DISCOVERING WAVES OF LEARNING IN A MULTI-LEVEL NETWORK

Keywords: Developmental Work Research, learning networks, levels of learning, multi-mediation, workplace development

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ABSTRACT 100 words
The paper analyzes the learning potential of a cross-workplace setting, in which the participants trained themselves to become in-house developers. It shows that multi-layeredness was confusing for the participants and led to questioning of the learning activity. On the other hand, by means of developmental tools they started to conceptualize the meaning of the multi-layeredness and expanded the potential of workplace learning. The waves of learning undulated vertically between the levels of network, horizontally across the workplaces as well as sequentially between the steps of workplace development. Returning to the steps left behind, which in a linear workplace development would implicate failure, becomes necessary in a network.

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1. INTRODUCTION

Learning in work-life networks has been assessed as one of the success factors of today's organizations and communities of practice (Ramstad, 2009). Learning in networks is multi-level in nature (Toiviainen, 2007) calling for mediation and innovative interventions. This paper specifically asks what this multi-level learning in a network means and how it may be analyzed. The case study analyzes the learning potential of a multi-organizational setting, in which the participants from various workplaces trained themselves to become in-house developers. It shows that multi-layeredness was confusing for the participants and led to questioning of the learning activity. On the other hand, by means of developmental tools they started to conceptualize the meaning of the multi-layeredness and expanded the potential of workplace learning.

The waves of learning undulated vertically between the levels of network, horizontally across the workplaces as well as sequentially between the steps of workplace development. This notion by the participants produced one of the main insights in learning: returning to the steps left behind, which in a linear workplace development would implicate failure, becomes necessary in a network.

This analysis is a part of the learning network project that we carried out in collaboration with regional work-life developers and with support of TYKES Work-life Development Programme in 2007-2009. We have previously analyzed the critical phases and the boundary crossing of the learning process, the co-configuration and implementation of a learning tool, and the curriculum created for the intervention (Kerosuo & Toiviainen, in press; Kerosuo, Toiviainen & Syrjälä, 2011; Toiviainen & Kerosuo, 2009;Toiviainen & Kerosuo, in press; Toiviainen, Kerosuo & Syrjälä, 2009). The analysis is based on the longitudinal discursive data gathered in the workshops, which offers possibility to focus both on the collective and individual-level data.

Theoretically, the analysis draws on the cultural-historical activity theory, in which the concept of cultural mediation is fundamental (Vygotsky, 1978; Wertsch, 2007; Lektorsky, 2009). Human consciousness and activity, therefore, also learning, are mediated by tools and signs created during the history of communities. Mediation, however, has multiple dimensions and meanings. In our case, for instance, the introduction of a tool for workplace development re-mediates learning between the levels of the network. The complexity is elaborated on by the concept of multi-mediation.

This paper is structured as follows. In section 2 we present the context of the study by discussing briefly what is meant by learning networks, Developmental Work Research and the Forum of In-house Development. Section 3 introduces the idea of a multi-level network and how this was applied in the forum's work. Section 4 includes the analysis, in which we elaborate on the thematic of the OLKC-2011 conference using the heuristics of undulating waves of learning in order to scrutinize our data in new light. The multi-level model that we developed for the learning network provides a framework to three types of undulation, vertical, horizontal and sequential.

2. DEVELOPMENTAL WORK RESEARCH FOR LEARNING NETWORKS

Learning networks are a specific type of collaborative interorganizational settings that have gained growing interest in the turn of the millennium. Researchers have made a distinction between *learning networks* formed with the deliberate interest in learning and development and *networks of learning* emerging in an evolutionary way alongside with the business and production activities (e.g. Bottrup 2005; Knight & Pye, 2005; Powell, Koput, & Smith-Doerr, 1996). The former are typically horizontal (peer-to-peer, trust based) networks, whereas the latter involve both horizontal and hierarchical relations. The proposed multi-level approach implicates that even learning networks have a vertical dimension across the levels the challenge being combining the horizontal and non-hierarchical vertical learning.

Historically learning networks represent recent developments of inter-organizational collaboration. They are often supported by public programs aiming at the enhancement of work-life innovation in a given regional area or industrial branch. *The Forum of In-house Development* (herein the forum) is an example of this type of learning network. It was set up to enhance intra- and inter-organizational learning and in-house development of workplaces in the South Savo region, Finland. Financed by a nation-wide work-life development program Tykes the forum was planned in collaboration with regional developers and university researchers (the authors of this paper). In the face of significant challenges of work and education in this part of eastern Finland the planners agreed on the goal of training workers to in-house developers by acquiring new work development methods, applying and disseminating the methods in workplaces, and learning from other developers with different organizational contexts and challenges.

The planners further agreed on adopting the methods of Developmental Work Research (DWR) (Engeström, 1987; Engeström et al., 2005) and elaborating on them in a learning network setting. Developmental Work Research is a widely-used approach in Finland and internationally (e.g. Hasan & Crawford, 2003; Hill et al., 2007; Holt, 2008; Warmington, 2009). One of its core concepts is the cycle of expansive learning (Engeström, 1987). The steps of the cycle are subsequent learning actions through which the learners expand their activity starting from the charting and questioning of the present situation; then analyzing the present activity and the developmental contradictions; modeling and analyzing the new activity as the solution to the present contradictions; experimenting and piloting with the new; consolidating, generalizing, and reflecting on the new activity. The model is informed by the cultural-historical activity theory including the concept of the zone of proximal development by Vygotsky (1978) and the object-oriented activity by Leont'ev (1978). Figure 1 shows a prototypical (and simplified) depiction of the cycle of expansive learning.

**6 Consolidating,
evaluating** and **reflecting**
on the new activity

1 Charting
-> Need state

5 Implementing
the new activity

2 Analyzing
-> Culmination of the contradictions
of the old activity, deadlock

4 Experimenting
with and elaborating on
the new activity

3 Modeling
-> Searching for and
planning a new expanding
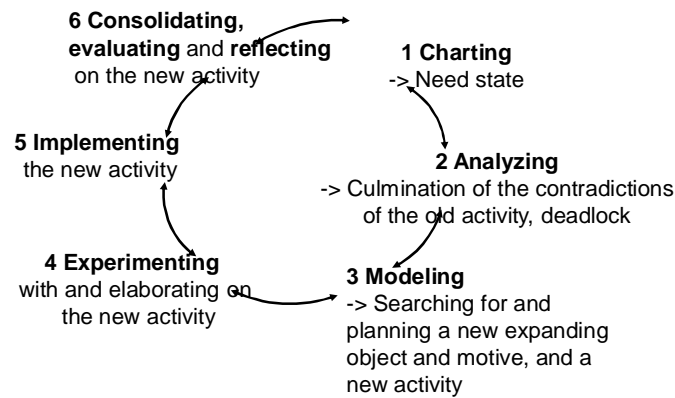object and motive, and a
new activity

Figure 1. The cycle of expansive learning and developmental work research (Engeström, 1987, p. 189; modified)

The authors of this paper got an assignment to contribute knowledge from the DWR and plan the learning agenda for the forum. The red thread of the agenda was combining the learning material with the workplace development projects that the participants planned and carried out during the forum's work. Based on the cycle of expansive learning and other conceptual tools of DWR we planned an approximately 18 months' process that we implemented in two cycles of network learning with two groups of participants. They came from various administrative organizations representing occupational health, industrial safety, the employment agency, and the environmental agency, and from units of social and health care representing mental health rehabilitation, juvenile psychiatry, dementia nursing, and reformatory youth work. Also an educational unit from the University of Applied Sciences participated in the second cycle of the forum.

This network learning process was supported by professional local tutors giving guidance to the participants between the meetings. The workplaces formed working pairs guided by one tutor. In the second cycle we even included the training of the local tutors in the agenda. The discursive data of this paper is drawn from the network meetings of the first forum from February 2007 to June 2008.

3. FORUM FOR IN-HOUSE DEVELOPMENT AS A MULTI-LEVEL NETWORK

We argue that the specifics of learning in a heterogeneous network stem from the fact that the activities evolve on multiple levels calling for multi-mediation of learning. This is based on our activity-theoretical premises and the findings of previous studies showing that multiple objects of activity are emerging parallel and intertwined calling for mediation (Toiviainen, 2007). But it also grew out of the experiences of the forum and of the participants' articulations of learning during the process.

We further contend that dealing with this complexity on a discursive level only is not enough to reach sustainable learning outcomes. Networks need material tools and practices, first, to be able to articulate and collectively share the multiple levels and, second, to work on them in order to enhance the mediation of learning across levels (Toiviainen, & al., 2009).

To concretize the levels of networks and the tools to deal with the levels we display figure 2. It shows the Development Radar that we designed as a tool for the forum by combining the cycle of expansive learning/developmental work research (Figure 1) with the levels of learning identified in the forum's work. The arrows represent the intermediate outcomes suggested for each step. The phases of the cycle were now located inside the circle leaving space outside the circle free for the levels. The levels were:

1. The workplace level – representing the activity of the in-house developers and the implementation of their workplace projects
2. The level of local tutoring – representing the activity of the local tutors and the guidance and peer-support for inter-mediate tasks addressing the workplace projects
3. The networkshop level – representing the activity of the Forum of In-house Development in joint meetings
4. The level of the extended networkshop – representing the activity of the Forum of In-house Development in joint meetings where the managers of the workplaces participated
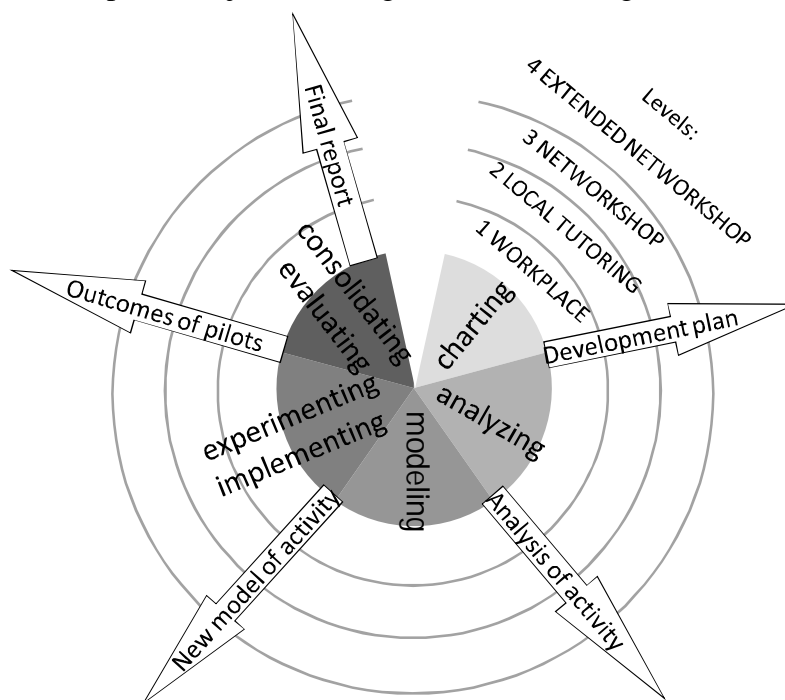

Figure 2. Development Radar. The cycle of Developmental Work Research and the levels of the forum.

The phases and levels of learning and development form the framework for analyzing the waves of learning. Three kinds of undulating movement of learning are illuminated by means of data excerpts: vertical (across levels), horizontal (across workplaces), and sequential (across phases of development).

In the following analysis we re-use the totality of the data excerpts from previous analyses, in which they were embedded in essential learning episodes of the forum and were interpreted in terms of co-configuration (Toiviainen et al., 2009), cultivation and enriching (Toiviainen & Kerosuo, 2009) of the learning tool "Radar", and in terms of transitional learning episodes that reveal critical expansions of the object of learning (Kerosuo & Toiviainen, in press). We selected excerpts demonstrating at least a minor learning dilemma and "categorized" them to illuminate the three types of waves of learning.

The data is retrieved from the transcriptions of the video-recorded meetings of the first cycle of the forum 2007-2008. If the tentative framework of the waves of learning proves useful in analyzing the multi-level learning in a network, we will consider extending the analysis to the entire data of the second cycle of the forum (2008-2009). The speakers in the excerpts are numbered in a running order. When a speaker appears again the same number is used.

4. VERTICAL, HORIZONTAL AND SEQUENTIAL UNDULATION OF LEARNING

4.1 Vertical undulation of learning

Vertical undulation of learning is directly associated with the levels of the network activity. The participants addressed the levels spontaneously when reflecting on the tasks and topics of in-house development. After the introduction of the levels embedded in the developmental cycle (figure 2) they referred to vertical dimension even more explicitly. As the workplace projects progressed new levels started to emerge. Above all, the workplace level became more nuanced.

Example 1:

In the early phase of the forum some of the in-house developers questioned the vertical undulation of learning between the network and the workplace levels. After discussing in small groups, one of the in-house developers summarized:

> Developer 1: Somehow the idea has not clarified enough how these networkshops support practical development work. And all three of us[in the small group] see that [the idea is] to familiarize ourselves with the method, familiarize with the world of developmental work research. And this has not clarified so that we could apply it in our developmental projects in the way we expected.

Example 2:

When introducing the levels of the radar model (figure 2), one of the in-house developers first associated them to the hierarchical levels of work organization. She (Developer 2) commented on the problems of vertical learning at workplace. Developer 3 reacted to this dilemma by emphasizing the means of (vertical) boundary-crossing.

Developer 2: Well, at least we clearly had confusion when we organized that meeting where we invited our management level, as the management level didn't have a clue before the meeting why they should be there. They were asking what was to happen there and why they should be there.

[---]

Developer 3: You were saying that when the management was involved, so the boundary crossing was: "what's going on?" If you could in that situation [have a tool to] define what you are aiming at, it would help a whole lot.

Example 3:

A non-hierarchical way of dealing with the levels within a workplace emerged later in the learning process when the in-house developers' projects progressed. The participants discussed the start of the pilots, which invited more workers (outside the forum) to participate in the workplace development. The comment of Developer 4 led to the notion of a sequential undulation of development, which will be presented below (subsection 4.3, Example 7).

Developer 4: …it came to my mind right now, that, as we have these multiple models – Developer 2 [from same workplace] has one filled-in model, I have one – so it came to my mind that we could have one Development Radar model for us in-house developers, we could have one radar to our coming pilot team [Department B]. (--) And one radar in Department A. Because we all are on very different levels. (--) Then we would have two, three radar models to reflect on.

4.2 Horizontal undulation of learning

Horizontal peer-to-peer learning and exchange is usually seen as the strength of networks. In the context of the forum, horizontal dimension refers to the "intra-level" learning, above all, across the workplaces, among the participants from different work organizations, between the workplace projects. A great part of the discussion that took place in the networkshops when the in-house developers presented their projects might be interpreted in terms of horizontal learning. However, not all discussion and exchange implicates learning and whether learning took place through lively discussions is extremely difficult to prove. Our examples of horizontal undulation concern the use of the radar tool and the dialogue with managers in the extended networkshop. We may re-visit the data in order to find out, whether other pedagogical learning dialogues (for instance, in the workplace-to-workplace "sparring groups") would indicate horizontal learning.

Example 4:

The in-house developers reflected on the meaning of the radar tool and the "radar round" that we carried out a couple of times during the process. Each workplace project reported to the group by graphically presenting the progress of one's project on the radar (figure 2).

Developer 2: Well it ["radar round"] is useful, it gives a mirror to one's own project, that "oh, those guys are already on that phase, I wonder what they have done differently, or should we possibly act in a different way…" But, on the other

hand, the understanding here is that, as we deal with different development topics, also the rhythm of development differs. So I find it most interesting to hear where each of us is proceeding – even though we seem to be the last!

Developer 4: I agree that this tool serves, it connects, serves in a sense that one hears in this small round that were folks are going; each one's project is repeated and repeated so that it becomes familiar; also other projects than that with whom we work as a pair [in local tutoring].

Example 5:

The potential of horizontal learning beyond the boundaries of the forum was discussed in the extended networkshop by the managers and the chair of the regional learning network. Whereas the forum (as a part of the regional network) had attracted organizations of public-sector and social care, the need to expand the in-house development to the small firms was highlighted.

Chairperson of the learning network: I am wondering how to get enterprises to join this. How to get this same template to work among the entrepreneurs? [--] What the [in-house] development could be, actually: bringing new tools to the work community. And simultaneously really developing a firm. [And we need] story tellers [from the forum] whose work communities are proportioned to the size of these small firms of South Savo.

4.3 Sequential undulation of learning

It is interesting that the major insight produced by the introduction of the levels concerned the steps and phases of the development (inner circle in figure 2). This temporal movement is the third type analyzed and we named it sequential undulation.

The representation of the basic cycle model of the Developmental Work Research (figure 1) may have given a somewhat misleading idea of a linear proceeding step by step. By adding the levels of learning into the picture and asking the participants to analyze the phase of their workplace project in this framework made them to articulate, first, the need for pendulum between the phases and, second, the need to deal with the asynchrony across the levels. In fact, they transferred this notion to the workplace and started to discuss the asynchrony of multiple development processes at work, as was already mentioned in section 4.1 on vertical undulation.

Example 6:

When discussing the progress of the workplace development projects "on the radar" some of the in-house developers expressed the need to return to the previous phases. The notion of a pendulum movement of the development activity was generally shared.

Developer 5: We have proceeded so that on this radar we are in the modelling and piloting phase. Next Monday we will have this modelling finished and presented to our personnel. But simultaneously we have expanded our task a little bit, as we have

this big organizational change (--). It causes us quite many breaks, sort of, so that we do not know who is supposed to take care of what. So last week we decided to start to keep a problem log, so, in a sense, we went back to the collecting of mirror material. And they [the notes on the problem log] are discussed weekly in our short meetings and we will agree on further actions. Altogether, on the one hand we have proceeded, on the other hand returned back [gestures the movement on the cycle].

Developer 1: About that moving on and getting back, I somehow think that the more one is proceeding on this radar, the bigger the risk, or wish, or desire to return backwards. Then the pendulum just broadens, or rather I am – I'm sure I may speak for [Developer 8 from the same workplace] as well – we are strongly prepared to move back and forth.

Example 7:

In the piloting phase the need to return to previous steps of development concerned new groups at workplaces who joined the pilots. Now the asynchrony of multiple cycles became evident having concrete effects on the implementation of the projects. The comments of Developer 6 and the Local tutor are continuation to the thoughts of Developer 4, Example 3. (Developers 4 and 6 came from the same workplace.) It suggests that vertical and sequential undulation were intertwined.

Developer 6: In some sense, we are having the phases of two processes; this group [of in-house developers] has already processed it and gone pretty far, and now, in a sense, we have to return backwards when starting the pilots.

Local tutor: Using different points of the radar for different groups would show this asynchrony, which is true. (It may be that) for the manager or management or for some outsider, the project looks very advanced in some respect, but then a new group emerges, the pilot group, for example – it's anything but self evident that it will question the old activity. It may be happy with the old, and if the cycle of expansive learning won't start, the whole community won't get anywhere. Those who are active will progress on their cycle, but the next one will always start from the beginning.

Example 8:

On the level of individuals, the acceptance of the pendulum between the steps of the workplace development partly shaped the in-house developer's identity. It legitimized the implementation of an experimental development activity, in which the actual steps were not predetermined by the theory. These excerpts are from the closing seminar where the participants reflected on personal learning process during the forum. Developer 2 builds on the notion of a pendulum movement, whereas Developer 7 seems to be confident in following the sequential steps towards the goals.

Developer 2: This picture is the picture of my in-house developer. It is (--) a part of a pendulum clock. That pendulum clock is [our work organization]. And this machinery keeping the pendulum in motion is the theory instruction we have got. On the pendulum, there sits a happy in-house developer with a triangle [one of the

models of DWR] in hand, that she will never lose grip of. The pendulum motion is not going one direction, but it is possible to come back, a little bit, and it's not a bad motion. And again forth and back.

[--]

Developer 7: This depicts my in-house developer. When I joined the learning network of South Savo, I felt insecure. So much theoretical knowledge available, but somehow I couldn't structure and internalize it too well. (--) But then this Development Radar was extremely important for me, something that clarified my learning process. From it I could clearly see what we had achieved, where we are now, and what should be addressed next. That's when I had a light bulb moment, in a way; and what followed was our development workshop [at workplace] in February, that made me nervous in beforehand, whether it will succeed and how it will go. But then it really succeeded well, the results were good and we made really good [products developed in the workplace project], that were implemented in April.

5. CONCLUSION

This paper asked what learning might mean in a multi-level network and how it might be analyzed in order to gain knowledge for the pedagogical researchers and "interventionists." We adopted the heuristics of the undulating movement of the waves of learning and from the data identified three types of undulation, vertical, horizontal and sequential. All these types were connected to the networkshop interaction, during which the participants discussed their developmental workplace projects and received guidance to the methods of Developmental Work Research. The data episodes concerned chiefly the use of the learning tool "Radar". Based on the feedback from OLKC 2011 conference we consider extending this template of analysis to the entirety of data from both cycles of the forum I (2007-2008) and II (2008-2009).

The undulating movements show that learning in networks is much more complicated than being horizontal peer-to-peer learning often conceived as the leading idea of networks. Learning is also vertical, but this does not implicate hierarchical order. It means that the participants learn to move between the levels of developmental activity. They may reflect on their own proceeding on various levels and they may comment on others' workplace projects from different organizational positions. These positions were also utilized in the forum's work where the participants were entitled with different roles in the sparring groups to "mirror" and spur each others' projects. But this is outside the data of this paper and needs more examination in future.

In addition to horizontal and vertical movement learning in a multi-level network is undulating sequentially. In the beginning, the discrepancy between the networkshop level and the workplace level made the in-house developers to question the forum's activity, which meant a starting shot to their learning. Instead of linearity the participating in-house developers adopted a pendulum method of moving back and forth on the steps of the developmental work research. They learned to deal with the asynchrony of workplace development stemming from the fact that new actors joined workplace projects in different

phases. The notion of asynchrony also helped understand the differences of the developmental needs and the pulse of change at various workplaces. In sum, returning to the steps left behind, which in a linear workplace development would implicate failure, becomes necessary in a network.

We have previously argued that multiple levels need to be articulated and represented by models and tools to enable the participants to deal with the multiplicity (Toiviainen et al., 2009). By means of developmental tools the in-house developers started to conceptualize the meaning of the multi-layeredness (pendulum, asynchrony) and expanded the potential of workplace learning. Based on the resources of the cultural-historical activity theory we emphasize that a skillful tool-use aims at the expansion of the object of activity, which implicates learning at individual and collective levels. Tools mediate learning, and given the multiplicity, tools for learning network should multi-mediate directionalities of learning, in this case, by interweaving the vertical, the horizontal and the sequential undulations across levels.

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