

PRIMARY TEACHERS' ASSESSMENT IN MATHEMATICS: RESOURCES EXPLOITED IN THE PEDAGOGICAL DISCOURSE

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Teachers' pedagogical discourse concerning mathematics education and, particularly, the resources they draw upon within it allow the study of how they make sense of and evaluate pupils' work in the mathematics classroom. The article focuses on the resources utilised within five primary school teachers' pedagogical discourse articulated in the context of a semi-structured interview on mathematics education issues. The analysis of the data indicated the exploitation of not necessarily compatible resources which might lead to surface or inequitable evaluations.

Key words: assessment, mathematics, resources, pedagogical discourse, teachers.

THEORETICAL CONSIDERATIONS

Assessment constitutes a critical factor of the educational process, which, in combination with others, shape teaching and learning. The relative research in Mathematics Education had been rather limited until early 1990s, focusing mainly on the development of tools for measuring mathematical knowledge (Gipps, 1999). The recognition of the determining role of assessment in cultural reproduction and social stratification, particularly in mathematics, with its profound consequences for future educational and professional success of both students and teachers, led to the adoption of a sociological perspective for its study. Within this perspective, assessment practices are viewed as social in nature: reflective of often implicit assumptions about knowledge and what counts as valued knowledge; about the relationship between learning, teaching and assessment; about teachers' evaluative practices and their understandings of students' achievements and curriculum demands (Wyatt-Smith & Gunn, 2009).

Contemporary views on assessment attribute special significance to the ways teachers make sense of and engage in the assessment process (e.g. Morgan, 2009). The investigation of these ways has been related to the notion of the pedagogical discourse, which offers a framework for studying the linguistic activity developed by a teacher with respect to teaching and learning mathematics that allows the identification of the meanings attributed by him/ her to the assessment process (Morgan et al, 2002). The pedagogical discourse is constituted through processes of 'recontextualisation' of knowledge and practices. These processes are determined by the agents responsible for them, the processes of selection, simplification, condensation, repositioning and refocusing through which this discourse is enacted and the resources exploited (Bernstein, 2000). Resources are accumulated knowledge structures people hold in their heads and "draw upon when they produce or interpret texts – including their knowledge of language, representations of the natural and

social worlds they inhabit, values, beliefs, assumptions and so on” (Fairclough 1989, p. 24).

Within the above perspective, teachers construct meanings when reading a mathematical text dependent on the features themselves discern in the text. These meanings are determined by the discourses enacted for the reading of the text for assessment purposes, designated by the resources and the positionings exploited (the latter concerns different relationships to students and authorities and different orientations towards texts and assessment tasks).

Morgan (1998) examined how teachers assess students’ texts (verbal and nonverbal behaviour) and found that they tended to draw on resources from different and often contradictory discourses. In a later study, Morgan & Watson (2002), looking at teachers’ assessment activity both in the classroom and with respect to written tasks, confirmed the previous finding, highlighting particularly the interpretive nature of the assessment activity due to the different resources individual teachers bring to the assessment task. These resources may include (a) teachers’ personal knowledge of mathematics and school mathematics, including their personal “mathematical history”, (b) their beliefs (conceived as dynamic rather than as static constructions) about the nature of mathematics and the ways these are related to assessment, (c) their expectations about how mathematical knowledge can be communicated, (d) their experience and expectations of students and classrooms, (e) their experience, impressions and expectations for individual students, and (g) their cultural background and linguistic skills as decisive parameters for the assessment process, related to downgrading students’ mathematical achievements (Watson, 1999; Morgan & Watson, 2002).

Morgan’s and her colleagues’ studies also showed that, when assessing students, teachers are positioned in certain, distinct and occasionally contradictory ways and this can lead to different evaluations of the same text (Morgan et al, 2002). For example, a teacher might be positioned as an examiner using personal criteria or criteria determined by exterior factors or as an advocate, who seeks opportunities to afford a grade to the student. Different positionings are likely to lead to the employment of different resources during the assessment process and, consequently, to the realization of different actions and judgments from different teachers or from a teacher at different times and in different circumstances. However, the issue teachers’ positions as they evaluate students’ work is not addressed here and it is only mentioned in order to provide a complete and comprehensive account of the perspective employed.

The sociological perspective for examining how teachers make sense and evaluate pupils’ mathematics productions briefly outlined above has not yet attracted much research attention. Only sporadically one comes across studies barely related to this perspective. For example, examining mathematics classroom assessment interactions from a semiotic point of view, Björklund Boistrup (2010), in accordance with Morgan’s and her colleagues’ studies, concluded that these interactions are part of

different discourses, which steer the individual towards what is valued and who has the authority to act, but also provide possibilities for active involvement, dependent, however, on the interplay of these discourses.

Also, Wyatt-Smith & Gunn (2009), focusing generally on assessment within a sociocultural perspective, view it as critical inquiry in need to be considered in relation to four main interrelated and interdependent lenses: (i) conceptions of knowledge, including its nature and the related capabilities to be assessed; (ii) conceptions about the alignment of assessment, learning and teaching and how teachers enact them in practice; (iii) teacher judgment practices, especially related to standards, moderation opportunities, requirements and expectations of quality performance and (iv) discipline-specific literacy demands required to participate in and contribute to knowledge. There are certainly similarities between these lenses and the discourse resources exploited by Morgan and her colleagues, both notions enabling particular characteristics of enacted assessment related to the suite of conceptions, values and assumptions at play to come to the fore.

The present study focuses on the resources designated in primary teachers' pedagogical discourse as a means to examine the meanings they attribute to the assessment process in mathematics. These resources constitute what Wenger (1998) calls a "repertoire", the elements of which shape the ways they think and act when assessing pupils' mathematical texts and thus their relevant assessment practice (the term 'practice' is used as suggested by Wenger, that is, to involve the whole person, acting and knowing at once). Gaining insight into the content and structure of this repertoire might be seen as important in understanding how classroom assessment occurs.

THE STUDY

The present study constitutes part of a research project examining primary teachers' pedagogical discourse about basic components of mathematics education developed in various contexts (e.g., in classroom, in informal exchanges, in interview settings and so on). The aim of the project was to study the resources exploited and the positionings adopted by the teachers within this discourse, seeking to understand how they make sense of and put in practice assessment in mathematics.

The focus here is exclusively on the resources emerging in the pedagogical discourse of five primary teachers evolving in the context of a semi-structured interview about mathematics education issues and, in particular, on how these resources frame the ways in which they understand and evaluate students' mathematical texts. The interview consisted of three parts. The first part included questions related to the nature of mathematics as well as to learning, teaching and assessing in mathematics, while the second part focused on teaching and assessment practices in mathematics. Both these parts intended to provide opportunities for the pedagogical discourse to unfold, allowing for the resources exploited by the teachers to emerge. The third part of the interview sought information related to the teachers' mathematics background

and professional profile. The pedagogical discourse developed around the questions of all three parts was completed over three meetings, each of which lasted for more than two hours.

All five teachers (4 females and 1 male) were teaching in public primary schools in the north eastern part of Greece and their professional profile varied in terms of teaching experience (5 to 19 years), their University degrees (one or more) and their professional activity (none to high participation to conferences, research programs and short training courses). The teachers were each the subject of a corresponding case study carried out in the context of the main research project, which included classroom observations as well as informal discussions and interviews, like the one under consideration here.

A combination of Grounded Theory and Content Analysis techniques was used for the analysis of the teachers' transcribed discourse (Thornberg & Charmaz, 2012; Berg, 2004), while the categorization/ scheme suggested by Morgan and Watson (2002) was used to identify the content and the structure of the repertoire of resources of each teacher. More specifically, a three stage analysis was followed: (a) careful reading of the data and detection of extracts relevant to each category of the scheme (b) coding of the extracts within each category and grouping them in sub-groups with relevant meaning and (c) repetition of the previous stage within each of the emerging sub-groups for the formation of the third level resources. For reliability reasons, the whole process was realized simultaneously by the two researchers. Finally, the systemic network was used to present the results of the analysis, as it allows a united depiction of the outcome in repeated levels of complexity, rendering thus transparent the internal relations of the data (Bliss et al, 1987).

RESULTS

The data analysis led to the construction of a systemic network for each teacher with regard to the resources s/he was drawing on within her/his pedagogical discourse and are informative of the ways s/he is making sense of and evaluates pupils' mathematical texts. The five individual networks were then combined to form an overall network of resources that depicts the content and the structure of the individual as well as the collective repertoire of resources identified. Due to space limit, only part of this overall systemic network is presented below. In particular, Figure 1 concerns the resource "Beliefs about the nature of mathematics and their relation to assessment" (see Morgan and Watson, 2002 above) which dominated all five discourses and especially its branch that focuses on the teachers' alleged assessment practices in mathematics, which is closely related to how they conceptualize and assess pupils mathematical productions.

Below an overview of the resources utilized and their interconnections is first provided and then particular features of these resources are discussed in relation to how teachers view and practice assessment, substantiated by data extracts.

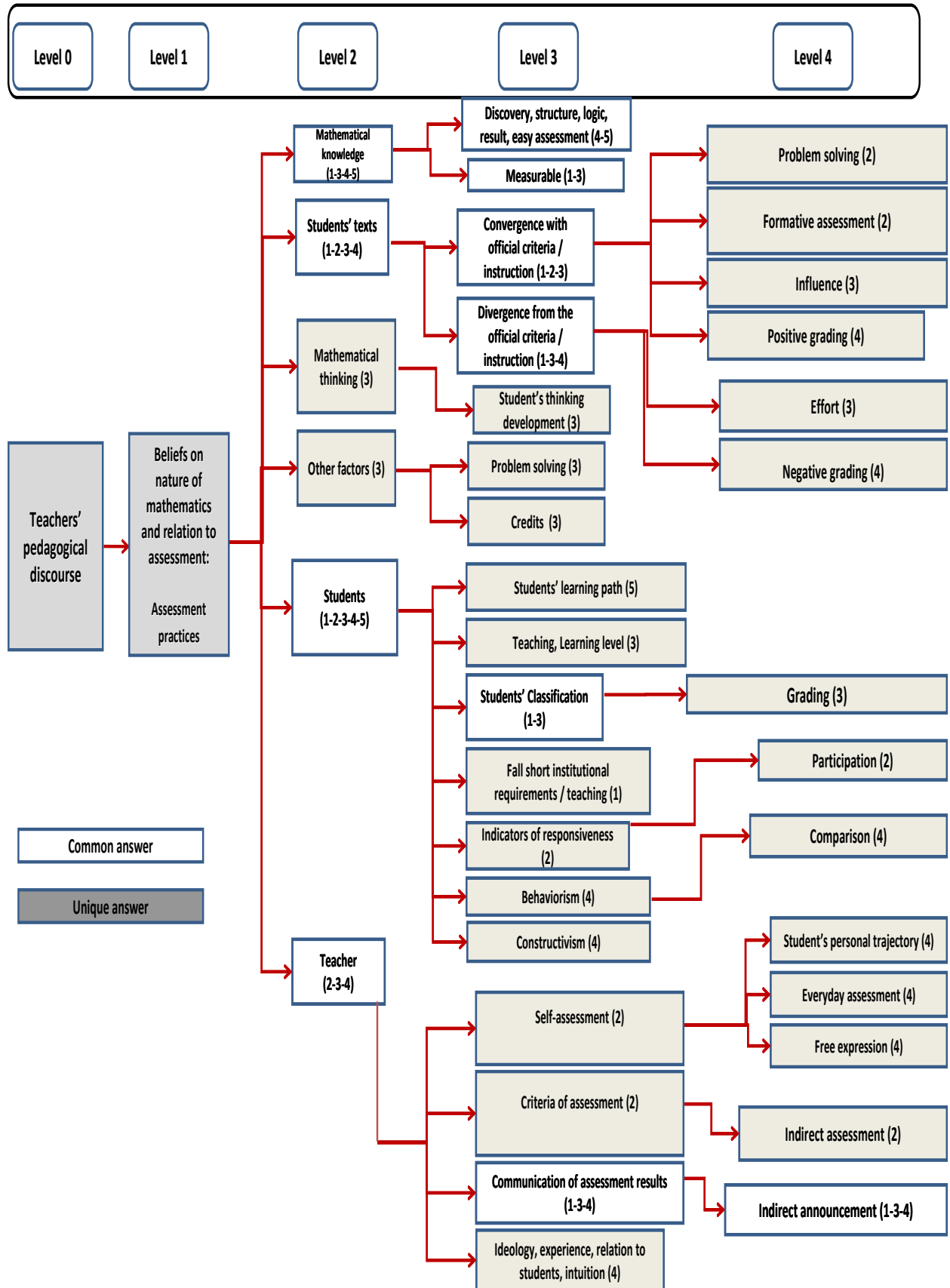


Figure 1. Teachers' alleged assessment practices as a sub-branch of the resource "Beliefs about the nature of mathematics and their relation to assessment" [1=Nikitas, 2=Chrisa, 3=Anastasia, 4=Antonia, 5=Antiopi]

Overall, the analysis showed that the teachers of the sample appear to approach the task of assessing pupils' mathematical texts with a set of predispositions and experiences. The resources they employed in their pedagogical discourse concerned mainly their beliefs about the nature of mathematics and how these are related to assessment, as well as their expectations about how mathematical knowledge can be communicated. In addition, these resources were more collective than personal, were frequently related to the official discourse of assessment and were often incompatible to one another across time and contexts.

The view that mathematical knowledge can be measured characterized two of the teachers' discourses (Fig. 1, levels 2 & 3 – mathematical knowledge).

I would say, it is more measurable in mathematics (the knowledge)... because, perhaps, we have to deal with more standardised things... What I mean...when we do, for example, simple additions, one succeeds and another does not. While the concept, what you define as love, can be discussed, you just need to convince me. But you can't convince me that $1+1$ makes 9, it is a little difficult to convince me. Perhaps this is the reason why assessing in mathematics is different...the results are more expected.

(Nikitas, 16 years of teaching experience, BA in Education & BSc in Mathematics, limited professional activity).

The teachers tended to judge students' mathematical texts on the basis of the degree these satisfy or not the official criteria of assessment, as substantiated, however, within the classroom (Fig. 1, levels 2 & 3 – students' texts). In this context, the assessment process allows the comparative classification of each student according to his/her mathematical behaviour and its divergence from the officially defined, as well as from the one designated as desirable in each class (Fig.1, levels 2 & 3 – students).

My tests are always in the "spirit" of the textbook, perhaps a little bit different with respect to the way questions are phrased or to the difficulty level. This means you might find much easier but also much harder exercises compared to the ones in the textbook. Not unrealistic (exercises)... neither I do something extreme, nor I look for genius students in the class... This is not my aim!

(Chrisa, 17 years of teaching experience, BA in Education, high professional activity).

For example, I will assess a student... I will give him two problems and if he solves them with no difficulty and somebody else solves half of it...this is for sure an indicator of assessing differently each one of them...interest and effort is what counts

(Anastasia, 19 years of teaching experience, moderate professional activity)

Teachers' pedagogical discourse often drew on resources related to learning behavior rather than to specific achievements, when reporting on individual pupils; they tended to avoid describing specific features of their texts. Although they valued oral language in assessing, the teachers were not consistent with this view. For most, evaluation was predominately based on a combination of students' written performance, memory and effort made. Furthermore, referred to the importance of knowing the students they were

about to assess, as this knowledge provided a framework within which they could interpret students' mathematical texts instead of drawing on informal, loose criteria (Fig. 1, levels 2 & 3 – teacher).

Few teachers articulated a pedagogical discourse that presented some internal coherence. All of them, however, tended to employ discourses which came from different fields, thus allowing conflicts and contradictions to emerge within their pedagogical discourse, which can be summarized as follows: students' mathematics knowledge is not imprinted in the texts they produce, is seen as if it can be measured on the basis of the compatibility of certain features it bears with official ones, which, however are disputed with respect to their effectiveness and the necessity in the classroom, thus questioning the traditional function of the assessment process to classify students according to their mathematics performance (Fig.1, across and within levels).

The safest index for my students' assessment is their willingness to engage with mathematics. That is, if I see a student, even if he is not good, to want to begin the lesson, to come to the board, to be asked, for me is the safest index

(Antiopi, 10 years of teaching experience, BA in Education, high professional activity).

I am not interested in all these! That is, when I am in good terms with my students, the difficult part is to allocate grades to them and many times I offer higher grades, because I am interested in their relationship with mathematics ... It is better for a student to be not always excellent but to be given "10/10", in order to escape home oppression... I also rely on the teacher's guide that describes the objectives ... But in mathematics, during my teaching ... How do I know what do the students know? ... by assigning some assessment tests. I do this often, very often! It might be some short exercises. It might be a problem to solve and is usually something intended for the average student, so they are not blocked. Short tests, small exercises ...

(Antonia, 5 years of experience, BA in Education and BSc in Mathematics, substantial professional activity)

Based on the preceding findings, the pedagogical discourses developed by the five teachers appear to share features but also present tensions as well as contradictions and inconsistencies with respect to how the assessment process of pupils' mathematics is understood and allegedly exercised. These discrepancies are due to the different set of resources utilized across time and contexts and emerge not only between teachers but also in a single teacher.

Generally speaking, the teachers' pedagogical discourse tended to draw on resources that come mainly from two opposing discourses (traditional/performance oriented and alternative/ competence oriented respectively) (Broadfoot & Pollard, 2000 drawing on Bernstein), to adopt official criteria, re-contextualised according to each teacher's personal biography in mathematics education and shows overall moderate internal coherence.

DISCUSSION AND CONCLUDING REMARKS

Teachers' assessments are inevitably influenced by a number of factors, neither necessarily relevant to the students' mathematical achievements nor indispensably compatible to the official evaluation criteria. This influences their official, summative assessments of individual students. The results of the study presented here support this and could be attributed to the fact that in the Greek educational system, teachers are not yet required to proceed to assessing students using reliable and clearly defined criteria (officially or personally) and produce judgments for which they will be accountable.

The results also suggest that different teachers can interpret the same text or similar students' texts in many different ways, either because of judging different characteristics as significant or because of attributing different value to similar features. These different approaches might arise in informal classroom assessment contexts as well as in official circumstances. Due to the highly interpretive nature of every assessment activity in mathematics, it is almost impossible for a teacher to avoid such discrepancies. This raises important questions related to issues of equity in mathematics education. More specifically, it brings to the fore the possibility that some groups of students, who do not share the same social, cultural and linguistic background with their teacher-assessor, might be provided with fewer opportunities to access the resources s/he draws in assessing. As a consequence, it is harder for them to produce texts bearing the features expected by the teacher, in order to be highly valued. This way, there is a strong possibility that these groups of students will be systematically disadvantaged because of their failure to exhibit the mathematical behaviour expected and valued by their teacher (Morgan & Watson, 2002).

It is clear that assessment depends heavily on teachers' interpretations of specific students' textual productions. These interpretations might not be compatible with students' intentions, depending on the personal resources exploited by the teacher when assessing. The pedagogical discourses articulated in the context of this study indicate teaching practice as the basic regulating factor in the assessment process, which re-contextualises the official discourse, in order to become functional in practice. This process finally leads to the formulation of a limited number of assessment criteria, mostly inflexible and not necessarily compatible to one another. Thus, assessment is downgraded to a simple "confirmatory" act of what students do rather than of what they are able to do in mathematics, based on criteria which are not always compatible to the official ones.

The matters discussed above illustrate the interpretive nature of assessment in mathematics and provide some insight into the possible sources of different evaluations, which are likely to disadvantage certain groups of students. Such an insight may enable teachers to engage in critical reflection on their everyday professional practice. The recognition of the incompleteness of their awareness of students' behavior, of the potential for alternative interpretations of this behavior and

its situated and temporary nature may increase the sources of evidence on which teachers base their judgements. Overall, may help them become aware of the social and cultural forces in effect, their own beliefs and practices included, when success and failure in school mathematics is at stake. Providing experiences and opportunities of reflection towards this direction can be of great value for teachers' professional development.

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