The Relationship Between Science Teachers’ Career Expectations and Different Professional Development Experiences

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Abstract

The relation between teachers’ experience, foreground and the intentions of professional development programs (PDP) has been investigated in a Danish case, where a balance between top-down and bottom-up processes intended to integrate local and individual perspectives of the participating teachers in the overall program. We combine data regarding the teachers’ participation in collaborative elements in the PDP and the teachers’ individual reflections on their relation to these elements in their personal career foregrounds. Three different participation trajectories were found: - Increasingly convergent entangling trajectory; - Mutually enriching but distinctly parallel personal and systemic trajectory; - Open-ended trajectory, that keeps different career options open.

Key words: Teacher experience, foreground, participation trajectory, professional development programme.

Background

According to Van Driel, Meirink, van Veen and Zwart (2012) many science teacher professional development programs (PDP) in educational reforms are designed with the intentions of successful change of science teaching. A PDP is a systemic entity where different stakeholders work together with the intention to create optimal opportunities for teachers’ professional development. Most PDPs focus on a group or cluster of teachers with different backgrounds and different years of experience. There is however a significant need to understand how to better support particular teacher groups, e.g. early-career teachers, novice teacher leaders, or the unique professional needs of mid-career science teachers. The information that could be gained from such studies has the potential to result in PDPs that better consider a professional progression of teacher opportunity and capacity (Avalos, 2011).

In this study, we focus on how science teachers’ career considerations affects their experience with professional development. Teachers’ participation in PDP is formed by a mixture of their own experience and the developmental possibilities offered by the PDP they participate in. The relation between teachers’ experience, foreground and the
intentions of PDP has been investigated in a Danish case. The Danish PDP intended to balance top-down and bottom-up processes to integrate local and individual perspectives of the participating teachers in the overall program. The Danish PDP put emphasis on collaboration from a systemic level by accentuating experience sharing. Even though most PDP’s carry intentions on improving the professional capacity of teachers, researchers argue, that teachers might develop some kind of resistance towards top-down initiated activities:

With all good intentions and research-based knowledge, district and school administrators sometimes create policies and routines that interfere with progress, and they wonder why teachers respond in unanticipated ways. Instead of jumping into collaboration with their colleagues, teachers sometimes organize to oppose new designs for their work or enact them in a routine fashion (Talbert, 2010, p. 556).

This suggests that a more participant including approach in designing and performing a PDP might be of advantage. Professional learning communities (PLC) has been used as a tool in the Danish PDP to support participant inclusion. But as we will document later the effect was not clear. Teachers’ had different expectations toward participating in the professional learning activities. This dilemma is addressed in the research literature:

We find that system conditions that support the work of PLCs – such as a comprehensive education plan, integrated learning resources, local knowledge resources, robust data and accountability system, extended time for teacher collaboration, and leaders committed to PLCs – are not sufficient to engender change in professional culture and teachers’ work lives. The literature point to goals for system change, but offers little guidance on the change process or warning of pitfalls and challenges entailed in changing professional culture from the top (Talbert, 2010, p. 556).

Teachers’ autonomy is considered a main obstacle for developing PLCs:

The challenges of developing teacher collaboration are many. One stems from a tradition of autonomy in teaching that works against the formation of PLCs. When instruction is considered private practice, teachers resist the idea of collaborating with colleagues on instruction. They resist even more the opening of classrooms to peer observation and subsequent feedback (Talbert, 2010, p. 557).

These findings indicate that collaboration and networking can be a key element in teacher learning, but the supportive effect depends on the degree to which the schools’ organisational structures and leadership support and enable teacher commitment.

**Learning communities across organisational boundaries are most likely to induce systemic change.**

However, it is when learning communities cross the boundaries of particular organisations or interest groups that systemic change on a broad scale is most likely. Any one group of stakeholders is likely to be insufficient to serve the needs of all participants in diverse contexts, as well as bring about the changes required in a complex and fast-changing world. In the Danish PDP teachers from different schools...
participated in the learning community. Community activities was organised by the municipal science coordinator in collaboration with external didactical experts from the local teacher college. This collaboration provided learning opportunities that was highly valued by most participating teachers (Sillasen, 2016; Nielsen & Sillasen, 2014).

This suggests that a more divergent approach to the concept of PLC is needed, one that includes systemic extensions with broader membership and involving divergent knowledge bases (Stoll, 2010). An alternative concept that might be used to describe learning communities is learning networks, or networked learning communities, as they are sometimes known. They are professional learning communities operating across a broader landscape (Jackson & Temperley, 2007; Sillasen & Valero, 2013). They share many commonalities with school-based professional learning communities and some similar goals. But their additional purposes include enlarging individual schools’ repertoire of choices and moving ideas and good practice around the system in order to help transform the whole system, not just individual schools, thus improving education for all students within a municipality. This capacity building involving several schools within a municipality is a collective responsibility and moral purpose is writ large. Teacher learning benefits are well documented (Lieberman & Wood, 2002), but evidence is also emerging of links with student outcomes (Kaser & Halbert, 2008; Katz & Earl, 2010).

**Significance of teacher foreground and network in the individual teacher’s participation.**

It adds to the troubles for PDP’s that each teacher has his or her own rationale for participating in a PDP. Their personal intentions for participating in PDP are formed by their lived experience and foregrounds (Daugbjerg, 2015). A large scale Danish PDP has attempted to meet this personal aspect of science teachers PDP participation by including network establishment at local schools within a municipality (QUEST, 2015). The Danish QUEST project is a large-scale (5 municipalities, 35 schools, 138 teachers), long-term (2012-2015) TPD project designed and organized following principles of Professional Learning Networks (Jackson & Temperley, 2007; Sillasen & Valero, 2013). The aim of the QUEST activities is to facilitate sustainable change of TPD in each of the participating schools’ and developing and maintaining networks amongst science teachers in each municipality. In QUEST, the purposes and activities were negotiated with the participating teachers in advance of course modules to ensure alignment between teachers foreground and the purpose of QUEST. Furthermore, the courses alternated with daily teaching and application of the science education approaches presented at the courses. This significant feature of the QUEST PDP is ‘the QUEST rhythm’, that provided the participating teachers with tasks regarding teaching, sharing, and collaborating with colleagues.

Diverse data have been collected and generated regarding the teachers’ participation in collaborative elements and regarding the teachers’ individual reflections on their relation to these elements in their personal career foregrounds. These data give us a picture of teachers’ participation trajectory within the PDP QUEST. By addressing
participation as a trajectory we are able analyse our survey and interviews for elements in the teachers utterances and actions that indicate coherence and incoherence between their here and now teaching and PDP participation and their stated career considerations. This is not to connect the dots and create a fixed picture. The intention is to mirror how participants perceive a PDP and what forms this perception. The mirrored reflection opens for interpretation of any coherence or incoherence.

The analysis in this paper will focus on the different individual benefits and hindrances teachers experience in the PDP. We present three cases of how teachers’ participation trajectories relate to the PDP systemic intentions: 1) a convergent relation, 2) a parallel relation, and 3) an open-ended relation. Such differences in the relation between the personal and systemic intention raises serious questions whether it is at all possible to create PDP’s that can meet the wondering of school administrators reported by Talbert (2010). We reflect on the options for increasing ownership of the PDP by directly addressing the teachers’ personal career foregrounds in the design and introduction to the PDP.

**Methodology**

Our primary interest is to understand the relation between the systemic and personal perspective, therefore we draw on data and methods that reveal how the participating teachers experience the possible participant trajectories given to the teachers by the PDP.

**Method**

The overall research design is mixed methods. (Creswell & Clark, 2007) One part of the data is a questionnaire distributed 4 times during the two first years of the project. In this article only data from the latest questionnaire is included. Teachers responded to 5 point Likert-scale questions and open ended categories focused on teachers’ experiences from network activities, from trials in own classrooms and from collaborative inquiries. This is supplemented with case studies in four schools including group interviews and observations from PLC-meetings. Qualitative data furthermore include interviews and observations of network activities. Likert scale questions are analysed by frequency, and open-ended reflections, and observation data, are categorized through an iterative data based process (Cohen, Manion and Morrison, 2007).

This has provided data on participants view on the systemic perspective of the professional development programme QUEST. The group interviews gave some insight into the personal perspective, but we have inquired deeper into this participant experience perspective through individual in depth interviews and observations with one teacher from each of the participating municipalities. The individual interviews were performed over two sessions. The first session focused on choice of teaching as a profession and generated a life history of the participants’ background as science teachers. This interview followed a semi-structured interview guide. This interview was followed by 2-4 days of observation of the participants work at their schools, including video observations of one or two of their science lessons. During these observation
days, many informal talks on science teaching were conducted. The final interview followed an individualised interview guide based on a preliminary analysis of the first interview and the observations.

**Research context - Participating teachers**

Our participants come from five municipalities placed in the central region of the mainland Jutland in Denmark. They all teach primary science or a science subject in lower secondary school. In QUEST 138 teachers are participating, 51 answered the last questionnaire used in this study, five were chosen for in-depth interviews and observation. One of these five left science teaching during the research period, so his data are not analysed. In this paper we present in-depth interview data from 3 teachers.

**Findings**

The QUEST PDP attempted to apply a participant including approach referred to as the QUEST rhythm, where the participating teachers were supposed to alternate between course input and working with this input at their schools. The questionnaire survey reveals that the participating teachers (figure 1) generally find this rhythm in the organisation of QUEST supportive.

![How has the QUEST-rhythm supported activities in module 4? (N=51)](image)

*Figure 1. Participating teachers’ evaluation of the benefits of the QUEST-rhythm, alternating between course activities and working at their local school.*

The participating teachers and the municipal consultants elaborate in group interviews on how they find the QUEST rhythm supports collaborative sustained relationships:

- “You have to implement it right away otherwise you lose focus.”
- “You have to solve tasks in relation to the local school science team and also in relation to the overall QUEST project.”
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- “The biggest threat for the interaction between municipal network and local science team collaboration is the conflicting agendas at the school.”

- “The interaction is effective in the QUEST rhythm, you have to go home to the local school and try things out. The trial also makes the following discussion more interesting because when you meet again and share knowledge, then there is somebody who really has tried it out.”

- “A condition for success of this form of professional development is a well-established science team work at the local school. If anything shall spread further then some kind of communication between colleagues is necessary.”

The overall purpose of QUEST to promote teacher collaboration as a tool for developing science teaching is well received by the participating teacher. This however does not reveal how the individual teacher sees his or her participation relate to his or her own personal experience, career considerations and foreground with participating in QUEST. In the individual interviews the science teachers tell, what they find interesting and relevant in QUEST.

Table 1.

<table>
<thead>
<tr>
<th>Danish interview transcript</th>
<th>English translation</th>
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<tr>
<td>Jeg vil fortsætte i det der med idedatabaser, rent kommunalt indenfor Mælkebøtte kommune, hvor hvis man havde nogle ideer og lagt dem ind, … hvor man så får noget feedback, ‘den var smart den vil jeg lige prøve af herude på skolen’ og det synes jeg, er en rigtig god ide. På den måde kan det bruges.</td>
<td>I will continue with these online databases of teaching ideas, it is strictly within the municipality of Dandelion, where you, if you have some ideas post them … where you get feedback. ‘That was a good idea that one I will try it out at this school’ and that I think is a very good idea. In that way, it is useful.</td>
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<td>Jeg blev mere gjort opmærksom på, at det man ser, og det man gør, det er altså, det man husker.</td>
<td>I have been made more aware, that what you see, and what you do, that is really, what you remember.</td>
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<td>….</td>
<td>….</td>
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<tr>
<td>Så er det måske mere vigtigt at vide at indikatorpapir i cola bliver rødt fordi det er en syre end hvis de ikke kan huske alt muligt om H⁺ ioner og alt muligt, som de ikke kan huske. Så er det første måske det vigtigste fordi de kan huske det.</td>
<td>So it is perhaps more important to know that litmus paper in cola turns red, because it is an acid, than when they [the students] can’t remember every detail about H⁺ and such stuff, that they can’t remember anyway. Then perhaps the former is the most important because that is what they remember.</td>
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Poul is clearly pleased with the design of QUEST and sees possibilities for developing his own science teaching and for contributing to developing his colleagues’ science teaching within the municipality. Poul also tells that he sees himself as science teacher in the future.
Table 2.
Birger, 47 year, 13 years as teacher
- participating science teacher from Daisy municipality

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<tr>
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<tr>
<td>Jeg prøver også at få dem [eleverne] til at undersøge. QUEST ligger meget op ad det som jeg også selv godt kan lide.</td>
<td>I try also to make them [the students] inquire. QUEST is close to what I also like.</td>
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<td>Jeg bliver nødt til at trække på, at de eleverde har telefoner, og jeg bliver nødt til at trække på, at de synes det er sjovt. Fordi ellers kommer vi ingen vegne. Hvis jeg skal stole på at de computere jeg booke [her på skolen], at de virker… De gør de ikke. Så mange har vi slet ikke. Når vi laver sådan nogle ting, så siger jeg: &quot; vil I ikke være søde og rare at tage jeres egne computere med?&quot;. Og det gør de, fordi de ved de virker.</td>
<td>I have to rely on that the students have [smart] phones, and I have to rely on that they find it fun. Because otherwise we get nowhere. If I should rely on, that the computers I book [here at the school] they work… They don’t. That many we don’t even have. When we do such teaching, I say: &quot; Please be kind and bring your own PC?&quot; And they do, because they know they work.</td>
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<td>Peer: Hvad forventer du er det største udbytte ved at deltage i et projekt som QUEST?</td>
<td>Peer: What do you expect to be the greatest outcome of participating in QUEST?</td>
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<tr>
<td>Birger: At få nogle kolleger der er med på det.</td>
<td>Birger: To have the some colleagues who take part in it. …</td>
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<td>Men det er det der med, at vi er ikke så gode til at arbejde sammen. Og det kunne jo være dejligt. Det synes vi også når vi har den her fag-fredag, så har vi faktisk ret stor succes med den. Og når vi først får sat os ned, så tager det faktisk ikke så lang tid at prøve at pejle os ind på, hvordan et undervisningsforløb skal ligge ift. det emne, vi nu gerne vil ind omkring.</td>
<td>But the thing is we are not that good at collaborating. And that would be nice. We also feel when we have these science subject-Fridays, and then we do have a great success. In addition, when we do get together, then it actually does not take that long to tune into how to teach a subject, we want to focus on.</td>
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Birger finds QUEST relevant because its didactical position is similar to his own. Generally he acts autonomously in relation to supportive structures. He does not use the computers the school generally provides and he finds collaboration very close to everyday teaching rewarding. Birger in other parts of the interviews expresses intentions of becoming a teacher educator.
Table 3.
Karl, 33 years, 7 as teacher
-participating science teacher from Marigold municipality.

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<tr>
<th>Danish interview transcript</th>
<th>English translation</th>
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<tr>
<td>… at bede folk om tage hjem og køre progressionstræer igennem, som er taget fra det her amerikanske ATLAS-projekt, som er super, som jeg er rigtig glad for at blive introduceret til. Det var et rigtigt spændende oplæg de to undervisere lavede om det, jeg kunne vitterligt se noget idet. Og så bede os om at gå hjem og køre det igennem på skolen med nogle kolleger på 2 timer for at få en ide om det, det rykker ikke og en meter.</td>
<td>… to ask people to go home and make progression-trees, which comes from the north-American ATLAS project, which is super, I’m very glad to be introduced to it. It was a very interesting presentation given by the two educators on that; I could really see something in it. Then they [the educators] ask us to go home and work it through at the school with some colleagues in 2 hours to get an idea of it that does not change a thing.</td>
</tr>
<tr>
<td>… men der sidder jo alligevel nogen [kolleger] som (.) som sidder der af pligt ikke. Det er forståeligt nok der er ikke så meget det; men så er det svært, så skal det opstå på 2 timer, så er rammerne ikke til at tænke videre. Så bliver sådan lidt at så afvikler vi det her fordi vi skal komme og give en tilbagemelding på et kursus, ja det gør vi hip hurra og det skal vi nok gøre det og stå og sige nogle påe ting, men det rykker ikke.</td>
<td>… but anyway there is some colleagues who sits there of bounden duty, right. That is understandable it is not as much that, but then it is hard, and it has to occur within 2 hours, the settings is not for thinking any deeper. So it becomes a bit that we do it and report it at the course, yes we do that hurrah, and we shall off course do it, go there and say some nice things, but it doesn’t change a thing.</td>
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Karl sees opportunities in what QUEST presents, but is also sceptical with regard to how much it really can change in his and his colleagues’ everyday teaching. Karl wants to assist his colleagues and furthermore expresses in other interviews intentions of becoming a municipal consultant within science teaching.

Discussion

The presented teachers tell of different experiences from participating in QUEST. These different stories might provide an answer to the wonderings of school administrators reported by Talbert (2010), that we presented in the introduction. Another perspective adding to the answer can be the participating teachers foreground for participating in QUEST that has previously been reported (Daugbjerg, 2015). The foreground perspectives address the participating teachers’ expectation to future benefit of their present participation in the ongoing PDP. Based on the same individual interviews and observations that we used in this study, an analysis of the three participating teachers’ foreground have been conducted (Daugbjerg, 2015). If we juxtapose these findings with this study’s focus on their participation trajectory, we can saturate our understanding on the individual teachers’ consideration during their participation in the QUEST PDP (Table 4).
Table 4.
Juxtaposition of the three participating teachers’ participation trajectory and their foreground. The latter from Daugbjerg (2015).

<table>
<thead>
<tr>
<th>Participation trajectory</th>
<th>Foreground</th>
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<tr>
<td><strong>Poul, Marigold municipality</strong></td>
<td><strong>Convergence:</strong> Uses seamlessly the provided systemic network and database structure for his personal and his colleagues’ development.</td>
</tr>
<tr>
<td><strong>Birger, Daisy municipality</strong></td>
<td><strong>Parallel:</strong> Acts autonomously to support his personal development agenda more or less disregarding the systemic supportive network.</td>
</tr>
<tr>
<td><strong>Karl, Dandelion Municipality</strong></td>
<td><strong>Open-ended:</strong> Addresses the gap between the systemic intention and his actual personal possibility to fulfil the intention. Karl is searching for steppingstones that can connect his personal foreground with the systemic supportive network. He wants to keep all career options open, both locally at the school and in relation to other opportunities within the municipal system.</td>
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</table>

The participating teachers’ foreground is aligned with their participation trajectory. Poul’s participation trajectory is convergent with the QUEST PDP’s intentions of creating a strong professional learning community. He finds that QUEST’s collaborative agenda supports him and his colleagues in their daily work with planning and teaching. His foreground is to continue teaching at the same school, which align very well with his experience of QUEST as being supportive. Birger’s participation trajectory is parallel to QUESTs collaborative agenda. He hopes that QUEST will help improve the local collaboration, but already finds that he and his colleagues have a form of collaboration that works. He relates to the QUEST agenda because it agrees with his view on science teaching. His foreground is to start a career outside school, which QUEST does not support him in. Karl’s participation trajectory is open-ended as he sees options in QUEST but also limitations. He finds the intentions of QUEST promising, but cannot see how they can be fulfilled within the given municipal framework. His foreground is very explicit as he sees himself as a municipal consultant, but he has not been able to make this career move yet. He is undecided of where his career is to go.
As mentioned earlier different measures were taken to align the purposes of QUEST with the teachers’ foregrounds:

- In advance of the modules, teachers were asked what concrete themes would be meaningful for them to work with.
- Aims and intended activities were outlined at the beginning of course modules.
- Teacher learning outcomes were assessed in open ended questionnaires. Responses were used formatively to improve new activities.
- The QUEST rhythm was continuously used as a tool for dialogue with peers and instructors. The dialogue gave opportunities for assessing joys, frustrations, didactical reasoning etc. leading to a better insight into what works and what doesn’t work for the teachers.

All these channels for alignment created a more joint understanding between participating teachers, consultants, educators and instructors of the purpose, options and limitations of QUEST as a PDP as seen in the focus group interview data. Still the individual teachers make up their own view of what a PDP like QUEST can contribute to their personal teaching and development.

The different teacher participation trajectories and foregrounds found in the QUEST project can inform the wonderings of leaders and administrators reported by Talbert (2010). If leaders and administrators acknowledge that teachers’ participation in PDP is guided by their own individual agendas, then perhaps they will be not surprised by the fact that teachers do not engage in PDP’s as the planners intend them to. Furthermore they may even be able to design PDP’s to be more inclusive and participant sensitive.

Studies that focus on the systemic and professional level simultaneously find that an organizational memory can bridge to future change when system leaders communicate the common principles and draw upon professional networks and leadership developed through the earlier reform work (Talbert, 2010). Our findings accentuate the importance of awareness of the individual teachers foreground in understanding their present commitment to the systemic expectation of the ongoing PDP. The individual foreground is part of a personal interpretative framework that guides the teachers’ daily teaching and any change initiative affecting it (Daugbjerg, 2015; Kelchtermans, 2009). Our inclusion of the personal level in the research on PDP show that a condition for fostering a PLC is what the individual teacher sees as foreground for participation and how his or her participation trajectory is aligned with the PDP.

**Conclusion**

We sat out to investigate how science teachers’ career considerations affects their experience with professional development. We presented their career considerations as participation trajectories and related these to their foregrounds for participating. The analysis of the presented teacher experience and PDP participation trajectories indicate that
Teachers who experience some kind of kinship between on the one hand their own personal foreground and their participation trajectory and on the other hand the systemic PDP agenda and organisation are more positive towards the PDP intervention.

Three different trajectories are observed:

- Increasingly convergent entangling trajectory.
- Mutually enriching but distinctly parallel personal and systemic trajectory.
- Open-ended trajectory, that keeps different career options open.

Teacher experience and foreground form a personal interpretative perspective through which the teachers relate to the local municipal framework and the PDP. These findings accentuate the relevance of designing PDP’s so that the participants’ expectations are brought forward and included in the design process. A way to do this can be to include an exercise in the start-up of PDP’s that makes the participating teachers explicate their foreground and expectations. These foregrounds can then be aligned with the purposes, options and limitations of a given PDP. This would make it clear which of the teacher’s individual career expectations the given PDP can meet, and what part of the teachers foreground that he or she must pursue in another context.

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