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TOWARDS PERCEIVING TEACHING AS A JOINT TASK IN AN INDIVIDUALIZED QUALIFICATION PROGRAM FOR MID-LEVEL ACADEMICS AT A GERMAN UNIVERSITY OF TECHNOLOGY

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Empowering teachers for facilitating modern engineering education is essential. Thus, universities put much effort in qualifying teachers in didactic training programs. Especially individualized programs have been positively evaluated in the Covid-19-year 2020 by participated teachers. However, participants missed (informal) networking opportunities. Two questions arise: How do participants perceive their qualification program in the coming years? And second, how can we design a program that balances the participants' thirst for an individual program compilation while establishing university-wide networking opportunities among teachers? This paper presents participants' perceptions on a qualification program at a German University of Technology for the years 2021 – 2022. Also, it presents key practices of a revised program. After four groups completed their program, data was gathered through online questionnaires and descriptive analyses (48 responses of 106 participants). Also, four semi-structured interviews were conducted and content analysis was used as interpretation method. Results show that this qualification program is positively perceived in terms of acceptance, learning, future teaching activities and program characteristics. Specifically, participants define their training group as trustful, but only a part of them feel to share responsibility for teaching. Their personal teaching networks consists mainly of staff from the same school within the faculty and other mid-level academics. Interestingly, they encourage to tackle teaching challenges within the wider university community. Thus, both individual pathways and informal, cross-disciplinary opportunities for dialogue should be possible in a program that is flexible in terms of time and topics. Hence, qualification programs should be designed to address the challenges of contemporary higher education as a teaching community rather than as individual.

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1 INTRODUCTION

Empowering teachers to enable modern pedagogy in engineering education is key in order to keep quality of teaching at a consistently high level while dealing with abrupt teaching transitions due to Covid-19 earlier (e.g. Sherman et al. 2023) or recently the enormous rise of artificial intelligence tools in teaching and learning (e.g. EUA 2023). Accordingly, associations and universities put much effort in qualifying teachers with didactic videos, podcasts, online or on-campus short formats, one-day workshops or complete training programs with varying approaches and workloads (e.g. E-teaching.org 2020, ECIU 2022, KI Campus 2023). Both, didactic qualification programs using cohort approaches according to Bulmann et al. (2018) and individual approaches have been positively evaluated as described by Bulmann and Bornhöft (2021). In the latter example that deals with the Covid-19-year 2020, participants found it more important to flexibly design their own program than go through a predetermined program in a cohort. However, they missed out on networking opportunities. Therefore, they recommended offering voluntary, primarily informal networking opportunities. Two main questions however remained and are pursued in this paper: First, how do participants perceive their flexible qualification program in the following years and how do participants describe their teaching networks. Second, how can we redesign the program so that the participants' thirst for individual program compilation and university-wide networking opportunities among teachers are balanced. This paper starts with describing the qualification program and the evaluation methodology. Results of participants' perceptions on the qualification program of a German University of Technology in the years 2021- 2022 are described. Based on these evaluation results and also taking reflections of didactic program experts into account, key practices of a revised program design are presented. This paper concludes on how to offer both an individual path as well as informal, cross-disciplinary options for dialogue in a didactic qualification program, striving for high quality, contemporary, transitioning engineering education.

2 METHODOLOGY

2.1 Implementing the Flexible Program

To ensure a high quality, contemporary education for mid-level academics, the executive committee of a German University of Technology initiated a flexible didactic qualification program, focusing on research assistants with teaching obligations. Attendance is obligatory for those funded by university budget. The program consists of 60-time hours over a maximum duration of two years. The aim is to enable participants to discuss didactic principles, apply methods and media to their teaching, develop their own teaching personality, present teaching-related products, and network across schools and faculties in terms of teaching. The program consists of an individual initial conversation (1 h), a variety of workshops (24 h), complementary elements (teaching project (21 h), peer visit (9 h), reflection (3 h)) and a final event for presenting the teaching project to the university public (2 h). Digital Teaching and Learning is a cross-cutting theme and reflects even more the adaptation of the training to Covid-19-disruptions in teaching and learning. Two main themes are offered, reflecting both the interest of previous participants and the identity and purpose of the university:

- “Higher Education and Engineering Pedagogy” (HE/EP) based on e.g. Berger et al. (2006) as well as
- “Engaging students in research with Research-Based Learning” (RBL) based on Healey (2005).

The broad area of HE/EP offers a wide range of didactic workshops in the catalog, while special RBL workshops have been offered continuously on two topics and additionally on varying topics. In the teaching project, participants innovate courses, analyze student learning or communicate about their teaching. In the peer visits, pairs of participants give each other feedback on their teaching in each other’s courses. In the reflection, participants review their teaching philosophy and practice. Every six months, a new group of participants begins and a previous group graduates from the program. Meanwhile, participants choose their own program path in regard to time and topics, based on their interests and needs for their current teaching practice and/or personal development. Flexibility, individualized pathways, and teaching practice based on a scientific foundation have been key features of the program since its inception. Four didactic experts guide the participants.

From the start of the program in 2019 to 2022, the program was constantly evaluated and iterated, based on the feedback of the participants and the reflection of the didactic experts. The program changes that were implemented foremost in summer 2021 include: (1) going back to on-campus workshops, (2) offering networking meetings in the reflection element, (3) shifting to the university learning management system, (4) suggesting to conduct peer visits with the teaching project partner, (5) recommending an optimal program duration of one year as well as (6) optimizing and digitalizing management processes to run the program.

The first group (G1) graduated in winter 2020/21, as described by Bulmann and Bornhöft (2021). From summer 2021 to winter 2022, 106 participants graduated in four groups (G2-G5). 55 participants were awarded with the certificate on the wide area HE/EP, while 51 participants received the special RBL certificate. 57 teaching projects have been carried out: 7 participants carried out their projects alone, 25 completed a project with a partner from the same school within the faculty, 10 with a partner from another school in the faculty and 15 even with a partner from different faculty.

2.2 Evaluating the Flexible Program and Deriving a Revised Program

We asked participants how they rated the qualification program after the first run and how they describe their teaching networks. We focused on the perceptions of four groups after they completed their programs: G2 (summer 2021), G3 (winter 2021/22), G4 (summer 2022), G5 (winter 2022/23). A mixed-method approach was applied: Data were collected from the four groups using self-administered online questionnaires and descriptive analyses (48 responses from 106 participants). In addition, four semi-structured interviews were conducted with participants of group 2 (summer 2021), of which two individuals completed the wide area HE/EP and two individuals completed the special area RBL. The interview guide focused on the overall evaluation of the program and the description of networks. The interviews were transcribed, coded, and interpreted using qualitative content analysis. Across the groups, the study was designed according to the first three levels of training

program evaluation by Kirckpatrick and Kirckpatrick (2015): *Reaction* (R), *Learning* (L) and *Behavior* (B), while the latter refers to participants' future teaching intentions. Additionally, perceptions on teaching-related networks have been addressed: First, groups of persons that participants considered important in overcoming teaching challenges have been roughly identified. Second, personal networking maps with three levels of importance were used and interpreted according to Jenert (2021). And third, microcultures have been investigated according to the four types of microcultures by Roxa and Martensson (2015): *The Commons* with high trust and high shared responsibility ('We are in this together'), *The Club* with high trust and low shared responsibility ('We'll always support each other'), *The Market* with low trust and high shared responsibility ('I look after myself') and *The Square* with low trust and low shared responsibility ('Who are these people?'). Results on program evaluation (section 3.1) rely on questionnaires of four groups of graduates (i.e. G2 to G5), while results on networking (section 3.2) are presented based on interview data (of G2) and survey data (of G4, G5). The training program was then revised based on the evaluation results, reflections by didactic experts on running the training, emphasizing recent needs in regard to university strategies and contemporary engineering education.

3 RESULTS

3.1 Evaluation of the Flexible Program

Participants' Reaction, Learning, and Behavior Regarding the Program

Participants of all four groups (G2-G5) perceived the flexible qualification program as positive according to the questionnaire results (see Table 1).

Table 1 Participants' perception of a qualification program aggregated for four groups graduated in 2021 and 2022.

Level	#	Item	Ø	n
R	1	I find a structured didactic qualification as research assistant important.	1,4	48
	2	I find it personally valuable that I have participated in the program.	1,8	48
L	3	I can develop initial approaches for an aligned course.	1,5	48
	4	I can develop initial approaches for a research-based learning course.	1,6	23
	5	I can develop initial approaches for a digital course.	1,5	47
B	6	I am motivated to develop my own teaching continuously.	1,3	48

With three levels: Reaction (R), Learning (L), Behavior (B), answers on a 4-point scale with 1...totally agree to 4...totally disagree, Ø: arithmetic mean and n: number of responses from groups 2 to 5

Participants' Perceptions on Individual Program Selection and Cohort Aspects within the Program

Participants rated the program positively in regard to the implementation of the four program characteristics: content flexibility (Ø=1.6, n=48), time flexibility (Ø=1.5, n=48), participants' needs (Ø=1.8, n=48), and teaching practice (Ø=1.8, n=48). In particular, participants find it more important to flexibly design their own program than go through a predetermined program in a cohort, i.e. 36 of 48 respondents voted for an individual design. So, the possibility to select workshops individually (groups 2-5: Ø=1.1, n=48) as well as to choose the focus of the complementary elements

(reflection, peer visit and teaching project) (groups 2-5: \bar{X} =1.5, n=48) was highly appreciated. In conclusion, participants appreciate the program's focus on their teaching needs and practice, and the opportunity to make their own decisions about their individual program pathways.

Participants' Perceptions of Program Support when it Comes to Solving Teaching Challenges

Participants experienced multidimensional challenges in Covid-19-times, especially related to organizing, designing, interacting, and assessing student learning in online teaching (despite group 5). Various program elements have been appraised as supportive to overcome these challenges (groups 2, 3): Impulses on digital teaching, such as didactic methods, techniques, tips, examples, the self-reflection element, peer visit element as well as exchange with other program participants, colleagues from other schools and didactic experts. Participants from group 4 (\bar{X} =2.1, n=12) and group 5 (\bar{X} =1.9, n=7) rated the support of the program as rather important.

3.2 Participants' Characterization of Personal Teaching Networks

Participants' Description of other Groups when it Comes to Solving Teaching Challenges (in Covid-19 Times)

Participants found it most important to overcome teaching challenges during Covid-19 times with colleagues of their own school and alone, followed by the university teaching community, didactic experts and colleagues of other schools (see Table 2).

Table 2: Participants perception of importance of others in overcoming teaching challenges

#	Item: "In COVID-19 times, how important is it to you to be able to master challenges with ...?"	\bar{X}	n
11	... colleagues of your own school?	1,2	48
12	... colleagues of other schools?	2,3	47
13	... didactic experts?	2,1	47
14	... the university teaching community?	1,9	47
15	... by myself?	1,4	47

Answers possible on a 4-point scale with 1...totally agree to 4...totally disagree, \bar{X} : arithmetic mean and n: number of responses from groups 2 to 5

Participants' Personal Networks for Teaching Exchange

The four interviewees (of G2) described their personal networks differently. Overall, they indicate that colleagues of the same school and other mid-level academics as well as professors, students, tutors, the program project partner and didactic experts are very important or important in their personal teaching network. Other groups, such as the IT department, the university's executive committee, industry colleagues, or previous colleagues are rated as a bit important (data not shown). This impression also correlates with the survey responses (of G4, G5) (see Table 3).

Table 3: Participants' perception of importance of other people for exchange on teaching

#	Item: "Who do you communicate with regarding your teaching, and how important are these people to you personally regarding your teaching?"	\bar{X}	n
16	Colleagues from the qualification program	3,1	21

17	Colleagues from the same school	1,2	21
18	Colleagues from other schools/ faculties	2,8	21
19	Colleagues from other universities in your discipline (e.g. other universities; city/ national/ international)	3,4	20
20	Didactic experts of the Center of Teaching and Learning	2,4	21
21	Administrative staff (e.g. examination department, student administration office, IT department, library or others)	3,0	20
22	Colleagues on other academic levels (e.g. professors, senior researchers/ lecturers, tutors)	1,7	21
23	other persons (e.g. friends, family, industry/ business)	2,7	21
Answers were possible on a 4-point scale with 1...totally agree to 4...totally disagree, Ø: arithmetic mean and n: number of responses from groups 4 and 5			

Participants' description of Networks within their Schools and the Program regarding Trust and Shared Responsibility

The four interviewees (IA, IB, IC, ID) of group 2 explained in which way they share teaching obligations within their schools (professors/ head of school, senior researchers, colleagues of mid-level academics, tutors) and how they feel supported by didactic experts and the project partner. Microcultures within the schools and the program are described in the following:

First, the four interviewees positioned their teaching networks at their own school within three types of microcultures according Roxa and Martensson: 'The Commons', 'The Club' and 'The Market'. The fourth item 'The Square' was not chosen:

"Personally, I think is this, 'we are in this together.' But of course, it doesn't work like that [...] So I would take either 'The Club' or 'The Market.'" (IA, L410-118).

"So, in any case 'The Commons' [...] always trust on [person XY] [...] So much what sharing concerns." (IB, L485-493)

"We are responsible together." (IC, L230-234), Rather 'The Commons' than 'The Market'

"Between 'The Commons' and 'The Club'. The professor gives me a lot of trust and I give a lot of trust to the tutors, but the levels of responsibility are different. It's somewhat hierarchical." (ID, L264-273)

Second, interviews (G2) and survey results of G4-5 outline that participants experienced the microculture within the program group predominantly within the three types: 'The Commons', 'The Club' and 'The Square', while 'The Market' was addressed only once. The digital format of the program was seen as hindering towards a feeling in the training group of 'We are in this together.' (in G2 & G5). In particular, the working culture with the project partner (within or beyond the same school) was highlighted as being trustful and sharing ('The Commons'):

„I think that's where the digital teaching was a bit of a hindrance. That you just didn't have the feeling that 'we are in this together' or 'we will support each other'. But when I think about the project now. There I would even say that that was actually 'The Commons'. That we took this on together and supported it.“ (IA, L422-427) “,“The exchange with someone who is not in the school [i.e. project partner], who is already on the teaching side, but is not in his own school bubble, that really helped me. It substantially improved my teaching, simply because it was a completely different perspective. We understood each other well. It was a really good exchange.” (IA, L104-110)

“The Commons [...] the two participants, with whom I did the project [...] they supported me relatively well. [...] Otherwise, yes. I would say ‘What are you doing right now?’ somehow so ‘The Market’ or ‘The Club’.” (IB, L499-517)

“More like ‘The Club’. We are a community of interest and want to make teaching better. But in the end, we do most of it on our own and in parallel and in independent groups. Even if a course goes over several schools, they are divided into several independent packages.” (IC, L237-240)

“Already so more ‘The Commons’. So, we have always acted as equals, especially in the workshops [...]. That things stay between us when it comes to a course, that you can tell each other things in confidence. We are in this together and go through it together and support each other in the things that are important to us.” (ID, L282-286). “Because it [the program] was digital, the exchange fell asleep. I only had exchanges with my project partner, otherwise we saw each other at the classroom events and we no longer had these discussions in breaks. That was difficult. That wasn't because of the program, but rather because of the [Covid-19] situation. The interpersonal level is very important to me, and it is precisely these discussions during breaks that lead to a more intensive exchange about things that are in teaching and things that are in everyday professional life. It's not just about what happens in teaching, but also what happens in research, and if all that falls away, there is less of a bond.” (ID, L115-124)

These results outline the complexity of personal teaching networks. Both, while organically growing networks within the schools are of significant importance, trustful and sharing networks to project partners beyond the schools turned out to be essential for some participants. Both can be enforced within an on-campus program.

3.3 Our ten key practices of the revised qualification program

Our ten key practices of a balanced qualification program are presented here: Some practices (#4, 5, 8, 10) have been already introduced in summer 2021 (see section 2.2) and are feedbacked by some participants of G4 and G5 (see section 3.1., 3.2.). All practices are reflected in the recently published program (ZLL, 2023).

Practice 1: Individual pathways: Our training offers individual pathways along personal goals for newcomers, advanced and scholarly teachers. These are set in the initial talk by each participant. This aims that participants with all kind of interest, didactic backgrounds and teaching duties find personal value in the program.

Practice 2: Balanced time flexibility: Our training offers time flexibility for participants to design their program within the maximum program duration of two years. This aims that the program fits in the participants' busy academic schedules. At the same time, three milestones (initial talk, project discussion, program reflection) are set within an optimal program duration of one year, envisaging to help structuring their pathways.

Practice 3: Thematically open orientation: Our training offers a wide-range of didactic topics like research-based learning, challenge-based learning and Artificial Intelligence tools in teaching and learning. The aim is to establish alternating specific areas and to initiate sub-groups sharing interest and responsibility in certain topics.

Practice 4: Networking among groups of participants: Our training offers various networking options, especially the first workshop and the network meetings. This is to subdivide the start-group into participants that share the same interest, teaching level or timing to implement the teaching project. It intends to build trust and reflect on shared teaching responsibility from the beginning.

Practice 5: *Acting in teaching practice with a partner from any school*: Our program offers to conduct the complementary elements (33 h) with a partner participant committed to in the first network meeting. The aim is, that participants develop their teaching competencies on a higher level, to build a partnership with high trust and high shared responsibility, to pool resources and for sure, to foster student learning.

Practice 6: *Support by professors/ school heads*: Our program welcomes professors to take part, among others, in the second milestone meeting where project teams meet the didactic expert to discuss their ideas. The intention is to understand each professor's teaching intentions, to jointly encourage participants, to reveal network opportunities and to guarantee a sustainable implementation of this teaching project.

Practice 7: *Supervision by didactic experts*: Our program offers each participant individual supervision in at least the three milestone meetings. Each supervisor is a didactic allrounder with special expertise and is responsible for all participants from two faculties. The aim is to build a trustful cooperation, offer didactic consultation and support participants in making progress in their own program pathway.

Practice 8: *Program delivery on campus*: Our program is offered foremost as an on-campus training. This intends to support informal, trustful exchange on teaching, research, and personal matters. Some digital elements (few workshops or milestone meetings) are offered online to suit better the time scheduling of all parties.

Practice 9: *Celebrating participants' achievements*: Our program offers a closing event within a university-wide summer fiesta. The Vice-President of Academic Affairs awards the program certificates. Participants present their teaching projects in a poster fair, and the most inspiring teaching ideas are awarded by the audience. This creates acknowledgement in a more informal get-together and communicates teaching innovations to all kind of university members.

Practice 10: *Robust program structure and processes*: Our program offers a robust and impactful general structure that is supported by optimized and digitally mapped processes. On the one hand, that helps offering that extent of individual pathways. On the other hand, it enables being active when facing abrupt challenges like digital transition due to Covid-19 or artificial intelligence tools in teaching and learning.

4 CONCLUSION

This paper outlines a didactic qualification program that is positively evaluated by participants over the last few years. It also sheds some light into participants' teaching networks which includes foremost colleagues of the same school, other mid-level academics, and the partner participant whom to share teaching responsibility and having a trustful partnership with. The ten key practices of the balanced program show on the one hand that each participant can be supported to grow as a teaching personality and to master direct challenges in courses. On the other hand, it paves the way for all participants to both rely on existing disciplinary networks and to build rich teaching networks with other participants, academia and administration staff which are then the backbone to (re)act as a university community on transitioning teaching challenges for engineering education that are around the corner. The results presented here are restricted due to methodological limitations. Future studies will focus on better understanding participants' networks and practices.

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