WITTGENSTEIN IN SUPPORT OF A SOCIAL AGENDA IN MATHEMATICS EDUCATION. A REACTION TO OLE RAVN CHRISTENSEN

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INTRODUCTION

Wittgenstein's conception of mathematics as constituted exclusively through social-historical development supports any kind of discourse about mathematics and mathematics education in which the "truth" of mathematics is of secondary importance. To Wittgenstein, mathematics appears as a network of different *language-games with family resemblances* thus subordinating discussions about the fallibility or infallibility of mathematical propositions. These games consist in procedures for the manipulation of – language: *meaning of language* is attached to the use we make of this language according to the rules that have been established for the games.

As Christensen argues, this position ('meaning-is-use') has significant consequences for the ways in which researchers in mathematics education may look at their field of research. Attention is diverted from the individual learner: language-games in mathematics appear as interrelational activities of teachers and students that are involved in using – according to certain rules – mathematical signs, terms, drawings, expressions and the like. A sociological gaze is promoted by which these collective activities as well as the underlying rules become open to examination.

A second consequence is related to the never-ending dispute about the relevance and function of practical settings (the 'non-mathematical context') for mathematics curricula. According to Christensen's interpretation, mathematics might be thought of as a network of techniques for representation and measure, thus qualifying practical settings as an essential component of school mathematics. Again, this is asking for a sociological point of view from which the 'mathematics in practical settings' can be analysed – in order to go beyond the common simplistic arguments for applications in mathematics education.

In my reaction to this plenary address, I am going to seize Christensen's suggestions by trying to elaborate, although sketchy, sociological positions, from which 'mathematics in practical settings' (1) and the 'rules of the game' (2) can be investigated.

1 PITFALLS OF THE PRACTICAL SETTINGS

In many countries, school mathematics curricula do not aim exclusively at introducing the students into formal mathematics but embrace, in some cases with top priority, applications and use of mathematics in mundane (mostly economic)

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situations. If, according to Wittgenstein, the meaning of mathematics is attached to the use we make of it, then the mundane situations become incorporated, at least partly, into what counts as 'school mathematics' as a knowledge domain. However, since the relationship between mathematics and the mundane is not as simple as it may appear at first glance, this is a terrain full of pitfalls (Damerow, 2007; Davis & Hersh, 1986; Dowling, 1998; Jablonka & Gellert, 2007; Keitel, Kotzmann & Skovsmose, 1993; Skovmose, 1998).

The mundane is not free from mathematics. Mathematics has penetrated many if not most parts of our lives. By its abstract consideration of number, space, time, pattern, structure mathematics has gained an enormous descriptive, predictive and prescriptive power: state salaries, social benefits, political decisions rely on mathematical extrapolations of data; mathematics-based communication technologies have already changed the habits and styles of private conversations. What has been called 'our time-space-money-system' is based on an underlying mathematical abstraction process that shapes society and exerts considerable influence on our everyday lives. This process, termed *mathematisation*, results in an increasing formalisation of the mundane. In many cases, however, the underlying mathematical abstraction is hardly visible, because it is "crystallised" in all kind of technologies, including social technologies. These technologies function as black boxes: nobody needs to reflect the underlying mathematical abstractions any more. This *implicit* mode of presence of mathematics goes often unnoticed, and so does the mathematics in the mundane.

There is nothing to disqualify the use of practical settings for learning mathematics, as Christensen argues. In fact, without inclusion of practical settings in mathematics curricula, only knowledge of the coherent, neutral, apolitical, "clean and uncontaminated" side of mathematics is distributed to students in mathematics classes. Where the other side of mathematics is a substantial component of mathematical classroom activities, mathematics is used in an essentially different way. In Wittgenstein's terms, students who are introduced to the political side of mathematics take part in a different language-game, with different rules and different meanings.

For making use of mathematics in practical settings, mathematics as a pure technique of representation and measure runs the risk of misrepresentation and overconfidence – as can be observed in many examples of tasks provided by the didactic conception of 'mathematical modelling'. A social conception of mathematics is needed, in which the social is not narrowed to ways of knowledge generation or to the issue of meaning. Mathematics is, of course, a result of socio-historical development, but this development is not restricted to signs and symbols; it is also about intentions and interests. Can Wittgenstein help us out, here?

2 THE RULES OF THE GAME

The learning of mathematics can be understood, according to Wittgenstein, as becoming accustomed to the rules of this particular language-game. By regarding the underlying rules of the game, attention is diverted from individual minds and towards the social complex of the classroom community of students and a mathematics teacher. As Christensen suggests, it might be interesting to delve into the socially relevant issues of equity and access to the rules of the game; of power and distribution of knowledge; of evaluation and assessment.

Within the context of the learning of mathematics, the language game of mathematics is always embedded in the specific institutionalised or non-institutionalised frame in which the learning occurs. In schools, the learning of mathematics is highly institutionalised and follows a rather unique and traditionally perpetuated set of rules. Mathematics classroom activity can be understood as a language-game apart.

Since, in the context of learning, the language-game of mathematics is embedded in the language-game established as teacher-student and student-student interaction in the mathematics classroom, it is subordinated to the principles of the latter. Whoever is involved in learning mathematics in school needs to follow the rules that govern the course of interaction and the production of legitimate text of mathematics classrooms.

This issue has attracted the attention of researchers in mathematics education. A growing number of these adhere to the theoretical framework provided by Bernstein (1996), formulated within the sociology of education, in which the focus is on how macro-sociological structures are engrained in classroom practice and how classroom practice acts as a reproducing device of social structures. One central component of this framework is the analytical distinction of two rules: the recognition rule and the realization rule. The command of these two rules is said to be necessary for legitimate participation in subject matter classroom interaction. Before students are able to produce ('to realize') legitimate text – within the language-game of mathematics education –, they need to recognise the specific classification principles established in institutionalised learning. Apparently, access to the recognition rule is neither evenly distributed to students with different social backgrounds, nor provided by educational practice.

Wittgenstein's concept of the language-game is supportive of making us aware, that students' differential success in mathematics education cannot be explained fully by intra-psychological differences. However, as Wittgenstein is dealing with the development and meaning of *mathematics*, and not primarily with institutionalised forms of learning mathematics, his explanation seems, to me, rather a form of inspiration than of conceptual fundament. For instance, consider his proposition (as cited by Christensen in the context of a rejection of Platonism): "The mathematician is an inventor, not a discoverer." (Wittgenstein, 1978, p. 99) We might ask whether we can substitute 'the mathematician' by 'the student' learning mathematics in school. Is the student an inventor, or is s/he a discoverer? Perhaps it is more sensible to regard the student as a discoverer. The mathematician might actually be inventing and establishing new rules of the language-game. As Platonism is rejected, this can be considered a process of creation. Contrary to the mathematician the student is not creating any new rules. This is particularly important, since the language-game of mathematics is embedded in the language-game that is legitimately exercised in mathematics classes. However, the language-game of mathematics classes is based on rules, which refer to the socio-history of schooling rather than of mathematics. As these rules remain to a large extend implicit, it is left to the students to *discover* them. Due to the established power differences between teachers and students, students' inventive scope is subject to severe restrictions. Wittgenstein modified, the successful student is a discoverer of the rules of the language-game exercised in the mathematics class.

A CONCLUDING REMARK

Wittgenstein's social interpretation of mathematics proves to be significant and inspiring for research in mathematics education, in fact. Owing to the theoretical character of his philosophical position any direct and straightforward 'use' of it for matters of research in mathematics education is, however, hardly feasible. Research in mathematics education that draws on Wittgenstein's conception of mathematics needs to explicate exactly how his position can be made use of. Again, as meaning-is-use, the process of this very explanation is the mechanism by which the meaning of Wittgenstein's position for research in mathematics education is generated.

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