

# COMBINING AND COORDINATING THEORETICAL PERSPECTIVES IN MATHEMATICS EDUCATION RESEARCH

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*The author presents and discusses general issues related to combining and coordinating different theoretical perspectives and approaches in ongoing work on people's affective and social relationships with mathematics. The discussion is based on two concrete examples: Coordination of a sociological perspective (habitus) with an anthropological perspective (situated learning) in combination with a theoretical gender perspective on the analyses of qualitative data. The ambition of the paper is to bring a terminological clarification of differences between "perspective" and "approach" into the work on networking strategies for connecting theories.*

## INTRODUCTION

For the last 15 years a new international research field has been cultivated in the borderland between mathematics education and adult education. In order to study adults learning mathematics, conceptual frameworks and theoretical approaches has been imported from the two neighbouring fields and restructured (Wedege, 2001). Mathematics education research has welcomed and incorporated this new field where adult numeracy versus mathematical knowledge is continuously debated (FitzSimons et al., 2003). In this context, "diversity is not considered as a problem but as a rich resource for grasping complex realities" — as is stated in the call for papers from Working Group 9, *Different theoretical perspectives and approaches in research*, CERME6. As a consequence "we need strategies for connecting theories or research results obtained in different theoretical approaches", and Prediger, Bikner-Ahsbabs and Arzarello (2008) propose a terminology for dealing with this issue in the article "Networking strategies and methods for connecting theoretical approaches". As they state this is the "first steps towards a conceptual framework", which is based on the work in the Theory Working Group of CERME5:

The terminology of *strategies for connecting theoretical approaches* is presented as pairs of strategies (understanding others / making understandable; contrasting / comparing; combining / coordinating; synthesizing / integrating locally) within a scale of degree of integration from "ignoring other theories" to "unifying globally". The term *coordinating* is used when a conceptual framework is built by well fitting elements from different theories. This can only be done by theories with compatible cores. The term *combining* is used when theoretical approaches are only juxtaposed. This does not require complementarity or compatibility. Even theories based on conflicting principles can be combined. Finally, the term *networking strategies* is used to conceptualize those connecting strategies, which aim at reducing the number of unconnected

theoretical approaches while respecting their specificity (Prediger et al., 2008, pp. 170-173). In this paper, I also follow Radford (2008) when he suggests considering theories in mathematics education as triples  $\tau = (P, M, Q)$ , where P is a system of basic principles “which includes implicit views and explicit statements that delineate the frontier of what will be the universe of discourse and the adopted research perspective” (p. 320); M is a methodology supported by P; and Q is a set of paradigmatic research questions.

The research project *Adults learning mathematics in school and everyday life* is an example of effort to grasp complex realities by connecting different theoretical approaches and perspectives (see [http://www.mah.se/templates/Page\\_\\_\\_\\_\\_76536.aspx](http://www.mah.se/templates/Page_____76536.aspx)). Here, the purpose is to develop a comprehensive theory on conditions for adults learning mathematics, i.e. to establish an interdisciplinary theoretical framework to describe, analyse and understand the conditions of adults’ learning processes — including social and affective aspects (Evans & Wedege, 2004; Wedege & Evans, 2006). In the research process, we find the relational interplay between theoretical investigations and empirical studies crucial when developing the theoretical framework, and different connecting strategies are used. Below, strategies of combining and coordinating are presented with two examples from this work. In the article “To know or not to know mathematics – that is a question of context” (Wedege, 1999), two theoretical perspectives (habitus and situated learning) are coordinated in the analysis of the data from a mathematics life history interview. In the paper “A gender perspective on adults’ motivation to learn mathematics” (Wedege, 2008), a theoretical gender perspective was adopted in the analysis of existing qualitative data from a large English research project on adults’ reasons for studying mathematics.

In this paper, I present and discuss theoretical and methodological issues from the work in progress on people’s affective and social relationships with mathematics, drawing on the work of the CERME Working Group. The focus is on the influence of combining and coordinating different theories on the research process. But first, I shall propose a terminological distinction between a theoretical approach and a theoretical perspective.

## **THEORETICAL APPROACHES VERSUS THEORETICAL PERSPECTIVES**

I adapt the understanding of “theory” as proposed by Prediger et al. (2008); i.e. the basic frame – or working definition – for discussion of conditions for connecting theories is “a dynamic concept of *theory* [or *theoretical approach*] whose notion is shaped by its core ideas, concepts and norms on the one hand and the practices of researchers – and mathematics educators in practice – on the other hand” (p. 176; my insertion and italic). According to this dynamic understanding, theories and theoretical approaches are constructions in a state of flux and theoretical approaches guide and are influenced by observation (p. 169). The notion of theory is broad when “theory” is synonymous with “theoretical approach”. A first consequence is that theory is not only a guide for thinking but also for acting – for methodology. In the article

“Theories of mathematics education: Is plurality a problem?”, Lerman (2006) examines the diversity of theories. He does not define “theory” but by looking at the examples and the proposed categorization of social theories within the mathematics education research community (1. Cultural psychology; 2. Ethnomathematics; 3. Sociology; 4. Discourse) it is obvious that Lerman’s understanding of “theory” encompasses methodology and even *problematique* understood as a paradigm for mathematics education research (cf. Wedege, 2001). This conception is in contrast to Niss (2007) who presents a static definition of theory as a stable, coherent and consistent system of concepts and claims with certain properties; for example, the concepts are organized hierarchically and the claims are either basic hypotheses and axioms or statements derived from these axioms.

Another consequence of “theory” and “theoretical approach” being used as synonyms is that “theory” is implicitly distinguished from “theoretical framework”, which does not automatically involve a methodology. The same goes for “theoretical approach” versus “theoretical perspective” and, in what follows, I shall suggest a terminological clarification of the latter pair.

I start by looking at the syntax and semantics of the two English nouns in the context of the debate in the Theory Working Group. According to the dictionary, “approach” is a verbal noun meaning the act of approaching (begin to tackle a task, a problem etc.). “Perspective” means a view on something from a specific point of view (seen through a filter) (Latin: *perspicere* = looking through). In our context, the noun does not have a verbal counterpart. The Danish verb “*perspektivere*” meaning “to put something into perspective” is not suitable here. In order to distinguish the two terms, I propose the following clarification: A *theoretical approach* is based on a system of basic theoretical principles combined with a methodology, as defined by Radford (2008), hence, guiding and directing thinking and action. A *theoretical perspective* is a filter for looking at the world based on theoretical principles, thus with consequences for the construction of the subject and problem field in research; that is the field to be investigated (cf. Wedege, 2001). For example, in the literature reference is often made to socio-cultural perspectives on mathematics education, simply meaning that social and cultural aspects of the educational phenomena are taken into account in research. Within the suggested terminology, it would not make any sense to talk about socio-cultural approaches without a reference to a specific theory, e.g. a socio-cultural approach – or *problematique* – like Engeström’s (2001).

In order to exemplify how different theoretical perspectives which share an emphasis on the social dimension in mathematics teaching and learning lead to different interpretations and understanding of a short transcript of students’ collaborative problem solving, Gellert (2008) compares and combines “two sociological perspectives” on mathematics classroom practice meaning. In order to “emphasise the theoretical grounds” of the two perspectives as he says, Gellert terms them “structuralist” and “interactionist” respectively. In this text, he is using the two terms “perspective” and

“approach” alternatively without any terminological clarification. However, it seems that his choice of terms is deliberate and that his usage matches the distinction proposed above. He is talking about theoretical and methodological “approaches to research in mathematics education” (pp. 216, 220, 222) and “research approaches” (pp. 220, 221), and he concludes:

The methodological approach I am sketching reflects a change of theoretical perspectives: Having identified relevant passages within the data material (from the structuralist point of view), these passages are analysed according to the standards of interactionist interpretation techniques (Gellert, 2008, p. 222).

In his discussion of the general issue of combining two theoretical perspectives, Gellert uses a piece of data – a short transcript of sixth-graders’ collaborative problem solving. He states that “by selecting and focusing on this particular piece of data I have already taken a structuralist theoretical perspective” because, from this perspective, the passage is “a key incident of specification of inequality in the classroom” (p. 223).

## **COORDINATING AND COMBINING THEORETICAL PERSPECTIVES**

A consequence of the terminological distinction between a theoretical approach and a theoretical perspective suggested above is this: In the network strategy of combining, theoretical approaches and theoretical perspectives are juxtaposed and they do not have to be complementary or compatible. But, in the strategy of coordinating, where well fitting elements from different theories are built into a conceptual framework, I consider only theoretical perspectives and they have to be complementary or compatible.

When theories are combined, a subject area is studied with different theoretical approaches. The area is structured into different problem fields to be investigated and different results are produced. When compatible or complementary theoretical perspectives are coordinated, the subject area is studied from an integrated perspective and one result is produced. According to Prediger et al. (2008) the strategies of coordinating and combining theories are mostly used for a networked understanding of an empirical phenomenon or a piece of data. In the following examples the aim of the networking is partly this and partly directed towards developing a theoretical framework.

### **Coordinating theoretical perspectives**

As an example of coordinating theoretical perspectives for networked understanding of a piece of data, I have chosen the analysis of a life history interview (Wedege, 1999). In a narrative interview with a 75 year old woman, Ruth, about mathematics in her life there is a contradiction which is well known in adult education: many adults resist in learning mathematics in formal settings while they are mathematically competent in their everyday life. This particular woman, who had really bad experiences with mathematics in secondary school, went to a Technical School to be a draughts-

man as 50 year old and she got the top grades in mathematics. But her dispositions towards having to do with mathematics did not change, neither did her beliefs about herself and mathematics. While some adults change their attitude to mathematics during a training course, others fail to do so. For some people, this means something for their image of themselves and their life project, for others not. These differences cannot be explained solely within the educational context and the students' current situations and perspectives. In order to expand the context for analysing learning processes and drawing a link to the lives lived by adult students, I have attempted to combine Lave and Wenger's concept of situated learning with Bourdieu's concept of *habitus*, i.e. systems of durable, transposable dispositions as principles of generating and structuring practices and representations (Bourdieu, 1980).

Lave and Wenger (1991) see learning as a social practice and the context of their analysis of learning processes is the current community of practice. The theory of *situated learning* is about learning as a goal-oriented process described as a sequence from legitimate peripheral participation to full participation. Throughout her life Ruth has participated in a number of different communities of practice (family, school, work, etc.). She learned a number of things in her mathematics lessons: that she was stupid at mathematics, that she was not interested in it, and that in any case mathematics had no relevance for her life. She was confirmed in this by never having failed in practical situations due to a lack of mathematics knowledge. When, much later in her life, Ruth got the highest grade in the subject of mathematics while being trained as a draughtsman, this did not change her idea of mathematics, the world around her, or herself. But the theory of situated learning does not present the possibility of explaining why her perception of herself had not changed, and why she never had any appreciation of mathematics.

Ruth's motivation to be a draughtsman made her overcome her blocks, but not her resistance to learning mathematics. Her intentions had changed but not her dispositions towards mathematics, incorporated through her lived life. According to the theory of Bourdieu, the habitus of a girl born 1922 in a provincial town as a saddler's daughter, of a pupil in a school where arithmetic and mathematics were two different subjects, at a time where it was "OK for a girl not to know mathematics", and the habitus of a wife and mother staying home with her two daughters is a basis of actions (and non-actions) and perceptions. Habitus undergoes transformations but durability is the main characteristic.

I have argued that the concept of habitus, developed and belonging in a sociological problematique as a concept of socialisation, can be coordinated<sup>1</sup> with Lave and Wenger's concept of situated learning in a problematique of mathematics education (Wedegé, 1999). In the first place, Bourdieu emphasises that the theory of habitus is not 'a grand theory', but merely a theory of action or practice (Bourdieu, 1994). The

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<sup>1</sup> The word I used in (Wedegé, 1999) was "combined" and not "coordinated".



habitus theory has to do with why we act and think as we do. It does not answer the question of how the system of dispositions is created, and how habitus could be changed in a (pedagogical) practice. This means that the concept of habitus can be used in a descriptive analysis of the conditions for adults learning. Lave and Wenger's theory of situated learning is also a partial theory, a theory of learning as an integral part of social practice. They are precisely trying to find an answer to the question of how people's dispositions are created and changed through legitimate peripheral participation (Lave & Wenger, 1991). Bourdieu and Lave/Wenger both aim at challenging the dichotomies of subject-object and actor-structure. Both are critical of phenomenology and structuralism while simultaneously having social relations as the focus of their subject areas. Bourdieu set himself the task of constructing a theory of action as social practice and Lave a theory of learning as an integral part of social practice.

A common core – or basic principle – in both theories is the understanding of learning as social practice. Furthermore, the two theories reject the idea of internalisation of knowledge and attitudes/norms, respectively. They mention instead active incorporation. Thus, the theory of habitus, as a social practice theory, does not encompass the theory of situated learning, but I have argued that the two theories are compatible and that the concept of habitus, which is developed and belongs in a sociological problematique, can be imported into an educational problematique about adults' learning mathematics together with the concept of situated learning.

### **Combining these with a theoretical gender perspective**

In the interview with Ruth, gender was an obvious aspect which might have been in the foreground of the analysis. The theories of habitus and of situated learning do not exclude gender aspects, but are a background dimension. In this section, I present another example of networked understanding of a piece of data – this time by combining the above with a theoretical gender perspective.

Complexity is a characteristic of the problem field in mathematics education, and diversity (gender, ethnicity, social class etc.) calls for multi- and inter-disciplinary studies and for different research methodologies. However, focus and methodology of any study are determined by its purpose, theory and research questions. For example Evans and Tsatsaroni (2008) have argued that research into gender within a social justice agenda requires both quantitative and qualitative methods.

When the research problem is formulated and the method and the sampling strategy are to be decided, the researcher has to choose among a series of factors and dimensions to reduce complexity. Gender is one of the aspects to be decided upon. In some studies, gender is a dimension in the *foreground*: the study is designed to investigate gender and mathematics – and gender is focussed in the purpose and the research question. In other studies, gender is a variable in the *background*: gender is just one independent variable among others.

Gender is in the foreground as an important analytical dimension in our on-going work on people's motivation and resistance to learn mathematics (Wedegé & Evans, 2006). So far we have not designed a new empirical study with gender in the foreground but we have access to rich empirical data from 81 semi-structured interviews with students (2/3 female and 1/3 male) from an English research project on adult students' reasons for learning mathematics, "Making numeracy teaching meaningful to adult learners" (Swain et al., 2005). In this project gender is in the background: none of the research questions are about gender but information about gender is available in the data. In a pilot case study with one of these students, Monica, I have tried to adopt a gender perspective for a small part of this data (Wedegé, 2008). The theoretical framework for this analysis consists of four analytical *gender viewpoints*<sup>2</sup> (*structural, symbolic, personal, and inter-actional*) (Bjerrum Nielsen, 2003). The analysis shows that the framework of gender viewpoints can be productive in locating gender in the data collected in the English project. The four gender viewpoints – separate or inter-connected – create new meanings to Monica's narrative.

From the structural gender viewpoint, gender constitutes a social structure, and men and women are, for instance, unevenly distributed in terms of education. For Monica, not having a high level of education has been a structural consequence of being a woman. As in many other families, girls were not educated in her family. They were brought up to fulfil traditional women's roles. Today, Monica is a single parent. In England – as in Scandinavia – the situation of being a single parent is closely connected with being a woman. Talking about reasons for attending the numeracy course, the students talked about the new governmental demands that single parents have to go back to work or alternatively go into training.

The core of our ongoing work is understanding motivation as a social phenomenon, which is also the case in the English project. Their theoretical framework is based on the work of, for example, sociologist Bourdieu and anthropologists like Lave (Swain, 2005 p. 31 ff) whom we have also used in our research. This theoretical choice had consequences for the questions asked to the students during the interviews, which in the case of Monica, for example, made it possible for her to talk about her childhood.

In the majority of studies in mathematics education, we find gender in the background. Hence, internationally, we have a large amount of data which has not been investigated from a theoretical gender perspective. In a recent overview of mathematics education research in Denmark and Norway, it was shown that very few studies were designed with gender in the foreground (Wedegé, 2007). However, a series of Nordic researchers intend to bring gender into the foreground and, through the latest 15 years, they have presented papers with a focus on gender. These presentations were based on data from their own previous research (quantitative or qualitative stud-

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<sup>2</sup> The term used by Bjerrum Nielsen (2003) is "perspectives". However, due to terminological constraints from the discussion in this paper, I have changed the term into "viewpoints".

ies) with gender in the background. That is, the researchers returned to their “own” data with questions related to their original problem.

## CONCLUSION AND PERSPECTIVE

Diversity of theoretical approaches and perspectives is a challenge in research on adults learning mathematics, as in mathematics education research generally speaking. Inter-disciplinarity is also a significant feature of this field where theoretical frameworks are imported and restructured (Wedegé, 2001). However, the researchers often import concepts from other disciplines, like psychology, sociology and anthropology, without any reflections on the process of import, integration and restructuring of the framework. Hence, there is a need for strategies for connecting theories from disciplines. Another problem is terminology and I see the present work, on developing terminology in parallel with strategies (Prediger et al., 2008), as very important in terms of quality. Hence, I hope that the proposed clarification of differences between the two terms “theoretical approach” and “theoretical perspective” will be adopted in the continuation of this work.

As mentioned above, the purpose – or the overall aim – of the research project “Adults learning mathematics in school and everyday life” is to develop theory, thus research with a *top-down profile* (cf. Arzarello et al., 2007). But if we look at the research process beginning in the 1990s, the aim of networking theories in the studies of adults learning mathematics alternates between top-down development and *bottom-up development* with the aim of understanding a concrete empirical phenomenon. The theoretical investigations and constructions iterate in continual interplay with empirical studies. In Wedegé (1999), the aim of coordinating theories is understanding and explaining a concrete empirical phenomenon combined with intentions of theory development; in Evans & Wedegé (2004) and Wedegé & Evans (2006), the purpose is conceptual clarification and development; and in Wedegé (2008), the intention is to combine with a theoretical gender perspective to revisit empirical data for new purposes. The aim of coordinating theoretical perspectives on habitus and on situated learning was to understand and explain a mathematical life history. But the arguments for compatibility of the two perspectives were general and not restricted to the data. In this and in the other studies, the development is driven by the concrete study combined with a general interest.

Combining and coordinating theories are steps on the road towards networking theoretical approaches in a new theory, but it is too early to say if our final networking strategy will be *synthesizing* between two or more equally stable theories or *integrating locally* some concepts or aspects of one theory into another more elaborated theory.



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