"WISHES, LIES, AND DREAMS": POETRY WRITING IN THE MATHEMATICS CLASSROOM

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It has been over ten years since I received Koch's (1970) book *Wishes, lies, and dreams* as a gift. In that book, Koch, a well-known American poet, described his experiences teaching poetry to children of different ages, socio-economic and language backgrounds in a Manhattan primary school. Having read a number of poems to the children, in order to "give them ideas, to inspire them, [and] make them want to write" (p. 10), Koch encouraged them to express their thoughts and emotions in verse. He organized each lesson around a simple topic: one day the children would write a poem full of wishes (*I wish I were ...*), on another day compose a series of lies, on a third day write a poem of dreams (*I dreamed ...*), and so on.

Koch's *Wishes, lies, and dreams* was a pioneering book in poetry education. His project, which took place in 1968, was funded by the National Endowment for the Arts, an independent agency of the US federal government that was set up in 1965. It was in 1969, one year after Koch had completed his teaching experiment, that this agency initiated a program called Artists-in-School. In this program, poets, actors, musicians, artists, and dancers were paid to teach in classrooms all over the country. Given the political climate of the period, it comes as no surprise that Koch's main intention was to *democratise* poetry and poetry writing, by overcoming poetry's supposed elitism and remoteness for children. The poems that Koch read to the children were an integral part of their poetry-writing activities and not simply the writing of others to be described, analyzed, and appreciated. He taught poetry in order to provide opportunities for all children, even so-called "non-English speaking children," to "see the world in a strong, fresh and beautiful way" (p. 47). [1]

Excited by the way Koch had awakened the children's poetic sensibilities, and touched by the poems the children had produced, I could not help but feel disappointed when I read that one of the ideas that did not turn out so well in his project was a poem about mathematics. The poet's confessed 'failure' to work with children on a poem about mathematics echoed in my mind for a long time. [2]

Koch was a successful and beloved teacher. He had taught writing and poetry courses at Columbia University for about 10 years before he began this project. Why had the children 'failed' to write interesting poems about mathematics? Why had such a talented poet and teacher 'failed' to inspire children in that domain? Maybe Koch was not familiar with the world and teaching of mathematics, but that would be too easy a response. Another reason might be the demands posed by combining the poetic use of the English language with mathematical content, especially for children whose main language was not English.

In this article, I discuss poems arising from a project inspired by Koch's poetry teaching ideas, a project that tried to reconsider his conclusions in regard to mathematics and poetry. Four classes participated in the project, one third grade, two fourth grade, and one fifth grade class (8 to 10 year-olds) from two primary schools in a semi-rural area in Greece. All classes participating in the project had a number of students of Albanian origin who had various degrees of communicative competence in Greek, the language of instruction, and varying levels of participation in the mathematics classes. The project's main purpose was to bring poetry writing closer to mathematics, following a belief in the dialogic relationship between written presentation and the construction of knowledge (Connolly, 1989).

Koch's aforementioned 'failure' to work on mathematical ideas brings dualisms to my mind such as; the world of mathematics *vs* the world of emotions; exact meaning and objectivity *vs* interpretation and subjective meaning; mathematics as language *vs* mathematics as bound up with linguistic practices. I criticise these binaries by building on the position that mathematics, contrary to common belief, is full of values, emotionality and desires (Cobb, Wood and Yackel, 1993; Pimm, 2003; Walkerdine, 1988).

Poetry and mathematics

The production of written texts in the mathematics classroom may well rest on two interrelated assumptions. The first assumption is based on a widespread notion that writing mathematics is akin to the 'formalistic' expression of mathematical meaning, with written language context being a 'dispensable' part of the experience. The second assumption is related to one pole of a heads-or-tails argument on the primacy of spoken over written language or conversely. As Stubbs (1980) observes, until the beginning of the twentieth century there had been a bias towards written language, understandable to a certain extent since linguists did not have the technology to study spoken language. In the twentieth century, though, along with the development of recording technologies, written language came to be considered a mere visual representation of spoken language.

Written texts are not only a stylistic expression of vocabulary and grammatical rules, but also partake in the construction of meaning. In writing, the active involvement of the communicating parties may heighten the awareness of thought processes and the understanding of conceptual relationships, facilitate reflection and ownership of mathematical

knowledge, and make possible the construction of work that is personally meaningful (Shepard, 1993). A dialogic relationship exists, then, between the construction and presentation of knowledge. As the poet Stafford has eloquently phrased it, a writer

> is not so much someone who has something to say as he is someone who has found a process that will bring about new things he would not have thought of if he had not started to say them. (in Connolly, 1989, p. 3)

Written texts in school mathematics are not impressions on paper of previously spoken words or firmly constructed mathematical ideas. Writing about mathematical ideas need not be synonymous with recording, copying, reproducing, reciting, or assessing mathematical content (Morgan, 1998). Addressing writing as a fundamental aspect of human existence is not to adopt one of the poles of each of the binaries that I mentioned earlier. For a mathematics educator, this stance could be translated into a willingness to investigate writing's potential to construct meaning in the classroom.

The relationship between poetry and mathematics, and their teaching in the school classroom, seems to be determined by their respective epistemologies. Poets and language teachers, on one hand, may agree with Keats in saying that mathematicians have "destroyed all the poetry of the rainbow by reducing it to its prismatic colours" (in Tahta, 1981, p. 43). Mathematicians and mathematics teachers, on the other hand, may agree with Newton in saying that poetry is nothing but ingenious nonsense (Kline, 1964, pp. 276-284). Poetry and mathematics, then, are both considered to be highly obscure pursuits, relevant only to certain, presumably quite distinct, audiences. Evident in this is an epistemological divide that, fortunately, does not exhaust the *possible* relationships of mathematics and poetry.

In invoking the union of mathematics and poetry, we should be alert to the danger of recreating hierarchies that place one practice in 'service' of the other. Twisting around the poles of this dualism, we may find arguments in support of mathematics *as* poetry, of *doing* mathematics as a means of engaging and satisfying our aesthetic interests [3], and of poetry *as* mathematics, of poems as mnemonic devices and of word problems as a means to present and/or investigate mathematical content. Treating poetry writing as a feasible medium of communicating mathematical meaning and exploring its educational potential in the mathematics classroom is ultimately to subject mathematics to the demands of metaphorical thinking and the faculty of language in general.

Poetry-writing in the mathematics classroom

Since the fall of European Communism, Greece has become a destination for immigrants. Even though my data refer only to legal immigrants, it is estimated that more than 1 000 000 immigrants live in Greece these days, making up about one tenth of the country's population. More than half of the immigrant population is of Albanian origin. In Greek schools, at all levels, students of non-Greek origin represent ten percent of the total student population. Almost 75% of the students of non-Greek origin are Albanian. An important issue that comes into play relates to the participation of children who do not speak the language of instruction fluently in classroom activities: are students not fluent in the language of instruction *able* to participate in poetry writing, and more particularly in the mathematics classroom?

How do equity issues play out in the mathematics classroom, especially in the Greek classroom where teaching is highly logocentric? [4] I analyzed the poems of students of Albanian origin, comparing them with those of certain Greek students who were both highly fluent in the language of instruction and high achievers in mathematics. In my analysis, I attempted to show that the *voice* of students of Albanian origin, heard through their poetry writing in the mathematics classroom, may challenge the assumption that students who are not fluent in the language of instruction are linguistically and intellectually 'limited' (Setati and Adler, 2000, pp. 244-250), as well as the pedagogical practices that reward 'verbosity' as a component of successful learning.

Teachers who participated in the project were surprised to find mathematics introduced into the domain of poetry, and *vice versa*. [5] The connection between mathematics and other school subjects is usually understood through its application to these subjects or through the commonly encountered, but meaningless, saying *mathematics is everywhere*. Moreover, poetry writing itself is rare in Greek primary schools. Children are taught to *appreciate* poetry and recite 'classic' poems on various occasions, mainly celebrations on national holidays, but not to *write* poetry. [6] Teachers based their decision to participate in the project partly on the grounds of curiosity.

At the beginning of the school year, I contacted the teachers and discussed with them the main purpose and details of the work. During the teachers' initiation to the project, they and I discussed a list of topics around which children could write poetry (such as colours, noises, dreams and comparisons). We proceeded in the same vein for poems about mathematics (the concept of zero, arithmetic operations, geometric figures and solids). To help the children we decided to follow Koch's suggestions, and apply certain formulas for each line, *e.g.*, *If I were ... I would ...*, or *A ... is like a ...*.

I had also translated several of the children's poems that are cited in Koch's books *Wishes, lies, and dreams* (1970) and *Rose, where did you get that red?* (1973). We decided to use a number of these poems, where appropriate, to spark children's motivation and to provide them with images that would eventually help them to express themselves in verse. During the initiation phase, I visited the classes informally in order to get to know the teachers and the students in their classroom environment. I attended both language and mathematics classes.

We started off with collaborative poems, each child contributing a line following a certain rule (*e.g.*, every line beginning with *I wish*, or every line consisting of a piece of advice to someone). As Koch (1970) suggests, collaborative poetry writing, an ancient poetry-writing practice, works well as a first activity since it relieves children of initial embarrassment and hesitation. Wherever the topic was appropriate, we accompanied the activity with visual or auditory stimuli (*e.g.*, writing poetry while listening to noises or sounds of the forest). We also worked around other ideas in the course of the year, seeking inspiration from calendar landmarks (*e.g.*, a poem of lies when close to April Fool's day).

In most cases, students spent a whole 45-minute session working on a single poem. While students were writing, we would go around the class discussing their ideas and the images they wanted to incorporate in their poems. We made clear to them that rhyme was not a requirement. Occasionally, we helped them in choosing the right word, but never corrected them unless they themselves asked for help with their grammar or spelling. We had the opportunity to work with their grammar and spelling on other occasions, since children had to edit their poems for a booklet that we prepared for each class towards the end of the school year. Once all the children had finished writing on a particular topic, they read their poems to the rest of the class.

Mr. Multiplication and Mrs. Division and Mathematical Lies

I am going to concentrate on poems that children wrote about *Mr Multiplication and Mrs Division* and *Mathematical Lies*. [7] With these two topics, unlike with the non-mathematical ones, we did not have any poems to read to the children before they commenced writing. We had decided to include multiplication and division in the same topic to encourage children to write about the relationship between the two operations. We gave a human existence to the two operations to emphasize their relationship. With the *Mathematical Lies* poem, it was helpful that the week before the children had written a poem about *Lies*, with each line of the poem including a lie.

Minas and Georgia were third-grade (8 years old) classmates (see Figures 1 and 2 for their poems about the first topic). Minas, a boy of Albanian origin, had come to Greece in the middle of the previous school year. He was very social, always grinning, and competent in communicating verbally with his classmates and the teacher. His ease in communicating might be attributed in part to the fact that he had a sister, who had been in Greece for two years, in the fifth grade (10 years old) at the same school. Having an intermediate level of competence in the official language can be misleading, however, as a deep understanding of meanings and participation in the classroom practices requires more than just the use of a technical vocabulary (Moschkovich, 2002, pp. 192-200). Georgia, a girl of Greek origin, one of the best achieving students in the class, had an affinity with poetry writing. She was thrilled when her teacher announced to the class that they would write poetry over the coming school year. Georgia's poetry writing ability was praised by her teacher and classmates alike.

As we can see from his poem (Figure 1), for Minas, writing *per se* was a *physical* act. The layout of the text, the alignment of the words, the struggle to restrain his verse within the margins of the paper, and the traces of his pencil on paper all suggest this. He made several spelling mistakes, did not put accents on most of the words, and occasionally omitted syllables of words. Minas presented Mr Multiplication and Mrs Division as entities possessing magical powers. Minas gave Mrs Division the power to decrease the size of people. Even though it appears to have confused weight with height, Minas is actually using an everyday expression:

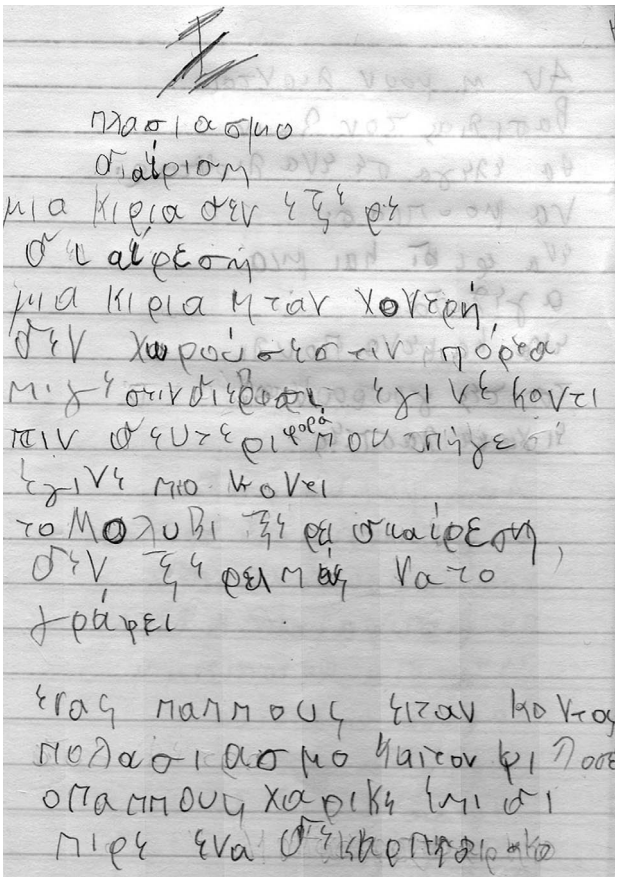
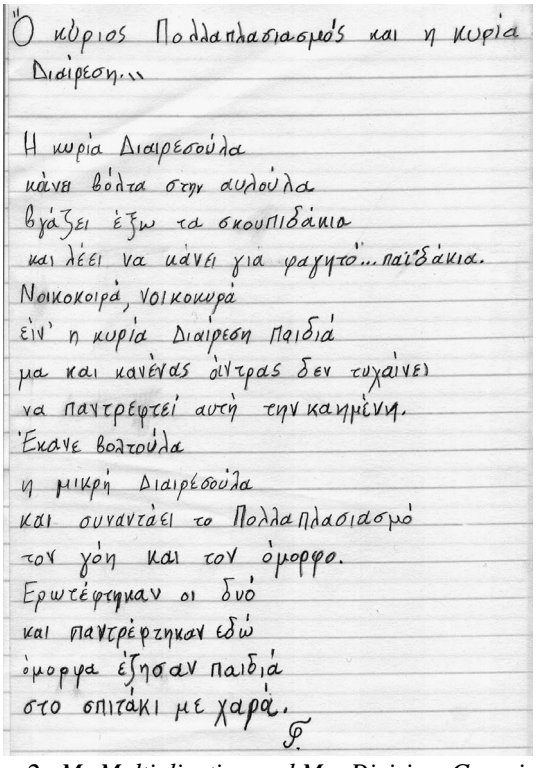


Figure 1: Mr Multiplication and Mrs Division, Minas, 3rd grade (8 years old).


Ο κύριος Πολλαπλασιασμός και η κυρία Διαίρεση...

Η κυρία Διαιρεσούλα
κάνει βόλτα στην αυλούλα
βγάζει έξω τα σκουπιδάκια
και λέει να κάνει για φαγητό... παιδάκια.
Νοικοκυρά, νοικοκυρά
είν' η κυρία Διαίρεση παιδιά
μα και κανένας άντρας δεν τυχαίνει
να παντρέψει αυτή την καημένη.
Έκανε βολτούλα
η μικρή Διαιρεσούλα
και συναντάει το Πολλαπλασιασμό
τον γόη και τον όμορφο.
Ερωτεύτηκαν οι δυό
και παντρεύτηκαν εδώ
όμορφα έζησαν παιδιά
στο σπιτάκι με χαρά.

Figure 2: Mr Multiplication and Mrs Division, Georgia, 3rd grade (8 years old).

> a lady was weighty/couldn't fit in the door/went to division became short/the second time that she went/ she became more short. (lines 5 to 9)

Similarly, he presented Mr Multiplication as having the power to increase the size of people:

> an old man was tiny/multiplication and he made him tall/the old man was thrilled because/he took a tenner. (lines 13 to 16)

The word tenner, even though it comes from a context of monetary exchanges, in everyday language is also used to refer to *things that make ten*.

Minas's dramatization is based on the effects that the two operations have on whole numbers. Even though both deal with size, Mrs Division appears to be specializing in weight loss and Mr Multiplication in height increase. Minas then did not fully utilize the fact that the two operations can cancel each other out. Minas was shorter than his classmates, so this metaphor might have been a self-ironising comment or the expression of a personal desire to grow taller. Gender stereotypes also echo in Minas's poem – the woman seems to care more about her weight while the man is more concerned with his height.

After the description of Mrs Division, Minas adds as an aside:

> the pencil knows division/it does not know how to/write it. (lines 10-12)

Children were often asked in class to perform operations on the blackboard, explaining aloud all the steps of the algorithm. The pencil here is a metonymy, symbolising Minas himself. Minas during mathematics class could not verbalize in Greek while performing on the blackboard, even though he could cope better when he worked silently at his desk with pencil, paper and numbers.

Looking at Georgia's poem on Mr Multiplication and Mrs Division (Figure 2), we can tell that, unlike Minas, she had written poetry before. With very neat page layout, and only one or two spelling mistakes, her poem seems to be driven by an attempt to make her verse rhyme. She added the diminutive "-oula" (*–ούλα*) and "-akia" (*-άκια*) to the end of many words in order to achieve rhyme (lines 1, 2, 3, 9, and 10), thus making her poem overly 'cute.' In striving to apply rhyme in her poem, Georgia reproduces stereotypes both about poetry and successful poetry writing (*i.e.*, *poetry = rhyme*). She presents Mrs Division as an orderly, but terribly lonely, housekeeper since

> no man has happened/to marry the poor soul. (lines 7 and 8)

Mrs Division may be so unpopular with men because of her mathematical links. Mrs Division meets Mr Multiplication the "charmer and the handsome" (line 12) and

> they fell in love with each other/and they got married here/they lived happily you children/in their house with joy. (lines 13 to 16)

We are left to assume that the two characters were meant for each other due to their arithmetical attributes, as comments in that regard are absent from Georgia's verse. The discourse that prevails in Georgia's poem expresses stereotypes about a woman's fortune, as her course in life appears only to be fulfilled through a successful marriage. This discourse actually blinkered her eyes from seeing the mathematical characteristics of Mr Multiplication and Mrs Division. Georgia's poem was received better by her teacher and the rest of the class than Minas's. The class, though, did enjoy Minas's metaphors, despite the fact that the teacher drew attention to his spelling mistakes.

Many children, boys and girls in all four classes, chose to present the two characters as two friends fighting over which is more important or more difficult as an operation. Loukia, a girl who sat near Georgia, was one of the very few other children who chose to resolve the argument in a happy marriage. Loukia was a shy girl who would never speak without the teacher's prompting. She was getting average grades, being ranked in the middle range of her class. She was not as popular as Georgia. However, despite voicing gender stereotypes, Loukia was the only child in all four classes who brought the other two mathematical operations into her plot:

> so our two operations got married/with best women Addition and Subtraction.

Writing a poem full of mathematical lies was one of the topics that children enjoyed the most. Their poems comprised mainly of false mathematical facts, especially in the fourth and fifth grade (9 and 10 years old) classes:

> seven and three is nine/nine and nine is nineteen/two is divided by 5, 7, and 9/the smaller angle is the obtuse/and the bigger is the acute/two tons is 500 kilos/ the rectangular parallelepiped has 10 angles/the hour has 70min/1 minute has 170 seconds/the triangle has 13 angles. (Christina, 4th grade, 9 years old).

Immediately after the Christmas holidays and before the children started working independently on poems about mathematics, the teacher had given the class a glossary of mathematical terms. Naively or not, the purpose of this glossary, as the teacher told me, was to provide the children with a memory aid. Almost all children used statements that appeared in this glossary to write their mathematical nonsense.

In most statements, children chose to drive the mathematical facts to falsity through exaggeration. For instance, instead of writing "1 minute has 170 seconds", it would have been adequate to write "1 minute has 61 seconds." Initially, I interpreted this behaviour as indicative of lack of knowledge of or uncertainty about mathematical facts. When they were reading out their poems, however, I could tell from the look in their eyes ("I am enjoying this, but I am really *allowed* to do this!") that exaggeration was integral to their 'lies.' In turn, their carnivalistic "blasphemies" (Bakhtin, 1984, pp.122-147) could be interpreted as disbelief towards mathematical truths. The presentation and organization of mathematical content in Greek textbooks and in the classroom is often based on or around questions of the type "What *is* a ...?" When definitions are used mainly as end-products and not also as processes of constructing understanding, the present indicative, *is*, indicates and invites believing (Richards, 1949, pp. 321, 334). Children's 'abuse'

of mathematical statements, then, was part of a discourse oppositional to the authority of the normal or expected in the mathematics classroom, both in terms of the subject itself and the figures that order it.

Blerta's poem on mathematical lies (Figure 3) differed from all the others. Blerta was one of two children of Albanian origin in one fourth grade (8 years old) class. She had attended Greek school for almost two years and was very quiet, mainly during language classes. Her teacher attributed her behaviour to the spelling and grammar mistakes that she often made and to her heavy accent since, as the teacher with a hint of irony said, Blerta was a perfectionist. Blerta, though, upset the process of writing poetry that we had engaged in thus far by using pictorial representations. Bernard, the other child of Albanian origin in the class, sat behind Blerta and, probably influenced by her, produced similar work (see Figure 4). Blerta and Bernard's lies are located in the mismatch between, what in Peircean terms would be called, an *iconic* (the image) and a *symbolic* (its label) representation of a mathematical idea. Blerta drew a rectangle and wrote "cylinder," a cube and wrote "5 angles," a circle and wrote "square," an acute angle and wrote "square angle," and two lines intersecting at 90 degrees and wrote "parallel." Bernard made a list of angle measurements and *matched* these measurements with a drawing.

When Blerta *read* her poem to the rest of the class the other children politely hurried to dismiss this work as "not poetry." On one level, detected in this response is the conventionality of the children's view of poetry. On another level, though, this dismissal of Blerta's and Bernard's work can also be seen as an act of collusion between them and those of Albanian origin. According to McDermott and Tylbor (1983), groups reach a consensus about what things they will talk about and how they will talk about them. The internalization of such a consensus makes it difficult for members of the group to talk and think otherwise. The two children, then, were 'excused' in a sense, since their work was interpreted as avoidance behaviour, a form of resistance to using the language of instruction. Yet Blerta's and Bernard's work may be interpreted as springing not from conflicts between languages (Greek and Albanian) or between registers (mathematical and everyday). Instead, it could be interpreted as a *freshcut* between forms of representation that had been used up until then in the poetry writing activity.

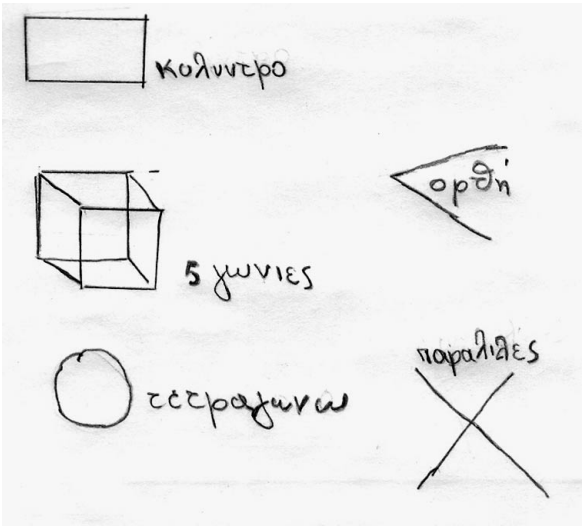


Figure 3: Mathematical lies, Blerta, 4th grade (8 years old).

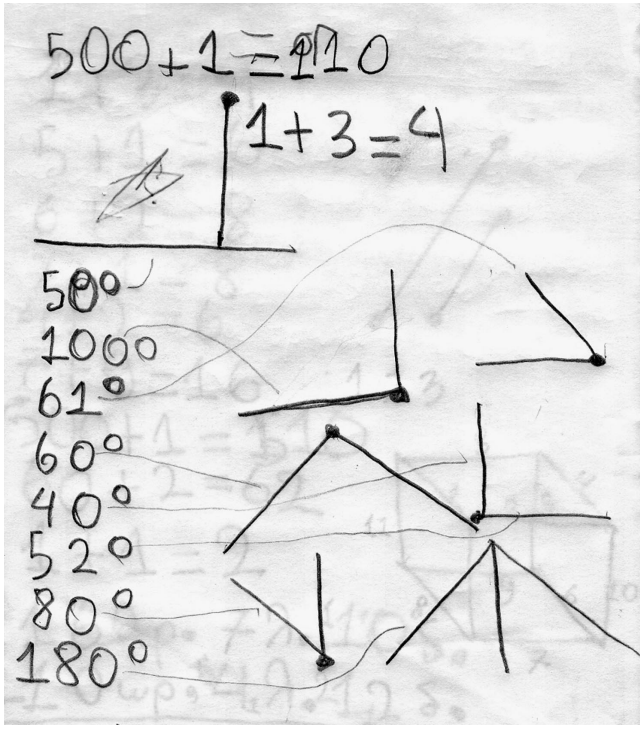


Figure 4: Mathematical lies, Bernard, 4th grade (8 years old).

On freshcuts in the mathematics classroom

Freshcuts, according to Mack, are metaphors that

> force the hearer to stop, notice and reinterpret, since the utterance is new, though the pattern will be pre-coded in the language. (1975, p. 244)

The topic of *Mr Multiplication and Mrs Division*, of course, led children to use a certain repertoire of metaphors. Even though we expect multiplication and division to increase and decrease the size of whole numbers, we do not expect them to be able to do so for the physical characteristics of people. Minas's depictions of the two operations were freshcuts, as these had not appeared in the class's discussions (at least those that I observed), and certainly do not appear in the primary school mathematics textbooks. [8] In a similar way, the implication of addition and subtraction in Loukia's poem were also freshcuts, another example of successful integration of mathematical content in verse.

In Georgia's poem, the extraneous words that had been accumulated in order to make verses that rhyme had replaced thoughts (Labov, 1972, pp. 201-240). Georgia interpreted the metaphors of Mr Multiplication and Mrs

Division literally. She did not transfer qualities from the mathematics to the everyday context, limiting thus the mathematical content in her verses. In this sense, Georgia showed a romantic mood with a preference for working closer to the metonymic axis of thought (Jakobson, 1960, p. 19). She created associations based solely on gender stereotypes and remained within this context all along manipulating its structure and syntax (*e.g.*, imposing rhyme on her poem in an attempt to make it look more like a poem). Minas, on the contrary, built on the suggested metaphors, switching back and forth from the everyday to the mathematics context, depicting Mr Multiplication and Mrs Division as function machines that increase or decrease certain physical characteristics of people.

Freshcuts give the writer and the hearer alike the opportunity to deepen their conceptions of the mathematical content by forming or trying to interpret the juxtaposed characteristics. Why, for instance, are addition and subtraction "best women" at Mr Multiplication's and Mrs Division's wedding? Freshcuts appeared also in non-mathematical aspects of the poems. In his poem, Minas used a novel way to express his personal aspirations and his feelings about his position in a logocentric mathematics classroom (to grow tall; to stop being a silenced bystander in the course of the lesson). On the other hand, Georgia's metaphors concerning a woman's position within mathematics and within society are dead metaphors, as they are voicing widely accepted stereotypes of a discourse on gender and mathematics (a woman being fulfilled through veiling her scientific talents and pursuing a successful marriage).

On another level, related to both the teaching of mathematics and poetry, Blerta and Bernard's way of expressing their mathematical nonsense through the use of drawings was a freshcut both in representing mathematical meaning and in writing poetry. The writing of mathematical nonsense in the poem of mathematical lies, besides being very entertaining to children since it was interpreted as an opportunity to mock authorities in the mathematics classroom, had an evident knowledge-construction element to it. Marking the boundaries of *nonsense* requires or attests to a sound marking of the boundaries of *sense*, as acts of classification (what is nonsense and what is not nonsense) are intertwined with acts of transformation (how sense becomes nonsense and nonsense becomes sense) (Stewart, 1989, pp. 3-46).

The parodying of mathematical statements in the poem of *Mathematical Lies* seems to run parallel to forms of carnival culture in the Middle Ages and the Renaissance. In the central arena of the carnival, people uttered comic compositions and profanities mocking those in authority as well as the very idiom of that authority. In that sense, the carnival square was not simply a place where the oppressed could blow off steam, but was truly a place for working out

> a *new mode of interrelationship between individuals*, counterposed to the all-powerful socio-hierarchical relationships of noncarnival life. (Bakhtin, 1984, p. 123, *original emphasis*)

Even though the 'carnivalizing' of mathematics was triggered, in part, by the research, the joy of the children while writing and reading their poems of *Mathematical Lies* and the eccentricity of their nonsense were unexpected and thus, suspended and reversed, albeit temporarily, hierarchies in the classroom. The experience of writing a poem of *Mathematical Lies* also prepared the arena for Blerta and Bernard's classmates to express, initially, mockery of the two children's demographic differentiation. To Lensmire (1994), that would have been expected, as the carnival square is the site where the relatively powerless turn not only against the powerful, but against the even more powerless groups (such as women, all sorts of minorities, or simply the un-cool children in a classroom).

Logocentric teaching and equity issues in the mathematics classroom

The 'art of teaching' has always been a seductive notion for teachers of all subjects, with the *art* being located in the ability, considered innate to a large extent, to explicate even the most complex ideas in plain language (Sadao Aoki, 2000, pp. 348-9). In his critique of the "explicative order," Rancière (1991) describes explication as a series of reasonings used in order to explain a series of reasonings that already exist within the material being taught. If a student cannot understand the first series of reasonings, why should we assume that he or she will understand the teacher's reasonings? And if the teacher's reasonings themselves need to be explained, we can see how, in Rancière's words,

> the logic of explication calls for the principle of a regression ad infinitum. (p. 4)

What brings an end to this regression of reasonings is the teacher himself or herself. The danger of the closure of meaning in "understanding" is evident at this point (Sadao Aoki, 2000, p. 365).

Over-reliance on the act of explication inevitably places emphasis on what Jakobson (1960) has defined as the poetic function of language, a "focus on the message for its own sake" (p. 153). 'Understanding' then, may become synonymous with 'being convinced' by the teacher's series of reasonings and not by the inner logic of the material discussed. It is a fact that what speakers say is always evaluated according to aesthetic principles, in other words, for its efficacy in 'moving' an audience. Despite attempts for reform, mathematics classes in Greece remain logocentric (Triandafillidis, 2002). In this process, teachers often follow the scheme of a triadic "dialogue," with the teacher asking questions, the students responding, and the teacher evaluating the responses.

In logocentric mathematics classrooms, students may end up valuing and, therefore, placing more emphasis on the *form* of mathematical arguments. Georgia's poems and their wide acceptance as successful are indicative of a teaching that values form over content. In classes where prominence is placed on teacher's explication of ideas and reasonings, students with a language background other than the language of instruction may be expected to experience additional difficulties. [9] In Greece, as in other countries with languages of instruction, the educational administration sees mastery of the Greek language as a prerequisite to accessing the mathematics curriculum. This requirement, in one respect, is based on the assumption of Greek linguistic homogeneity. Indeed, the assumption that in monolingual

classrooms students share the same language and, therefore, that language can be a common vehicle towards the construction of mathematical meaning, has been greatly challenged (Moschkovich, 2002; Setati and Adler, 2000).

Due to the small number of cross-cultural schools in Greece, students like Minas, Blerta and Bernard attend 'sheltered' classes, where Greek is taught as a second language intensively for one year. [10] In practice, though, especially in schools in semi-urban settings, an 11-year-old Albanian student may find himself or herself attending language classes in a first grade (6 years old) class, while following the curriculum of other school subjects at a grade that matches the age level. In another respect, then, antithetical on the surface to the one described before, being highly fluent in the language of instruction is not a prerequisite for becoming fluent in the language of mathematics. This oxymoron is based on the common folklore that the language used in the classroom does not affect the mathematics that is being taught (Zevenbergen, 2001).

The previous myth – an ideological construct tied to the belief in mathematics as an all-explaining theory – to a large extent rationalizes another common folklore among primary school teachers in Greece, namely that children of Albanian origin *do well in mathematics*. The evidence for these children's aptitude in mathematics is usually based on their performance on arithmetic operations. This romanticizing of Albanian children's mathematical ability actually serves in *othering* these children in the mathematics classroom, by limiting their participation in classroom events to those that require the direct performance of algorithms performed silently on the blackboard or on paper. Moreover, to state that Albanian children 'do well in mathematics' is equivalent to saying that they do not – or cannot – do well in any other subject.

Concluding remarks

Looking back at the poems that the children wrote, I will make some suggestions about poetry writing in the mathematics classroom and the teaching of mathematics in general. Poetry writing in the mathematics classroom may be seen as part of a pursuit of articulating *all* children's voices related to cognitive matter, the content of mathematics, but also to exploring emotions, actions, and expressions. Minas's and Georgia's poems have much to tell us about their conceptions of arithmetic operations, personal aspirations, and feelings and practices related to the teaching of mathematics in the classroom, as well as about gender stereotypes and the education of language minorities. Even if the Albanian students' preference for the metaphoric axis of language was partly a result of their weak mastery of the Greek language (and therefore its metonymic axis), their poems may still also be perceived as freshcuts, cutting through a deficient model of education.

Mathematics is thought to be detachable from a context of origin mainly because it operates through the processes of decontextualization and recontextualization. The re-framing, or transferability of mathematical content and processes within mathematics and across disciplines, is often discussed in curricula as a *desired* standard (Coxford, 1995). As a result, mathematics often ends up colonizing other school subjects under the banner of interdisciplinarity. The relationship of mathematics to other subjects is viewed in terms of its ability to be applied in the teaching of those subjects and *vice versa*, which ultimately creates a primary school curriculum that, to use Dewey's (1990, first edition 1902) words, may "divide and fractionize" (p. 184) the world for the child. This compartmentalizing is certainly the case in the Greek educational system, in which some subjects are thought to be better for discipline and others for culture. In this article, poetry writing in the mathematics classroom was itself proposed as a freshcut, crossing the boundaries between the disciplines of mathematics and poetry.

As previously discussed, mathematics and poetry are two intimidating school subjects. Mathematical ideas and processes, as well as poems, end up becoming hackneyed discourses to be explicated, learned, applied and recited on various occasions, but not created and owned by the children. In Bakhtin's words, "[t]wo voices is the minimum for life, the minimum for existence" (1984, p. 252). In this sense, the findings and the analysis here may strengthen the voice of those normally excluded by the education system, while suggesting new ways of seeing mathematics, its teaching in the classroom, and the potential of children not fluent in the language of instruction to express their mathematical and poetic imaginations.

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Notes

[1] Koch found the term "non-English speaking children" to be a misleading administrative term. He stated strongly that

> the degree of literacy certainly makes a difference in a child's ability to write easily and confidently, but it does not form its imagination. (1970, p. 47)

[2] Koch did not even quote any of these attempts, nor did he explain why he felt that the mathematics poems were not up to the standard he had expected.

[3] Look out for, Sinclair, N., Higginson, W. and Pimm, D. (in press) *Mathematics and the aesthetic: modern approaches to an ancient affinity*, Springer-Verlag.

[4] This logocentrism in the mathematics classrooms is also observed in other countries. See, for instance, Santagata and Stigler (2000), Schütte (2005).

[5] This project took place over the course of one school year, with visits on a weekly or, occasionally, on a biweekly basis. In all cases, I jointly taught all classes with the teacher of the class. Since 2002, a cross-curricular, cross-thematic framework has been implemented on an experimental basis in Greek primary education. The suggested holistic teaching approach and horizontal linking of school subjects was framed in large measure in terms of projects that concerned language, public health and environmental education. Students work on cross-disciplinary projects during the, so called, 'flexible-zone' of the school timetable, usually a two-hour session every week.

[6] When teachers in Greece want to give students the message that they should know something very well, they often say: "You should know it like a poem." This saying illustrates the way learning, whether of mathematics or poetry, is conceived to be knowledge learned by rote and performed flawlessly.

[7] The courtesy title 'Mrs' in Greek is used as an equivalent to 'Ms' in English.

[8] Children are only aware of the time-saving "shortcuts" (Mack, 1975, p. 243) related to multiplication expressed by their teachers as: "we multiply if we know the few and we want to know of the many", and for division: "we divide if we know the many and want to find the few.

[9] In support of this argument comes the fact that the mathematics classroom may rarely be considered a place where linguistic feedback should be provided for students to improve their language skills (Cleghorn *et al.*, 1998, pp. 463-4).
[10] In Greece, there are 13 cross-cultural primary schools (1st to 6th grade, 6 to 11 years old) out of a total of 5570, 8 cross-cultural gymnasiums (7th to 9th grade, 12 to 14 years old) out of a total of 1729, and 4 cross-cultural lyceums (10th to 12th grade, 15 to 17 years old) out of a total of 1047. Sheltered classes in primary schools may be created if at least 4 students of very low competence in Greek attend the school.

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The education of the child must accord both in mode and arrangement with the education of mankind as considered historically; or, in other words, the genesis of knowledge in the individual must follow the same course as the genesis of knowledge in the race.

Herbert Spencer