A "Factory of triangles" in a multicultural class *

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Abstract

The inclusion of foreign students in the classrooms is currently a widespread reality in Italy which has modified the structure of the classes, creating a perceivable increase of discrepancies in the class group and as such, generating educational problems which are both new and delicate. A sector of educational research has addressed this problem and has begun to define principles, to identify theoretical reference frames and to plan and experiment with hypotheses on adequate and formative ways in which to respond to the needs that have arisen. This work aims at giving an example of applied methodology in teaching in a multicultural class.

1. Introduction

This work deals with the implementation of a teaching unit which has been carried out in two first grade multicultural classes of a Secondary School in Florence, namely the I.C. "Gandhi".

The changes in the classrooms, originated by the phenomenon of foreign students inclusion, particularly refer to the increase of differences in the class group, a fact that poses an educational task. Above all, we can observe (together with other authors, see F. Coin, 2013) that the discrepancies derive from the characteristics of the culture of provenance, from the previous scholastic experience which have taken place in educational systems that are different from our own, and from different levels of knowledge of the Italian language. To these factors, one can add those related to the social-economic situations of the families who are often not very open to cultural integration. In addition to this, these families are often devoid of awareness of the situation and of suitable skills by which to support their children at school. As a result, many of these pupils suffer from forms of unease that are both emotionally and relationship based. This is mainly seen through the tendency towards isolation, mistrust or indifference to school activities and the inability to concentrate/participate adequately. Sometimes these pupils demonstrate signs of suffering (up to and including the refusal of normal modes of

* This workshop is part of the dissemination activities of the Project Multiculturalism, Migration, Mathematics Education and Language – M^3 EaL, funded by the European Commission (Project n.526333-LLP-1-2012-1-IT-COMENIUS-CMP). Project partners: University of Vienna, Austria - Charles University in Prague, Czech Republic - University of Paris-Est, Créteil, France - University of Thessaly, Greece - University of Pisa, Italy - University of Siena, Italy - University of Agder, Norway. Project website: http://m3eal.dm.unipi.it

behaviour and the fulfilment of disturbing behaviour). As regards cognitive and scholastic difficulty, the problem is more articulated. In accordance with the results of other researches, the data from this present research also lead us to relate the difficulties of learning met by foreign students (in particular, those of the first generation) to the use of Italian as a second language, while no specific cognitive deficiency has been highlighted. In fact, these problems considerably become less or cease altogether with the acquisition of the new language. When these problems persist among immigrant students of the first generation or they appear among those of the second generation, again, they are as a consequence of closure to the social context of single families, or more often of the entire ethnic group, and of the inability or impossibility of adults to follow the scholastic experience of their children. The incidence of this second component is proven by the fact that analogous cognitive problems are frequent even amongst Italian pupils who come from poor family backgrounds.

With all that has been said, we have tried to underline that the actual, educational problem in a multicultural class resides in the *differences between individuals*, that are in part generated by the *differences between cultures*. A successful control of the situation with the described characteristics seems to call for an efficient intervention of support in the linguistic sector (already foreseen by ministerial politics) and the production of didactic materials for the subjects of study in Italian L2, but above all, it calls for the availability to the teachers of clear guidelines, directed at facing the lack of homogeneity among the classroom individuals, both with regards to the different levels of relational development (starting with the adjustment to the group) and to cognitive development (starting with motivation to work).

The highlighted points indicate, as a target, a model of educational planning that can be easily customised and is subordinate to a new interpretation of learning. Theoretical frameworks exist to deal with the situation corresponding to new “model” of the classroom, just as there exist methods and good practices that conform to this, although these are not actually widespread and carried out in the school system. During the last few years research has begun that deals with possible applications in education of a very general theory of knowledge, called *enactivism*, which was developed in the 80’s starting with the contribution of the biologists Maturana and Varela (1984), and explicitly introduced by Varela, Thompson and Rosch (1991), remaining connected both to biology and to philosophies of experience, such as hermeneutics and phenomenology.

The enacted approach focuses on *sense-making as a situated, embodied activity*. There are basically two characterizing principles:

- the subject is conceived as a living being, capable of auto-producing components having nature of processes, which are embodied in the living being,

- the transformations that the subject operates with regards to itself originate from the relationship between the external environment and the internal individual structures, whatever their current state is.

Several already consolidated methodologies (*cooperative learning*, *manipulatives use*, …) agree with these principles and are integrated in the enactive approach, which emphasizes the importance of setting environments apt to favor action and individual experience in the social context, and providing instruments apt to reduce verbal instructions.

Finally, this integrated approach provides theoretical principles and useful instruments to face the already examined educational problems, frequently appearing in multicultural classes.

2. The proposal

The proposal concerns the geometrical concept of triangular shape with its fundamental properties and relations.

The unit follows an active learning approach, by the Structuralism scheme (*sensory-motor experience – mental images - concepts*), which takes into account the subject with his/her previous background, the relationship between the subject and his/her environment, the subject's action, perception and gestures, empathy. As regards *image-schemata* (the perceptual-conceptual primitives allowing the organization of experiences in spatial relations), the *contact* schema acts.

Moreover, the unit refers to Emma Castelnuovo's method, in which the cognitive development starts from the actual individual stage (*continuity in learning*), and the mathematical cognition emerges by the subject' actions (*operational internalization*), in a sort of guided reinvention process, based on the use of simple concrete materials.

Just sticks, hooks, strings, tacks, tablets are the materials required to perform this activity: they allow children to create *dynamic figures* to be handled. Moreover they offer a 3-dimensional experience, that has to come before the 2-dimensional one (for example, allowed by ICTs use).

Acting with these artifacts, the students may naturally go from the idea of a three sided figure, to the idea of triangle, up to the congruence and similarity relations between triangles (fig.1, fig.2). At the same time, trying to describe what they are doing and seeing they gradually develop the language, even the disciplinary one.

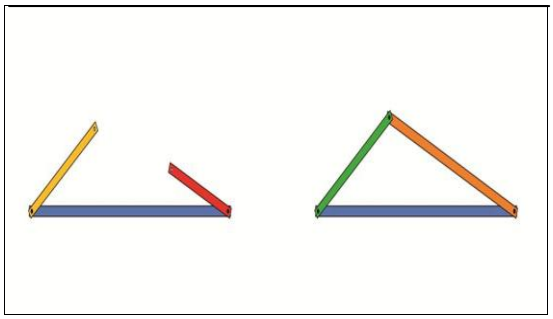

Figure 1

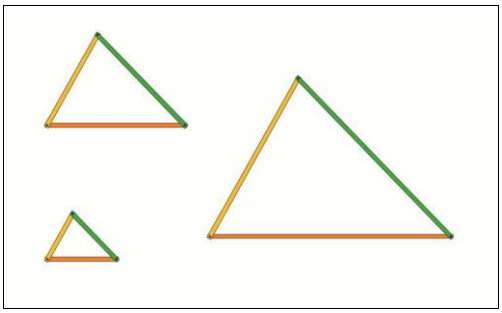

Figure 2

The proposal is divided in four increasingly complex phases, indicated below.

Phase 1.

a) *presentation* of the "geometric meccano" with its possibilities of use, made by the teacher;

b) *composition* of articulated figures of fantasy, made by the students, working in small groups;

c) *reproduction* by drawings the nicest compositions maintaining the relative structures;

d) *setting up the motivational context* by: an individual activity of conjunction of three sticks; a consequent work of observation of the own composed figure and search of mental images (closed eyed) of triangular objects; a projection of a sequence of photos to show the wide diffusion of the "triangulation" in any culture and age of human history;

e) *discussing* the "fortune" reasons (use in daily tools, architectural structures, artistic works, measurements, mappings, …) and even the theoretical importance of this shape.

Phase 2.

I step.

a) *approaching the problem* of the triangle *existence condition*: an activity, in small groups of pupils, to be carried out - with two different triples of sticks, in two successive times – aimed at the discovery of the fundamental possible cases (the existence of *just one* "closed" figure, namely a triangle / of *a lot of* "open" figures …);

b) *fixing ideas* by graphical representations of figures exemplifying the two different situations (one pupil in the group takes on the role of "reporter");

c) *solving and explaining a combinatorial problem* about the number of possible triangles which can be obtained using five sticks of given different lengths (adapted from "Sticks and Triangles", 21° RMT):

II step.

a) constructing triangles under one given element (side or angle) condition: students experience the construction of triangles with a given side (angle) trying to find out which elements may change by movements; later they discuss on what they saw.

III step.

a) *constructing triangles under two given elements (side&angle or side&side or angle&angle) condition*: students check for various possible configurations of concrete figures;

b) *problem posing session* on the analysis of what can happen if another side (angle) is given.

In these three steps, the *unicity conditions* emerge and lead to give ground to the equality criteria between triangles understanding.

IV step.

a) *defining activity*: rigorous verbal description of some peculiar shape types takes place; geometrical terms (isosceles, right, equilateral and scalene triangle) are revisited.

An analogous didactic procedure may be followed to introduce the similarity criteria between triangles, and to approach the geometrical shape concept, differentiating the “gender-sense” and “specie-sense” of it.

3. Comments

The outcome results confirm the efficacy of the active learning method adopted in the proposal, which both fosters the conceptual representation and promotes the ability of communicating and argumentating. Indeed the action-based experience on concrete objects leads to detect properties which facilitate the mathematical objects construction. At the same time, a language development happens from a simple and common way of expression, to a coherent and more and more rigorous one: activities such as working in pairs or in small groups while handling an artifact, generate a spontaneous and productive social interaction, supported by gestures, words, drawings ... It is essential the teacher role of guide and observer of instinctive students’ actions, corresponding their sensory-motor experience through the real objects, and about used and produced words and linguistic expression. A semiotic analysis can be actually done by student’s productions.

As for the dealt with topic, the shape of an object appears to be an adequate field within developing rational thought.

Finally, for what concern the affect domain the proposal may have very positive effects, because of the game-like and serene atmosphere, the independence in acting-imaging-thinking, the relationship with peers.

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