

Examining interpersonal aspects of a mathematics teacher education lecture

Andreas Ebbelind¹ and Tracy Helliwell²

¹ Linnaeus University, Sweden

² University of Bristol, UK

In this paper we present findings from an initial phase of a more extensive study focussed on ways in which prospective mathematics teachers negotiate meaning from mathematics teacher education situations. The focus of this paper is on the language of one mathematics teacher educator and specifically the interpersonal aspects from one mathematics teacher education lecture in Sweden for prospective upper-primary school teachers. We draw on the enactivist view of cognition as a theoretical basis for a methodology we develop that utilises Systemic Functional Linguistics as an analytical tool for studying language-in-use. We exemplify our interpretations through a series of extracts from the mathematics education lecture. This initial phase of our study has exposed several important questions about how participating in an initial teacher education situation may contribute to the development of teacher identities, questions we raise throughout our analyses to provoke further investigation as part of our future research.

Keywords: mathematics teacher education, mathematics teacher educator, enactivism, systemic functional linguistics, language

1 Introduction

In this paper, we turn our attention to one mathematics teacher educator with a focus on the interpersonal aspects of the mathematics teacher educator's language-in-use during a mathematics teacher education situation. By interpersonal aspects of language-in-use we are specifically referring to "the identities and relationships of the participants in the communication" (Morgan & Sfard, 2016, p. 100). In doing so, we aim to contribute with insights to the research field of mathematics education about how the language of mathematics teacher educators, during teaching situations, may construe the identities and relationships with prospective teachers of mathematics. We highlight a process during a teacher education programme that illustrates how the teacher educator uses past and present experience when talking about mathematics, mathematics education, and prospective teachers' future teaching of mathematics (Ebbelind, 2020). The content of the lecture is then used by the prospective teachers to re-negotiate their ideas of mathematics, mathematics education, and the future teaching of mathematics. In this paper, we report on part of a more extensive study to

ARTICLE DETAILS

LUMAT Special Issue
Vol 12 No 1 (2024), 113–125

Pages: 13
References: 14

Correspondence:
andreas.ebbelind@lnu.se

[https://doi.org/10.31129/
LUMAT.12.1.2147](https://doi.org/10.31129/LUMAT.12.1.2147)



understand how prospective mathematics teachers negotiate meaning from mathematics teacher educators' language during mathematics teacher education programmes. Understanding this negotiation of meaning addresses the relationship between interaction during teacher education situations and the kinds of meaning realised by the prospective mathematics teachers from those situations. In this way, we are interested in experiences as they are happening which we call pre-reified processes, i.e., what can be observed as happening during teacher education situations that precede and give rise to what others might term beliefs, knowledge, and identity (Ebbelind, 2020; Skott, 2018). A reification process can be described as how lived experiences are represented as something abstract, as reifications. Depending on the perspective used, reifications often include identities, knowledge and beliefs. In this paper, we aim to identify possible ways the mathematics teacher educator supports prospective mathematics teachers in realising meaning during a teacher education situation through analysing his use of language.

We conceptualise mathematics teacher educators as bricoleurs. A bricoleur forms language in each teaching situation, from pre-existing material (for example, research literature or student literature) or past and present lived experiences (for example, as a learner of mathematics or as a classroom teacher of mathematics). During lectures, mathematics teacher educators assemble ideas using whatever experiences come to hand in the immediate social teaching situation.

1.1 Background

This study differs from existing research within mathematics education, in three ways: Firstly, in relation to research perspectives and research interests; secondly, in relation to the study of language within mathematics teacher education; and thirdly, in relation to research about mathematics teacher educators. We briefly expand on each of these areas in this section, before discussing our theoretical approach. In the introduction, we mentioned the first way in which this research differs from existing research on beliefs, knowledge, and identity in that our interest is in the pre-reified processes that precede and give rise to what others term beliefs, knowledge, and identity. We focus on processes to reduce the emphasis on objectifications in research about mathematics teacher educators and to have a clear focus on the mathematics teacher educator and the prospective mathematics teachers.

Secondly, this research differs from existing research on the study of language within mathematics teacher education. There already exists a large and evolving body

of research focused on the use of language within the domain of mathematics education (Planas et al., 2018), covering topics mainly related to “the language of the learner, the language of the teacher/classroom and the language of mathematics” (p. 198). However, mathematics teacher education and mathematics teacher educators only receive one reference in Planas et al.’s. (2018) overview in relation to the use of language, under the title, ‘What more could we learn in the next decades?’ Planas et al. (2018) ask themselves how the methods and research results from the three categories above (the language of the learner; the language of the teacher/classroom; and the language of mathematics) play out during mathematics teacher education situations by mathematics teacher educators. In our view, this question corresponds to a need to pay more attention to issues of language responsiveness in teaching by mathematics teacher educators, to start developing a picture of the kinds of meanings prospective mathematics teachers can realise from teacher education situations in which they engage. Thus, this paper contributes to an identified gap within the field of research on language.

Finally, Beswick and Goos (2018) consider research on mathematics teacher educators, as a general gap within the community of mathematics education research. They define a mathematics teacher educator as “anyone engaged in the education or development of teachers of mathematics” (p. 418). The research community needs to understand mathematics teacher educators’ ways of participating in mathematics teacher education situations. One way to build this understanding is by studying the language of mathematics teacher educators, since mathematics teacher educators guide prospective mathematics teachers in their learning and social development as teachers-to-be. Thus, the language of mathematics teacher educators is an area of research yet to be established, and this research locates itself within this unresearched area. In the following section, we briefly introduce enactivism as the theoretical underpinning of this study, before outlining the methodology (for a more detailed methodological discussion, see Helliwell & Ebbelind, in press).

1.2 Enactivism: the theoretical approach

Enactivism is a theory of cognition (learning) that is rooted in biology and viewed from an evolutionary position. In this view, cognition is not a representation of an independently existing world or the construction of an external reality, but rather, it is a continuous adaptive process in which we as individuals co-evolve with our environments (Maturana & Varela, 1998). Learning can be described as “a recursive

process linked to actions in the world giving feedback leading to adapted actions” (Brown, 2015, p. 192). Therefore, learning is not seen as a *product* of reification within a context or environment, rather, learning is an active process viewed as dynamic, situated, and emergent (Maheux & Proulx, 2015). We use principles from enactivism to inform our research methodology, and to support and guide our study. Enactivism guides the process described within this paper as a main criterion for research (Gee, 2010) since we view methodology and results as intimately connected.

2 Methodology: A recursive inquiry

In this section, we present the methodology that is underpinned by the enactivist view of cognition, the basis of which is a recursive inquiry. In a recursive inquiry, the research process involves “a repeated interaction, with results from one iteration feeding into the next” (Coles, 2015, p. 239). Our research (beyond that reported in this paper) is designed so that each phase of analysis feeds directly into the next phase. A key feature of a recursive inquiry is to acknowledge the relationship between data and the analysis of that data, or in other words, between text and context. Thus, it is important to acknowledge that, as researchers, we are not able to separate ourselves from what we observe, and from the process of data analysis. Therefore, we situate the context of the empirical material alongside our own context as researchers, including our teaching and research backgrounds. In the following section, we outline some of these contextual features before describing how we analyse the empirical material.

2.1 The context of the study and the researchers

The empirical material we use in this paper is a transcript of an introductory lecture and seminar for a 30 ECTS (European credit transfer accumulation system) credits (one full semester) mathematics education course. The mathematics teacher educator has been a teacher educator for over 30 years and is well known in Sweden for his academic skills. In this course, he works with prospective teachers to teach upper primary school students (aged 10-12 years) in the context of the reform mathematics movement. The reform mathematics movement “promotes a vision of school mathematics that focuses on students’ creative engagement in exploratory and problem-solving activities as they develop their understandings of significant mathematical concepts and procedures” (Skott et al., 2018, p. 164). In Sweden, prospective teachers

at these levels educate to become generalists. As a result of this situation, primary teachers will usually teach a variety of subjects. Due to the range of subjects they are expected to teach, their level of education in most these subjects can be modest and their professional motivation is often linked more to the profession as a whole than specific subject disciplines (Ebbelind, 2020).

The community of mathematics teacher educators and mathematics education researchers is a diverse group of individuals from various professional backgrounds and contexts. The authors of this paper are both university-based mathematics teacher educators and researchers in mathematics education. Andreas works at a university in Sweden where he teaches prospective teachers both at pre-school (aged 1-6) level and primary school (aged 7-12) level. He was a pre-school teacher and lower primary teacher for ten years before moving to work at the university as a mathematics teacher educator. His research background links in different ways to Systemic Functional Linguistics, social practice theory and symbolic interactionism. Tracy works at a university in the UK teaching prospective secondary school (aged 11-18 years) mathematics teachers on a one-year postgraduate programme. She taught mathematics in secondary schools for thirteen years before moving to the university as a mathematics teacher educator. Her research background links to the perspective used in this study, enactivism, specifically in relation to the study of mathematics teacher learning and the learning of mathematics teacher educators.

In terms of enactivism as a methodology, Reid (1996) sets out two features of enactivist research: “the importance of working from and with multiple perspectives, and the creation of models and theories which are good-enough *for*, not definitively *of*” (p. 207, emphasis original). As (multiple) university mathematics teacher educator researchers from different cultures and contexts (e.g., Sweden/UK; Primary/Secondary), we consider our different histories of experiences as shaping the ways we each see the world of mathematics teacher education which includes the way we see our data. Thus, in this recursive inquiry, we utilise multiple perspectives by looking at the same data but through different lenses, making multiple revisitations of data using these different perspectives. In relation to creating theories that are good-enough for, not definitively of, we acknowledge the potential for multiple interpretations of the data, and do not claim to be reporting on some external truth of the situation. Rather, we present our interpretations which we invite readers to examine for themselves.

2.2 Analysing the lecture

In terms of using enactivist methodology to inform the analysis of language, Coles (2015) describes “five mechanisms that allow an approach to language and learning, consistent with an enactive view” (p. 239). Specifically, these five mechanisms are: recursive inquiry; the systematic search for pattern; equifinality; micro-analysis; and meta-communication (Coles, 2015, p. 239). In this paper, we explicitly exercise two of the five mechanisms (the systematic search for pattern; and micro-analysis), as described briefly below.

According to Coles (2015), the search for pattern involves splitting or segmenting data “in a systematic manner” (p. 239) to identify observable similarities and differences. In the first stage of our analysis, our systematic search for pattern, we use Systemic Functional Linguistics as an analytical tool to split and segment the data so that patterns may emerge that point us to particularly significant moments within the transcript that merit further analysis. Systemic Functional Linguistics serves to uncover, through functional analysis, how the teacher educator produces a particular wording in a specific social practice. Every text reflects that it is about something (ideational meta-function), is addressed to someone (interpersonal meta-function), and uses a particular mode, spoken or written language, for example, to express its meanings (textual meta-function) (Ebbelind, 2020).

In this paper, we focus on the interpersonal meta-function. How the teacher educator is addressing the prospective teachers and other entities that may construe identities and relationships of the participants in the communication. The interpersonal meta-function relates to voice, tense, polarity, and modality. Voice refers to the personal pronoun in the text. Tense refers to whether the proposition is valid for the past, present, or future. Polarity marks if the proposition has positive or negative validity. And lastly, modality relates to the degree of certainty in an utterance (Halliday & Hasan, 1989). We exemplify each of these aspects in the next section. Having used Systemic Function Linguistics as an analytical tool to identify significant moments within the data, we then employ a more detailed ‘second stage’ of analysis by adopting the micro-analysis techniques as described by Coles (2015). In short, this involves approaching “small sections of transcript with a slow and repeated reading, keeping some questions in mind” (p. 241). The questions that Coles suggests, in keeping with an enactivist view of cognition, are: “What pattern does it follow?”, “What pattern does it break?”, “What distinction is implied?” (p. 241). It is not the intention in this paper to present a full account of the analysis, but we present four extracts from the

full transcript based on the significant moments identified during our systematic search for pattern.

3 Analysis and results

In the analysis, we first focused on the voice of the text by marking personal pronouns but, at the same time, marking entities or objects that were evident in the transcript. In the transcript from the lecture, the teacher educator is present through “I”, “my”, “me”, and a “we”. The teacher educator shares the “we” with the prospective teachers. Prospective teachers are present as “you”, “some of you” while teachers in mathematics, as a unit of people, is present through “all” and pupils learning mathematics as “they” and “them”. The teacher educator implies that pupils and some prospective teachers think mathematics learning “is as it is”. The teacher educator relates to the subject of mathematics, collectively, with “many times”, “many students”, “do this”, “it (mathematics)”, “these” and “each other”. Subject voices that are present in the lecture are researchers like “Andrej Dunkel”, “Anna Sfard” and “Governmental reports and steering document”.

Then we marked the tense to highlight if the proposition was valid for the past, present, or future. Many things related to the past in the lecture: the teacher educator being a teacher and teacher educator for a long time, prospective teachers own experience of teaching, being a father and teaching children at home, past reports from the national board of education, experience from being in a classroom teaching, reflecting on deficits in own teaching in the past, the deficit in prospective teachers own past and current experience at the university, and positive experience of being a former teacher and past use of mathematics textbooks as not optional. There are also references to the present: this ongoing lecture, current ongoing mathematics teaching with no understanding, the deficit of not understanding mathematics, students do assignments from the teacher educators past, talking about the experience of this “new mathematics” (expected to be different from their experience), solving problems (expected to be different from their experience), what is mathematics and what is the role of language when teaching today. While most parts in the transcript refer to the past or present, only a few parts relate to the future. These are getting pupils in your (prospective teachers’) future classrooms to think, your responsibility to make things happen, and the future goal of getting pupils to understand (expected to be different from their experience).

Next, we marked the polarity to stress whether the proposition indicated positive or negative polarity. The transcript contained much negative polarity. For example, “not remember”, “not feel”, “not their (understanding)”, “not understood”, “not thinking”, “not understanding”, “not fun”, “not simply”, “not really”, “not do”, “not have”, “not obviously”, “not done”, “not teach”, “not want”, “not explained”, “not know”, “not feel”, “not but”, and “not think”. The use of negative polarity is closely connected to a discursive counterpart, in most cases this counterpart is past experience.

Finally, we marked the modality, which reflects the level of certainty that a clause has. Modality is mostly very high throughout the lecture referring to reform mathematics, family relations, the national board of education, recommendation to the students’ future teaching (strong, “we have to”), critical case from the teacher educator’s past, national mathematics tests, how it should be when teaching (concerning how it should not be), and being ironic about the use of textbooks and governmental investigations of mathematics teaching. However, when the teacher educator talks about the prospective teachers as solving problems, the modality is low. When the teacher educator addresses the prospective teachers implying them to synthesise the content and later make an analogy for students to understand, the modality becomes low. There are also examples of low modality related to mathematics as something for the students to master.

In the systematic search for pattern, we highlighted those emergent patterns from the transcript with its foundation in the analysis above. Here we outline nine observations made:

1. The mathematics teacher educator positions the prospective teachers as a unit, ascribing them all with negative experiences of mathematics.
2. The mathematics teacher educator often goes from past experience to present experience of future teaching.
3. When going from past experience to present experience of future teaching negative polarity is used. The negative polarity is almost exclusively used with negative past experiences of teaching mathematics.
4. Concerning the entities referred to in the text, familiar sources are the experiences of the mathematics teacher educator and the experiences of the prospective teachers.
5. Looking at the tense, we identify that this lecture lacks focus on current and future practices.

6. When focusing on current and future practices, the main parts relate to the deficit story of prospective teachers in relation to mathematics.
7. Modality becomes low only in relation to the prospective teachers and the subject of mathematics. For instance, when the teacher educator talks about the prospective teachers as solving the problem. When the teacher educator addresses the prospective teachers, implying them to synthesise the lecture's content and later, when the teacher educator makes an analogy for the prospective teachers to understand. There are also examples of low modality relating to mathematics as something for students to master.
8. Throughout the lecture, modality is predominantly high, for instance, when referring to content to teach, family relations, the national board of education, the recommendation to the students' future teaching (strong, "we have to"), the critical case from the teacher educator's past, national mathematics tests, how it should be when teaching (concerning how it should not be), being ironic about the use of textbooks and governmental investigations of mathematics teaching.
9. An observable pattern in the transcript is a shift from high to low modality or vice versa.

We will now present the findings from our micro-analysis phase by presenting four short extracts of transcript from the mathematics education lecture, keeping in mind Coles' (2015) suggested three questions: What pattern does it follow? What pattern does it break? What distinction is implied? Even though some of the extracts below contain many of the observed patterns above, we mainly focus on one or two in each extract.

The first extract, extract 1, exemplifies a common theme found in the lecture. When the teacher educator addresses the prospective teachers, the modality is low (e.g., "I think", "do not feel", "was not", "will then try"), otherwise the modality is high throughout the lecture. In the first part of the extract, we can also interpret how the teacher educator starts ascribing the group of prospective mathematics teachers as having had negative experiences of mathematics.

Extract 1: "One has understanding of things when one does not have to remember what one must remember to be able to know" (Andrejs Dunkels). I think many people here today... who have gone through the whole school system and high school do not feel that way... was mathematics not really something you had to remember ... do this here and it will be alright [...] Students often do not have the skills needed to be able to present their thinking in writing ... It is not

simply [...] how many doors do you have at home? what you come up with, we will then try to bring into this lecture. You should think ...

Throughout the lecture, the mathematics teacher educator implies that most (low-modality) prospective teachers have had a negative experience of learning mathematics as students and directly addresses the prospective teachers' previous experiences to promote the reform agenda. We ask ourselves if there is a deficit story here that is non-outspoken, and if that story is consistent throughout the whole mathematics teacher education course (something that we will explore as this research project goes on). An interesting question arising from the analysis concerns the implication of first positioning prospective teachers as students with negative experiences and then aligning them with today's mathematics students, like in the following extract. How do the variety of prospective teachers align with this story? How do the prospective teachers understand the given story?

The following extract, extract 2, exemplifies a common pattern found in the lecture and illustrates a break in pattern concerning modality, from high modality (e.g., "too many students", "we know that") to low modality (e.g., "if you understand", "we want our students", "students often also") back to high modality (e.g., "we must", "you must", "we have to").

Extract 2: Too many students have not understood anything ... We know that from the reports from the national board of education. If you understand, you really do not have to keep such a lot in mind because you know why it is as it is, and you can just pick it up and use it and we want our students to be able to do that in the future. Students often also do not have the skills needed to be able to present their thinking in writing [...] We must... you must in the future be able to write mathematically yourself... we have to give students these tools to pass the national tests.

At the beginning of the lecture, we interpret the teacher educator as positioning all prospective teachers within a deficit story. The prospective teachers were grouped into the category "students". What does that mean for the prospective teachers when the teacher educator repeatedly addresses students' experiences during the lecture? In the background, there seems to be a general failure of past teaching of mathematics that is addressed. The failure is used to promote another type of teaching by the mathematics teacher educator.

In relation to this "failure" the teacher educator addresses mathematics as a subject with low modality. The break in patterns here can be observed in the analysis by observing the personal pronoun and the tense. If the tense relates to the current

ongoing practice, like extract 3 below, and addresses the prospective teacher (e.g., “you”, “we”) the modality mostly becomes low. If the tense relates to future teaching practices, like in the last part of extract 2, the modality becomes high. Extract 3 below is an example of low modality, when the teacher educator addresses the subject of mathematics.

Extract 3: What can it [mathematics] be ...You have to think a lot about this ... It is not that obvious [...] Should we jump into the world of mathematics ... the world that this course is about ... In mathematics, it is not quite as obvious...

Even though the mathematics teacher educator promotes another agenda, namely the reform agenda, the mystification, or exclusivity of mathematics is still a part of the way the lecture is conveyed. One interpretation from the analysis, is that there seems to be a narrative style that can be identified within the transcript, in that there is a story that unfolds. A question this raises for us is how this style influences the prospective teachers while construing the identities and relationships of themselves as teachers-to-be.

The final extract, extract 4, exemplifies a commonly identified pattern. By looking at the tense, one can conclude that this lecture lacks focus on current and future practices. The main parts of the lecture relate to the past experiences of the mathematics teacher educator and the past experiences of the prospective teachers.

Extract 4: If you do not understand, mathematics is not fun, and it is not so strange really ... so this is connected. I know that I thought it was terribly unfair when I studied mathematics many years ago... because I was a student who did a lot of stuff... did lots of examinations and it went well all the way, but I did not have much understanding of higher mathematics ... I got a completely different experience as a teacher ... when I taught the students ... the students had the same perception and experienced the same as I did ... which I had always experienced and they had passed the courses, but they had not really understood ... Then I really started to think about how to learn to understand ... for real ...

Throughout this lecture the teacher educator promotes the idea that there is another story to tell about teaching and learning mathematics than the expected experiences of the prospective teachers. By observing the analysis of the text there is a kind of anticipation of something to come.

4 Discussion

In this paper we have explored the interpersonal aspects of one mathematics teacher

education lecture in Sweden since those interpersonal aspects can contribute to constructing the identities and relationships of prospective teachers during initial teacher education situations. We focussed on the pre-reified processes (i.e., what can be observed as happening during teacher education situations) to exemplify the potential meanings that may be realised by the prospective mathematics teachers. At the beginning of the lecture, one possible interpretation is that the prospective teachers are positioned within a deficit story. What does it mean for the prospective teachers when the teacher educator frequently addresses their experiences as students during the lecture? In the background, there also seems to be a sense that mathematics teaching has, in the past, been unsuccessful. This failure is used to promote another type of teaching by the mathematics teacher educator who invites the prospective teachers to question their own experiences in relation to the aims of the reform agenda. In doing so, the teacher educator almost exclusively draws on the past experiences of himself and the expected experience of the prospective teachers. The mathematics teacher educator uses his own development as a mathematics teacher as background to promote their change of perspective. We now ask how participating in this initial teacher education situation may contribute to the development of a teacher identity. The process of analysis has led us to asking several questions, it is beyond the scope of this paper to specifically address these questions here, we hope to do this as our study continues.

In this paper we have, with a shared interest, set out to identify possible ways the mathematics teacher educator supports the prospective mathematics teachers in realising meaning during a teacher education situation. In doing so we have used our different research backgrounds. In the next phase of this project, we intend to analyse transcripts from a prospective mathematics teacher attending the exemplified lecture and seminar. This will be done in our pursuit to understand how prospective mathematics teachers negotiate meaning from mathematics teacher educators' language during teaching situations. One broader question that may be of interest within the mathematics teacher education community, is whether mathematics teacher educators arrange their teaching during teacher education programmes with the background of the deficit story of prospective mathematics teachers. How are we, as mathematics teacher educators ourselves, affected by the media debate, that aims to win over the prospective mathematics teachers whose experiences in relation to mathematics may be looked upon as problematic.

References

- Beswick, K., & Goos, M. (2018). Mathematics teacher educator knowledge: What do we know and where to from here? *Journal of Mathematics Teacher Education*, (21)5, 417–427.
<https://doi.org/10.1007/s10857-018-9416-4>
- Brown, L. (2015). Researching as an enactivist mathematics education researcher. *ZDM Mathematics Education*, 47(2), 185–196. <https://doi.org/10.1007/s11858-015-0686-3>
- Coles, A. (2015). On enactivism and language: Towards a methodology for studying talk in mathematics classrooms. *ZDM Mathematics Education*, 47(2), 235–246.
<https://doi.org/10.1007/s11858-014-0630-y>
- Ebbelind, A. (2020). *Becoming recognised as mathematically proficient: The role of a primary school teacher education programme* [Doctoral dissertation]. Linnaeus University, Linnaeus, Sweden.
- Gee, P. (2010). *An introduction to discourse analysis: Theory and method* (3rd ed.). Routledge.
<https://doi.org/10.4324/9780203847886>
- Halliday, M. A. K., & Hasan, R. (1989). *Language, context, and text: Aspects of language in a social-semiotic perspective* (2nd ed.). Oxford University Press.
- Helliwell, T., & Ebbelind, A. (in press). Combining enactivism with systemic functional linguistics: A methodology for examining (mathematics teacher educator) language. *Journal of Mathematics Teacher Education*.
- Maheux, JF., & Proulx, J. (2015). Doing|mathematics: Analysing data with/in an enactivist-inspired approach. *ZDM Mathematics Education*, 47(2), 211–221.
<https://doi.org/10.1007/s11858-014-0642-7>
- Maturana, H. R., & Varela, F. J. (1998). *The tree of knowledge: The biological roots of human understanding* (R. Paolucci, Trans.). Shambhala. (Originally published 1987).
- Morgan, C. & Sfard, A. (2016). Investigating changes in high-stakes mathematics examinations: a discursive approach. *Research in Mathematics Education*, 18(2), 92–119.
<https://doi.org/10.1080/14794802.2016.1176596>
- Planas, N., Morgan, C., & Schütte, M. (2018). Mathematics education and language: Lessons and directions from two decades of research. In T. Dreyfus, M. Artigue, D. Potari, S. Prediger & K. Ruthven (Eds.) *Developing research in mathematics education. Twenty years of communication, cooperation and collaboration in Europe* (pp. 196-210). Routledge.
<https://doi.org/10.4324/9781315113562-15>
- Reid, D. (1996). Enactivism as a methodology. In L. Puig & A. Gutierrez (Eds.), *Proceedings of the 20th Annual Conference of the International Group for the Psychology of Mathematics Education* (vol. 4) (pp. 203-209). <http://www.igpme.org/publications/current-proceedings/>
- Skott J. (2018). Re-centring the Individual in Participatory Accounts of Professional Identity. In G. Kaiser, H. Forgasz, M. Graven, A. Kuzniak, E. Simmt & B. Xu (Eds.) *Invited Lectures from the 13th International Congress on Mathematical Education*. ICME-13 Monographs. Springer. https://doi.org/10.1007/978-3-319-72170-5_33
- Skott, J., Mosvold, R., & Sakonidis, C. (2018). Classroom practice and teachers' knowledge, beliefs and identity. In T. Dreyfus, M. Artigue, D. Potari, S. Prediger & K. Ruthven, (Eds.) *Developing Research in Mathematics Education*. (pp. 162–180) Routledge.
<https://doi.org/10.4324/9781315113562-13>