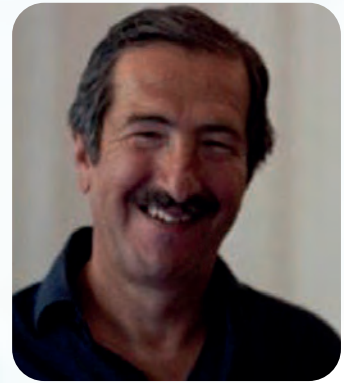


Dissemination of mathematical culture through games

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The organization of the Kangourou contest scheduled in March is not the only duty of ours: our Statute solicits to take care of the dissemination of mathematical culture among young people (article 2). Probably this one is the most difficult task to satisfy. I am aware of this difficulty when reading the various reports sent by the adhering countries and I have already pointed out that at last year General Assembly.

I gathered a small group of professors of the University of Milan, and we set ourselves a goal: to create every year a new original game-box and a 16-page magazine dedicated to the educational mathematics laboratories that can be carried out in the classrooms.

At Orchid, if I will be allowed to do that, I will make a speech to present this new game. On the occasion of the gift exchange, you will be able to see the game and the magazine. The game is CE certified, however, due to copyright reasons, I am not able to give it for free. Anyway, copyright agreements are available.

In what follows I point out the principles we have worked and we will work on.

Poligonopoli and more: a reflection on the use of games in mathematics education

It is well known that learning mathematics involves not only disciplinary content, but also emotional, social and cultural aspects, and it is often in the latter that lies the reason for the negative approach that many students have towards this subject.

The math game contest and the other dissemination activities proposed by Kangourou certainly provide an extremely effective opportunity to improve the perception of the subject, but sometimes it is not enough. In order to involve more students and to provide teachers with valid tools that can be easily integrated into current educational programming, we have designed a series of playful educational activities that arise from the specific needs and difficulties of students, are closely related to curricular content and are designed to be used in small groups, involving the whole class and using the playful context to activate non-traditional learning processes even in the most fragile students.

The proposal of game-based teaching activities within math lessons has many advantages: on the one hand, it downplays a subject normally considered hostile and, on the other, it actively involves students in the lesson, transforming them from mere spectators to actors in the learning process.

The playful situation makes it possible to create an informal learning environment in which the student develops both motivation and mathematical skills, thus succeeding in regaining self-confidence and triggering a virtuous circle that, through the improvement of their self-esteem, also leads them to achieve more satisfactory results.

Indeed, the competitive component inherent in the game pushes the student to concentrate, to seek effective and personal strategies and to memorize the mathematical concepts involved. Through the game, students interact with peers, learn to manage time effectively and to work in teams. In addition, when a math question arises in a game context, the student is genuinely interested in understanding the teacher's explanation, both to convince himself of the fact that he or she actually made a mistake (thus losing the chance to win the game) and to avoid repeating it during subsequent games.

An example of this type of activity is Poligonopoli, a game that aims to improve spatial and geometric visualization skills by helping students recognize polygons in noncanonical positions and develop creative and flexible thinking. In fact, the ability to interpret complex figures as the sum or difference of simpler figures turns out to be very useful in tackling more traditional geometry exercises and reality problems.

Without going into the details of the rules (that can be found at <https://www.kan-gourou.it/store/poligonopoli>), the general idea of the game is that players roll dice to move along a path (see Figure 1) and in doing so acquire elemental polygons, which must then be used to purchase figure cards that are offered for sale. The goal of the game is to buy the maximum number of figure cards, which can be purchased if the player has all the elemental polygons needed to obtain the figure by sum or by difference (see Figure 2)

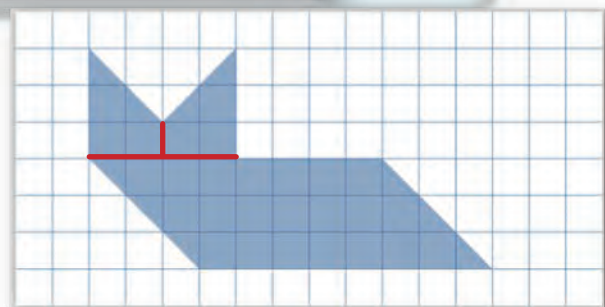
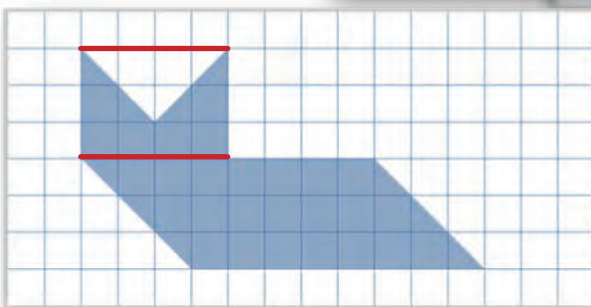
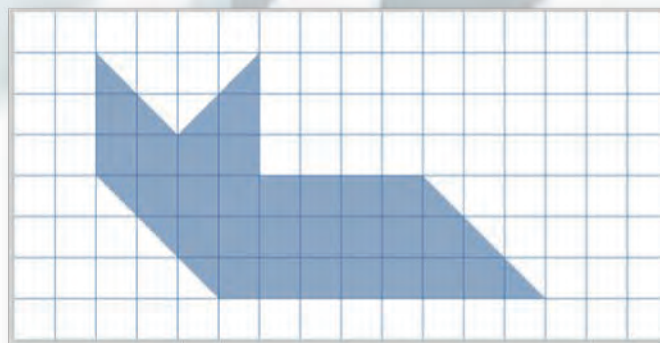


Figura 2. On the top the figure to be purchased. Bottom left its decomposition by a rectangle minus a triangle plus a parallelogram; bottom right the same figure decomposed as the sum of two trapezoids and a parallelogram.

Once a player makes its purchase proposal, the other teams have to check the correctness of the polygons used for the purchase. If a player makes a mistake by attempting to purchase a figure without having the correct polygons, it is given a penalty point, while if the polygons are correct, the player takes the figure card and the polygons used are placed at the bottom of the deck. The fact that the responsibility for detecting the mistakes is shifted from the teacher to the students makes the latter very careful not only to detect the mistakes of others but also to avoid their own mistakes.

It is worth to notice that the game has been designed so that are not necessarily the "good at math" students who win. In fact, in order to succeed in buying figure cards it is necessary not only to find a correct geometrical decomposition, but also to possess the right elementary polygons, and this depends more on luck in the roll of the dice than on any mathematical skills. On the other hand, for students who are convinced that they are not "mathematically inclined", winning against the "good ones" not only constitutes a form of revenge, but also provides a tremendous motivational boost and can become a valuable source of energy even in view of a greater commitment to more traditional types of math lessons. Indeed, it happens that some students discover their "math skills" for the first time precisely through play, and that it is the playful experience that marks a turning point in their relationship with this discipline.

However, for students with more difficulty in math, it may be helpful to organize homogeneous game tables so that, on the one hand, they can take their time to think without feeling pressured and, on the other hand, they do not slow down the pace of play for more able students.

Finally, on the Kangourou website <https://www.kangourou.it/images/poligonopoli/concorso.pdf> we ask students who have played with Poligonopoli to help us expand the game by sending in their suggestions for new figures. The best cards will be made available to everyone on this site, ready to be downloaded, printed and used for new games! Of course, the cards chosen will bear the name of the class and school that designed them.

