higher importance than feasibility. The two clusters *Cultural Change* ($\Delta = 0.25$; $p < 0.02$) and *Central Data Repositories* ($\Delta = 0.30$; $p < 0.01$) clusters also have a difference which is statistically significant. The opposite trend, a higher feasibility and a lower importance is observable in the clusters *Novel Services* ($\Delta = 0.25$), *Critical Accompanying Research* ($\Delta = 0.25$) and *Cross-linking of the IT infrastructure* ($\Delta = 0.20$), although in all three cases the results are not statistically significant.

We also investigated differences between the groups that we identified via the questionnaire (see table 1 and 2). First, we compared students and employees. For the group of employees, we combined researchers, management and teachers. We found significant differences in the *Cultural Change* cluster, both regarding feasibility and importance. Employees ranked the importance of cultural change on average higher than the students (IM(Employees) = 3.92; IM(Students) = 3.64; $p < 0.005$), while students ranked the feasibility of cultural change on average higher than the employees (FE(Employees) = 3.43; FE(Students) = 3.70; $p < 0.02$).
Next, we compared novices with less than three years of experience, with experienced users who have more than three years of experience using learning technologies. We found no significant differences between those groups for any of the clusters.

Cluster	Student		Employee		Novice		Expert	
	IM	FE	IM	FE	IM	FE	IM	FE
Digital Governance	3.61	3.45	3.80	3.37	3.64	3.36	3.70	3.37
Cross-Linking of the IT Infrastructure	3.11	3.28	3.12	3.32	3.08	3.18	3.05	3.33
Flexibilization	3.48	3.42	3.62	3.46	3.67	3.38	3.51	3.49
Central Data Repositories	3.52	3.17	3.65	3.34	3.57	3.24	3.62	3.34
Novel Services	3.38	3.53	3.31	3.48	3.40	3.39	3.29	3.58
Hard- & Software	3.58	3.09	3.78	3.08	3.51	2.89	3.72	3.17

Support Institutional Ecosystem	3.39	3.22	3.56	3.28	3.47	3.01	3.44	3.36
Internal and External Cooperation	3.41	3.43	3.58	3.56	3.33	3.36	3.60	3.59
Critical Accompanying Research	3.53	3.73	3.60	3.75	3.48	3.68	3.60	3.78
Cultural Change	3.64	3.70	3.92	3.43	3.80	3.54	3.77	3.53

Tab. 4: Average importance (IM) and average feasibility (FE) ratings of the clusters by participant group

4 Discussion and Conclusion

The participants of this GCM study have provided many statements and we could observe interesting relations between them. Across all groups of stakeholders, changes in attitude and mentality are rated as the most important statements. Openness towards digitalization, not blindly following trends and cooperation between departments are requested repeatedly. At the same time, many of these statements are also rated with low feasibility relative to their importance. This discrepancy is highest among the group of employees. One can assume that this group has experience with the difficulties involved in achieving cultural changes. This large concern with matters of attitude and mentality could be indicative of a process that is in its earlier stages. In comparison with similar studies from other countries, e.g. the Netherlands or Australia, it is noticeable that these studies discuss more issues of concrete implementation and optimization. In fact, the results that we have obtained are quite comparable with those from studies that are now more than a decade old [Wo05].

On the other hand, topics beyond attitude and mentality, such as wishes for specific hardware or services do exist. They are, on average, seen as less important. Yet this does not necessarily mean that they should not be part of a successful digitalization strategy. The higher variance for these statements shows that these specific wishes are important for some but may not matter for others. On the topic of purchases, it is also notable that statements which require significant investments to be realized, i.e. a “modern” infrastructure, are mostly seen as not very feasible. This again indicates that there are certain experiences and frustrations in place.

What we found surprising but at the same time very encouraging is that there are few differences between the students and the employees for almost all issues.

Those that aim to increase digitalization at higher education institutions should keep these results in mind when planning their strategy. The mentality and attitudes towards digital transformation efforts should be regarded as at least as important as the implementation of new technologies and services. The other way around, simply implementing the technologies without regard to the mentalities, may be less fruitful and it is conceivable that its adoption may be hindered by a lack of acceptance.

While we think that the GCM methodology is suited to capture a representative range of opinions, there are bound to be opinions which were not captured, thus we cannot claim to provide a complete overview.
To summarize the observations, there are still a lot of cultural and policy issues which seem to stand in the way of adoption. Addressing them should be the main focus of digitalization efforts in higher education.

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