TEACHING STYLES IN THE CLASSROOM: HOW DO STUDENTS PERCEIVE THEM?

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During mathematical activities, speech and written signs often are closely connected with extra-linguistic ways of communication, such as gestures, tones of the voice, silences, postures, and so on. Some teachers use these resources more than other teachers that prefer to write mostly on the blackboard. Such different choices may lead to different students' perceptions and may influence their learning. This paper analyses students' notes, and a questionnaire is used to investigate their feelings about the teacher's attitudes, gestures, and rhythms of lecturing. It is shown that the 'body components' are effective for grasping difficult mathematical concepts.

BACKGROUND

While teaching mathematics, teachers use not only speech and written signs on the blackboard, but also other resources, such as gestures, gazes, artefacts, and body movements. Studies in Psycholinguistics and Psychology, in fact, show that cognitive processes are strictly grounded in the human body, and in its location in space and time (Lakoff & Johnson, 1980; Lakoff & Núñez, 2000; Seitz, 2000; Gibson, 2002). Hence, a semiotic approach to teaching-learning processes in mathematics is useful to understand the personal appropriation of signs by persons within their social contexts (Arzarello, Paola, Robutti, & Sabena, 2009).

According to Peirce, a sign is anything that "stands to somebody for something in some respect or capacity" (Peirce, 1931-1958). Within this wide perspective, Arzarello (2006) has introduced the concept of the semiotic bundle, which allows studying signs and gestures – and teaching-learning processes – in a multimodal approach. Discoveries in Neuropsychology (Gallese & Lakoff, 2005) underline the embodied aspects of cognition and show that the brain's sensory-motor system is multimodal rather than modular. Multimodality consists in interactions among different registers within a unique integrated system, composed by various modalities: gestures, oral and written language, symbols, etcetera (Arzarello & Edwards, 2005; Robutti, 2005).

An important example of semiotic bundle is given by the unity speech-gesture. Over the last decades, in fact, experimental evidence in Psychology has shown that gestural and verbal modalities are strictly intertwined in communication, as well as in thinking (McNeill, 1992; Goldin-Meadow, 2003). Another example of semiotic bundle is given by the unity speech-written signs. It is also shown by recent Neuroscience results (Dehaene, 2007). During the teaching/learning activities, both teachers on blackboard and students on their notebooks often write when speaking.

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This paper examines how the choice of one semiotic bundle versus the other (speech-gesture vs. speech-written signs) can influence students' feeling about teacher's attitude, as well as about the perceived rhythm of the lecture, and the sensing of teacher's gestures.

PREVIOUS RESULTS AND METHODOLOGY

Eighteen lectures have been videotaped and analysed in three subsequent steps. Only university lectures on mathematical subjects have been chosen for the analysis, in order to avoid any noise given by lack of discipline from students. In a first step (Andrà, 2009), seven videos had been examined considering both the semiotic context (Arzarello, 2006) and the communicative strategies (Di Raco, 2000). In a second step (Andrà, in press), six new lectures have been analysed, according to the classification defined in the first step. One of the purposes of this subsequent analysis was to apply the results of the first one to new cases and to check whether the classification fits them. Moreover, in order to examine how the use of gestures and written signs influences the students' feelings, at the end of each lecture, a questionnaire (figure 1) was given to the students. A similar questionnaire was given to each teacher for comparing the teacher's intentions with the student's receptions. The number of students involved in answering the questionnaire was 178.

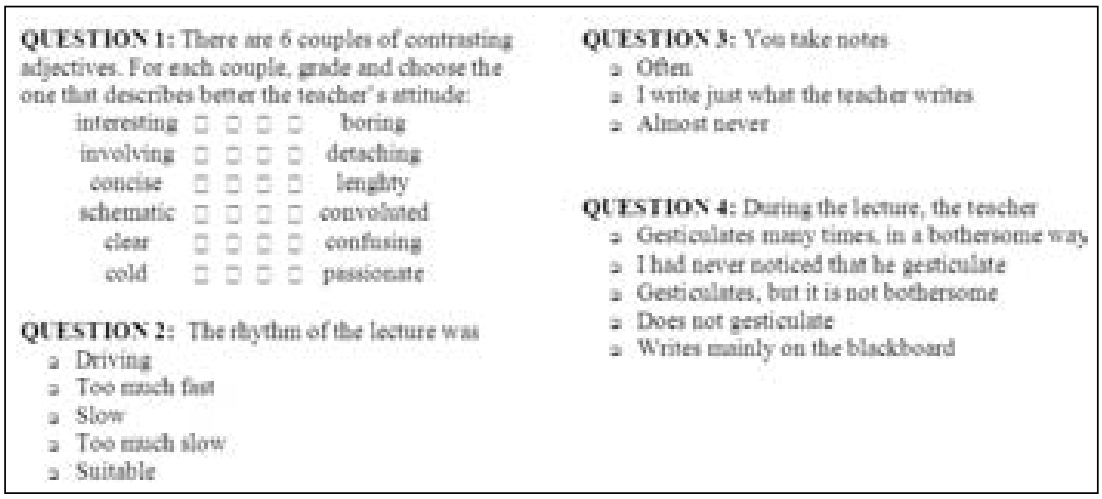

Figure 1: the questionnaire

In a third step, five new lectures have been videotaped and analysed, considering some new variables:

- the use of the space in the classroom: *is the teacher always close to the blackboard, or does s/he flutter about?*
- the use of the tone of the voice: *does the teacher change her/his tone when the relevance of what s/he is saying changes?*
- the use of the silence breaks: *does the teacher perform silence breaks? When does s/he use them? How? How long are they?*

The same questionnaire of the previous step has been given to 132 students and the 5 teachers. In this step, moreover, students' notes have been examined and teachers have been interviewed after their lectures.

In this paper the results of the last step are presented.

In order to analyse the use of the space in the classroom, a map the class has been considered and seven different areas have been distinguished, as shown in figure 2: areas 1 to 3 are near the blackboards, area 4 corresponds to the space behind the desk, areas 5 and 6 the sides of it, and area 7 is the area before the desk, the one that is nearest to students.

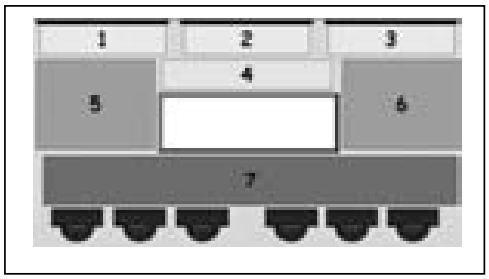

Figure 2: A map of the class and the seven areas

The *voice intensity-time spectrum* has been considered for analysing the performance of silence breaks and the changing of the tones of the voice.

Teaching styles

Analysing the lectures, Andrà (in press) distinguishes two distinct trends:

- When the communication takes place mainly *through the body* of the speaker, the use of the blackboard is very limited. Following McNeill's taxonomy (1992), the first part of the lecture is characterized by a great number of iconic and metaphoric gestures, and few signs are drawn. Generally, gestures used in this first part are repeated afterwards: the speaker is introducing the lecture and the concepts s/he is talking about return during her/his speech. S/He broadens these concepts, gestures utilized at this time are repeated, and are intertwined with words as an inseparable unity. During the subsequent part of the lecture (more extended in time), the production of iconic and metaphoric gestures falls off. At times cohesive signs are used, e.g. to connect teacher's words with the signs written on the blackboard. These are never erased and accompany the whole speech. Hence, written signs enrich the semiotic bundle made of speech and gestures.
- When the communication takes place mainly through *the blackboard*, the unity speech-written signs is central in the semiotic bundle, and gestures serve only to enrich it. Deictic and cohesive gestures (McNeill 1992) are dominant. The blackboard is always at the centre of attention, because the speaker is writing on it or because s/he just points it. The blackboard is written, filled and erased many times.

Going deeper in details, it has been noticed that a sort of cutting point between the two trends is hard to be established: many teachers, in fact, alternate *body phases* and *blackboard phases* during their lecture. A *body phase* consists in a time interval, during the lecture, in which the teacher behaves like the first trend described above: s/he uses metaphoric/iconic gestures, s/he modulates the tone of her/his voice and uses silence breaks. S/He also stays away from the blackboard (areas 5, 6 and 7 of figure 2). In a *blackboard phase*, instead, the teacher writes on blackboard, or performs mainly deictic gestures for joining what s/he is saying to what s/he has written. As a consequence, s/he prevalently stays on areas 1, 2 and 3 of figure 2.

Teachers that have prevalently *blackboard phases* during their lectures have been classified as *blackboard-style teachers (BlaST)*. Teachers that have prevalently *body phases* during their lectures have been classified as *body-style teachers (BoST)*.

Two examples

R is the best representative *BlaST*. She, during a 50-minutes lecture, does not make any silence break. Before writing on the blackboard, she performs *body phases* behind the desk to introduce the concepts, then she writes them on the blackboard and finally she comments them using deictic gestures and adding signs on it. She writes everything she says, and the students reproduce in their notes what is written by her. As a consequence, all the notes are similar. Referring to figure 2, R stays for 45% of time close to the blackboard (she stays 15% of time close to each one of the areas 1, 2, 3), for 33% of time on area 4 (behind the desk she performs *body phases*), and for the remaining 19% of time sideways (areas 5 and 6). She never goes far from the blackboard (area 7).

S is the best representative *BoST*. The percentage of silence breaks in a 75-minutes lecture is 40%: in other words, in a ten minutes interval he speaks for 6 minutes and stays silent for the other 4 minutes. During such breaks, students talk, answer to his questions, comment on what he says. The blackboard is rarely used. Students' notes differ so much among each other. Referring to figure 2, S stays for 52% of time close to the blackboard, for 28% of time on the left side of the desk (area 5), and for the remaining 19% of time near the students (area 7). Since S has a *body-style teaching,* he can go far from the blackboard, while R cannot do it: she has to stay close to where signs should be written.

THE ANSWERS TO THE QUESTIONNAIRE

It has been shown that two distinct trends can be defined looking at how a mathematics teacher uses her/his body, rather than the blackboard. Moreover, two examples have been briefly shown. Till now, the analysis has focused only on the teacher. The teacher, however, communicates to students. Students are listening to him, and often take notes about the concepts s/he teaches. Now it is sketchily reported how students perceive the two styles of lecturing. All the eighteen lectures of this study are considered (i.e. not only R and S cases).

In figure 3, the six couples of opposite adjectives describing the teacher's attitude (question 1) are shown. Examining the answers to the questionnaire, I observed that almost 90% of students select the voices corresponding to the 'very' and the 'quite' grading of the 'positive pole' in each couple (for instance, 'very interesting' and 'quite interesting', while no more than 10% finds that the teacher has been boring). For this reason, I report only the percentages referred to these 'positive' alternatives.

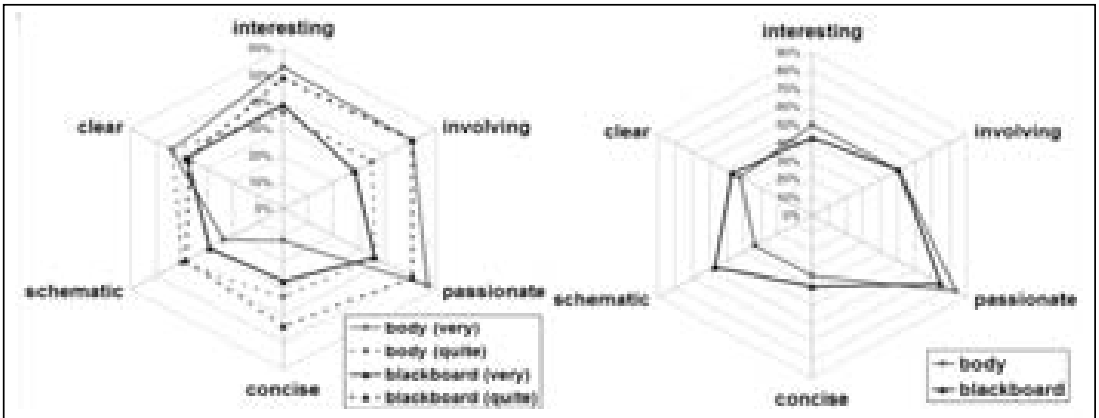

Figure 3: Keviat diagrams for the given ratings about teachers' attitude, on the left by students, on the right by teachers.

Moreover, the six couples can split into two groups:

- Three of them help describe the feelings (involving, passionate, interesting): more than 50% of students say that the *BoST* is very interesting, very involving and very passionate; an analogous percentage says that the *BlaST* is quite interesting, quite involving and quite passionate. In other words, considering the adjectives describing the feelings, the curves corresponding to the 'very' for the *BoST*s and the 'quite' for the *BlaST*s are the same. Looking at the questionnaire for teachers, it has been observed that they judge themselves as interesting and involving as it is perceived by their students, and more passionate.
- The other three ones refer to the teacher's method (schematic, clear, concise). The *BoST* is perceived as less concise and schematic, but clearer, than the *BlaST*. Looking at the questionnaire for teachers, it has been observed that *BlaST*s judge themselves as concise and clear as it is perceived by their students, and more schematic. On the other hand, the *BoST*s' answers reveal that they think to be as concise and clear as *BlaST*s, but less schematic, partially in accordance with students' perceptions.

The opinion on the rhythm of the lecture varies from one teaching style to another (table 1, left). In the *BoST* case, the rhythm is perceived mostly as suitable (53% of students) or driving (33%), while in the *BlaST* case it is perceived as more fast with respect to the previous case: 13% of students say that it is too much fast, 38% that it is driving and only 37% that it is suitable. A possible interpretation is that there is a

percentage of students that write their notes slowly, and are not able to follow what the teacher is saying and writing. This does not happen if the teacher make many silence breaks, as the *BoST* does. Looking at the teachers' answers, all of them say that students seem to be interested to the contents of the lecture, but *BoST*s think that the rhythm is suitable, while *BlaST*s perceive that it is driving. Subsequent interviews of teachers involved in the experiment revealed that, for instance, the desire of S was to be slow enough to let students think, while R does not make breaks because she wants that students pay always attention to her (she believes that silence may lead to distraction in her audience).

Rhythm?	BoST	BlaST
Too much fast	1%	13%
Driving	33%	38%
Suitable	53%	37%
Slow	9%	0%
Too much slow	2%	0%

Notes?	BoST	BlaST
Often	85%	78%
Just what teacher writes	10%	22%
Never	5%	0%

Table 1: perception of the rhythm and how much students declare to take notes.

Table 1 on the right reports students' answers about the frequency of taking notes during lectures: in the *BoST* case, most (85%) of them say to take notes often, while in the *BlaST* case there is a higher percentage (22% instead of 10%) of students that say to write only what the teacher reports on the blackboard. This is not surprising, since the *BlaST* writes almost everything on the blackboard. As a consequence, the answers 'often' and 'just what teacher writes' may coincide. In the *BoST* case, however, a (small) percentage of students prefer to do not take notes and just listen to – and observe – the teacher.

The questionnaire asked also an opinion about teacher's gestures. In the *BoST* case:

- iconic and metaphoric gestures are heavily utilized, but 20% of students declare to have never noticed them,
- 20% students say that the teacher wrote on the blackboard mostly, and
- only a half of students realize that the speaker made gestures, and such gestures were perceived as not bothersome.

In the *BlaST* case:

- only 20% of students says that the teacher wrote mostly on the blackboard,
- 25% says that s/he did not make signs or that it had never been noticed, and
- 50% says that the speaker gesticulated mainly.

It seems that students do not notice the 'main tool' chosen by the teacher for communicating, namely the body in the *BoST* case and the blackboard in the *BlaST* case. Students' attention is focussed on the other supports (on the blackboard in the

body-style lectures, or on the body in the *blackboard-style* ones). A possible interpretation is that the main tool has been perceived by the students as an underlying entity, which forms a semiotic unit with the speech. This apparently confirms the hypothesis about the semiotic bundle model. The rhythm of the lecture is beaten by the use of this tool. Students noticed a change in the rhythm (associated to a change in the tool used, for example from gestures to the blackboard), rather than the smooth use of the main tool. Accessory tools become central in their perception, since they correspond to a change in the rhythm of the teacher's lecture.

DISCUSSION

It has been shown that students' perception of type, frequency and use of gestures is closely related to the teaching style. The impact of each style on students' feelings has been analysed through a questionnaire. Students seem to be mostly involved in the case the teacher uses mainly her/his body when speaking. When the blackboard plays a central role, a little lost of such involvement is observed. When the teacher uses her/his body to communicate, students often take notes and the rhythm is perceived as suitable in most cases. In the *blackboard-style* case, someone says that the rhythm is too fast. A possible interpretation of this fact is that the use of the blackboard assumes all the students be able to grasp the concepts at the same speed, namely the speed of the teacher's writing.

A didactical suggestion that comes from this analysis is that, when an important concept has to be taught to students, it is better to use *body phases* instead of writing immediately it on the blackboard. Standing in front of students, in fact, allows the teacher to perceive better how much her/his audience is understanding what s/he is saying (e.g. s/he can observe students' facial expressions). Moreover, it yields to use more gestures and students feel to be more involved. It is important to take care not only of gestures, but also of the silence breaks, of the tone of the voice, and of the use of the space in the room. Only after such a *body-phase*, the blackboard can be employed in order to 'fix the ideas'. Teachers should pay attention, in this phase, to their rhythm: it should be suitable for everyone. Hence, after finishing writing, it seems necessary to perform a silence break again and check if everyone is still following the teacher.

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