Brown, Tony:

Mathematics Education and Language
Interpreting Hermeneutics and Post-Structuralism

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1. Introduction

The relationship between mathematics and language is a classical issue in the philosophy of mathematics. The intuitionist Brouwer claimed that mathematics and mathematical thinking cannot be represented adequately in any language, formal or natural. According to this point of view, mathematics is a "pure" mental activity. In mathematics education this idea is represented by constructivism, as initiated by Piaget. Here, mathematical activity and language are considered two different domains.

The opposite point of view, to see mathematics as language, is for instance presupposed by the claim, often made in the spirit of logical positivism, that mathematics is the language of science. To see mathematics as symbolic formalism, as suggested by Hilbert and Curry, represents also the thesis of "mathematics as language". In mathematics education this thesis has been translated into the claim that students should learn to speak the mathematical language correctly.

In *Mathematics Education and Language,* Tony Brown proposes a new and interesting approach to the discussion of the relationship between mathematics and language: neither seeing mathematics as separated from language, nor seeing mathematics as language. One of the main objects of the book is to suggest a theoretical framework by means of which to understand the interplay between mathematical and language activities as they take place in actual classroom practice.

Brown's discussion of linguistic aspects of mathematics education builds on an extensive set of "grand" theories from hermeneutics, critical theory, linguistics, post-structuralism and social phenomenology. In this way, Tony Brown prepares a new ground for theorising in mathematics education.

2. Summary of the book

Mathematics Education and Language has eight chapters, and as an introduction Brown presents a short and useful review of recent research concerning mathematics education. In particular, he relates his own work to the current discussion of constructivism: "... I concur with those who suggest that radical constructivism provides an inadequate account of how the social web of discourses intervenes in the process of individuals declaring how they see things" (p. 19).

This task of showing to what extent radical constructivism provides an insufficient theoretical framework for understanding the complexity of the relationship between mathematical activity and communication is extremely relevant in the present situation in mathematics education. Constructivism has been successful, but also "successful" in ignoring alternative theoretical approaches. Brown's work helps to bring us beyond this ignorance.

In Chapter 1, Brown relates action and meaning, and refers to (among others) Wittgenstein, Searle and Austin. Furthermore, Brown draws our attention to the works of Ricoeur, Husserl, Dilthey, Gadamer, Habermas, Heidegger and several others. By presenting the phenomenological roots of hermeneutics, Brown tries to show that mathematics becomes "a subject of hermeneutic understanding if the emphasis is placed on interpreting mathematical activity" (p. 49). This mathematical activity "might embrace the generation of mathematical statements" (p. 49). A mathematical activity cannot be described without considering it also a linguistic activity. This claim is very different from Piaget's original idea that relates the development of mathematical knowledge to reflective abstraction which are considered to be mental processes.

Chapter 2 brings post-structuralism into the picture. Brown refers to authors like Derrida, Foucault, Walkerdine and Saussure and discusses the linguistic framing of mathematical thinking. According to Brown, the meaning of a mathematical expression cannot be located as an entity "outside" language. Such an interpretation of meaning has accompanied mathematical philosophy inspired by the work of Frege, who firmly established the "referential paradigm" in the philosophy of mathematics. This paradigm has also framed an approach in mathematics education, concentrating on how children develop "the notion of ...". Supported by Saussure, Brown takes us in a quite different direction. Signs are not being seen as having meaning in themselves; the meaning of a sign depends on its relationships to other signs. Meaning "only emerges as signs are combined in "stories" generated within activity. Meaning is produced in the process of signifying ... The ontological qualities of the mathematical phenomena located are not specified outside of this frame. The symbolic expressions themselves are formative of meaning" (pp. 64–65). In parallel with Saussure's distinction between *langue* (language as structure) and *parole* (language as activity), Brown distinguishes between mathematics as structure and as activity.

Chapter 3 discusses the problem of sharing mathematical perspectives. Although meaning and also mathematical meaning become open and dynamic concepts, mathematical meaning is also framed by language. Language provides a resource for sharing mathematical ideas. This point is illustrated by different classroom examples, and Brown summarises in the following way: "Hermeneutical views of language do not see communication as passing around the ready made objects of the traditionalists, nor as restructuring knowledge, as suggested by the social constructivists. Rather, communicating is about operating on someone's knowing. Mathematical statements made during the course of activity provide snapshots along the way and serve to orientate thinking which continues to evolve" (p. 98). Communication means creation of meaning, change of meaning, sharing of meaning. Communication becomes a process by means of which mathematical meaning emerges and develops.

Chapter 4 offers classroom examples of students doing mathematics. This chapter provides an introduction to the central Chapter 5, which introduces a theoretical frame for interpreting classroom observations. Here Brown uses a framework borrowed from social phenomenology, first of all Schütz, in defining the notion of "personal space". Brown suggests this notion as the theoretical unit for understanding activities in the classroom, and for understanding personal meaning, as well. I shall return to the notion of "personal space" in the next section.

Chapter 6 deals with teacher-student interaction as an introduction to the next chapters which, first of all, considers the teacher's perspective of the classroom. If the student is located in a personal space, and this space is the source for the student's action and for the construction of meaning, then a successful communication between students and teacher seems to presuppose that the teacher has a "good guess" of the nature of the student's personal space. The chapter discusses how the teacher may map out "a picture of the individual student's understanding through the evidence available in the immediate classroom situation ..." (p. 5).

Chapter 7 considers the mathematics teacher's professionalism. The hermeneutic perspective of classroom activity has a particular significance for the teacher. A major question to Brown is: "How can the teachers move towards offering descriptions of their classroom which become instrumental in shaping subsequent practice and research into it?" (p. 176). Brown suggests "professional writing" in which teachers can structure and account for their practice. The teacher, as a "practitioner researcher", may bring changes to the classroom through acting in the classroom, but also as a producer of reflective writing. "In particular, I seek to demonstrate how writing produced within such work itself becomes scrutinised as an integral aspect of practice and instrumental in the process of self-reflexive practitioner-led change" (p. 178). Brown offers extensive examples of how this can take place.

Chapter 8 contains the conclusion, and Brown emphasises that radical constructivism has focussed on how the individual constitutes his or her mathematical knowledge without acknowledging how society constitutes the individual (see p. 216). Brown concludes his study by trying "to tease out some of the areas where the modern brands of hermeneutics assist us in transcending the limits of constructivist inspired analysis towards providing a fuller account of the relationship between language and mathematical activity" (p. 217).

Brown emphasises that the framing of mathematical experience in words must be seen as an integrated part of mathematics itself, and this "framing in words" is inseparable from a less visible cognitive mathematical activity (see p. 222). Thus, Brown does not agree with classical intuitionism, which sees mathematical activity as mental processes different from any linguistic activity. Naturally, Brown is also far from assuming the opposite idea that mathematics in fact is a language. The idea of mathematics as framed in language (although not "captured" by language, and not at all identical to language) is very fascinating. This seems to suggest an important philosophical interpretation of mathematics which can promote a further development of the philosophical understanding of mathematics. I would look forward to a discussion of this interpretation with respect to Lakatos' notion of proof-generated concepts, to Kitcher's idea (presented in *The Nature of Mathematical Knowledge)* that mathematics can be seen as an idealised theory of actual operations, as well as to other recent contributions to the philosophy of mathematics.

The structure of *Mathematics Education and Language* is clear, although I do not find that the book develops in a "harmonious" way. The analysis in the first five chapters appears "progressing", but instead of developing these ideas further Brown takes a new route and brings teacher training and the teacher as a practitioner researcher into the picture. Naturally, this topic is related to the first part of the book, but I do not find that this brings the book together in a coherent study. Thus, the theoretical framework, developed in Chapter 5, does not seem to play a significant part in the rest of the study. Although the book contains very interesting and relevant studies, it also reveals a putting-together-different-studies-in-one-book approach.

3. "Personal space"

A theory about the relationship between mathematics and language which sees mathematical activity as framed by language, and which sees communication as essential to the production of mathematical meaning must search for a conceptual tool for grasping certain characteristics of the situation in which the individual is located. In Chapter 5, Brown embarks on this project.

In *The Problem of Social Reality*, Schütz has introduced the notion of "the world within reach" in an attempt to analyse and to understand a person's activity. Schütz relates this notion to Mead's notion of "manipulative area", which includes the objects "within reach". However, the "world within reach" is broader, as it also includes the world in which the individual has the potential to work.

Brown continues this line of generalisations by introducing the notion of *personal space*. That this notion is broader than "the world within reach" is emphasised by Brown: "The personal space of any individual also incorporates some concern about other people sharing the social situation and how these people contribute to the perceived constraints" (p. 136). The notion of personal space becomes essential in the interpretation and understanding of any person's action. This also applies to students' actions in a mathematical classroom. Brown finds "that it is the individual's experience of the world, of mathematics and of social interaction which govern his actions rather than externally defined notion of mathematics itself" (p. 136). It is with reference to "personal space" we must search for an understanding of the specific interplay between mathematical activity and language.

Brown presents a classroom episode in which a group of four 12 years-old girls are working with a task dealing with symmetry. The students are given three shapes: a square, a rectangle and an L-shape. The task is: “Try to make as many symmetrical shapes as you can. Please mark on the line of symmetry with a dotted line” (p. 137). The students have been working on the task for a while and come up with several “correct” arrangements. Then, some interesting new possible solutions emerge in the discussion among the students, and Brown reports from this discussion. I briefly illustrate the nature of the activity by a few diagrams (see Figure 1).

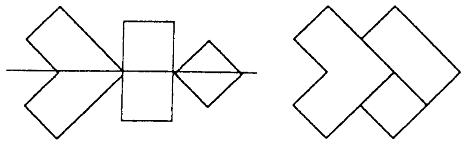

Figure 1: Symmetrical shapes produced by the students using a square, a rectangle and an L-shape.

By putting himself in the shoes of Klavanti, one of the students, Brown uses this episode to illustrate the notion of personal space. Brown writes: “Klavanti’s perceiving is continuously changing during the course of the lesson. As she proceeds she has a variety of things before her ...” (p. 143), and Brown mentions:

(1) The drawings of previous shapes seen now.
(2) The teacher’s presence seen now.
(3) The cardboard pieces manipulated and touched now.
(4) The table arrangement and the way her friends face her.
(5) Particular arrangements of the pieces seen now.
(6) The apparent attitude of the other girls towards her.

Brown continues: “She will also have experienced, for example”:

(1) The teacher’s lesson introduction.
(2) Arrangements previously made with the cardboard pieces.
(3) Drawings of the various arrangements.
(4) Past situations restraining personal behaviour.
(5) Previous work on geometry and line symmetry.
(6) Past social situations in general and with Meerah, Gitar and Michelle in particular [the other girls in the group].

Brown then adds: “Taken together such categories, which evolve through time, form aspects of Klavanti’s perceived world” (p. 143). This remark puzzles me. A rereading of the list does not clarify the idea of categories. I think much more analytic work is needed in this part of the study. I find it necessary to delve deeper into the situation. It is a challenging task to identify categories which form aspects of a perceived world. At this part of the study, I am not in need of any more references; instead I am interested in following an analysis which, based on observations of what Klavanti has before her and observations of what she has experienced, brings us to some categories stated in more general terms. I find this task has to be carried out, before it is justified that “personal space” is really a useful conceptual tool. This justification is a challenging theoretical task. However, being led to this point by Brown’s analysis, I feel convinced that he could help the reader the next steps forward.

However, instead of bringing the analysis further based on the discussion already presented of Klavanti’s perceived world, Brown suggests a semiotic perspective: a person understands his or her personal space “through the signs that suggest it” (p. 147). Brown, then, follows Schütz in using Husserl’s notion of *appresentation*. The *appresenting* entity is within the immediate perception, this is the “pointing” entity. The *appresented* entity is the entity which is “pointed at”. To illustrate by an example (also mentioned by Brown): certain written down algebraic expressions are appresenting, as they call to mind certain geometric configurations which, then, are the appresented entities. An *appresentational situation* is defined as a situation in which groups of *appresenting-appresented* entities occur.

A personal space is interpreted as an appresentational situation. Therefore, the analysis of such situations could assist us in a further theoretical understanding of personal space. As this space is seen as the source for action, “personal space” becomes a main analytic tool for understanding a student’s mathematical activity. If we consider, by the help of Wittgenstein, Austin and Searle, that meaning and “use of language” are closely related, we see the analytic potentials of the frame suggested by Brown. An understanding of appresentational situations brings unity to the interpretation of personal space, mathematical activity and mathematical meaning.

However, it seems to me that Brown needs to provide us with more help, by making the reader see how the theory of appresenting situations might clarify the categories which constitute aspects of a personal space, as for instance Klavanti’s perceived world. This is not meant as a criticism of the framework developed so far. It is a strong recommendation for Brown to continue his research project. I would suggest Brown, then, to bring into focus again the questions: How does personal space structure an interplay between language and mathematical activity? How do the categories of personal space operate in this interplay?

The notion of personal space, interpreted as an appresentational situation, helps to emphasise that the actions of a person are not to be seen as actions in a *de facto* world. Brown puts it very nicely: “Each person acts in the world she imagines to exist” (p. 154). This is a very strong and clear summary of the idea of this part of the book. An appresenting entity is related to an appresented entity, and this world of appresented entities becomes part of the world in which the individual acts. In my opinion this idea provides a fruitful starting point for a general study of action. In the next chapters, Brown uses this idea in his discussion of the teacher perspective and of the practitioner researcher.

4. A side remark

It is always interesting to study the index of a book. In *Mathematics Education and Language* we find both a Subject Index and a Name Index. In the Subject Index, I read “Dienes 51, 104”. I certainly expected to find this reference in the Name Index. I also found the references: “British, 3, 18, 241”, “scientists, 14”, “German, 43”, “Come to me, 123.” and “Video-tape, 166”. The later brought me to the following sentence: "I reproduce here a transcription of the section of video-tape produced by the Open University ...". Producing a useful and relevant subject index is a difficult task. I will recommend to Kluwer that they pay more attention to such editorial aspects of the book.

5. Perspective

Brown explains how he develops the theme of critical mathematics education by developing a "theoretical frame around the experience of individual students and teachers, by providing classroom examples and by demonstrating an approach to teacher education which facilitates the introduction of such a style of work" (pp. 19–20). It seems to me that Brown is involved in an extremely important project in trying to develop such a theoretical frame. This is crucial for the further development of critical mathematics education.

Brown's theory of personal space is promising, but it needs further analytic development. To me, an understanding of mathematical activities, also in the classroom, presupposes that the political dimension of mathematics education becomes present in the study. Studies which see mathematics education as situated in a complex political and cultural context are in need of an adequate theory of "experience". This will bring new dimensions to further studies of issues such as "mathematics education and democracy", "empowerment", "project work", "thematic approach", "exemplary principle", "ethnomathematics" – all of them topics of importance for critical mathematics education.

I find *Mathematics Education and Language* interesting and important. Brown makes an important contribution to the further development of critical mathematics education, and I look forward to studying the continuation of his work.

6. References

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