Chapter

Perspective Chapter: Teaching Intuition and Creativity - An Interdisciplinary and Playful Approach

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Abstract

The students attending the Italian technical and vocational high schools have often a critical behavior towards the classes of Mathematics and Italian. They usually believe that these disciplines are sterile and marginal with respect to their main interests that rely on subjects characterizing their professional choice. We made some experiments intended to wake up the interest and reactivate the lost creativity in these two disciplines. We report on an interdisciplinary experience in the first-year class of a technical high school where we introduced a series of games in the classes of Mathematics and Italian, with the intent of stimulating creativity and empowering the students. In Maths, we applied the puzzle-based learning technique. In Italian, we used the creative writing technique. Despite the limited time devoted to this experience, the outcomes have been extremely positive.

Keywords: creative writing, creativity in mathematics, divergent thinking, gaming

1. Introduction

From the very first days of high school attendance, especially in Technical Institutes or Vocational Institutes, many students often assume adverse attitudes to deal with Mathematics and Italian. This results in hostile behavior and lack of interest, sometimes originating from low self-esteem or negative experiences in the early school years. These attitudes are an obstacle to good performance and successful inclusion in the school curriculum from the very beginning. There are many misconceptions in the minds of students. Perhaps due to previous negative experiences or an uninspiring social context, On the one hand in mathematics, most of the students consider the discipline dry and boring. They associate it to mechanical aspects of the mere algebraic calculation, neglecting instead the creative potential. On the other hand, in Italian, many students seem convinced that they do not know how to write, they are very concerned about the form rather than the content, and often, in front of the requests of the teacher, they take a passive attitude, almost giving up.

In this chapter, we want to illustrate an interdisciplinary project carried out in a first-class of a Technical Institute. The objectives of the project were mainly to

overcome the misconceptions mentioned before and to highlight the creative and intuitive component of the two subjects by stimulating students to curiosity and study [1, 2].

According to psychologist Max Wertheimer [3], the key objective of school activity is to foster so-called "productive thinking" in students, i.e., to orient students to solve new and unusual problems in order to stimulate their intuition. Our aim was just this: to propose activities that can bring out the students' intuition in solving problems, the so-called insight of Köhler [4, 5], that is, to activate those cognitive mechanisms, those mental jumps that allow to solve situations never faced before or to face known problems in an original, more immediate and brilliant way.

In other words, we wanted to enhance and put in the foreground the productive aspect of thought, refraining from mechanically applying formulas, grammatical rules, or procedures that passively reproduce already known knowledge and would make the discipline devoid of real meaning.

As other objectives, functional to the main one, we set out to strengthen the observational and abstraction skills as well as to foster the critical thinking of the students. In addition, we tried to awaken divergent thinking to build new knowledge from the acquired experiences [6]. All these skills are often dormant in the students, now belonging to the digital generation, more and more accustomed to the passive use of electronic communication tools and little predisposed to direct interaction with the objects of the real world. Observation, the use of materials and objects, and their manipulation has been the main tool to trigger the process of intuition and creation. A concept supported many times by Emma Castelnuovo, which remains always relevant, is that "one thing that is very missing in school today is the hand-brain relationship" [7].

However, a positive aspect of the new generations of so-called "digital natives" is that learning does not develop in a sequential way, but rather in a reticular way, i.e., following different directions at the same time. From this point of view, we are faced with students who are more predisposed to deal with interdisciplinary topics and to conceive knowledge as a "unitary whole". They are naturally disposed towards carrying out tasks in groups or online, being able to deal with connections between multiple disciplines and knowledge [8]. These are very important skills at the base of social learning as intended in [9]. In this perspective, our experiment aimed to create links, similarities, and communion of methodologies between different disciplinary areas, the humanities-literary and the scientific-mathematical, trying to guide students towards the concept that both are linked by the common denominator of creativity and intuition.

The experience proposes a fruitful interaction between the two disciplines of mathematics and Italian, linked by the common thread of potential creativity. This is an essential aspect in learning the contents and customizing the tools of the two subjects. For this reason, we were inspired by the technique of puzzle-based learning and creative writing, leveraging on the playful component of the activities, using as much as possible materials taken from everyday life, and proposing to the student's role-playing games or engaging questions solvable through teamwork, according to the methodology of cooperative learning.

The center of the learning process becomes the student, with his characteristics and his specificities. The passive transmission of content is replaced by the proposal to the student of authentic and contextualized problems ("authentic and situated learning"). The student, together with her mates, is stimulated to find the solution and formalize it, activating a metacognitive process that also leads her to reflect on how

she arrived at the final result and to have a greater awareness of her own learning process. These are the key competencies of "Learning to learn", "Mathematical competence", "Communication in the mother tongue" specified in the Recommendation of the European Parliament and of the Council of the EU, 2006 [10].

Students are presented with "complex, open-ended problems", i.e., situations that are challenging for the student, contain a dimension of challenge in relation to the knowledge and experience possessed, solicit the activation of resources, and lend themselves to different modes of solution [11, 12].

Even though we dedicated only a few hours to this experience, the effects were tangible both at a motivational level, affecting the students' self-esteem, and at an objective level, as could be verified in the school parallel tests carried out at the end of the school year in the two disciplines.

In the following we will briefly survey the concepts of puzzle-based learning and creative writing (Section 2), then we will present the details of the activities carried out in class in Mathematics and Italian (Section 3). A brief report on the results achieved will conclude the chapter.

2. Learning by playing

One of the lacking aspects in most school curricula, at any level, is the development of problem-solving skills, whether in mathematics or arising from other contexts. Generally, schools instruct students on how to apply so-called "rules", whether mathematical or grammatical or how to solve exercises by applying formulas or predefined schemes. In this way, students have difficulty framing problems, extracting relevant information, developing critical thinking, and proposing solutions [13]. It is well known [14, 15] that this mode of learning has the effect of killing students' creativity and interest, and in most cases induces them to resort to learning by heart instead of reasoning.

The techniques that we adopted to awake the reasoning skills and the creativity of the students are mainly puzzle-based learning and creative writing. Both techniques are very playful and engaging since the beginning.

2.1 Puzzle-based learning

Puzzle-based learning [16] is a learning approach that is intended to develop reasoning skills, perseverance, and motivation in dealing with problems. That is, it intends to build the fundamental foundations of what problem-solving is. This is done not from real problems, but rather by taking cues from games that do not require any special contextual knowledge and that have the sole intent of being engaging and challenging [17].

In this context, the curricular teacher and the external expert become guides and facilitators of knowledge within a community of learners [18] which is the classroom. Each student becomes the main player of a learning process where she is an active builder of her own knowledge, acting in cooperation with peers, according to the theories of collaborative learning and guided discovery of Vygotskij [19, 20].

In practice, the role of the teacher is not to "teach" how to solve problems, but rather to propose stimulating games for all students, to follow their reasoning, to arrive together with them at the solution [21]. The teacher must be ready to accept methods of solving problems other than the one she has thought of, or tried to solve

together with the student's problems posed by them. In short, the fundamental purpose is not the solution of problems, but the effort that is made to achieve it. The teacher must therefore be ready to get involved and not be uncomfortable in the face of possible setbacks. Adopting a sporting similarity, the teacher takes on, during puzzle-based learning, the role of the coach, whose motivational skills must be preponderant over the merely technical ones.

The assessment phase is also strikingly different from the usual context. After the first few games, the enthusiasm shown by the students in arriving at a solution on their own goes far beyond a good grade. Therefore, more than rewarding the result achieved, the effort to reach it is to be encouraged even if it was not successful [22].

2.2 Creative writing

Creative writing is a way to approach the world of literature and to acquire greater critical awareness. It is closely linked to the idea of "invention", so it does not have universally valid rules, but rather has "techniques". The invention is a very important moment that must be guided and trained. The literature on creative writing is particularly rich [23]. However, we took advantage of the presence of the local writer Luigi dal Cin, who has also a long record of collaborations with schools at all levels. According to Luigi dal Cin [24], many writers agree that invention springs from five mental attitudes:

Inspiration: the first mental attitude is the most important and is developed mainly through the "fantastic pair" (the juxtaposition of two concepts, characters, situations, very different from each other).

Proliferation: linking different situations and characters, even contradictory ones, to the first idea.

Selection: select characters and situations.

Preservation: do not forget anything that was initially discarded.

Re-crossing: resume the plot of the story and try to develop it even with what was initially discarded.

It is curious to note that, although with different terminology and in a context very distant from the creation of a story, we find similar techniques in the design of heuristic algorithms for solving mathematical problems: Genetic algorithms, Simulated Annealing, Neural Networks, Tabu Search, Evolutionary algorithms, etc. [25].

Creative writing techniques also go beyond those mentioned above, however, given the purpose of the experience, it was deemed appropriate to focus on some of the simplest and of immediate impact on the students.

3. The experience in class

The flow of our experience is summarized in **Figure 1**, where the connections between mathematics and Italian are pointed out.

3.1 Mathematics

Starting from the assumption that the mathematics that is taught in school is, among all disciplines, the one that students find more and more difficult to assimilate in its concepts and in its many applications, the hours dedicated to this project appeared instead as a sort of "game of the mind" captivating and pleasantly full of

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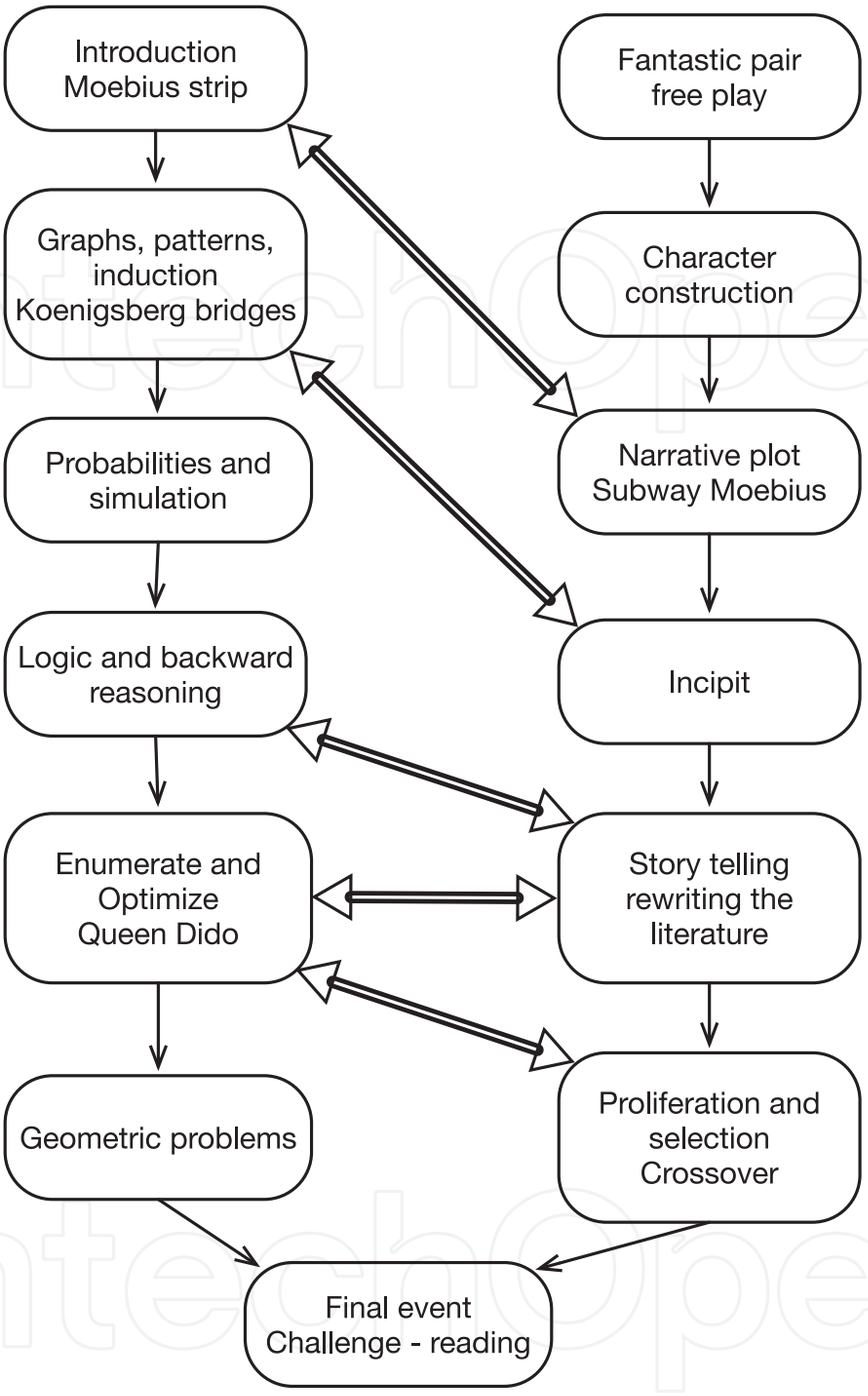

Figure 1.
Connections between activities.

surprises [26]. The students immediately showed interest and enthusiasm in addressing the proposed questions, showing curiosity and willingness to collaborate. The lessons were held according to the mode of cooperative learning, through pair/group activities: students, placed at the center of the learning process, were guided and trained in problem-solving by the external expert teacher who stimulated in them the desire to experiment with new strategies and new methods. According to Bruner's theories [27] developed about fifty years ago, but still very relevant, the concept of discovery learning can be a suitable way to foster in students' minds a way of thinking

independently. The student is actively involved in identifying the key ideas of the discipline, which are not presented in a "pre-packaged" way by the teacher: the student, during a research-action path, defines hypotheses, makes predictions, has intuitions, investigates the nature of what she is studying, comes to new results independently, through one or more paths, according to progressive discoveries [28].

We report briefly on the experiences made during the ten hours of this project, listing the activities and their purpose.

3.1.1 Meeting 1: let us break the ice

The most critical aspect of the designed activities is to immediately get students into the mindset of puzzle-based learning and cooperative learning by taking an active role. We tried to address this issue with a very engaging physical puzzle. The kids were organized into groups of three and a volunteer was identified in each who was not afraid to dishevel. The volunteer wore a T-shirt and her hands were tied with a rope that left about twenty inches of play. The challenge was to take the shirt off and slip it back on so that when it was pulled back on, it would be inside out with the label on the outside and back. The task of the volunteer's assistants was to help him in the movements that are restricted by the rope and suggest the actions to be taken to get to the solution. The teacher can only help observe what happens, in case some group gets stuck.

3.1.2 Meeting 2: let us use our hands and learn to observe

As Emma Castelnuovo argues, knowledge begins with the use of the senses. The purpose of the second meeting is to stimulate the spirit of observation and subsequent abstraction. This can be done through the use of simple materials. For us, it was paper ribbons about twenty centimeters long and three wide, glue and scissors [29]. Taking a cue from the T-shirt game, where we played with the "inside" and the "outside," we invited students to create a simplified physical model of the T-shirt by building a ring with a paper ribbon. We then invited them with a ribbon of the same size to build a different T-shirt model, where it was not possible to distinguish the "inside" from the "outside". The students came up with the well-known Moebius ring. The property of having a unique surface has been verified by drawing a longitudinal line with a pencil in the closed ribbon. We then prompted them to observe the properties of the ring they had obtained by cutting the ring with scissors along the traced line, or by cutting it longitudinally, remaining one cm from the edge. The manual activity and the use of colors stimulated the imagination of the students. As the activity unfolded, one of the students uttered a phrase that gave the measure of how well the message on the creativity potentials had been understood: "This isn't math: it's modern art!". The activities with the Moebius strip were also recalled during the creative writing meetings where some stories have been created starting from the mathematical properties.

To reiterate the importance of the spirit of observation and the use of information, we proposed a simple question: in three identical boxes we put chocolates with the same external appearance, but with different tastes (type A and type B). In one box we put chocolates of type A, in another one type B, and in the third one a mixture of the two types, moreover a label was added to each box (A, B, A/B), but it was said that the labels were all wrong. The question was to determine how many chocolates needed to be tasted in order to correctly attribute the labels to the boxes.

It has not been easy to find chocolates that were right for us. We went to an artisan chocolate shop whose saleswoman, faced with our bizarre request, was so intrigued that she wanted to try to solve the game as well.

3.1.3 Meeting 3: model building with graphs, recognition of regularities, and the idea of induction

The third meeting was dedicated to the introduction of graphs as a tool for mathematical representation. We started with the story of Euler and the bridges of Königsberg, starting milestone of Graph Theory. We discovered together planar graphs and how to represent geographic maps by means of graphs, then the problem of coloring maps and graphs. We also explored the same coloring problems when the graph is arranged on a Moebius ring made with transparent paper. We finally tried to count the number of arcs of a complete graph, using induction.

3.1.4 Meeting 4: probability and simulation

The concept of probability is usually very abstract, but if it is associated with the game, it becomes much more engaging. We have studied a sort of puzzle related to the probability that recalls a television quiz. In the game, there are 3 boxes available: one contains a prize, while the other 2 are empty. The contestant chooses one of the three boxes without opening it. Then the host opens one of the remaining two boxes that he knows do not contain the prize and asks the contestant if she wants to change her choice. The question is, putting aside superstitious factors, which choice maximizes the probability of finding the prize? The intuitive answer (the probability that the prize is in one of the left two packages is identical) is wrong. It is difficult to convince us of this using reasoning while using simulation it is obvious. We then divided the groups of kids into two teams simulating the game: the groups on one team kept the choice unchanged, and the other team always changed it, repeating the experiment 20 times each. Putting the results together gave a good estimate of the actual probability of the two choices.

3.1.5 Meeting 5: logic and combinatorics: goat-cabbage-wolf, zombie

Logical/combinatorial reasoning questions are among the best known, however, it is worthwhile to dwell on the topic to go beyond intuition and develop more rigorous reasoning to support what has been intuited. We started with the classic question of the goat, the cabbage, and the wolf to ferry, resorting to drama. We then generalized the game to the problem of having to get three zombies and three humans to cross a river in a boat carrying at most three people. However, the humans can never be outnumbered either in the boat or on the banks of the river otherwise they succumb. Finally, we solved and logically analyzed the following tautology using three volunteers. Matteo looks at Agata and Agata looks at Alberto. Matteo is engaged and Alberto is not, while it is not known if Agata is. Is anyone engaged looking at anyone not engaged?

3.1.6 Meeting 6: reasoning backward

The most common approach in problem-solving is to advance the reasoning forward to reach the solution after a series of steps. However, when reasoning gets stuck

someone may get discouraged and quit. If we adopt the point of view of a detective facing a crime scene, it is more productive to reason backward from the final result. Many questions are more addressable if explored backward, think for example of the mazes in puzzle newspapers, or economics problems where a company sets goals and asks how to achieve them. Therefore, we studied together some questions such as the following one. A colony of algae begins to populate the surface of a lake. Each day the area covered by the algae doubles and is completely covered by day 10. On which day is the surface of the lake half covered? Finding the answer by reasoning forward from day 1 is complicated, it would involve making assumptions about the initial coverage of the lake and proceeding by trial and error, much simpler instead is to start from day 10 and go backward.

3.1.7 Meeting 7: we enumerate and eliminate

The proposed problem-solving approach is based on a simple principle: enumerate the solutions by eliminating the impossible ones, what remains is the solution. This simple principle soon clashes with the size of the problems to be solved, which could grow exponentially with the number of alternatives to be considered. It is therefore necessary to combine enumeration with the use of logic to recognize as soon as possible the unfeasible combinations. One of the girls proposed the so-called Einstein's puzzle[1] that in principle requires the enumeration of 5^3 combinations, something impossible to do manually, and for this reason, it discouraged everyone in the class. Thus proposed a series of questions of increasing difficulty inviting groups to tackle them using the enumeration technique. At the end of this path, we have faced Einstein's question together and we have been able to complete it in a short time.

3.1.8 Meeting 8: optimizing

Optimization problems are simple enough to grasp, after all, optimization is inherent in human nature, and in nature more generally. Despite optimization concepts are usually introduced at the university level, there are successful examples of optimization experiences in school. Emma Castelnuovo introduced the geometric interpretation of Linear Programming in her textbooks. Malucelli and Fantinati [30] illustrates an optimization experience in an elementary school. Experiences of optimization problems tackled in medium schools and in high schools are surveyed in [31].

We started with the example of the oldest documented optimization problem: the founding of Carthage, i.e., the problem of enclosing in a fixed perimeter the maximum possible area. We pointed out that the question in optimization problems is not to find one possible solution, but among all possible solutions to identify that maximizing or minimizing a given objective. We have therefore addressed some simple optimization problems. Starting from the isoperimetric problem of queen Dido. A second one considers a scheduling problem. Four people must cross a dangerous bridge at nighttime, and to do so they need a flashlight. The bridge holds at most the weight of two people and there is only one flashlight available. The people have different crossing speeds: 1, 2, 5, and 10 minutes respectively, and when two people cross the bridge, having to hold the flashlight they must do so at the minimum of their two speeds. Which crossing sequence guarantees the minimum time to get all the people from one

[1] https://web.stanford.edu/laurik/fsmbook/examples/Einstein%27sPuzzle.html [Accessed 2021-10-25].

side to the other? The sequences are obviously infinite, but one can exclude all those with redundant crossings. By adapting the enumeration techniques to the optimization case, we reached the solution.

Another problem addressed was the following. The town of Comacchio[2] is built on 13 islands. A sudden cataclysm destroys all the bridges and the mayor must decide which ones to rebuild so that from any island it is possible to reach any other island using paths that involve the crossing of even more than one bridge. The cost of rebuilding each bridge is given and the mayor obviously wants to minimize the overall expense. We invited students to reason using a graph model and each group came up with their own algorithm comparing the solutions obtained.

3.1.9 Meeting 9: geometric problems

Geometric problems have the great advantage that they can be represented graphically and also constructed physically. Therefore, they are very concrete and can also be manipulated easily. We have dealt with various problems of the arrangement of lines and points on the plane. One question posed by one of the students was to find a way to cover with three consecutive segments 9 points arranged on the plane on 3 rows and three columns. Or arrange 10 points and 5 lines on a plane so that each point falls on the intersection of exactly two lines. Then we moved on to consider the problem of covering with dominoes an 8x8 chessboard from which we eliminated the opposite corners. Finally, we considered together with a personal way of proving the Pythagorean theorem.

3.1.10 Meeting 10: the final challenge

Instead of concluding the experience with a conventional test, we wanted to propose to the students, organized in groups of two or three, a small competition with prizes. We prepared about ten questions of various difficulties, each associated with a score. The final ranking considered the overall score totaled by the groups. The purpose of the challenge was not to see who had managed to better acquire the concepts, but rather to increase the self-esteem of the boys and girls. Indeed they were faced with the evidence that all the proposed questions were within their reach, and that before embarking on this path they would not even have tried to solve them.

3.2 Italian

The outcome of the entry texts made at the beginning of the year evidenced that the class had some difficulty in dealing with written texts. In particular, the main problems were arising from choosing and following an outline. In addition, many students had not acquired any method of writing. Therefore, during our experiment, we tried to increase first of all the self-esteem of the students. Then we focused on stimulating interest in writing, in the narrative plot and its development, leaving the issues on the form only to a subsequent moment. The specific objectives on which the work in class was developed were aimed at fostering creative capacity and skills in writing a narrative text. To do this, different types of creative writing techniques have been practiced, such as the "fantastic pair", various role-plays, the description

[2] https://en.wikipedia.org/wiki/Comacchio [Accessed 2021-10-25].

through the five senses, the dramatization of parts of the text. The students then had fun playing with classic texts of literature by rewriting some parts previously read and explained in class by the teacher.

This type of less classical and more playful approach has led the class to develop first the pleasure of reading, and then the curiosity in writing and the development of a narrative plot that is almost never predictable. The writing games were often developed in small groups. During the curricular hours of Italian, the teacher has therefore tried to implement in class the experiences of creative writing structured on the model of the "Grammar of Fantasy" by Rodari [32]. Therefore, we worked on the creation of a narrative text by putting into practice various creative writing techniques suggested by the author, ranging from the creation of a fantastic pair to fantastic hypotheses. We also tried to stimulate the student's imagination and strengthen their self-esteem, trying above all to enhance the error as a very important moment of creation. It was explained to the students that error should not be demonized, but should be seen as a fundamental step in creation. Therefore, as an important and sometimes inevitable moment in order to arrive at the correct solution or dynamic of the action.

We carried out the work in different ways. Generally, the activity opened with a brainstorming session to focus on the important issues on which we decided, from time to time, to work. The various ideas were then developed through group work, in which the creative writing techniques introduced by the teacher were put into practice. The students had fun, from time to time, to produce different types of texts following the proposed methods and inventing new ones. Always motivated by the thought that creativity comes through manual skills in writing and that one cannot write well only with theoretical knowledge: practice is of utmost importance to develop a personal style. Following the advice of the local writer Luigi Dal Cin, the lessons were articulated as follows.

3.2.1 Meeting 1: free play with the fantastic pair

The students, in pairs, carried out the creative writing exercise, trying to let interact with very different characters (e.g.: the teacher and Tarzan) and to develop the story that was taking shape.

3.2.2 Meeting 2: construction of characters and landscape

Students were invited to build fantastic or invented characters starting from careful observation of reality and what happens every day. The students described people, events, real places that struck them and that have remained in their memory. One student, for example, imagined and described the figure of a traveler and the landscape:

> *"... man is like a star that lives by its own light for millions of years, showing its splendor to all, but remaining far away."*
> *"... the landscape outside had changed in a very short time from a thick fog to a blue sky, it seemed to be among the stars, it was surreal and mysterious."*
> *"... the mountains filled with white like an hourglass."*

3.2.3 Meeting 3: "a subway called Moebius"

In order to create a link between the work of mathematics and that of Italian, an entire activity has been dedicated to the Moebius ring. The meeting began with the

short video Wind and Mr. Ug[3], in which a story is constructed that exploits the properties of the Moebius strip. We then moved on to reading and commenting on the science fiction short story "A subway named Moebius" by A. J. Deutsch[4]. The story examines the concept of "node" from a mathematical point of view. After reading, we tried to stimulate the class on the main themes proposed by the story and on the relationship with the shape of the Moebius strip. Subsequently, various exercises were proposed, extracted from the manual in use, on the objective and subjective description of places and characters of everyday life.

3.2.4 Meeting 4: construction of a narrative plot

We proceeded to construct a story that starts from a series of data planned in advance (for example historical period, setting, role of the main character, ...). The students, divided into small groups, had fun making the characters interact, some planned in advance, others created according to the plot that was developing. They came to realize that it is important to start writing even when you do not have full knowledge of the overall plot.

3.2.5 Meeting 5: the importance of the incipit

The class analyzed several incipits of famous short stories or novels of Italian and foreign literature: for example, The Betrothed, by Alessandro Manzoni, science fiction stories, etc. The students were invited to express their opinion on what they considered to be the most interesting incipit and to motivate their preference and then to develop different incipits, experimenting with narrative styles and literary genres.

3.2.6 Meeting 6: storytelling in the first or third person

Several short stories were analyzed in class. The class was then asked to develop creative writing stories in the first and third person. We tried to make the students understand that the narrator is chosen according to the effect that we want to achieve in the reader. In fact, first-person narration is emotionally stronger and more intense at the cost, however, of a certain subjectivity, while third-person narration is more objective but less empathetic.

3.2.7 Meeting 7: the rewriting of literature texts

The students were invited, at first, to analyze some important texts of Italian literature (The Betrothed in particular) and then to rewrite parts of the stories or novels by changing the setting and introducing invented characters and situations.

3.2.8 Meeting 8: proliferation and selection

The stories developed in the first two meetings were resumed and rewritten, according to the criterion of proliferation and selection of settings, situations, and characters in the light of the techniques learned.

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[3] https://www.youtube.com/watch?v=4mdEsouIXGM&t=8s [Accessed 2021-10-25].

[4] https://www.fadedpage.com/showbook.php?pid=20210556 [Accessed 2021-10-25].

3.2.9 Meeting 9: crossover

The plot of the initial story was resumed, developing, setting, and characters also trying to include what was initially discarded.

3.2.10 Meeting 10: reading and evaluation

The different groups were invited to present their work to the class, taking advantage of multimedia presentations that summarized the plot of the different stories, accompanied by images. The presentations also included the sentences that the author and the readers liked the most. The subsequent evaluation was therefore based not only on the written production, but we tried to give an overall assessment of the work done, keeping in mind also the relational aspect.

4. Achievements and conclusions

At the end of the experience, the satisfaction questionnaire has been administered to the students. The outcome is summarized in **Table 1**.

The full satisfaction and enthusiasm in having participated in the experience have emerged also from the free comments. For example the comments of question (1) have been: the project was helpful "because this way you compare what we are doing in class also with a university teacher, and you can hear his opinions", projects like this "help you understand things better", "because it is interesting how he explained mathematics in a different way making the lesson less heavy but useful", "because, with projects like this, you learn to use logic" (motivation repeated several times).

This testifies that the perception by the students about their personal skills in the disciplines of Italian and mathematics during the experience is considerably high compared to the perception they have during standard curricular lessons.

In addition, in the parallel test of mathematics that involved all the first classes of the Institute, concluding and summarizing the ministerial program carried out during

Question	Very positive	Mild	Very negative
	(%)	(%)	(%)
(1) Would you be interested in continuing the project the following year?	95	5	0
(2) From a mathematical point of view, do you think projects like this are important in curricular time?	89	11	0
(3) Through the proposed activities, has your interest in mathematics increased?	16	52	22
(4) Do you think the project was important for the development of your logical-solving skills?	84	16	0
(5) Have you encountered particular difficulties in solving the proposed questions?	0	16	84
(6) If you had to self-evaluate your work during the project, what would be your opinion?	16	84	0

Table 1.
Percentage answers to the satisfaction questionnaire.

the school year, students have reported the following results: 20% scored between 6 and 7 over 10, 70% scored between 7.5 and 9, 10% scored higher, placing themselves in the range of excellence of the school. Note how the average score for the institute is between 6 and 7, on a scale ranging from 0 to 10. Moreover, the fact that none of the students were rated insufficient, shows that the interdisciplinary course of creativity and intuition was also useful as an activity to reinforce self-esteem, to make up for deficiencies, and to strengthen the logical-solving skills of students who initially had a negative rating.

In Italian, the criticalities highlighted by the entry test have dissolved. The result of the parallel tests at the end of the year was very positive: the average score was between 8 and 9 and only one student was slightly insufficient. It should be noted that in the other classes of the institute the incidence of insufficient evaluations was greater than 50%. A special note must be done considering the students with special needs present in the class. The proposed activities have been revealed to be very inclusive. The two students have been constantly engaged and participated with great satisfaction and with excellent results.

In conclusion, although the experience was limited to one class and only 20 curricular hours, we can say that the enhancement of creative and "manual" aspects proposed in the project has given encouraging results. Indeed the subsequent year, in the same class a second advanced edition has been proposed, as described in [33, 34] maintaining the same playful approach. Moreover, the same activities have been proposed to the new first-year classes in the following years.

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