

**Taking into account metaphors, autobiographies and non verbal languages in the
professional training of mathematics teachers**

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1. Introduction.

The project we are going to describe was born in 2002, after two different but, in their respective fields, equally passionate professionals met. They are Angela, mathematics education lecturer at the University of Pavia and Anna, educator with experience in theatrical performance. The goal was to give scientific subjects’ teachers a new taste for their work, so as to have a positive follow-up in their teaching activity.

The basic issue and guidelines of the project can be summarised as follows: “Can mathematics come out of the abstract world in which it is commonly confined and ‘humanize’ itself, that is approach individuals in their physical, corporeal, emotional and relational dimensions and not only in their cognitive one?”

We initially worked in synergy to focus on the possible contact points between the two poles of our project: what could theatre and mathematics have in common?

Our first “discovery” concerned the sharing of a common language: apart from the different contents we express, we both were fascinated by *poetical* thought, made up of metaphors and symbolism, that is a major component of the richly evocative force of theatre but comes out of the complexity of mathematics too. However, admitting that poetry may be a part of mathematics is not an easily acceptable assumption, even for teachers: mathematics should take back that dimension of discovery and play it generally has only in the very first years of the school educational path. Play thus becomes the second path on which theatre (actually the true *ars ludens*) and mathematics meet: we can play with mathematics reinterpreting it creatively and reinventing it in a new way.

This does not imply, like many could superficially think, a trivial and unrealistic simplified version of the subject: mathematics is not easy, as it is the case for any other form of learning, but it is beautiful and fascinating and can be felt (and made feel) as such.

This is the main effort we meant to make with this project: to get individuals closer to mathematics not to simplify it but to arouse passion, thus breeding the desire to know more in depth and, finally, to learn.

We meant not to create a lesson-show which meant to explain concepts, but a theatre as a meeting point; a theatre that through the active grotowskian¹, involvement of the spectator, made him feel the vitality, necessity and beauty of the scientific subject, even beyond its immediate rational understanding.

Not a theatre to *understand* mathematics but a theatre to *live* it, intervening not on students but on teachers, who are consequently turned into creators of more significant didactical actions, having the chance to recreate in their classrooms what they experienced in the project.

2. The project “Stage in the classroom, the classroom as a stage”.

Among the general ideas that shaped and characterised the project we must say that metaphorical discourse played a central role. Interpreting this kind of discourse both as verbal and non-verbal communication, that is to say referred even to gestures, expressions, images, objects, sounds, we already underlined in a previous investigation (Pesci 2003c), how metaphorical discourse is able to reach deeply the person thanks to its symbolic features.

This is a typical trait of metaphor as a privileged mode of communication, which favours positive interpersonal relations. This is a relevant characteristic in the educational process, especially for a subject like mathematics, often painfully or at least unpleasantly connected to many individuals’ stories.

We must also stress the importance of autobiographical activities, narratives expressed through different communicational codes and related to one’s own personal life.

¹ J. Grotowski, *Per un teatro povero*, Bulzoni, Roma, 1970

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At last, key to the project was of course theatre, considered in its double nature of performance, with an explicit recalling of J. Grotowski's teachings and of cognitive act, recalling the classic meaning of theatre as a privileged moment of *paideia*.

To build up the project we drew on the so-called Playback theatre, a particular kind of *social theatre* which was bred in the U.S. in the 70's with the work of J. Fox; Playback theatre descends from the Morenian psychodrama, transcending its ontologically therapeutic structure to develop its more properly artistic nature in a scenic way, thus finding contacts in several forms of "theatre outside theatres" at the times arising in Europe too (e.g. the Theatre of the Oppressed by A. Boal). The choice of the Playback Theatre has not just a formal value, but rests on a peculiarity allowing to trace a meaningful *trait d'union* with autobiographical discourse, that is to say the centrality of the stories of the participants to the theatrical performance. These stories are collected, publicly narrated and performed by actors who thus offer the possibility to the protagonist to see himself in a different perspective.

The level of consciousness and responsibility reached by participants is so high that, even if we are talking of a theatrical project intended for teachers who are not professional actors, it does not end up in an amateur thing: it is something done by and intended for active and determinate individuals, determining for the theatrical event; it is a theatre that does not merely "happen" in the spaces, does not "use" objects, but takes possession of both spaces and objects giving them a new life and filling them with significance; it is a theatre that does not simply put the actor at the service of a text, but integrates text and action at the point that they live harmoniously in the actor and then in the audience that welcomes them: it is a theatre moulding each action on the basis of a work that each actor has previously conducted on himself, the only way that makes it possible to render it true and necessary and thus be perceived by the spectator as such.

Hence the choice to create a training course based not on the teaching of theatre techniques (with the risk of turning them into useless, or even harmful, superstructures, far from each one's everyday teaching mode), but a path leading the involved teachers to structure the theatrical action mode as *forma mentis* fit for any of their professional actions, apart from any specific reference to theatre, a *modus operandi* as a distinctive trait of one's own professionalism.

The project "The stage in the classroom" involved eight middle school mathematics teachers of the Secondary School Specialization School of Pavia, graduated in Biological, Natural and Geological sciences. Four of them were in-service teachers while the others did only some supply teaching but did not teach during our experience. Their age varied from 26 to 44 years old. All chose freely to be involved in the project, sometimes with the objective of a possible link with their apprenticeship work. The project developed in 12 meetings, for a total of 40 hours in a period of about 3 months.

It took place in the hazardous everyday setting of a common classroom; thus, as the objects and the spaces absorbed the professional story of each teacher they took new significance: they were the same as before but reinterpreted in function to their new task.

We started with some metaphors from which each participant had to choose the fittest to describe their own personal relation with mathematics, with reference both to their stories as students and their teaching reality.

Starting from the verbal metaphor we then moved to concrete action: everybody has been asked to think about an emotion connected to his story with mathematics and express it through the use of a coloured balloon with a gesture which narrated in a metaverbal mode this emotion and thus "offer" it to the others, creating a dialogue based on looks, postures, perceptions, gestures.

Going further on this non-verbal communication, we proposed the realization of dialogues where gestures would be connected to unusual sounds: the use of natural numbers in order to favour an empathetic listening to the other.

All these steps, so unusual and far from the everyday classroom practice, took a long time to be assimilated and always needed moments of discussion and verbal exchange.

We then entered the plot of the mathematical question we chose, the duplication of the square, asking participants to approach it through a cooperative work and using different materials, so as to favour a "creative" and personal solution strategy, recalling the principle of Socratic *maieutics* which says that knowledge derives from one's own experience and action: notion must never be a starting point but

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always an individual and gradual discovery everyone reaches through his own personal resources (this same principle can be found in the grotowskian theatre).

After a short autobiographical work based on photography, we started to engage in the actual theatrical work, drawing on all the previous experiences : we recalled the metaphors chosen in our first meeting, formed groups based on similar metaphors and asked to dramatize and represent the metaphor chosen by the group; major importance was given also to the objects each one had brought with relation to the explored issues, as they were symbolic mediation tools related to the emotional impact of each one's own story.

All this work was collected in a short representation, a sort of "scenic study" still far from being a real theatre play, but surely useful for a first evaluation of the completed steps as well as of the reached results and as an occasion for making the idea underlying the whole project visible.

3. The evaluation of the experience through the voice of participants

At the end of the project we proposed a questionnaire to the eight participants, as it seemed important to us to have a specific and personal reflection from each of them about their experience with us, in order to understand better the sense they had attached to the collective activity:

- 1) *Do you think that this laboratory changed your relation with mathematics?*
- 2) *Did the non-verbal dimension indirectly stimulate a rethinking of your personal life experiences?*
- 3) *Do you think this experience could have some kind of follow up in your everyday teaching practice?*
- 4) *Do you have any other reflections to share?*

From the answers we knew that the project had been perceived by all as a deeply involving experience, being able to touch different problems, from the most personal ones to professional issues and we also got interesting reflections on the teaching profession itself, on the personal relations with mathematics and the social interactions marking the educational process.

Here is a significant synthesis of the answers, without going into a complete analysis:

"..The re-elaboration and reflection... touched my life experience widely, with interesting episodes emerging from the contributions of the group." (Sauro)

"I think... that my idea about how mathematics can be shared and taught in a serene and playful way, starting from a simple meeting of people, has changed..." (Silvia R.)

"[non-verbal dimension] brought to the surface many emotions and feelings linked to my school experience and this has been useful for a better understanding of my pupils, since I could see in them many things I lived on my own skin"(Laura T.)

" The exchange (balloons) has been very important, like the metaphor discussion, the breeding of the most diverse emotions with photos and the possibility to communicate without words"(Maria Elena)

" At first the non-verbal dimension has been difficult to live but gradually it became funny...This mode of representation helped to bring to the surface meanings that differed from those we wanted to express at the beginning. This had a lot more flexibility than the verbal mode" (Sauro)

"This kind of experience made it clear that to know a person (in particular a pupil) and his relationship with the discipline are much deeper things than what first impressions can suggest..."(Laura R.)

"The double student-teacher mirror can do nothing but increase the empathy and comprehension of the different moods of my students. The rethinking of my past life plays a role in the relationship in the classroom allowing a better comprehension and patience" (Maria Elena)

" It has been underlined the importance of non-verbal dimensions of communication of one's own messages to the others (especially pupils); it is important to reflect on how these aspects are essential (usually teachers do not care about this) and reflect on how to improve communication" (Filippo)

"The experience has been very interesting from the relational point of view... It made me understand, sometimes surprisingly, the relationship of our colleagues with mathematics, their difficulties as students and this can help us to be more empathetic with our students' difficulties. I mean that there are colleagues that have overcome their difficulties, graduated and became mathematics teachers" (Sauro)

"It seems to me that this approach can have a great impact on the quality of relationships in the school environment..."(Silvia M.)

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It seems that participants got the global sense of the project, i.e. the need for a personal reflection about oneself to have a positive follow up in the classroom, to be lived everyday as a stage where teachers and students engage as persons as a whole, using different forms of communication to build knowledge and at the same time to re-elaborate their own problems and look for collective wellness.

With reference to a possible follow up of the experience in the everyday practice of a teacher, we want to underline the importance of perception, based on one's own past life, of the urgency of focusing on the emotional-tonic resonance of everything that is offered and happens in the classroom didactical scene.

It is important to succeed in offering a didactical action, in each classroom, that takes some things into account: the search for a cognitive-disciplinary understanding must also be a search for bodily adaptation, for welcoming the other, for organization of times, spaces and non-verbal languages to make our discourse reach the individual in depth, thus leaving a significant trace in him.

The classroom can be seen as a privileged place for a cathartic action, towards a rethinking of one's own past relationship with both the discipline and the others, starting from a specific work on the teacher himself.

No doubt that this experience is just the first step towards this awareness, however the path we have chosen seems to be promising and the results encourage us to carry on.

The next goal, our "unrealised dream", is the realization of a real theatrical work, where mathematicians are directed by professional actors and that has all the qualitative and stylistic features of theatre and manifests the soul of mathematics beginning from the choice of texts (the idea is to rewrite a theorem in a dramatic way). The objective is to design an intervention for a wider audience of mathematics teachers, to be benefited both in their initial training and in view of a life-long training.

References

- Attisani - Tomassini - Puppa, 2001, *Linguaggi della performance*, Università Ca' Foscari, Venezia
- Barba E., 1993, *La canoa di carta*, Il Mulino, Bologna
- Bernardi - Cuminetti (a cura di), 1998, *L'ora di teatro*, Euresis Edizioni, Milano
- Boal A., 1990, *Il poliziotto e la maschera*, La Meridiana, Molfetta (Ba)
- Casula C., 1997, *I porcospini di Schopenhauer*, Franco Angeli, Milano
- Cunti A., 2002, Quale didattica per l'adulità, *Istituzioni di Educazione degli adulti*, a cura di Demetrio, A. Alberici, Guerini e Associati, Milano, Sezione Seconda, B7, 1-25
- Damasio A. R., 1999, *Emozione e Coscienza*, Adelphi
- Demetrio D., 1997, *Il gioco della vita*, Guerini e Associati, Milano
- Demetrio D., 1996, *Raccontarsi. L'autobiografia come cura di sé*, Cortina, Milano
- Dotti L., 1998, *Forma e azione*, Franco Angeli, Milano
- Fabbri D., Munari A., 2000, I laboratori di epistemologia operativa, in *Apprendere nelle organizzazioni, Proposte per la crescita cognitiva in età adulta*, a cura di D. Demetrio, Carocci, Roma
- Formenti L., 1998 *La formazione autobiografica*, Guerini, Milano
- Fox J., Dauber H., (eds.), 1999, *Gathering Voices Essays on Playback Theatre*, Tusitala Publ., NY
- Gallo Selva A., 2003, Dire, Fare, Contare, *Tesi di Master in "Linguaggi non verbali e della performance"*, Università di Venezia
- Gamelli I., 2001, *Pedagogia del corpo*, Meltemi, Roma
- Goffman E., 1969, *La vita quotidiana come rappresentazione*, Il Mulino, Bologna
- Gordon T., 1991, *Insegnanti efficaci*, Giunti e Lisciani, Teramo
- Grotowski J., 1980, *Per un teatro povero*, Bulzoni, Roma
- Lapierre A., Aucouturier B., *La simbologia del movimento*, Edipsicologiche, Cremona
- Lecoq J., 2000, *Il corpo poetico*, Ubulibri, Milano
- LeDoux J., 1998, *The Emotional Brain*, Phoenix, Orion Books Ltd
- Malara N. A., Zan R., 2002, The problematic relationship between theory and practice, in Lyn English (Ed.), *Handbook of International Research in Mathematics Education*, Lawrence Erlbaum Associates
- Manes S., 1999, *68 nuovi giochi per la conduzione di gruppi*, Franco Angeli, Milano
- Mustacchi C., 1999, *Ogni uomo è un artista*, Meltemi, Roma
- Pellerey M., 2001, Origine e sviluppo degli approcci per 'competenze' nella formazione professionale, *Studium Educationis*, n. 2, 461-484
- Pesci A., 2003 a), La classe come palcoscenico, *Tesi di Master in "Linguaggi non verbali e della performance"*, Università di Venezia

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Pesci A, 2003 b), Insegnanti di matematica e studenti: come migliorare il lato umano delle loro relazioni?

L'insegnamento della matematica e delle scienze integrate, Vol. 26B n. 4, 521-545

Pesci A, 2003 c), Could metaphorical discourse be useful for analysing and transforming individuals' relationship with mathematics?, *Proceedings 6th International Conference of the Mathematics Education into the 21st Century Project, The Decidable and the Undecidable in Mathematics*, A. Rogerson (Ed.), 224-230

Quaglino G. P., Carrozzì G., 1998, *Il processo di formazione. Dall'analisi dei bisogni alla valutazione dei risultati*, Franco Angeli, Milano

Rogers C., 1997, *Terapia centrata sul cliente*, NIS, Roma

Ruggieri V., 2001, *L'identità in psicologia e teatro*, Ed. Scientifiche Ma.Gi., Roma

Salas J., 1993, *Improvising real life*, Kendall/Hunt, Dubuque, USA

Vacis G., 2002, *Awareness*, Rizzoli, Milano