Combining theories to reach multi-faceted insights into learning opportunities in doctoral supervision

Kobayashi, Sofie; Rump, Camilla Østerberg

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Sofie Kobayashi & Camilla Østerberg Rump
Department of Science Education, University of Copenhagen, Denmark
skobayashi@ind.ku.dk

Extended abstract

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Introduction

The aim of this paper is to illustrate how theories can be used in combination to explore opportunities for learning in doctoral supervision. While our earlier research into learning dynamics in doctoral supervision in life science research has focused on illustrating learning opportunities (Kobayashi, 2014; Kobayashi, Grout, & Rump, 2013; Kobayashi, Grout, & Rump, 2015) this paper focuses on the methodological advantages and potential criticism of combining theories. As argued by Clarke et al. (2011) the use of multiple theoretical approaches can yield less partial accounts than mono-theoretical research. Learning in doctoral education and from doctoral supervision is a complex endeavour, involving cognitive, social and emotional aspects of learning. Zembylas (2005) suggests three theoretical perspectives with the aim of linking cognitive and the emotional in science learning; conceptual change, socio-constructivism and post-structuralism. In the present study we re-examine data from earlier research to show how the use of different theories side-by-side can mutually inform each other in the interpretation of data.

Methods

The data has been derived from four observations of supervision of doctoral students in life science, each with a doctoral student and two supervisors. We select one episode from one supervision session, which we have identified in earlier work as a particularly good illustration of an analysis where combining theories yield deeper insight and understanding. We use the term *combining theories* with reference to Bikner-Ahsbahs and Prediger (2010). In their paper about networking of theories they advocate exploiting the diversity of theories in mathematics education as a source of richness rather than seeing the many different theories as a challenge for scientific progress. They describe the landscape of possible strategies for connecting theories along a gradient between the two extremes; ‘ignoring other theories’ and ‘unifying globally’ with respect to degree of integration. Our aim with using a diversity of theories is to gain a better understanding of a complex empirical phenomenon which cannot be understood or described in depth by one theoretical approach alone. For this purpose Bikner-Ahsbahs and Prediger argue that the different approaches need to come into interaction by combining or coordinating theories. In their terms *coordinating theories* means to build a conceptual framework by fitting elements from different theories together in an analysis. However, this approach becomes questionable if the theories are not compatible, as for instance individual constructivist theory or conceptual change on the one hand, and sociocultural perspective on the other. As argued by Packer and Goicoechea (2000) the constructivist perspective presume a dualist ontology, a divide between the knower and the known, the subject and an independent world, while the sociocultural perspective assumes a non-dualist ontology where learning is a process of becoming when the person as an acting being engages in activities in the world. Thus the perspectives on learning we set out to use have

different core assumptions and should not be used in coordination in one conceptual framework. Instead we use them in parallel, but in interaction. This is described in the results section below.

Results

Firstly we employ the concept of Legitimate Peripheral Participation (Lave & Wenger, 1991) in a coarse grained analysis. In the selected episode (Table 1) the doctoral student presents his reasoning behind his sampling procedures. The learning opportunity that can be identified from the participation perspective is the opportunity to practice, and the responses from his supervisors confirm his membership of the community of scientists.

Table 1. Episode from doctoral supervision in life science. Numbers refer to turn-taking or utterances.

101	PhD student	So I needed to select some ecological zones, which could represent kind of the whole country, but in a very small area
102	Main supervisor	Yes
103	PhD student	and for that I used a layer for some ecological zones that FAO, what's it called, defines them
104	Main supervisor	Yes
105	PhD student	from, it has to do with crops, I haven't investigated how they produce them
106	Main supervisor	No
107	PhD student	but what I thought, it was better to look at that than for instance soil types
108	Co-supervisor	I think you are right about that
109	PhD student	because FAO's are defined according to a biological response, you can say, a plant says something about something complex, it says something about humidity and season and soil type and so on. So I used them as, as interpreter, you can say
110	Main supervisor	I would like if you, next time, would demonstrate this for [name of co-supervisor] and me, because then we are better prepared when we arrive, that we have kind of, eh, right?
111	Co-supervisor	Yes, that's a good idea
112	Main supervisor	that we also feel that we have good insight in the map, actually
113	PhD student	Yes

In a finer grained analysis of the episode we use positioning theory (Harré & van Langenhove, 1999) to be able to say more about how the positioning may affect the PhD student's opportunities to recognize himself as a scientist. As an analysis of positioning requires us to propose storylines that draw from the cultural context, we first need to gain a better understanding of the content of the speech-acts in the interaction. Therefore we employ variation theory (Marton & Tsui, 2004) to study learning opportunities from the individual acquisition perspective, what Zembylas terms conceptual change. The use of variation theory reveals opportunities to learn about ecological zones. The PhD student contrasts zones based on soil types with zones based on crops as relevant selection parameters. He then expands the space of learning with by

generalising across aspects of biological response of the crops, humidity, seasons and soil type. This analysis of content is needed for us to propose the storyline of 'scientific reasoning'. A second storyline hypothesized in this episode is 'thorough fieldwork preparation' as the main supervisor asks the PhD student to demonstrate the map, and by doing that he simultaneously acknowledges the work of the PhD student as thorough. This affects not only the way the PhD student can see himself in the situation, but it can also increase his self-efficacy beliefs about his scientific thinking.

Discussion and Conclusions

This analysis illustrates how combining theories can enhance our understanding of learning opportunities. The partial analyses with each theoretical framework inspire or stimulate each other to an extent that they almost depend on each other in this case. The theories used in this analysis do not undergo any changes, as when coordinating theories and even theories with different ontological assumptions can be intertwined to yield a better understanding. On the other hand the theories are not merely supplementing each other as they bestow one another when intertwining the interpretations to get a multi-faceted insight into a phenomenon. The use of different theories becomes fruitful because of the interaction between theories.

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