

Controlling Mathematics Classrooms: a Case Study

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The gap between research findings and their application to practice is a major continuing problem in mathematics education [Kilpatrick, 1981; Wheeler, 1989]. Perhaps the most important reason for this is that the university-based research often investigates questions that promote the self-interest of the researcher and hence is of little concern to teachers. University research does not directly address the central problems of classroom instruction in which one teacher must teach a diverse group of 30 to 40 students. Moreover, findings from such research do not translate directly into prescriptions for classroom instruction since such instruction, successful under specific situations in strictly controlled experiments — by focusing e.g. solely on one aspect of the teaching process — may not work in more complex classroom settings.

A fact that seems to corroborate the above thesis is the ignoring of one significant variable that directly affects teacher practice in the classroom: the struggle for control, or the conflict between teacher and pupils in mathematics classrooms. There is no mathematics teacher in the world who has not faced disorderly classrooms, where most pupils are badly behaved, inattentive, gaze listlessly out of the window, swear, and wander about in class and only minimally comply with work demands. These challenges arise from time to time in the experience of all teachers, whether they are straight out of training or well-established in the profession. The struggle for survival in such a classroom is a lasting nightmare for mathematics teachers. Insecurities about their ability to control a class of some 30 (all too often 30 plus) children loom large in the minds of many inexperienced and even of experienced teachers [Emmer *et al.* 1984].

Nevertheless this significant variable is not taken account of in research because, in my opinion, it does not interest the university researchers. As long as research ignores the complex and problematic nature of real classrooms and refuses to account for the meanings and purposes of teachers and pupils in specific situations, or to attack problems deriving from manifold and unstable variables, it is doomed to failure. Therefore, a central implication of proposals for realistic research is that curriculum research and development, leading to the improvement of schools, ought to belong to the teacher, indeed to all teachers working individually or cooperatively with colleagues in the education service. I shall argue that well-founded curriculum research and development in mathematics education, based on the study of classrooms, rest on the work of mathematics teachers, and the study of their work should be undertaken by teachers themselves.

In this article, I will try to express my concern about the problem of disruptive behaviour in mathematics classes as a permanent phenomenon that is there, week in week out, involving a growing number of students. For this purpose I will present the case of an eleventh grade mathematics

classroom which consisted of very difficult students. This example, although it constitutes an extreme case, will be used to show how a mathematics teacher at heart remains helpless in his/her daily struggle with the problems which appear in a common mathematics classroom, in spite of the enormous bulk of research conducted in this field.

Struggle for control in an eleventh grade mathematics class

CLASS CHARACTERISTICS

The class I will describe is in a large comprehensive upper-level high school in Patras, Greece, including urban students from a variety of socioeconomic levels. I have been teaching mathematics in this school since 1985. Academically the school is organized into two bands (college bound students and non-college bound students). The school day is organized into six or seven lessons in the morning, ending at two o'clock. B6 is an eleventh-grade class where the majority of students are non-college bound. Since the final differentiation takes place in the twelfth grade, mathematics is a compulsory subject for all students. It is a large class of eighteen boys and thirteen girls, aged between sixteen and seventeen. This class was chosen because it had been marked out by almost all teachers as the most disorderly class in the school. B67 themselves had been marked out by their mathematics teacher not only as low achievers but as excessively troublesome, a view confirmed by the other teachers who taught them. As the history teacher, who spent most time with the class and was responsible for them, informed me, seven students were without one parent and three came from broken homes. Nearly all of them were working class pupils from troubled homes with low socioeconomic status. They included non-readers, persistent 'lazies', and indifferent anti-school pupils who were low achievers. Mathematics was taught five times a week by a woman teacher I shall call Mrs S.

I spent 8 class sessions observing the behaviour of the students in mathematics during the last term of the school year 1990/91 and 14 experimental teaching hours as their regular mathematics teacher for the remainder of the term. I took notes and made audio recordings of the 22 class sessions as well as conducting interviews with the mathematics teacher and with each student.

LIFE IN THE CLASS

Although the observations were limited, the patterns of behaviour I observed were consistent enough to suggest that they were typical. My presence did not affect the behaviour of pupils much, because as a teacher of this school I was not unknown to the pupils. Of course my presence might have affected Mrs S's behaviour by eliminating some of the more aggressive aspects of teacher control. But as the pupils told me afterwards, in the interviews, there had not been dramatic changes.

On entering B6 mathematics class, an outsider would be dazzled by what was going on. Students were talking loudly to each other or to the teacher. There was a continuous scraping of chairs accompanied by banging of desk lids. Pupils constantly wandered about, taking things from each other's desks or throwing things. For instance, one boy threw a compass at another and the other threw a rubber at him when the teacher's back was turned. I observed pupils walking in and out of lessons with a shouted comment, such as: "I am going to the loo", or "I am going to take an aspirin". Such appearances and disappearances created additional reason for disorder. Sometimes some boys bothered the girls, making loud comments about things irrelevant to the lesson. I also observed some B6 students reading comics or other school books which they hid as the teacher approached. Sometimes at the back of the class, pupils played bingo or talked about other things. When they realized I had seen them, they laughed up their sleeves.

Generally the picture which emerged was of pupils who were anxious, inattentive, having a very short concentration time, with sudden outbursts and unpredictable classroom behaviour, unable to control themselves for more than five minutes. The amount of real work completed by these pupils in mathematics lessons was very little and its quality was very poor.

Mrs S was a 36-year old mathematics teacher with 8 years in the profession. Talk and drill was the common strategy used to teach mathematics. She told the students about mathematics and they were expected to learn by listening and watching. A single text was used in whole class instruction. As she entered the class she asked students about the previous day's assignment. Afterwards she introduced the new topic, explaining the new materials by writing a few examples and notes on the board. Then new exercises were assigned for the next day. If there was time, students worked on the homework while she moved about the room answering questions.

Of course the problem was that she never succeeded in applying the plan she had in mind before entering the classroom. She was constantly interrupted by pupils who were shouting, wandering about, and not paying attention. Any attempt to break away from routine work, e.g. involving students in discussion, seemed impossible because other pupils would not listen, or their disruptive behaviour would increase as a consequence of discussion. Students talking at inappropriate times or asking questions to slow down the pace of a lesson possess a classroom discipline problem that is among the most troublesome for most teachers. As a result Mrs S quickly gave in and set them routine reading from their books or allowed them to prepare their homework. Clearly, this was a survival technique invented by Mrs S to control the class. But the same things occurred when Mrs S had set the class to work doing exercises, and then moved round the room in an attempt to help them. As soon as her attention was given to one pupil, other pupils began to engage in non-curricular activities. She therefore had to break off from her task to go and deal with these problems, which appeared again as soon as her back was turned. Sometimes she circled round for the whole lesson, or she stood back to address the

whole class and bring them to order, only to be interrupted by a new request for help, the whole process starting again. It was evident that Mrs S made great efforts to teach a bit of mathematics to these pupils and at the same time to keep the class under control. In spite of the noise and the repeated interruptions she never sent any pupil out of the room. She tried to help them in her own way, but they were indifferent.

THE TEACHER VIEW

The purpose of my conversations with Mrs S was to examine the mathematics teacher's views about the behaviour of B6 and about her professional response to this behaviour. Mrs S appeared to sympathize with the problems faced by the B6 pupils. She appeared to regard pupil behaviour as a natural rather than a pathological response to an inappropriate and problematic environment. "What fault is it of the children that they come from a deprived home background?" In addition to offering socioeconomic and pathological explanations, she described them as persons who demanded human rights and needed help. When asked to account for all the disruptive behaviour her first thought was to blame the system: "The timetable is inappropriate, the mathematics curriculum is unsuitable for these students. The textbook content is largely unsuitable. It contains very difficult mathematics, a great deal above the ability level of these pupils. They can't cope with it." She argued that BN6's inability to do mathematics was a major cause of problem behaviour. Most of the pupils she described as "lacking confidence in their work. A sense of frustration with their results causes unacceptable behaviour. If they think of themselves as bad, or failures, then they are far more likely to cause class control problems. Aren't they?... They have a very short concentration span and find it difficult to give their full concentration to whatever it is they are doing. That is why they are inattentive and sometimes become impatient while your attention appears to be with somebody else"

Mrs S also appeared to apologize for the way in which she taught the class: "I feel that a lot of the trouble is nothing to do with the teacher at all. You try to do certain things, but when you put it into practice it changes. Their behaviour is unpredictable. You can't say all right, all right every time and forget it. And, you know, a lot of things arise that are nothing to do with your lesson". When she was asked what else she might do to improve this situation, she said, annoyed: "Nothing". Then she exploded saying: "All right, what do you expect from me? Of course I know that they have psychological and emotional problems in their out-of-school lives. There is no doubt that a student who cannot satisfy his/her needs at home may come to the class hungry for recognition and attention. But I am not a psychiatrist. I am not a psychologist. I only know how to teach mathematics, I don't talk about sex problems. Maria and Katerina, for example, play part of the great ladies, having boyfriends older than themselves. I can't talk about family problems. I talk about mathematics. It's all in this context. We have no time to pay more attention to students' problems. And there is too much content in the grade 11 curriculum to be completed in one year".

In a sequel, she felt that exchanges between herself and the students were hurried, but she argued that under these circumstances she could not do any better. She felt pressured by the curriculum and the school authorities who would not abandon the typical standards of academic work in favour of an entirely practical syllabus aimed at the needs of the less academic pupils. Thus while she recognized the social and psychological difficulties of pupils, as well as their need to be treated in a friendly way with a show of understanding and sympathy, she claimed that under the existing conditions one could not expect any better. In short, because she ultimately blamed the system rather than the pupils, it was the system which she attempted to avenge, at the same time defending herself against it by keeping teaching down to a minimum and accepting behaviour which challenged the system. On the other hand, her more serious problem was that she was not able to complete the whole content of the grade 11 curriculum. This resulted in mechanical and boring lessons and an absence of any communication with pupils on a person-to-person basis. She may have recognized the value of such communication but she believed that it was impossible under the existing constraints and circumstances. In this way a vicious circle was formed, with the children becoming ever more alienated from themselves and from their teacher. This in turn led to problems of bored, apathetic and disruptive behaviour, particularly as children moved up the school and began to see clearly how little they would be able to derive from what went on within it.

THE PUPILS' VIEWS

The evidence drawn from interviews with pupils showed that they saw their behaviour as a natural response to an inappropriate and boring curriculum. Moreover they gave teacher inefficiency as an additional cause of disruptive behaviour. Almost all of them said that mathematics was the worst of all subjects and they felt a detestation for it. Nikos, maybe the most disruptive student, said, for instance: "I hate mathematics . . . The only mathematics teacher I remember, although only vaguely, is the one who allowed me to spend most of my time outside the classroom" (laughing). They also said that Mrs S was very typical and she gave very boring lessons.

- Maria: We come in the room and she speaks about mathematics until the bell rings. Work and work, explanations and exercises, all the time.
 Me: And what should she do instead?
 maria: If you've finished your work you could talk to your mate. She doesn't allow us any free time as for instance, Mr K does (the technical drawing teacher).
 Me: And what does Mr. K do?
 Maria: He may be more strict in a way, but he lets us do a quiz, or play bingo.

Most of the students complained that Mrs S did not provide pleasurable activities nor allowed alternative activities to allay boredom. So they had taken it upon themselves to fill the gap. Spiros, for example, said:

- Spiros: What she should do is have a limit of time for work, and then, say, . . . let us discuss or play for ten minutes or let you eat in class, or go out of the class and have a cigarette, or do what we want.

- Me: Do you find it right to smoke in school?
 Spiros: I didn't say in school. I said outside school. I don't see why we can't have a cigarette, for instance, on the basketball pitch in the back yard.

It appears that the overall theme of these students is that more free time would be the best way to relieve the boredom. But besides the boredom and detestation they felt for mathematics, they also agreed with their teacher that an important cause of disruptive behaviour was the inappropriate and boring mathematics curriculum, curriculum that was uninteresting and irrelevant to them. The curriculum was perceived by them as being of no value in helping them live their lives and preparing them for a vocation and also enriching their leisure time. The curriculum was oriented, in terms of the material contained, towards an academic career. This is a more general problem, particularly at the upper secondary school level, which has its historical reasons. Children are given material the main justification which is that it prepares them for further study later on, rather than offering them skills that are of practical or immediate value.

- Demetris: All this mathematics has no any interest or value for me. Why do I have to learn this junk? I'll never use it!
 Me: Why? What do you intend to do after school?
 Demetris: I'll sail away.
 Me: Won't you need mathematics there?
 Demetris: Maybe only a little arithmetic, nothing more. Can you tell me where logarithms will be useful to me?
 Me: Maybe you'll change your opinion when you grow up and become, for instance, a shipping engineer
 Demetris: No, I won't.

Most of the students, as they explained, to me, came from a cultural background which did not value the study of mathematics. Moreover they seemed to believe that in the long run their performance at school would not affect their job opportunities.

- Angela: My mother does not know any more than the four operations to keep the household accounts.
 Me: What do you intend to do as soon as you leave?
 Angela: I'll look for a job. Maybe I'll become a hairdresser. And you can be sure that no one will ask me if I know quadratics or arithmetic and geometric progressions. Will they?
 Me: Mm . . .!
 Katerina: Now it is too late for me to learn mathematics.
 Me: Why do you say that?
 Katerina: Because I have lot of gaps from the previous grades I can't do anything by myself. I need continuous help, step-by-step. I can follow the steps, but I don't know how to start . . . I was never good at mathematics. I don't know what is wrong but I think it goes in one ear and out the other.

Some students put the blame for disruptive behaviour on Mrs S. It was her tendency to be too soft which, in their opinion, caused the trouble.

- Thanasis: sometimes it was hell in class, and what did she do? She just ignored it. She knows that no one pays attention to her but she goes on as if there is nothing wrong.

Me: So why do you think she does it?
 Thanasis: I don't know... Maybe she wants to complete the content at all costs. Maybe she is not interested if we learn or not. Anyway, there are some of us who can do the work. They don't want to do it because if they know the teacher's soft they won't do it.

Discussing this problem in another part of the interview, Alexis said that Mrs S should "make them do it".

Me: How?
 Alexis: Shout at them and tell them they're not going out till they have done it. Then they'll do it.
 Me: But if even after that they will not?
 Alexis: Send them out if they mess about and send them to the uncle.
 Me: Who is "the uncle"?
 Alexis: The head. You know, sir, all the students call him that.
 Me: And then?
 Alexis: And then they won't do it again. To the uncle. Just send them straight there. It is a bit stupid to let them off the hook.

Of course sending pupils out of class of the "the uncle" might be a useful way of gaining time, but this solution is one to which I could not agree. The solution to classroom conflict needs to be found in the classroom itself; otherwise the game has been lost for the teacher.

Students in the interviews also expressed their general views about school and the whole system. Nine of them appeared to be members of a counter-school culture with a tendency towards opposition to authority. They rejected and challenged the school authority. They rejected and challenged the school authority and expressed their dislike of it and of the things for which it stands. The teachers and the school were seen as prime representatives of such authority and were treated accordingly. These students disliked school. They could see no purpose in it, considered it oppressive, and as a rule disliked all teachers.

Nikos: I hate school.
 Me: Why?
 Nikos: Why do we have to come to school? It's stupid. I think school is a waste of time.
 Me: Do you?
 Nikos: It wastes all the day.
 Me: Nothing in school is good enough?
 Nikos: No...I think there is something
 Me: What?
 Nikos: I meet my girlfriend here [laughing].

Another boy, Kostas, said that "the game is not fair".

Me: What do you mean?
 Kostas: This year I was punished five times for coming late to lessons. But there are teachers who are regularly late... Sometimes they don't come till about a quarter to nine.
 Me: And what time does the lesson begin?
 Kostas: Half past eight.
 Me: Why do you think that happens?
 Kostas: I don't know.
 Bety: They (teachers) tell us not to smoke in the school and when they see a student smoking in the yard they punish him. But nearly all of them smoke during the breaks. Isn't it unfair?

This type of injustice seemed to be a serious reason for misbehaviour to these pupils, as well as a cause to hate the school and see no purpose in it, considering it oppressive and unjust. The nature of school rules, the system of sanctions and punishments the leadership styles adopted by the head and by the management staff, and the general philosophy and ethos of the school, all seem to play an important part in influencing children's reactions [Hargreaves, 1967, p. 14; Apple, 1982, p. 96]. As the interviews indicated, many class control problems come from children who feel themselves to be caught up in a system which they do not understand which fails to understand them. Bored, frustrated, and defensive, they see school simply as yet another source of difficulty in what is already a difficult enough life.

Summarizing the views expressed by Mrs S and B6 pupils we can see that there was agreement in that

- (i) The class often engaged in disruptive behaviour
- (ii) This behaviour was a natural response to difficulty in concentrating on, and performing tasks which were regarded as difficult, inappropriate, and boring.
- (iii) The system is seriously responsible for the problems that students face in mathematics and for disruptive behaviour.

However there were some discrepancies between the teacher's and the pupils' views:

- (i) Pupils claimed that much of the boredom of mathematics lessons was the teacher's fault, while Mrs S claimed that she was doing the best she could under the existing circumstances.
- (ii) Pupils claimed that much of their disruptive behaviour was the teacher's fault, as for example, the tendency to be too soft and reluctant to treat them individually.
- (iii) Pupils stated their teachers' unjust behaviour as a cause for conflict and resistance. Neither Mrs S nor any other teacher that I spoke to mentioned this as a possible source of disruptive behaviour.

Towards another approach to the problem

For me, as a mathematics teacher, and at the same time as an educator, B6 constituted a challenge. Although a rich knowledge about the psychological, sociological, and educational factors that affect students' classroom behaviour has been developed over the past two decades [Glasser, 1986; Delamont, 1983; Phares, 1973], it does not help the ordinary teacher develop skills and techniques in guiding this behaviour into more appropriate and acceptable channels. The teacher who is interested in class control in concerned first and foremost with the practicalities of the subject rather than with a purely theoretical knowledge of who has done what by way of research. The problems of B6 were real, and they spoke directly to teacher practice. The also asked for simple solutions that were within a teacher's power to adopt. The remedies which are usually suggested by sophisticated research either require substantial reform of the organization of the system [Glasser, 1969] or the deployment of complex techniques which are not within a typical teacher's repertoire of skills. Therefore they do not provide the sort of solution which any teacher could put

into operation in any classroom immediately. On the other hand I liked the idea of trying my views about teaching and teacher-pupil communication in practice. Thus I decided to become the mathematics teacher of B6 for the rest of the term (14 class sessions).

The aim of these experimental lessons was to explore what would happen when a teacher, working under the same constraints, attempted to adopt a more person-to-person type of communication, replacing survival strategies with discussion, formal teaching with activities, and imposition of knowledge with negotiation. Through open discussion I intended to reveal myself as a person to the pupils, putting the problems of disruptive behaviour on a more honest basis.

Mathematical activities were chosen to emphasize the learner's involvement with mathematics rather than the teacher's presentation of content [NCTM, 1989, p. 129]. I had in mind not to present content during the class but rather to make the didactical conversion from mathematical content and knowledge to mathematical activities suitable for the pupils. I hoped that a focus on mathematical activities for the pupils would reduce their disruptive behaviour and help them learn some mathematics.

By encouraging the negotiation process I wanted to encourage pupils to play a greater part in the development of their own mathematical meanings. Negotiation is goal-directed interaction in which the participants seek to attain their respective goals. Traditionally, the teacher is given authority and power by society for the specific education of its pupils, so he/she tries to impose his/her goals and intentions on the pupils; these may be different from the pupils' goals and intentions in the classroom. Negotiation offers alternatives to the mere imposition of knowledge from the powerful teacher and contributes greatly to the reduction of the conflict in the classroom.

However I did not assume the teacher role for B6 as an "expert" who knew better than others how to manage these children but as a part of an experiment which was to try a new model of communication in essentially unpredictable situations, having as its impetus the hope that something good would come out of it.

All the lessons and discussions were tape recorded. Children had not much difficulty accepting me as their typical teacher for the rest of the term because they already knew that I was a university researcher and at the same time taught mathematics in their school. I told them that I was engaged in research about teacher training and I was, therefore, interested in the pupils views about what could be done to improve the mathematics classroom environment. I also pointed out that whatever they said would not be passed on to Mrs S or the rest of their teachers. The evidence which follows is a combination of selected transcripts from the recordings, which represent what was said and done in different lessons, and my thoughts and feelings as these happenings occurred.

The beginning of class is always an unstable time because students come from other settings where a different set of behavioral norms apply. In the first lesson the pupils entered the classroom in their usual noisy manner. I explained to them the aim of my presence there and my

intention to become their mathematics teacher until the end of term, and asked them to describe to me how they wanted the lesson to be carried out from there on

- Tasos: Don't try sir. You won't succeed.
Soiros: Are you going to be our teacher? Don't waste your efforts. You won't be able to control us.
Katerina: Mathematics is difficult for us and we have many gaps from the past.
Me: It's never too late. What I want is to do some teaching with you, and then you tell me what I've done wrong and whether it could have been improved in any way.

My major objective with this discussion was to get B6 working as quickly as possible. After a bit of noisy discussion the pupils preferred to work together in small groups as a new experience for them. They took five minutes to move their desks into new groups. The pupils began noisily pushing desks together and talking loudly and it seemed to be that they enjoyed this, and used the occasion to stop listening and do something. I had decided not to follow the official curriculum about geometric progressions and involve students in cooperative group work through activities. During this work I hoped to introduce a number of issues which I would discuss with individuals and small groups. The effect of these mini-discussions was, however, short-lived. The groups continued to generate too much non-curricular entertainment and consequent noise. They had outbursts that included banging on the desk from time to time, pupils speaking loudly and calling to ask for something, or chatting as they worked. Sometimes their voices threatened to seriously disrupt the work of others. Therefore, I decided to attempt to begin an exchange of ideas on the subject of noise and misbehaviour.

- Me: Why all this noise? This is one of the things that goes wrong, isn't it? Tell me, have I done something wrong to make you as noisy as that?
Alik: No. Maybe you should punish them. Maybe you should shout at them, sit.
Christos: Shut up Alik! You're just annoying me!
Me: I don't really think I need to shout at them because they know what they must do.
Nikos: Shout at us and we'll shout back!
Thanasis: You must keep order. I like a teacher to be strict but not too strict.
Katerina: What is wrong is that I am not interested in doing all this work.

This interchange led me to ask the students to tell me what I would have to do so that the mathematics lessons become interesting to them. I needed to listen carefully to the pupils perceptions of the lessons. Kostas gave reasons which, he claimed, explained why the behaviour of everyone in the class was poor.

- Kostas: Sir, you may do your best, but we don't like mathematics. The curriculum is of no interest or value to us. It is boring... Then a seven-lesson morning is too long for us.
Me: And what do you propose?
Kostas: We have the right to enjoy ourselves.
Me: What I really wanted to know is what someone like me can do to make the lessons better for you.
Nikos: Nothing! (laughing)
Spiros: We must have more free time. The curriculum is overloaded

- Panagis: What you should do is have a limit of time for work, and then tell us to do what is wanted.
- Tonia: You might have one lesson where we can do what we wanted, and another lesson for work.

As the discussion progressed it became clear that none of the pupils named anything which I had done as a cause for their misbehaviour. The first thing they were interested in was the joy of living; and disruption, rather than a study of mathematics, seemed to provide the best opportunity for this. They felt that they had the right to enjoy themselves, and this was something which they would not give up easily. Tonia's solution involved everyone (teacher and pupils) giving up something and everyone gaining something.

- Me: But one of the things that worries me is the amount of noise. What must we do to reduce the noise?
- Maria: What you have to do is to be strict, sir. You tell us you don't want to let us run away with what we want to do shouting to each other. If they do it again send them out if they mess about and send them to our uncle. That is the danger!
- Gerasimos: Yea. Send them out of the class.
- Nansy: If they make a lot of noise, say "out"!

Most of the pupils were suggesting that punishment was the only solution if I wanted pupils to behave in a different way. If the pupils were excessively noisy I would be given the right to punish. Of course this was something to which I could not agree since it would be in opposition to the purpose of this research, which required evidence of a change of pupils' behaviour which was not imposed. On the other hand, I felt that if I wanted to gain time I had to accept Tonia's bargain. Using this solution I would gain at least one lesson of work and release from the need to impose discipline. The acceptance of Tonia's proposal would allow me to achieve my prime objective — the prevention or disruptive behaviour — while leaving me space to pursue my teaching role, continuing to look for some curriculum activities which might be attractive enough for the pupils. We all agreed that a part of free lessons would be spent in listening to the tape, playing it back, and discussing the problems of the previous lesson without messing about.

The next 12 lessons were held within the terms of the bargain. There seemed little doubt that the discussions and explicit agreement reached between the students and myself affected their behaviour, and mine. We all behaved in ways which were different from our behaviour in the first two lessons. The work phase of the lessons was characterized by long periods of quiet and reduction of outbursts. The discussions during the free lessons were followed by a reduction rather than a continuation, or escalation, of disruptive behaviour. This claim is corroborated by the tape, recording long periods of silence and quiet movement and talk. However it would be inaccurate to give the impression that there were no interruptions. But there were few occasions where noise reached a level when I felt it necessary to make a general comment. Most of the interruptions were work-related and seemed to stem from a long habit of shouting out for things which students needed. For example, in a period of near silence, Panos suddenly asked:

- Panos: (shouting) Who's got my compasses?
- Me: Can't you ask quietly and not disturb people, Panos?

During the work phase my initial task had been to produce a curriculum which would be flexible enough to accommodate the varying interests and current skills of B6. Of course, the degree to which this was possible was constrained by the available time, by the official syllabus, and the limitations of my own skill and imagination. Nevertheless, within these constraints, I attempted to attain two things simultaneously: on the one hand, to provide opportunities for the pupils to do something which they and I would feel was worthwhile, and, on the other hand, to persuade them to take an honest stance towards me, as well as for me to maintain a human stance towards them by inviting them to discuss the reasons for their actions with me during the free lessons.

However, the improvements in the pupils' behaviour must not be considered tremendous. Several pupils gave a clear indication that they still had no interest whatever in the mathematics curriculum. Their opposition to it was total and was demonstrated by a resistance to even talking about the problem during the free lessons. When I attempted to pursue discussions with them which might lead to the discovery of work in which they would be interested, I met with their refusal to communicate with me. Their eyes never met mine, and it was as if they did not wish to believe that this situation could be improved. On the other hand these pupils reduced their disruptive behaviour, forced by the rest of the pupils' increased willingness to take discussions seriously. For instance, when during the free lessons, Nikos and Spiros' shouting and scuffling threatened to disrupt any serious exchange of ideas about the curriculum, I also threatened to switch of the tape recorder and said:

- Me: OK. If you don't want to talk about it, I'll go. It is impossible to get on under these circumstances.
- Maria: Shut up, Nikos! We're talking.
- Gerasimos: If you aren't interested in this you can go out. Send them out, sir.
- Katerina: OK. What do you want, sir?

This increased willingness for discussion resulted in reduction the noise and created space for me to talk with pupils and develop relationships with the class which in turn made it possible to engage in curriculum activities which had previously failed. Of course, one must not expect that because of the changed general behaviour and stance, the pupils' learning improved. Although most of them found the curriculum in some way rewarding, many of them were not prepared to engage in it, nor prepared to moderate significantly their general behaviour towards mathematics. In spite of the fact that the curriculum *per se* was no longer the primary cause for disruptive behaviour, nevertheless the conclusion must be that most of B6 learned very little mathematics. In fact, as the evidence from my lessons with B6 demonstrates, mathematics learning is a very complex process which depends on a variety of factors outside the mathematics *per se*. Progress with a class like B6, if it happens at all, may be very slow; but a curriculum based on honest communication, negotiation, and discussion of ideas seemed to be a possible way forward, providing a human environment which could be used to minimize the disruptive behaviour and the tension that exists in the mathematics classroom between teacher and pupils.

Concluding remarks

The purpose of this research was to deal with a real-life practical problem that every mathematics teacher is provoked to cope with in a mathematics classroom. Therefore it was initiated to describe the phenomenon or disorderly mathematics classrooms as well as to explore the validity and practical applicability of the writer's beliefs on the interpersonal communication between teacher and pupils. Although the specific results of this case study cannot be generalized to all teachers and all classrooms, I believe the struggles Mrs S and I went through (regardless of our specific responses to them), are struggles all teachers go through. This naked truth led me to try and apply a human person-to-person approach to mathematics classroom conflict in a way which any mathematics teacher, in any school, without any extra resources, could attempt tomorrow. For this purpose during the teaching hours I spent as B6's mathematics teacher, I attempted to work without sophisticated plans and models and predictions about how they would behave. These lessons were used as an open-ended experiment based on my faith that if any solution to classroom problems would be creatively achieved, its exact nature could not be predicted, nor pre-planned. Therefore there was no detailed research plan, no clear idea of what a positive result would be like, and there was not even an independent observer. Nevertheless, some conclusions can be drawn in spite of the untidiness of the evidence.

The most unquestionable conclusion is that the situation in B6 classroom was extremely complex. The evidence from my observations, interviews, and discussions showed disorderly behaviour with unpredictable outbursts and a variety of response and resistance. This response could be directly explained by cultural or psychological or sociological interpretations, but more fruitfully as an expression of human concern.

The second clear conclusion which can be drawn from the evaluation of data was that an improvement in classroom behaviour generally, and reduction of noise in particular was noted as a consequence of an alternative approach towards pupils concerns, based on the triptych: human communication-discussion-negotiation.

However the evidence cannot demonstrate clearly what were the pupils' motives which led them to reduce their disruptive behaviour. There is always the possibility that the pupils conformed not out of consideration for me, but because it suited their own purposes. Similarly my decision to negotiate the official mathematics curriculum with B6 pupils could be interpreted as an attempt to balance their rights with my personal need to survive, and therefore that I was engaged in strategic survival more than education. Nevertheless, although the curriculum was clearly an important factor in the interaction between B6 and myself, a more significant factor appeared to be the interpersonal framework within which the lessons took place.

This last fact has valuable pedagogical implications for day-to-day practice. It suggests that teachers need to talk with and listen to their pupils on a regular basis, especially about problems of classroom interaction, trying not merely to understand their pupils but giving those pupils the opportunity to understand them. So, through interpreting

each other's language and actions, a teacher and student can formulate a negotiated reality, based on the principle of decidability. As teachers, we must adopt a person-to-person relationship with pupils as soon as they enter the school, encouraging them to criticise us or the curriculum, or inviting them at the end of a course or the subject, and how it might be improved. More attention should be paid to students and teachers as human beings, to schools as systems at the service of society and mathematics as a sociocultural system of knowledge and not as a finished and static body of results and rules. The essence is to look for new roles for schools and teachers. Schools should abandon their traditional role as mere transmitters of knowledge and give priority to their social, cultural and psycho-emotional roles, while teachers should see themselves as partners in a common search and shared process of building up knowledge who never adopt an arrogant, imposing, authoritative attitude.

Finally, although the purpose of this research was merely to pinpoint the problem of disruptive behaviour and controversy in mathematics classes, opening up a conversation on it, the discussions and responses of the students within the real classroom environment gave rise to serious additional issues concerning the cultural, sociological, and psychological dimensions in the so-called reality of a mathematics classroom [Bauersfeld, 1980; Varma, 1989; Hargreaves, 1975]. I believe that a more systematic study on uncovering this complex reality is needed through long term research. All experienced mathematics teachers know that order has to come first or everything else is lost. Without expecting "ready-to-wear" remedies it is reasonable to think that the development of research will make available some knowledge which will enable teachers to face the difficult didactical problem of managing the life in this complicated cognitive society: the disruptive mathematics classroom.

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