

SCIENCE AT THEATRE

handbook

TABLE OF CONTENTS

INTRODUCTION	3
HANDBOOK STRUCTURE: GUIDELINES TO ITS USE	3
SECTION 1 - THEORETICAL AND METHODOLOGICAL ASPECTS	5
1. SAT: SCIENCE AT THEATRE	5
1.1 An Overview of SAT methodology	5
1.2 The goals of SAT method	6
1.3 The design of a "SAT lesson"	8
1.4 The mindset of the facilitator	9
1.5 The art of narrating	11
2. TEACHING SCIENCE	12
2.1 Goals of teaching Science	12
2.2 A comparison of teaching methodologies	13
3. THEATRE IN SCIENCE DIDACTICS: OPPORTUNITIES AND CRITICALITIES	19
3.1 The writing of a script	19
3.2 Different levels of theatrical representation	24
3.3 How to make a story out of science	24
3.4 How to develop the story	25
3.5 Writing the script	25
4. THE THEATRICAL WORKSHOP: SPECIFICITIES OF THE WORK WITH/FOR THE YOUNG	24
4.1 The working context: organisation/management of the workshop setting	24
4.2 The workshop methodology	26
SECTION 2 - FROM THEORY TO PRACTICE	34
Foreword	34
5. PROMOTING TRAINEES' PARTICIPATION: HOW CREATE THE "CONFORT ZONE"	35
5.1 Preparatory training sessions: the process in 5 meetings	35
6. SCIENCE-THEATRE EVENTS: THE IMPLEMENTING PROCESS	51
6.1 Constraints and resources.	55
6.2 The process: a list of hints	57

INTRODUCTION

Science At Theatre (SAT) is a Transfer of Innovation project approved within the Lifelong Learning Programme (LLP) - sub-programme Leonardo Da Vinci - implemented during 2013-2015.

It fosters a didactic methodology based on the transfer of the Science contents contained in the compulsory education curriculum through the application of drama techniques.

The method has been developed by the Department of Physics of the University of Rome "Tor Vergata" and the Cultural Association "Il Globetto" and is the result of a long-standing experience (more than ten years) in producing, organizing and divulgating "Science performances" addressed to lower secondary students.

During the implementation process, the SAT methodology has been transferred in Italy, Greece, Turkey, Latvia and The Netherlands to partnership members.

Direct beneficiaries of the transfer activities realised were mainly secondary school teachers and students.

HANDBOOK STRUCTURE: GUIDELINES TO ITS USE

This handbook was reviewed during the implementation of Science At Theatre (SAT) project, in cooperation with all partnership members.

The overall methodology we present here is the result of a transnational work aimed at integrating two good practices:

- a didactic path to teach Science contents, as contained in the compulsory education curriculum, through the application of drama techniques. This was developed by the Department of Physics of the University of Rome "Tor Vergata" and the Cultural Association "Il Globetto" - the result of more than ten years experience in producing, organizing and divulgating "Science performances" addressed to lower secondary students;
- a training-education process based on the principles and techniques of drama writing, developed by the Italian social cooperative "Moiselle Le Blanc". Between 2009 and 2014, this method was transferred - within two transnational projects¹ - in Italy, Romania, Greece, Germany and The Netherlands, addressing teachers, educators, trainers and socio-cultural practitioners working with young people at risk of social or occupational exclusion within interventions coping with early school leaving.

¹ "Writing Theatre (2009-2011) and Writing Theatre at School (2012-2014), both approved within the LifeLongLearning Programme (LLP) - sub-programme Leonardo Da Vinci - Transfer of Innovation projects. On June 2012, Writing Theatre project was invited to participate - as a LLP good practice - at the Inclusion Conference 'Lifelong Learning for All', held in Birmingham - UK. info at: www.wrtingtheatre.eu

The Handbook is divided in **two main sections**:

Section 1 Includes 4 chapters and illustrates theoretical and methodological aspects.

Chapter 1 Introduces the general aspects of the SAT methodology.

Chapter 2 Focuses on the importance of teaching/learning scientific knowledge through direct experience, analysing the difficulties encountered by students of different schooling levels.

Chapter 3 Presents the principles on which drama writing is based.

Chapter 4 Analyses the methodology of the theatrical workshop.

Section 2 "From theory to practice" is articulated in two Chapters and provides practical examples for the realisation of training workshops aimed at the creation and development of Science - Theatre events.

Chapter 5 Provides a format of 5 meetings focused on basic activities - typical of drama workshops - that are preparatory to the phase of conceiving, writing and realising a Science -Theatre performance.

Chapter 6 Illustrates the creation process of a Science-Theatre event, where scientific contents and drama techniques are integrated.

SECTION 1 - THEORETICAL AND METHODOLOGICAL ASPECTS

1. SAT: SCIENCE AT THEATRE

1.1 AN OVERVIEW OF SAT METHODOLOGY

Science can be a fun and fascinating game. SAT methodology has been structured to propose a teaching and learning process aimed at stimulating the young's interest towards Science and scientific contents and the use of creative skills. Developing events based on the connection of theatrical techniques with scientific experiments represents a learning/teaching experience different from the traditional one - generally based on the top-down transfer of notions - and focuses on interactivity and cooperation.

Results of the application of this methodology can be recapped as follows:

- fine-tuning of the teaching of scientific subjects;
- increasing of young people's/students' interest in learning scientific contents and notions, even the most complex ones;
- strengthening of young people's/students' motivation to work in group and of the integration/inclusion of young people/students with behavioural problems and/or disadvantages;
- outline of an innovative profile of educator/trainer-facilitator;
- promotion of cooperation networks of education/training bodies/organizations (both public and private) working in the same territory/area;
- fostering the increase of young enrolling in Science Faculties.

One of the strengths of the SAT model is the ability to directly involve all the participants and beneficiaries of the lesson, changing contents, methodology and linguistic register in connection with the students' level of education. The age range between 7 and 10 years old is the easiest to engage, but it is essential to set up a simple dialectic, thus transforming an abstract concept into a story, a play or a practical example, bearing in mind the importance of using scientific language when necessary.

Being aware that Chemistry, Physics and Mathematics are often considered boring and difficult subjects, only intended for a few talented students, our lessons are structured in such a way that all students can participate and be involved in the many experiments each lesson is made up of.

Our aim is not merely to turn sciences that are often labelled as hard and complex into a playfield full of charm yet devoid of content, but to lead the teaching of these subjects into a different world, the experimental one. Learning and memory are enhanced by their association with emotional activity. All of us remember more easily when our emotions are involved, whatever these emotions are: excitement, curiosity, suspense or anger. In addition, memories associated with positive emotions have been proved to be easier to recall and organize in a clear and accurate way. The success and value of our initiative lies in having found a discerning method that presents Science in a way which always involves the whole classroom and not just the best and most gifted students.

1.1.1 The capturing and the management of attention

The attention span of a student increases with age: yet, between 11 and 14 years old, students also tend to become less willing to get involved into such an experience and to become protagonists in it. The professionals who intend to use our methodology must know some useful tricks to catch and hold the attention of the entire audience. A basic device, which determines one of the main features of the SAT method, is to use in each lesson a theatrical vocabulary that includes jokes, games and improvisation. This simple formula facilitates the transfer of concepts and definitions and fosters debates and reasoning inside the work team.

1.1.2 Dramatization

The dramatization of our lessons and texts is a key point for the implementation of our model. Theatre is big: this definition applies not only to the props, whether they are machines or scenery, but also to the gestures of the actors themselves. Movements should be wide and broad and well emphasized, so as to be clear and theatrical. When we denote something, our whole arm should move; when we mimic a movement or an action, it must be visible to every member of the audience. In our lessons we transform a laboratory into a real stage using colourful scenes, tables full of instruments and props. The instruments are the first that need to be *theatrical in size, so a bottle of water becomes a 5-liter tank!*

When we cannot build or equip ourselves with instruments of such size, we use a camera, which projects live on a big screen the details of what is happening, or we take advantage of photos, diagrams, presentations and videos. All these precautions allow the entire audience to take delight in the lesson and transform a simple experiment into a great show.

1.2 THE GOALS OF THE SAT METHOD

1.2.1 Science as solution of enigmas

The typical cognitive process of a child is grounded on curiosity: first the child learns through experience, and then he/she starts reasoning on the experience made. The SAT didactic approach can be defined as "the workshop of curiosities", where the young are encouraged to discover the world around them, through scientific experiments and games. Consistently with other known approaches (as, for example: IBSE - Inquiry Based Science Education; "Science for Children" of Harold Kroto; the "Hands-On" programme created by Leon Lederman; etc.) the education path we propose - definable through the formula "the game of the scientific theatre" - is based on the following pedagogical principles:

playful-theatrical approach: trainees are directly involved in the lesson, turning themselves into "actors of scientific knowledge" by means of the dramatization of scientific themes and topics.;

experimental methodology and interactive counselling: the trainees' reasoning is being fostered through the application of the "learning by doing" approach, supported by theatre performance and use of lab equipments;

cooperation criteria: trainees are directly involved in the creation and conceiving of theatre performances through which they explain scientific phenomena. In this process they share information and ideas and cooperate in the shaping of a "collective know how".

In this frame, the main goals of the SAT approach are the following.

1st. To make trainees understand the concept of "accuracy" implied by Science itself: the charm, appeal and beauty of Science lie in its precision.

One of the most engaging experiments is the one about the mixing of polar and non polar liquids (liquids that can or cannot be combined with water). Before starting the experiment, students are told to work in pairs and simultaneously, since we want to show them that a scientific experiment must always be reproducible: if someone living in Rome makes an experiment and obtains certain results, the same results have to be obtained by a person living in Riga, if he/she makes exactly the same experiment.

2nd. Personal and common learning

Whatever topic, theme, lesson, experiment or game the facilitator is approaching, it is important to involve and help each trainee and the whole group to "understand". If they do not know the answer to a specific question, if they have not grasped a concept, the facilitator has the task to lead each student and the entire group in finding the solution, using each one's abilities. For example, if it is necessary, the facilitator will have to repeat the experiment again and again, or stimulate trainees in making logical associations, etc.

3rd. Everybody must feel at ease

The atmosphere is important: the more relaxed it is, the better it is for everybody (facilitator included!). Trainees will be more inclined to pay attention and understand; the facilitator will be more efficient in making the group work and achieve "learning outcomes". But what are the main elements to consider so that the group feel comfortable? First of all, compared to traditional education, the facilitator benefits from the fact that no grades or marking are foreseen. He/she must respect everybody: it means that he/she must be able to involve - at the same level - all trainees, even the ones with specific problems and difficulties. Furthermore, he/she must incentivize the exchange of opinions between trainees: challenge and competition are positive feelings and attitudes if correctly managed and educated. The facilitator has to make trainees understand that everything that happens in the workshop, the work and the results of each one represent an opportunity for the group to learn something. That is why "games" are important and "playing" is important. It is advisable also to reward trainees with "gadgets" (that must be consistent with the work that trainees are doing).

4th. Take advantage of previous knowledge and informal reasoning of participants

The understanding of the world around us depends on knowledge. This knowledge is partly instinctive and partly influenced by one's own socio-cultural background. Informal reasoning, unlike formal reasoning, takes into account all the implicit elements of a problem or of an experimental situation. The use of both these aspects allows the full involvement of a young person, everything he/she knows and is able to do: the trainee learns and understands that his/her "reasoning modality" can be of support to make and understand scientific contents; he/she learns that the conceptions he/she holds about reality can naturally evolve and turn into scientific concepts. This is possible when one rationally looks for an answer to the questions arising during the experimental phase. Science is not far from our daily life!

1.2.2 Maieutics and the scientific method: a collaborative construction of knowledge

The most practical way to assimilate a concept is to make students deduce and express it, starting from the observation of a phenomenon and then guiding them with questions, conveniently directing the dialogue: an application of the Socratic *maieutic* method.

Often, talking about science, especially Mathematics and Physics, a common mistake is to fall into abstract formulas and data, which only have mnemonic value for young people/students/trainees. Nevertheless, while noting the importance of formulas and definitions in Science, we have developed a set of methods aimed at reversing the conventional teaching process. We reverse the order of abstract concept and its practical application, so that one no longer has a formula or a theorem to be proved but a phenomenon from which you extrapolate a law. Understanding the goals and the tasks of scientific matters is one of the first moments in which students are involved. Merely stating a definition or a law, which will often be ambiguous for someone who hears it for the first time, may prove fruitless. The matter we are facing is not defined only by the use of words of known meaning, but also by an example which allows trainees to clarify in a certain and very practical way what we are focusing on. Trainees are carefully guided, through a series of appropriate questions, to the logical deduction of the reasons at the base of the observed system.

The aim is to bring students to fully immerse themselves in the process of discovery, till they forget that the phenomenon observed has already been explained and demonstrated: it is the enthusiasm of the whole group that leads each single student to assimilate the information in a deeper way, without rote memorizing.

1.3 THE DESIGN OF A "SAT LESSON"

Please be accurate in planning your lesson-event. The design of a lesson starts from the selection of a theme that must be consistent with the education curriculum followed by the students. Once the topic has been chosen, it must be studied taking into account different points of view (i.e. scientific, environmental, historical and mythological) if that is the case. Then, the facilitator/educator/teacher selects experiments that are useful to make trainees understand notions strictly linked to the chosen topic, following two main criteria: they must be suitable for the students' level of knowledge and they must be suitable for dramatization (this means they must be "intriguing", so as to show the scientific phenomenon being analysed in a surprising and spectacular way).

If possible, create a story around the experiment, so as to capture the student's curiosity and attention. Please remember that the goal is to help trainees to more easily understand the scientific notion you want to "hand over", so, do simple things: your "audience" must clearly understand what is happening (during the experiment), what is the problem/query that is being addressed so as to contribute to the inference of the solution/answer. Also remember that the experiment must be understandable by everybody, not only by the more capable students!

The experiment must be visible to everybody so, if necessary, use a projector to show it on a screen. If possible, use everything you can to make your lesson spectacular, as if you were on a stage: costumes, lights, music, etc.

The rhythm of the lesson is very important: trainees must pay attention from the beginning to the end, so, it is advisable - in the planning phase - to write the "script" of the lesson paying attention to all details.

Also the involvement and active participation of the audience (trainees) is important, that is why it is advisable to foresee in the script the making of questions and games addressed to trainees themselves.

The guidelines necessary to develop an innovative and efficiently dramatized lesson:

1. Identification of the topic;
2. Identification of the experiments which have to illustrate the scientific topic; they will be chosen in relation to comprehensibility, feasibility and showmanship;
3. Writing a script: the “scriptwriter” must possess or acquire skills and flexibility in Science and Education;
4. Creation of a set design and of multimedia supports which attract and involve the audience;
5. Choice of the proper facilitators who will:
 - learn how to relate within a workgroup;
 - overcome trainees' psychological obstacles: inhibitions, fears, uncertainties, shame;
 - gain self-control and self-confidence;
 - give vent to their creativity;
 - increase the sense of responsibility towards the working group and the final result to be obtained;
 - have a scientific and/or theatrical professional qualification.

1.4 THE MINDSET OF THE FACILITATOR

According to Maria Montessori:

“the study of the conditions necessary for the development of spontaneous activities of the individual, is the art of inspiring joy and enthusiasm for the job. The stress of work, the study of learning is the result of the interest and nothing can be assimilated without effort (...). But effort is the bringing into action of the individual's entire energy, and this happens only where interest is felt (...). An educator who succeeds in evoking interest – interest leading to choice of some action and the carrying out of it with the whole energy of the chooser, all his constructive enthusiasm – such an educator has awakened a man to life”. (M. Montessori, “Introduction” to *Psychogeometry*)

Whether you work with a particularly frantic class or with an extremely passive one, be these Primary, Secondary Low or High School students, one of the key points for a successful lesson is to forget all that is obvious to us.

The facilitators need to be the first who have to wonder about what they are going to show students.

Enthusiasm is contagious and if the very teacher is not surprised and does not add emotions to what he/she wants to convey, even students will just acknowledge a simple sterile fact: the rainbow becomes only a sequence of shades of red, green and blue.

These lessons are not always easy to be kept; often we are presented with challenging classes with which it is difficult to properly interact. The facilitator's surrender should not be an option.

Also in this case there are some expedients useful to manage an audience, a class, or even a single problematic fellow.

Each group has its own leader, to recognize him/her is one of the key points for the best performance of a lesson.

The simplest solution is to transfer popularity and power from the “heckler” to the facilitator who holds the lesson; the positive outcome of this process involves the recognition of a new leader figure. The risk of this method is to exclude and isolate the heckler, so this must be absolutely avoided except in extreme cases. However, the best option is the simplest one: to be able to involve the “problematic” member; in this way all other students will lose their fear of exposure and will be able to benefit from the lesson in the way it has been conceived.

All teachers/trainers/educators know that, in a group of students, when they ask a question there will be the usual two or three persons who will answer.

Even here we have subverted the classical order, avoiding “punishing” a lack of knowledge and at the same time trying to reward the preparation of the student. We help each student with calm and logic, even the least gifted, to succeed in deducting a concept or a definition. Prizes are a great incentive to ensure that the group is involved: we are not talking about the formulation of a mark: rather we offer something concrete as, for example, a poster of the periodic table of the elements, transformed into a big colourful cartoon.

The facilitator must be able to create a working environment which constantly feeds the already deep-rooted interest in the young.

A prerequisite for the optimal success of teaching is in fact to bet on the spontaneous interest of the young, on their natural impulse to act and learn. If placed in a suitable environment, according to their own personal development path, students kindle an interest in learning, working, building, carrying out the activities started, testing their strength, measuring and controlling it.

Whoever is embarking on the road of playful learning in Science should know how important words are.

Language is a factor which must be given great care: beginning with the drafting of the script, as well as in the testing stages, we proceed with the understanding that the communication intentions have to be clear, arouse curiosity and interest, and above all must give the correct scientific information so that the audience is aware of it in a complete and exhaustive way. How do you explain simply things which are complex? How do you universalize the rule of Albert Einstein: “If I can explain it to my barber then it means that I have understood it too”?

Concrete experience, imagination, and the search for simple explanations of natural phenomena, become essential tools to understand, broaden knowledge, create curiosity. All this should not prevent the operator from maintaining a scientific rigor which guarantees the cultural and the educational value of the operation.

1.5 THE ART OF NARRATING

The art of storytelling has always been an essential component of human nature: stories, metaphors, myths and legends have been used since ancient times as a means of communication and teaching, to convey information and knowledge. Ancient storytellers, in transmitting their wisdom so that others could learn it and benefit from it, had to make sure that the lesson would have been learned and understood by those who listened to it. To meet this need, narrators discovered that the best way to emphasize information, and at the same time help its recall, was to create in the audience’s minds fantastic and vivid images into which

information was woven. By dressing up Science with a light touch of drama or play, we can convey knowledge with a new and interactive formula: through a series of experiments and multimedia supports, students will get acquainted with terms, laws and instruments while having fun, and thus awakening their curiosity about the world, about the forces which govern it and the elements it is made of. Of course, not all the participants will follow on to become scientists, but it is proved that a good number of them will continue to cultivate the love for science, once they will consider it not a sterile academic subject but a means to better understand the physical reality in which they live. SAT methodology focuses on the testing and understanding of physical phenomena, through a “scientific” gym aimed at developing personal cognitive and creative abilities.

We are what we know. This is SAT.

Key points of SAT model:

1. *The involvement of all participants with strategies to get attention.*
2. *The transformation of abstract concepts into stories, games, practical examples.*
3. *The execution of many experiments aimed at:*
 - a. involving the participants;
 - b. stimulating sensory impressions;
 - c. using these sensory impressions as a starting point to:
 - i. build definitions;
 - ii. formulate hypotheses (to stimulate creativity and the spirit of observation);
 - iii. start a logical deduction;
 - iv. check the deductions made when starting from the hypotheses.
4. *The implementation of a theatrical dimension, through the use of a media and multimedia stage, with experimental demonstrations designed for the purpose.*
5. *The facilitators:*
 - a. know and use the language of drama;
 - b. are familiar with the subjects to be transferred to the students;
 - c. know how to use scene tools, whether they be experiments or otherwise;
 - d. know how to remove young people's resistances and how to manage the group;
 - e. know how to obtain and regulate attention, properly managing peaks and relaxation moments;
 - f. know how to use the Socratic and the scientific method; they should repudiate “ready” notions, encourage participants to construct concepts and deduce from experimental observation.

2. TEACHING SCIENCE

In this chapter we will analyse the importance of scientific knowledge and of learning science through direct experience. We will analyse the inherent difficulties in transmitting science and we will discuss some of the difficulties encountered by students at different stages of their schooling.

2.1. GOALS OF TEACHING SCIENCE

2.1.1 *The necessity of promoting science*

The PISA (Programme for International Student Assessment) is a project of the OECD (Organization for Economic Cooperation and Development) that aims to assess 15-year-old students of all member states in three areas: reading, mathematics and science. The assessment is carried out every three years and the comparison with previous tests, in the eyes of the Organization, is a means to evaluate the efficacy of each country's education policies. One of the official goals of the member states is to reach, by 2020, a percentage of 15% or less of students with a "low achievement" in the three areas.

In 2012 the European Commission published a document (EU2012) discussing the results of EU countries in the 2012 test as compared to the same countries in the 2009 test. The results showed that for mathematics there was a significant lag in the progress towards the expected goal, while reading and science were more in line with what was needed to reach the 2020 goal. It was also pointed out that overall progress was nonetheless slow and there were strong disparities between different members of the Union. Stress was put on how results of the 15-year-olds were strongly influenced by their socio-economic conditions, the fact they were first- or second-generation immigrants and the positive effect of early schooling. The vast disparity between countries of the Union, as well as the disparity between different parts of the same country in many member states reveals the necessity of a more structured and organic approach to teaching, particularly in the field we are interested in: science.

As an example, in Italy, where the SAT project originated, there is a common deficit of scientific knowledge, so much so that media frequently use the expression "scientific illiteracy in Italy". This situation leads to a general estrangement from scientific issues, to the point that when choices (typically: policies) arise on themes that are related to science common reactions are lack of interest, uncritical support of extremist positions or credulity towards pseudo-scientific ideas.

The methodology of science is capable of developing in people the capacity to solve problems, to conjecture solutions and to find the best one, evaluating them all through logic reasoning, experience and the search for inner contradictions; it develops the refusal of uncritical acceptance of an idea (especially the authority principle) and the understanding and, if possible, the quantification of the uncertainty that is tied to a solution. This methodology, this *forma mentis*, is often not understood by people in general and is consequently not used, despite its fundamental importance even in many areas that are not strictly scientific, but are overall tied to the furthering of knowledge and the bettering of life in a community.

It is thus necessary to face the problem of how to improve the situation, of how to integrate the teaching of science as it is done in school with other initiatives that are typically presented as extra-curricular activities. In this purview many methodologies have been explored, even unconventional ones, examining their efficacy and adapting them according to the results.

2.1.2 The importance of experiments in the natural sciences

Modern science (which is conventionally made to start with Galileo) rests on the concept of *experiment*, on its repeatability and on its universality. Experimental setups are carefully designed so as to discriminate between different hypothesis on the way nature works: the experiment (or, generally speaking, a series of experiments) will give the possibility of choosing univocally the correct interpretation of the workings of a natural phenomenon, and it will be the same for any man in any part of the world (*repeatability*); it will manifest as a measure, and the language with which a certain phenomenon is described and analysed is that of *mathematics* and/or *geometry*; most importantly, the experiment will give as a result its *degree of uncertainty*, a measure of how much the information is precise and, conversely, of how much still remains unknown.

If natural science (that which attempts to describe the physical world) is then experimental by definition, the experience of executing an experiment must be at the centre of its teaching. As we will see in the next section, the possibility of learning through an experiment reflects onto the single pupils what has been the historic journey of the scientific process: students often have pre-existing ideas on how the world works, ideas that are not necessarily fully correct. Presenting them with experiments that demonstrate certain physical or chemical laws allows them to live the same experience the original discoverers did: to experience in person, hands-on, how nature really behaves. This helps them to eliminate possible incorrect or incomplete ideas they might have had, substituting or integrating them with the correct ideas. But unlike a frontal lesson, their learning will not be passive, but active: they themselves become the "discoverers" of the phenomenon they are studying and the concept they have learned is necessarily impressed more deeply in them.

Moreover the experience of the scientific method represents a fundamental component of the baggage of knowledge that we wish to transmit to students: whatever the subject or subjects they will choose to study and whatever their future profession, the experience of scientific reasoning and of researching through "reasoned experiments" (in Galileo's words) become a fundamental element of maturity and a powerful tool available to the young citizen.

2.2. A COMPARISON OF TEACHING METHODOLOGIES

We have spoken about how important it is, even culturally, to transmit scientific knowledge and of the importance of experiments, both conceptually (science is based on experimental verification) and didactically (laboratory experience allows pupils to "touch with their own hands", to verify in a real situation the theories they have learned and to observe the difficulties and errors that are always involved in a real measurement). But even if this idea of transmitting science in a complete way is taken for granted, the problem arises of *how* to transmit it. In this section we intend to briefly touch on some results of research in the field of teaching in general and of the teaching of science in particular: these results, that are the fruit of research dating back to the first decades of the last century, have raised awareness on the necessity to revise or integrate many methodologies that are still at the base of how science is taught in schools.

2.2.1. Comparing traditional teaching and constructivism

In the third chapter of her book (*Difficulties with mathematics*, Zan, 2007), Rosetta Zan highlights how traditional teaching is based on a "model of learning according to which it is possible to simply transfer knowledge from one subject (the teacher) to another (the pupil)". In this context the only question is how best to effect this transfer. The role of communication, which is primary, is often underestimated, implicitly confiding in the capacity of language to completely transmit the information: especially in the field of the sciences, which are thought to have, by definition, a formal language that is well-structured, rigorous and free of ambiguities. In this context there are no problems in explaining the subject: the pupil is a container into which information is siphoned. Any "error" in the siphoning will be due only to the deficiencies of the pupil (insufficient commitment, inability, etc.) or to insufficient explanations, the remedy to which is to repeat or integrate the explanation, but always within the same framework (Figure 2-1).



Figure 2-1: the concept of traditional learning

Zan, on the other hand, reports many of the studies that, in recent decades, have completely revised this model of learning, especially those of Gardner on teaching mathematics. What emerges is an approach to learning that has been dubbed *constructivism*: far from being empty containers, pupils (and human beings in general) are active subjects that *construct* or *build* and interpretation of the reality that surrounds them, creating relations, rules and interpretations. Already at the age of five or six, children have developed proper theories about three aspects of reality: matter (objects), life (living beings) and mind (human beings) (Gardner, 1991). They use these theories to interpret reality and they build them by comparing their experiences, making hypothesis and constructing theories that tie these experiences together and explain them. Often, at this age, conflicting and contradictory theories can coexist, and children do not perceive they are contradictory because they pertain to different areas (one way of reasoning on one subject is not in conflict with an opposite way of reasoning on a different subject: in technical terms we say that the *context* and *scope* direct the mode of reasoning).

Knowledge is thus *constructed*, as years pass, through the constant comparison with reality, searching for interpretations and theories that can explain the world we confront ourselves with: and this process starts in early infancy.

The natural consequence of this is that when teaching we are not faced by an empty container that must be filled, but by a thinking human being who already possesses a precise set of theories, knowledge and mental processes that can potentially be in conflict with the knowledge we, as teacher, want to impart; and this, we must stress, is true even at a very early age.

If we are not aware of the array of previous knowledge of the pupil, we risk either not being able to impart the knowledge or to impart it superficially: the pupil will learn passively the "rules" and the "notions" of our subject, but will not make his own the cultural whole, the "way of thinking" that is the main asset and result of the study of scientific subjects.

An extra drawback is also the fact that in many school tests and exams the attention is focused more on the result rather than on the procedure used to obtain it.

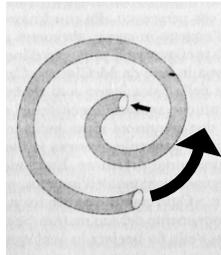


Figure 2-2: the answer given by 30% of the people interviewed to a test by McCloskey on the trajectory of a ball when exiting a spiral tube.

On this subject there are the extremely interesting results of a series of tests by McCloskey (1983), as reported by Schoenfield (1985), on notions of physics. In one of these tests the subjects were asked to draw the trajectory of a ball pushed with a strong force into a spiral-shaped tube on its exit: 30% of the subjects drew results like that shown in Figure 2-2. The most surprising fact is that half of these had followed courses in physics! Schoenfield comments that probably the results would have been different if the problem had been given in the typical context of a physics problem (with start and end velocities, coordinates, etc.): the "traditional" context of a "physics test" would have "re-activated", at least in subjects who had followed physics courses, the concepts they had studied when studying dynamics and they would have then used them. But this underscored that the learning process of these subjects had not acted sufficiently deeply to prompt a reorganisation and restructuring of basic notions of dynamics.

Other studies have confirmed how the same problems, of mathematics or physics, when given in different contexts activate different interpretations, some "scientific" and others "non-scientific".

Thus, modern authors' scepticism towards the idea that our patterns of thinking can be reduced to the knowledge of a certain number of rules of logic and notions, whose possession is sufficient to naturally proceed in a certain way to solve a scientific problem, is well justified. Gardner (ibidem), in particular, writes that "in almost all students there is the "unschooled" mind of a five-year-old child that is fighting to emerge and express itself".

The natural consequence of this approach is that the teaching of science must set aside time to give the opportunity to students to construct or re-construct their own theories. As a consequence all those activities that help students discover reality through their own personal experience are fundamental, as they give them the possibility to build new concepts and new knowledge.

2.2.2. Scientific misconceptions and methods to overcome them

Basing themselves on the constructivist theory outlined in the previous section, many authors speak of "misconceptions", or alternatively of "pre-conceptions" or "alternative conceptions". These are all those theories that are pre-existent at the moment of learning a certain subject in school, and they are the result of organising and using various daily experiences. They are often called "ingenuous theories" because although they have a certain internal coherence, they are not immune from internal contradictions and their validity is limited to the more common daily experiences.

To overcome misconceptions it is necessary first and foremost that they be known. Some misconceptions are known to be particularly widespread. Let us think of the idea that "a heavier object falls faster than a lighter one": although the first proofs of the contrary can be dated back to Galileo, it is still a fairly common idea!

Thus the first step of an educator is to identify what the most common misconceptions are among his students. The second is to develop strategies that allow the students to "experience" counter-examples that bring them to question their misconceptions. These experiences must tackle a precise scientific phenomenon (a precise aspect of chemistry, physics, etc.) and must allow the student to gather experience and reason autonomously on it. The ideal case would be that of experiences in which the students (maybe in small groups) can face a scientific problem and be free to explore it to find solutions, maybe wrong at first, but that they can check until they reach the right conclusions.

The teacher in this way becomes a guide in a problem-solving and learning process that, as it is made by the student himself and is not imposed on him from above, becomes part of his deeper knowledge and not simply a superficial layer that covers deeply embedded misconceptions.

Such an experience is obviously hindered by the strictly regulated schedule of schools: even normal laboratory experiences are inevitably a reduced part of the curricula of subjects like chemistry and physics; how greater is then the problem of trying to introduce a laboratory experience that should be organised as a "free problem" with a vast amount of time available to explore possible solutions.

So it is fundamental to use to the utmost any curricular and extra-curricular opportunity to give students the opportunity to engage in studying sciences in a hands-on, and not simply notion-imparting, way. All possibilities of making laboratory experiences, of any type, should be encouraged to allow that exercise of the "practice" of science that is essential for a correct transmission not only of notions but of the *forma mentis* that is proper to it.

2.2.3. The challenges of scientific teaching towards primary, lower secondary and upper secondary school students

It is fairly obvious that students of different ages require different approaches when teaching science to them. We will discuss difficulties encountered in the three orders of the Italian school system: primary school ("elementary", 6- to 10-year-olds), lower secondary ("medium"; 11- to 13-year-olds) and upper secondary ("superior", 14- to 18-year-olds).

In elementary school science is taught as a general subject, without dividing it into specific subjects as happens later on in the other orders. At this age the attention of a child is very different from that of an adult: it is thus necessary to stimulate a child's curiosity, which is very strong, so as to draw him towards

learning the subject. This age is also of fundamental importance because, as we indicated previously, it is when the first conceptions and theories about how nature works are formed (and have, indeed, already been partly formed). The elementary school thus represents a priceless opportunity to give pupils who are at the beginning of their journey of learning a tangible experience of how nature works; it means giving them the opportunity of making it a part of their deep-rooted set of knowledge; it means allowing them, in other words, to "build knowledge" with solid bricks and to make it deeply their own. Experiencing shows dedicated to science and having the opportunity of making simple laboratory experiments can therefore be powerful instruments to support teaching in class.

The difficulties are evident too: if, as we will see, schools often lack the funds to maintain science laboratories in the secondary school, where they should be compulsory due to the curriculum, it is obviously unthinkable that primary school structures might have them. On the other hand, the nature of the experiences that can be offered to elementary school pupils should be close to their daily experiences, and not require complicated setups: the simple observation of how bodies fall, how a seed buds, or chemical and physical properties of matter. It is paramount to use all possible opportunities to expose children to the possibility of *experimenting* nature.

The attentive tutor who wishes to involve children of this age group in active science experiences will immediately notice an important problem: the experiments, especially those typically done in a "laboratory" environment, risk appearing like "magic". This risk is obviously higher for smaller children (like those of primary school), but it is a risk that must be run because the attention and curiosity of smaller children *must* be stimulated and scientific experience *must* as a consequence have a wonderful aspect to it. It will be the teacher's difficult job to choose and conduct the experience so that the scientific idea behind it is highlighted, along with what can be learned from it, but at the same time maintaining the sense of wonder tied to it: after all, don't we want to communicate that science *is* beautiful and that nature *is* wonderful, as wonderful as studying it is?

Extra-curricular opportunities of laboratory activities or of generic scientific experiences (among which a themed outing, or the experience of a SAT laboratory) are opportunities that must be taken to get students closer to the practice of science; furthermore, it is fundamental, in this phase, to underscore in every moment *why* things happen in a certain way.

During the three years of lower secondary (medium) school boys and girls have the possibility of accessing the first mathematical and geometrical tools with which they can analyse observed phenomena. Teaching of science remains general (there are no distinct courses) but there is a distinction with the Technology course, which is more centred on practical applications of science.

At this age, many of the spontaneous ideas on "how the world works" have crystallised, and it becomes paramount to activate processes to make them evolve. This is another moment when practical experience can positively impact on transmitting to pupils the "reality" of nature. The scheduling difficulties in finding the time to perform these activities remain.

In the upper secondary school the different areas of science (biology, chemistry, physics) are introduced separately and more organically. How this is done depends on the programme of the chosen secondary school. The mathematics on the curricula (which in some cases arrive to the point of including the field of calculus) do not always proceed organically with what would be necessary to introduce certain concepts; this is normal: it is unrealistic to expect that differential calculus be introduced as early as the first or second year, when it would theoretically be needed to study kinematics! Moreover, while many schools offering programmes with a "scientific" or "technological" specification (especially so-called "technical" and "professional" institutes) often have adequately equipped spaces to allow students laboratory experiences, this is not always the case with other programmes, where science plays an apparently fundamental role, but remains confined to the teaching of theory, with occasional practical demonstrations: in too many schools the science laboratory (physics/chemistry/biology) is run thanks to the good will of the respective teachers, in the absence of a dedicated technician and with minimal budgets, if it is not outright absent or in decay. If at this level of study it is fundamental to fully introduce the concept of experimental science (and consequently the laboratory experience is also paramount) it is also fundamental that the student have a full understanding of why things happen.

It is thus important that the experiences performed during the year have the following characteristics:

- they must be *important*, in the sense that they must give information on the main topics of the course programme and on the development of a certain topic;
- they must be *structured*, i.e. they must guide the student logically through the understanding of the subject being studied;
- they must be *clear*, i.e. they must give the student the possibility of understanding which part of reality they are explaining the workings of, and how this is being done;
- they must be *attractive*, because they must entice the student to experience them.

Any activity (laboratory, SAT, etc.) must be conceived with the goal of involving the student in the discovery process: the upper secondary school is a great opportunity for boys and girls to build their own scientific knowledge basing it on discovery and observation of the real world, and not on pre-existent misconceptions or on concepts coming from above in a way that is uncritical and purely theoretical so that these concepts, in the end, only remain on the surface of students' knowledge.

3. THEATRE IN SCIENCE DIDACTICS: OPPORTUNITIES AND CRITICALITIES

3.1 THE WRITING OF A SCRIPT

To write for theatre implies to have a good knowledge of theatre itself, since even if it shares common principles with other writing typologies, it is necessary to keep in mind that theatre Authors write for a tridimensional space, the stage, where real time actions take place.

The dramatist, before elaborating the play, must structure his/her own ideas, working so as to shape them according to the three essential moments characterising theatre writing: initial, core and final phase. Nothing can be left to chance: it is necessary not to make the audience feel awkward. For this reason, each phase should follow and correspond to the emotional flow of the story, so as to keep alive the attention and concentration of the audience.

The novice approaching drama writing must first of all know Aristotle's six elements: **action, character, ideas, language, music, spectacularity**. In this regard, the novice must take into account some basic aspects:

- the author must always begin from the Character and from his/her evolutions. To have a good idea for a theatre script does not mean to interest the audience, because this interest depends more on the "show" than on the subject. Ideas might be countless and stem from one's own experiences but, actually, what makes ideas efficacious is the way in which they develop: a good idea must suggest a conflict, the personal growth of the character, designing and achieving spectacularity;
- the way the characters speak is important: as in real life, each individual holds a specific expressiveness and a linguistic code. So, the character must be linguistically described, to help the audience identify the character's personality and identity;
- the writer's ability is to reach the audience with the emotions, thoughts, events of the character's life, in a very limited time: the author must know how to confine the necessary unfolding of the events in a short time, respecting the consistency of the story and, so, not creating confusion in the audience.

Perception, feeling and imagination are the roots of writing, but no handbook can teach them: what can be learned is the right way to organise and develop ideas. In the following paragraphs we provide the elements useful to approach a drama script, starting from Aristotle theories up to the reasons which can induce the writer to tell about a specific story or topic. The central thread will be, in any case, the climate of confidence/trust to be created among the author and the audience, by means of the characters and the play-acting.

3.1.1 The starting point

To start writing a script it is necessary to know the difference between DRAMA - that is the action - and THEATRE, that is the place where the action happens. In a drama, each action causes the following one and is the result (effect) of the preceding one; the actions sequence designs the PLOT. Drama can be defined as the sequence of actions performed by persons in contrast with each other: the clash of ideas, emotions and thoughts will lead to a struggle between conflicting forces and to its final solution. The background of each play is the individuals, so the author must always start from the characters. Before going on, it is necessary to know - at least in general terms - Aristotle's Theory on drama and to analyse

the six elements that it is based upon: action, character, ideas, language, music, spectacularity. The aspect that we will focus on in particular is the character's role.

ACTION: an action must provoke a reaction. Therefore a drama action implies the action of one character producing a reaction (another action) on the part of another character. The sequence of these actions creates the drama plot through which the characters evolve. Sometimes there might be "under plots" the function of which is to support the main plot and make it progress. The development of actions within the drama is always linked to the evolution of the character since, as we have already pointed out, actions produce other actions and, by consequence, a conflict and its final solution.

IDEAS: For Aristotle the idea is what we commonly define "topic". The most relevant aspect is not the idea itself but the way in which it is described. In fact, it may be clearly declared by characters, or the audience can understand it through the actions performed. In any case, it is advisable not to be too direct towards the audience: the audience is more interested in the drama if the ideas behind it unfold together with the progress of the action. The author must never forget that one of the characters of the drama is the audience, which plays an active and specific role in the performance.

LANGUAGE: is what the actors say during the performance. From language the character's background is understandable. Space and time limits of the drama performance, lead the author to resort to some expedients to help the audience understand those elements of the story that could be too long and difficult to explain. For example, the tone can make us catch some specific aspects of the character, or a dialogue can accelerate the knowledge of elements related to the characters' life.

MUSIC: it has a meaningful sensorial, emotional and direct impact on the audience, since it can help to catch an atmosphere, a character and a setting. For this reason the dramatist while writing must necessarily consider the role of the music: it may be used to comment on the story or merely as a song; or it can be music for dancing or merely as a sound....

SPECTACULARITY: as music, also the spectacularity acts on the audience's senses supporting the comprehension of the drama in all its aspects. Spectacularity is the visual element, the seeing, the special effects, the surprise...

CHARACTER: his/her role is essential. The dramatist cannot work out the drama without thinking of the character. Characters, in fact, hold the audience's attention and attention is due to "what the characters do, how they act". A character is action: his/her identity is shown and described through the actions he/she makes. Further, the character must be interesting: what bonds the character to the audience is his/her identity. Therefore, it is necessary to work on a character who excites the audience to follow his/her adventures: on one side the character must be perceived by the audience as "trustable", but on the other the character must solve his/her own crisis and conflicts, must evolve and change consistently with his/her own goals.

So, when creating the character/s, the author must take into account that:

- since the performance is time limited, it is necessary to introduce, at the beginning of the drama, all the elements necessary to quickly make the audience know and grow fond of the character. These elements may be what the character says of him/herself; what the others think/say of him/her; what the character does;
- once the character has been introduced and the audience knows him/her, it is necessary to give him/her specific goals; to make him/her face difficult situations; to give him/her the skills to overcome all the obstacles encountered;
- to make the character develop and evolve, he/she must necessarily meet an antagonist, since it is through the clash between individuals that the change happens;
- the character's personality within the drama is first declared and defined, then transformed, all in front of the audience. The character tells and develops the plot created by the author, just by acting and speaking;
- each character holds a threefold relationship: the one with the author, the one with the actor playing the role, and the one with the audience;
- the author must give life to characters by showing their specific tempers so as to justify their actions: that is why the bond between author and his/her characters is very strong. In fact, starting from an ordinary person, the author must give life to a real character, holding a unique personality;
- to make the audience feel strong emotions the author must draw on his/her personal experiences and interiority. So, the author must be an acute observer of the world around him/her to gain credibility with the audience: each character must be based on real life;
- the author must hold a clear idea of every feature of his/her character, since actions, behaviours and emotions of the character must, on the whole, be coherent;
- the dramatist can never forget that his/her character will be performed by an actor/actress. It implies that the author must provide as much information as possible to put the actor/actress in the condition of playing the character's role in the correct way (consistently with the author's idea);
- the language too is important: the way the character talks defines and highlights his/her socio-cultural background, his/her personality. Therefore, to find the right tone for each character is essential.

To sum up, in order to create a character, the author must have a clear and complete idea of: who he/she is, what he/she will do and how he/she will do it; the language he/she will use; through what actions he/she will change; what goals he/she must and will achieve; etc.

3.1.2 The drama "key-steps"

The dramatist has to imagine the work he/she will write, and then use the technical knowledge that can translate the imagination into text. The writer must provide the ideas with a structure: since it is the action that makes characters grow and the plot evolve, the author must make a list of actions and successively define the **three core moments** of the drama.

The first step is the "very beginning", that is, the action or the set of actions from which the story starts. This starting point is strategic, since it must capture the audience's attention and introduce the central

even of the drama. During the drama beginning, spectators must be introduced to characters, central action, tone and style, so it is through exposition that the audience comes to know what has happened and what is going to happen. The means to communicate to and with the audience can be the dialogue, the monologue, the action or the scenery elements and setting. The exposition can be "*performing*" when it uses the scenery elements and stage setting to tell a tale; or "*introducing*", when it addresses the audience directly.

The **second step** is the longest and it is characterized by moments of tension and of relaxation. It is during this phase that the character grows and develops, going through a crisis. This central part of the drama must transfer to the audience the feeling of tension and create expectations.

The **third step** implies the performing of the conflict that must be solved through the "**climax**" (the whole of the actions leading to the solution of the conflict). During this phase all questions provoked in the audience at the beginning must be answered. It is essential that at the denouement all characters have achieved their goals and a chance of "redemption" and development has been shown, for each one of them.

The author must use any kind of expedient to capture the audience's attention, whose participation can be of an emotional, ethic or intellectual nature. Actions are more important than words, so something must be always happening on stage and each action proposed has to be meaningful and interesting. A dialogue must always be followed by a fact; actions and words must be consistent with each other; the author needs to know clearly what will happen or how the character will act and then think about what the character will say. Finally, the audience can be diverse and the author must provide all the information necessary to put each person of the audience in the condition of receiving the message.

3.1.3 The point of view

When the Author writes a script he/she must choose the character who will represent his/her own way of thinking. But a work does not imply the protagonist's point of view only, it has to offer the spectator different points of view among which to choose. The issue of the "point of view" - related to a piece of work - must be analysed taking into account different levels:

- the author's point of view, that is the author's freedom to express his/her opinions through the story;
- the teller's point of view, that is, who is telling us what has happened and what will happen;
- the other characters' point of view: as in life, each character involved in the work will have his/her own ideas, opinions and way of thinking.

Therefore, it is important that the dramatist - before starting - declares from which point of view he/she will decide to tell the story. In this way he/she will obtain the respect and the attention of the audience. Very often it happens that spectators take a liking to the character on which the author would want to provoke a critical judgment. The affinities between audience and characters generally depend on the level of comprehension of the character's personality, on the side of the spectator: the more the character expresses itself the more the spectator observes it and will be willing to understand and accept its

features. It helps us to remember that when performing a "core" action of a play, we must necessarily take into account the play-acting circumstances: the same topic, in fact, can be seen and read under different points of view. Therefore, while writing the script, the dramatist must have a clear idea of the performing circumstances and of the possible involvement of the audience; nothing can be left to chance, the author must clearly know in which direction to drive the audience.

3.1.4 The drama script

Since it must be performed, the drama script has its own specific features and rules. There is no narrator, there are no descriptions of what is happening or has happened. The plot develops through the characters' lines. Characters tell the story by means of their words and actions.

Therefore, depending on the role that each character has in the story, a script must imply:

- a leading character, the main character around whom the story develops;
- other characters, who will act as antagonists of the leading role or will be useful/essential to the development of the plot;
- background characters, who may or may not say very few lines.

The drama script is generally divided in **acts** and **scenes**. Acts are different sections of the script. Each act is divided in scenes that change following the entrance or exit of one or more characters.

Essential to the script are:

- the **stage directions** (captions), short indications by the author about, for example: place and time of the story/action; the way characters enter or exit the stage; the way characters move, speak, dress, etc.. They are generally written using "*italics*" or inserted between lines using "()" brackets. Their length may vary: a few words or longer sentences;
- the **lines**, are the main element of the text. They represent the dialogues and exchange between the different characters: their function is the one of making the plot develop. Through the characters' words, in fact, the audience come to know present and past events linked to the story; the characters' identity and emotions; events not directly performed on stage, etc.

Some conclusions

Writing for theatre is a profession, inspiration and genius are not enough; technical means must be known and handled so that everything we are willing to communicate will follow a direction, will be organised and cleared up in our mind. It is not possible to write a drama if we do not know the rules of play-acting, if we do not respect and recognise the spectator's role, if we are not going to follow the rules allowing us to structure a text so that it will catch the attention of the audience. Ideas without shape and structure do not communicate, do not reach the addressee or can be misunderstood. The success of a drama depends also on the value of the characters, the emotions they succeed in conveying. For this reason the author must know very well the type of character he/she wants to picture. A drama aims at involving, interesting and pleasing the audience. To reach these goals the author must follow the drama writing rules, to give his/her inside world and, most of all, to get the audience involved in the story development.

3.2 DIFFERENT LEVELS OF THEATRICAL REPRESENTATION

Communicating science in a "theatrical" way can be done at different levels. Even the simple "acting out" of a concept can represent a first level of "theatralisation". At a more complex level we arrive instead at a full theatre performance. Between these two poles lie different intermediate levels.

Example 1

Simple level (from Il Meraviglioso Mondo dell'Acqua (IMMA) - The wonderful world of water). To show the proportion of drinkable water with respect to the whole hydrosphere, with an audience of roughly 150 people, all the audience is asked to stand, explaining to them they represent the whole hydrosphere, i.e. all water on the Earth. Then all of them are made to sit, save five, who represent fresh water (roughly 3%). Of these five, four are then made to sit, as they represent the frozen water in the polar caps. The last person is made to stand at centre-stage inside a loop: a hula-hoop with blue cloth tied to its sides so as to form a soft cylinder. The presenter gradually raises the loop at different heights on the person (his knees, his chest...) enclosing in the cylinder an increasingly larger part of the person and leaving a progressively smaller part exposed; while he does this the presenter points out the various proportions of polluted water, inaccessible underground water, etc. In the end, with the loop at the height of the person's neck and only his head sticking out, he points out that the person's head represents, with respect to the whole audience, the entirety of available drinking water (roughly 0.03%).

This experience is not a proper theatre show, but exemplifies how a concept can be "theatralised". Other similar examples, which are much used in scientific outreach, are showing the relative distances of Solar System objects in scale along the corridor of a school, or explaining the geologic time scale from the formation of the Earth to today by relating it to a distance (again, a school corridor) or to a timeframe (the 24 hour day).

Example 2

Advanced level (from the SAT show currently being prepared by the students of the Istituto Professionale Diaz). Two friends find themselves locked up in a science museum at night. The statues of the scientists who worked on subjects related to the properties of water suddenly animate and tell their stories and their experiences.

This experience is closer to the concept of SAT: it is a proper theatrical performance with a story, characters and a set, where scientific discoveries are presented.

3.3 HOW TO MAKE A STORY OUT OF SCIENCE

Let's start from a definition: *"a story is a tale in which an event develops with the resolution of a tension around some characters"*.

If the story works, we experience an emotional link to the characters or the event as it is told: the stronger the emotional link, the stronger our involvement. If we remain strangers to the events or emotionally detached from the characters, the result is poor.

Putting science into a story can be done in different ways. We will outline now some ideas on how this merging can be done and their specific related characteristics.

a) Science as the main character: this is the case of a show in which the scientific subject is the main topic and is perfectly integrated into the story. Typically, to obtain this merge the most obvious method is to tell the story of a scientific discovery or of a series of discoveries that define a subject, or else to tell the story of one or more scientists whose actions define the subject.

b) Science as a prop for the story (marginal): here science (real or fantastic, with varying degrees of realism) is used to justify certain events in the narration. Typical examples are the technological gadgets in the *James Bond* film series or the science-fiction premises behind many superhero stories. The main character here often has a mythical aspect and special characteristics together with typically human traits and problems that allow us to identify with him.

c) Science as a frame/backdrop of the story: it is the typical case of science-fiction, where the premise of a more advanced scientific knowledge and technology is used to create an environment in which the story develops. One example is the conjuring of flesh-and-bone dinosaurs in *Jurassic Park*, another one is the convincing trip of *Interstellar*. In these two examples the story that unfolds is coherent with the context, and is lived by normal people, who are heroes only because of the courage they display in the context of the story.

d) Science in a container-show: it is the case in which scientific experiments or explanations of a scientific subject are presented inside a show/play that puts them together linking them with some common thread. For example, the IMMA show we quoted in 6.1 uses as *trait d'union* the subject of water and presents a series of experiences that display its characteristics.

As can be seen, cases a) and d) are those in which science is really the protagonist, while in the others it represents a backdrop or a pretext inside a story that potentially talks of something else.

3.4 HOW TO DEVELOP THE STORY

There are two possible approaches:

a) BOTTOM - TOP: one starts from the subject and the experiments/experiences one wishes to present and then searches for a story that can tie them together creatively.

b) TOP - BOTTOM: one starts from a story on a scientific subject (or on something that can somehow recall the subject at hand) and then finds a way of inserting specific experiments/experiences in it. It is obvious how in real life the two approaches will necessarily alternate and complement each other: for example, if one has started from the experiments and then gone on to develop a story, as this development progresses it will probably happen that the experiments will be revised or outright changed to better integrate them into the story.

3.5 WRITING THE SCRIPT

It is useful to start the job of writing the script with a group effort. The objective is to choose a basic idea through a collective exercise of improvisation: this will allow the group to outline a story keeping in mind the scientific subject that is to be presented. Once the theme and the experiments related to it have been chosen, a first stage in building the theatrical script can be made through an exercise of group narration, guided by a leader who will support the group throughout it: the leader will start narrating the story; the others, one after the other, will continue the story from the point where the previous narrator stopped. This gives everyone an opportunity to brainstorm ideas on the development of the story *while developing it*. When guiding the building of the story, keep in mind it is fundamental to always be clear about where we intend to go, without curbing the imagination.

At this point, splitting up the participants into groups if useful, we proceed to write the plot, dividing it into 3 parts:

1. the prologue;
2. the action (development of the plot);
3. the conclusion.

To write the plot, put your main character(s) at the centre, considering his/their characteristics. At this point identify their abstract goal; for example: the protagonist is isolated, made fun of, excluded by all; his abstract goal is to be accepted.

Now associate the abstract goal with a concrete goal that can kick off a story; for example: the protagonist wants to make his name as a scientist.

Then make a list of the obstacles that prevent him from realising his concrete goal.

To help prepare such a list and write the plot, try to answer some of these questions:

1. Who is the protagonist?
2. What does he/she want? What is he/she looking for?
3. What happens?
4. The protagonist is aided by luck.
5. The protagonist is hindered by bad luck.
6. The protagonist hits rock bottom.
7. The protagonist risks everything.
8. The reward: what does the protagonist obtain?

Now you have your plot. Write the plot down and - working in group - make a list of the characters that appear in it (remembering to define, for each one, name, appearance, character, manner...). The time has come to divide the plot into scenes. At this point, having built the framework, we will add, scene by scene, the monologues and the dialogues; we will add the description of actions, and the notes.

Example

PROLOGUE

The protagonist is solitary boy, very bookish, physically funny, who is made fun of by everybody. He has a great passion: the world of water. In the prologue, we find him amidst many books, studying, thinking and imagining himself as a great, famous scientist, whom everybody respects for

his discoveries.

1st SCENE

At school. In the science lab. The headmaster communicates to him that he has been chosen to participate in the most important scientific contest between European students. All his classmates make fun of him because on the same date they will be at the end-of-year school trip.

2nd SCENE

Bell rings. Everybody leaves. He remains alone in the lab. He starts studying. The subject he will present at the contest is naturally the wonderful world of water. He delivers a monologue on the beauties of this element, as if he were at a conference. It is now dark. He is tired. He falls asleep.

3rd - 5th SCENE

In his sleep, he meets scientists that illustrate to him their experiments and discoveries (insert the different experiments).

.....

6th SCENE

It is morning. A student comes in and wakes him up. She gives him a glass of water and tells him she won't go on the school trip, but will go with him to the contest because she believes in him. One by one all his classmates enter. They have all given up the trip and, with the money, have made him a gift: a kit for the perfect scientist. He is their hero. He is moved. He collects with his finger one of his tears and starts speaking: "Like a drop of water in the ocean, each tear is a micro cosmos that is different from each other...". Nobody is laughing any more, now. They are all listening to him. Slowly the lights dim.

Curtain falls.

3.5.1 The package

Some suggestions, now, on page formatting. In the Anglo-Saxon and North-American world everything that pertains to a script is highly codified, which means that in drama and script-writing a script can be written in only one possible way: to the point that submitted scripts can be rejected just because of bad formatting. In other realities the situation is quite different and there are scripts, even by well-known playwrights, which are not easy to read.

In play-writing there are two levels: the stage direction/description and the dialogue/monologue. These two levels must be laid out on the page according to precise rules, which reflect their relative weight and allow an easier reading and comprehension of the text. There are then the *asides* and the *subtext*: these are those notations that allow the reader, especially the director and actors, to better comprehend the personalities of the characters.

A good font for writing can be, for example, COURIER NEW, which was developed so that each letter occupies the same space, so that each line contains the same number of keystrokes and has the same size.

There should be 60 strokes per line. Each page is made up of 30 lines. In many contests a minimum and maximum number of pages are specified. The line spacing must be 1.5.

To keep the page layout similar on a word processor it can be useful to select the text and choose on the ruler the margins at 1 and 16, which is roughly 60 strokes.

On the **first page** the title, the name of the author, the year and, if desired, the place where the script was written are all indicated. If desired, an image can be added.

The **second page** contains the list of all the characters, the place and the timeframe of the action. Many playwrights insert the description of the scene at the beginning of each act; others add a description of the emotional, family and physical peculiarities of the characters on the second page.

On the **third page** the text begins with the description, the dialogues/monologues and the asides. The stage directions should be written in italics, while the spoken lines shouldn't. The names of the characters should be at the beginning of the line in uppercase letters; the asides, inside brackets, in italics. Between the title of the scene and the direction notes or the dialogue there should be two blank lines, while between the directions and the dialogue one. There should be no blank line between one spoken line and the next.

Example of correct layout

ACT I - SCENE 1

The scene is occupied by three chairs, a table, a door to stage left. Seated on one chair is Mario, tall, long hair, casual dress. He is smoking...

MARIO (*to himself*) Who would have ever thought it possible?

LUCIA (*offstage*) You've always been a simpleton.

4. THE THEATRICAL WORKSHOP: SPECIFICS OF WORKING WITH AND FOR THE YOUNG

The workshop setting and methodology we approach in this handbook is different from the one usually adopted within theatrical tradition, for the following reasons:

- it is addressed to groups of people who have no experience in drama/play work;
- locations and spaces are not specifically related to drama context;
- it is strictly focused on the concept of “game”.

In this frame the workshop is characterized by the “learning by doing” method and adopts the principles and techniques of dramatization (writing, performing, directing, etc.) to:

- educate to critically read and re-write the text using different linguistic codes and narrative styles;
- foster the acquisition of communication skills and a personal expressiveness;
- strengthen the use of imagination and the awareness of personal creative and reasoning abilities, by activating problem solving and risk taking skills;
- educate to learn “team work” rules and modalities, developing self-esteem and respect for the community and “the other”.

As a consequence, the workshop context is for all trainees and trainers a real experience, an opportunity of personal and collective growth by playing “role games” and storytelling. To play a game underlines, in fact, the respect for rules and principles based on practices of cooperation and spirit of sharing, necessary to realise a goal through team work. Trainees learn to relate to each other, to overcome limits and dreads, to master their own skills and abilities simultaneously enriching the socio-cultural background of all people involved: young, adults, students, trainers, educators.

4.1 THE WORKING CONTEXT: ORGANISATION/MANAGEMENT OF THE WORKSHOP SETTING

4.1.1 *The space*

The workshop setting is very simple: it could even be a classroom. The most important aspect is its dimension: it must be balanced according to the number of participants to allow them to comfortably move around. Essentially, the space must be tailored to the realisation of both dynamic and static activities.

No benches or tables are allowed, only chairs that at the beginning will be arranged in a semicircle, so that all participants can look at each other. Also the facilitator must always take a position in space – with respect to the semicircle – where he is visible to all participants.

Chairs are a very important “tool” within the workshop: they are necessary when trainees will be asked to make individual/collective writing exercises; they could become “stage equipment” for the realisation of improvisation exercises (individual, collective, in group).

Each participant must have a personal notebook and a pen, to make the writing exercises requested both during the workshop and “at home”.

The room must be equipped as follows:

- a projector and a monitor, to make trainees visualize – when and if necessary – audio-video materials, slideshows, etc.;
- a music centre, to listen to music (especially during the exercises that require a background music);
- exercise mats: to perform physical exercises, especially the relaxation ones;
- if possible, different objects/items to be used during the improvisation exercises (cloths, hats, bags, etc.).

4.1.2 The Team

For each workshop the team must include at least:

- **a facilitator** – ideally a field expert, competent in drama techniques and principles, with experience in training and competent in psychological, social and pedagogical fields;
- **a tutor** – an educator, trainer, teacher, socio-cultural worker, possibly linked to the trainees. In case the drama workshop approaches specific disciplines or subjects (as in the case of Science-Theatre), the tutor must be an expert of those topics, so as to support the “processing” of specific contents within the drama context and framework;
- **an observer** - an educator, trainer, teacher, socio-cultural worker, etc. not necessarily linked to the trainees;
- **a video technician/operator** – not necessarily a technician; his/her role is important since the methodology assumes the audio-video recording of the workshop sessions.

All team members must share the idea that beyond the "qualitative" results that the group will be able to achieve, (the goal of the workshop is not make trainees become drama authors or actors), the value of the work is giving trainees the chance to grow and develop their personality and life-skills. The workshop is in itself an organisational set-up focused on:

- the creation of a positive and effective relational climate, not only among trainees but also between trainees and "trainers";
- moments of socialization;
- the recognition and respect of individual differences;
- the identification of personal skills and artistic talents.

Therefore, the team must know, share and agree on the aims, goals and principles of the education and training path developed during the workshop sessions.

Let's try to identify some specific aims staff members must pursue, which are valid for any kind of theatre action. We can divide them into inward/personal and technical ones, which have different importance depending on the work, especially with regard to trainees' age.

Inward and personal objectives:

- To learn how to communicate within a team.
- To overcome psychological obstacles: inhibitions, fears, doubts, embarrassment.
- To acquire self-control and self-confidence.
- To give free play to one's creativity.
- To increase the sense of responsibility towards the group and the final result to be obtained.

Technical objectives:

- To study and learn theatre techniques: acting, singing, dancing and linked activities.
- To study and learn diction.
- To understand and learn drama writing.
- To understand the principles of putting on theatre performances.

4.1.3 The participants-trainees

For each workshop the maximum number of participants is 15.

Trainees can be young or adults, the important aspect is to guarantee that inside each workshop the participants' age is homogeneous.

4.2 THE WORKSHOP METHODOLOGY

"To be someone else" is an experience; it allows trainees to enter new creation processes and rules: *"the workshop is a way to provide trainees with all kinds of means of expression, to facilitate their own growth and help them to overcome and widen their own limits"*².

Theatre is an inter-disciplinary methodology that supports the development and strengthening of one's own competences and abilities of communication and thinking. Poetry, History, Literature, Physics, Philosophy, Maths and/or Science in general can be used as "drama signs" and supply drama with meanings. In the workshop trainees undertake a process of personal development, towards a change; they acquire specific language and tools, which, in turn, meet two fundamental assumptions:

- discovery of self and of personal natural qualities: students test themselves and so rediscover themselves as owners of a personal, almost unique message. Exercises done during theatre workshops lead to awareness and confidence in physicality: acting on stage, in fact, implies "to move consciously". Such work can be carried out only if subjects show others their simplicity and their ability to trust and convey trust;
- to complete oneself through confrontation with others: students participate in a constructive meeting and in confrontation with mates, through theatrical dialogue. Working in group - based on observation and on sharing mutual feedbacks - makes each student aware of the experience.

² Fernando Bercebal, *Drama. Un estadio intermedio entre juego y teatro*, Ed. Ñaque, Ciudad Real Editora, 1995

Drama workshop makes trainees learn and apply some necessary basic techniques:

- in approaching the "monologue", they learn: concentration, observation, breathing, relaxation, imagination, improvisation, memory;
- in approaching the "dialogue", they learn: space sharing, the balance of two bodies within space, contact, good listening, communication and understanding between two individuals.

Generally speaking, the different techniques used in a drama workshop aim at establishing a conscious and deep communicative contact between individuals, both off and on stage. This is possible only if students/trainees learn to trust and know each other: self-knowledge and respect for others are very important. In this sense the work of facilitators is fundamental: it is up to them to create within the group an atmosphere of open sharing and relationship, based on creative cooperation.

In brief....key aspects of the workshop activities are:

- All interventions have a collective nature, so as to foster sharing, exchange and socialization.
- The didactic programme and the process do not differ from traditional theatre courses.
- The work is focused on individual creativity: it means that is aimed at stimulating each participant to use his/her own imagination.
- Comicality and games are necessary and useful to overcome trainees' embarrassments and difficulties.
- High value is given to the performing action, since it is an occasion to valorise trainees' personality and individuality.
- The work must be oriented to the growth of each trainee's personality, so that each one learns something more and different about him/herself.
- The use of drama techniques is important to correct lacks and deficiencies related to language; to make trainees learn to master and control their own bodies; to train memory; etc.
- Each intervention needs accuracy: trainers must act professionally so as to properly relate with each trainee and with the whole of the group. Goals to be achieved must be shared and agreed.

4.2.1 Pedagogical goals and characteristics of the workshop method

The pedagogical value of theatre is not only communication: it offers the opportunity to show and perform the life and values of different cultures, stimulating trainees to a cross-cultural approach and educating them to tolerance and respect. So, as far as education is concerned, the main goals of the use of the (theatre) workshop methodology are:

- to motivate trainees to acquire critical thinking and reasoning abilities. Trainees are asked to read a text, analyse it and re-create it by means of creativity. To convert a text in a performance, in fact, implies the carrying out of a critical-analytical process by the trainee;
- "learning to learn", that is, the acquisition of a method. Here the learning object is not only a specific ability, but something more: as Gregory Bateson said, learning produces a change in the person who learns. To teach/educate trainees to learn new methods (such as the theatrical one, for example),

implies that they are stimulated to use curiosity, creativity, talent and intelligence: when facing (new) difficulties or emotions, they are forced to reconsider experience and interpret reality in a different way. As a matter of fact, learning abilities are only partially innate and normally they are underused. In general it depends on poor self-consciousness and on the inclination to refer to deeply-rooted habits and beliefs.

So, the goal is to make trainees aware of their own learning ability, through a self-empowerment process aimed to:

- acquiring an open minded approach (towards new experiences and different point of views);
- developing and valorising personal creativity and a reflective/analytical predisposition.

4.2.3 The tools of the theatrical workshop

Introspection, improvisation and interpretation are the basic elements of the drama workshop, based on the *role-playing game*. Theatre can be a "game" and, in fact, if properly used, it teaches trainees not to be afraid of being aware of themselves, by "putting themselves in somebody else's shoes".

The final product, that is "the performance", must be considered as "a test" for the facilitator/educator: the work done in the workshop will be successful if each trainee appears to enjoy the making of the performance and to have acquired self-consciousness and a sense of belonging to the community (the group, in this case).

In the following we introduce the "main tools" of the drama workshop.

a) The game

The universe of game, as the one of theatre, implies rules that must be known, respected and followed. The main aspect of a game is its "dramatic nature": as Landy R. said, in fact, *drama represents the dialectic amongst reality, imagination and daily life: the young or the adult playing a game explores his/her own life context by means of imagination.*

In education/training terms, the "theatre game" gives trainees the opportunity to start a personal change process. That is why, for example, it can be very useful to support the young while they are growing up and, in particular, to help them face the emotional, social and school failures they might live. To play the theatre game, in fact, offers trainees the chance to perform successfully: each one of them is asked to "make the best of it" - consistently with each one's own potentialities and abilities - and to positively use their energies "in doing" something. So, in therapeutic, education and prevention terms, theatre is a means leading trainees to:

- use imagination, free expression and creativity to work on themselves and start a process to positively re-define their personal identity (self-esteem);
- master expressive modalities and different communication codes;
- become aware of personal behaviours and relationships;
- learn problem solving skills;
- work in a group.

b) Improvisation

Among the techniques learned in the workshop, improvisation is considered an essential subject for playing and for educating trainees to drama. Generally speaking, theatre improvisation can be aimed at:

- the creation of a text, starting from a plot: while performing, trainees should always be able to bring to the starting point everything they improvise, in order to leave room to mates interacting with them and make sure that their improvisation doesn't diverge too much from the plot;
- building a drama play from a theme or a hint: trainees are asked to make a performance on daily life aspects and problems, so as to make them enter, understand and mediate reality;
- experimenting body expression, meant as total gestural and verbal invention. Trainees are involved in seeking and discovering a personal new physical language.

Lessons of improvisation are basically based on practical exercises, through which students learn to know and master their expressivity and different levels of spontaneity. To give an example, the sequence of improvisations to be given to the students, could be:

- description and explanation by the facilitator of the situation to be put on. An example might be: "*You are a ten years old child, this is your grandmother, you're in the public gardens near your house*";
- trying and repeating the most significant actions that make up the situation;
- repetition of earlier actions, by creating a specific map of space;
- repetition of actions by adding dialogues;
- addition of a beginning and an end to the performance.

To facilitate those engaging in improvisation, the story to be developed should have a well defined structure, consisting of three main parts: **a beginning, a development and an end.**

The **beginning** is the part where the story is introduced, where the setting of the story is explained and the situation leading the main character to action is told.

The **development** is the part where the features of characters are outlined and the tension of action is created, through the obstacles and conflicts that the main characters must overcome during the story.

The **end** is the last part containing the climax of the story. The end should then show if the protagonist has reached or not the target set in the first part.

It is also important to make trainees understand that improvisation doesn't mean "leaving everything to chance", but to have clear in mind the structure and the stage development of what we want to express, in order to set them into a specific set of rules which, if met, lead to a possible performance.

During the improvisation exercises, it is essential for trainees to find an inner correspondence between behaviour, motivation and communication (how I act, why, how I speak): this takes place through the proper use of body, voice, space, rhythm and possible additional elements.

Three key aspects of improvisation can be outlined:

- **the object**, real or imaginary, meant as any support for acting, with which a fictitious exchange takes place and which creates a relationship. At an early stage students learn to precisely determine the real or invented object, by giving it a fictitious value, and creating a relation with it;
- **the purpose** according to which actors, who improvise, move: that is the creation of stories, and thus the constant search for different elements that are the substance, the context and the meaning of the plot;
- **emotional ties**, that actors, by improvising, create with other people or objects around them.

This makes it obvious that improvisation occurs when one or more individuals can give rise to a verbal or non verbal action, establishing a meaningful relationship between them. Only in a climate of security and trust in the working group, students, as individuals, can discover themselves and their peculiarities in relation to others; again, just by interacting and cooperating with their partners and with the audience, they build a memory common to the same group that makes the group homogeneous.

In this sense, improvisation exercises are useful as common experience, and facilitate the shift from "me" to "us", without sacrificing any of the two terms, through a path leading to collective creativity. Therefore, improvisation is an important tool to establish and to improve human relations and to foster a sense of community: it emphasizes both human independence and interdependence. Improvisation exercises teach trainees cooperation and respect for others' time and modalities of performance: it allows shyer subjects to act and to gain confidence near the stronger ones, in a non-competitive but highly collaborative situation. Individuals who improvise gradually discover their unexpected abilities and develop a strong sensitivity towards the group/community.

c) Concentration, spontaneity and imagination: key ingredients of improvisation

Theatrical improvisation plays on students' mastery and development of three key elements of the art of performance: concentration, spontaneity and imagination.

Concentration is the element enabling those involved in an improvisation to overcome nervousness and fear of the judgments of others. From a technical point of view, concentration is essential for students, because through it they can stand any kind of characterization and performance, by properly complying with any situation. It is possible to list some exercises which develop concentration based on feelings perceived by the senses:

1. in visual training students learn to focus on what they see around them and observe it in details;
2. the auditory training exercises lead individuals to perceive clearly what they listen to and to analyse specific sounds;
3. in the tactile training, through the use of hands, students learn to recognize the difference in density, size, roughness and structure of what they touch.

Moving in this direction, students can enrich concentration exercises by working on the combination of different senses and then being able to develop them into a structured performing sequence, built through improvisation.

Once the techniques of concentration have been improved, great space should be given to **spontaneity**: the greater the achieved level of spontaneity will be, the better the quality of the improvisations will be. To encourage spontaneity one should avoid censoring personal instinctive reactions caused by specific stimuli: the more subjects will be absorbed in what is happening during an improvisation, the more they will find it easy to face with spontaneity and immediacy the situation taking shape on stage.

To expand their **imaginative activity**, trainees must understand the importance of observing things, events and real people around them. It is from the development of the ability to observe real life that trainees can develop the ability to invent "new ways to use common objects in imaginary space and situations", and so create real neo-narrative situations.

d) Interpretation

The study and interpretation of a text is an integral part of the performing act. In the staging of a text, performers, by conveying themselves in the Work, will make it different from any other, they will interpret it subjectively. Even by putting on a simple fairy tale, the drama genre above all others, a deep analysis of the text enables performers to shape their own point of view, that, moved onto the stage, will make their narrated moment unique and very personal.

e) Movement

Body and space, but also gestures, words and pauses: everything on stage is movement. Even stillness grants movement to stage action, as well as pauses grant it to lines. The awareness of one's body on the stage enables performers "to be" and not just to appear. In Drama schools people start from movement: teachers ask trainees to cross the stage diagonally, to walk naturally without stiffness or anxiety, as if they are going to the supermarket or along a corridor. And trainees immediately experiment how difficult it is....Movement is a fundamental element of theatre performance, since behind and before the act of moving there is "thought".

Being supported by the expression of those playing them, characters gain movement from written words. But there is not just physical movement. There is also the emotional one. That's why even silences, pauses, suspended moments, are movement. Because beneath them it is possible to read the thoughts and feelings that support them and fill them with real meaning.

f) Voice

Movement and interpretation we mentioned before are well matched with voice, which they are faithful servants of. A good knowledge of the use of voice, enable great stage mastery. But voice is also "*a natural process, ruled by hearing and lighted up by physical mental and volitional activities. (...) It is the product of two opposing forces: one given by the column of respiratory air directed from down up, and the other consisting of the vocal cords, that in their movements of adduction and tension offer resistance to the discharge of the respiratory column.*" (R. Maragliano Mori).

Therefore, the use of voice is a purely technical event which implies a specific training, made up of firm abnegation, care and exercise. Those writing about theatre, but even more those learning to do it, should know that a line - thought of or pronounced in a specific way, following the narrative structure they have in mind - will have an effect that will be so much more incisive the more it will enable actors to "say it" in the right way. Here, therefore, drama and vocalism walk along parallel paths: the word is correctly understood by the audience when it is "said" as the Author thought it. That's why playwrights implement stage directions, through which the authors/directors explain how actors must deliver a line, i.e. which registers or intentions they have to use. So those about to write a text are supported by trusted allies indissolubly linked to the use of voice: pronunciation, articulation and breathing. Students learning to write for theatre should therefore be able to choose the right words for their drama intentions, but they also need to know how to say them, or whether it is better to use a word rather than another. Finally, they have to take into account that each word spoken on stage must be understood by the audience and be relevant to the emotional moment of drama telling.

g) Drama

The structure of the written and told story is organized according to the most variable criteria. Drama is all that, written following a construction developed according to well-defined criteria, enables its performance. Basically everything that is written can be drama, provided that it can be performed. One of the many exercises of improvisation done in theatre school regards "staging anything", even a song or a dialogue stolen from the bar. That is to make "drama" something that was thought of for other purposes. What are the criteria or, let's say, the rules (even if not codified) to be used to write a drama?

The idea, what Aristotle called "theme/topic", which is described and disclosed through the whole development of drama. The rhythm: when thinking something for theatre, it should always be remembered that staging needs very exact timings to be respected and that these should be followed to keep alive the attention of those listening. Music and scene as well give rhythm to drama: music highlights the different moments of the plot and becomes itself a character; set designing makes people "live" the story and it enables them to comfortably accept the convention of fiction. Characters: the cornerstone of the plot, they should have very specific connotations from the beginning of the play. So, the author is responsible for providing the audience, even from the early scenes, with the characteristics of each character, in order to get the audience involved.

i) Direction

The whole theatre system is in the hands of directors who, through a critical analysis of the text being staged and a subsequent personal interpretation, "create" the performance. That is, they add to the written word a spectacular nature. Direction is a set of very complex technical, emotional and content elements that "make up" the play. It takes advantage of the essential support and steady cooperation of lighting, set design, music and choreography, which enrich and complete the same performance. The director's work is based essentially on two cornerstones:

1. the audience. Directors show the audience their personal reading of the work. During their work of staging the play, directors are in the shoes of the audience, sometimes by interpreting its tastes and

trends; sometimes by giving a personal and original interpretation. In all cases, the audience is considered as an element of the performance: good directors should always respect audience and try as much as possible to allow it to "enter" the show and "touch it";

2. the actor. The actor on stage is the performer, not just of the author's text but also of the point of view and the stylistic taste of the director. Directors should then have a very close dialectical relationship with their actors and explain to them their ideas in a complete and exhaustive way. Directors themselves should be actors: they should know how to deliver a certain line in order to enable actors to perform according to their directions.

l) Set designing and costumes

Like actors, set and costume designers have a direct and continuous relationship with the direction. In accordance with directors, they choose and implement sets and costumes, key elements of theatre performances that enhance the visual aspect of performances by encouraging audience involvement. The starting point of their work is as always the idea directors have of the text to be staged. Based on this, they decide how to make effective the setting and costumes actors will wear on stage.

Ever since ancient times, set designing and costumes have been main elements of drama art: through costumes, characters are narrated, since these provide the audience with information about the social, psychological and narrative features of each character. On the other side, the set is where the action takes place: when the curtain rises, the set is the first narrative contact with the audience, telling about the context in which the story develops.

m) Lights, audio and technology

We live in a time where technology, in all its forms, is an integral part of our daily lives. Performance could not be free of it and it uses technology to realize anything regarding staging: video projections, lasers, lights, digital audio tracks, special effects, they all support drama narrative and its performance. The technological elements we have today are largely managed by artistic and technical managers of the various sectors making up the performance: set designers, those responsible for lights (often replaced by directors), sound engineers, stage managers, etc.

The purpose of all this modern technology is the same as that of the ancient Greeks who dealt with theatre: to amaze, to impress and to get the audience involved in the stage action. To get the audience entering the story and touch people. After all, the *deus ex machina* coming down from heaven caused in the audience the same effect that today might be caused by a video projector, a laser cutting or a thousand watt sound effect: it spurs audiences' imagination and wraps the viewer in an imaginary space-time place. Basically it takes and then cradles them in the world of imagination.

SECTION 2 - FROM THEORY TO PRACTICE

FOREWORD

In the first section of this handbook we have illustrated the theoretical and methodological aspects related to the importance of learning science through direct experience and of using education-training approaches based on a workshop setting. In this frame, we have:

- introduced a theoretic-methodological model where drama techniques and practice are applied to support the teaching and learning of scientific contents;
- explored in detail the organizational aspects, the content elements and basic principles of a drama workshop.

Since the present handbook addresses educators, teachers, trainers and professionals working with young people at risk, not at risk and/or with different difficulties and/or disabilities, the following second section provides practical examples for the realisation of training workshops where scientific contents and theatrical techniques are integrated and applied, so as to put trainees in the condition of creating, developing and performing a real Science-Theatre event.

Therefore, to guide addressees in the design, organisation and implementation of the workshops, the structure of this section is as follows:

- first part (chapter 5) - presentation of a format of 5 meetings³ (total duration 17 hours), where a range of basic activities - typical of drama workshops - that are preparatory to the phase of conceiving, writing and realising the Science -Theatre performance are proposed. These activities are necessary to make trainees know and experience all aspects implied by a group work based on principles and techniques of drama writing and performance, so as to make them acquire the "tools" needed to create and develop a script and a theatrical event;
- second part (chapter 6) - step by step presentation of the creation of a Science-Theatre event, where scientific contents and drama techniques are integrated.

³ from the Writing Theatre handbook "Methods and techniques of Writing Theatre" - LLP-LDV 2009-2011 and 2012-2014. info at: www.writingtheatre.eu

5. PROMOTING TRAINEES' ACTIVE PARTICIPATION: HOW CREATE THE “CONFORT ZONE”

5.1 PREPARATORY TRAINING SESSIONS: THE PROCESS IN FIVE MEETINGS

Table 1 – FIRST MEETING	
Title: “Let’s come to know each other”	≈3 h
<p>The facilitator introduces the Team leading the whole workshop.</p> <p>Then, he/she will present to participants the work programme and the goals that the group is expected to reach, since it is important at this stage that Team and participants agree on and share results and learning outcomes.</p> <p>After this, the facilitator asks all trainees to sit down (chairs having been already arranged in a circle or semi-circle) and to tell – one after the other – their names..... <i>The workshop begins</i></p>	
<p>The facilitator gives each participant a notebook and a pen.</p> <p>Then, he/she asks everybody to recall an event of their life linked to “the pen” (<i>nothing difficult, only the first image they remember thinking of the pen</i>) and to write about it down in their notebook.</p> <p>Now the facilitator asks: <i>“Why, in your opinion, has the pen been chosen as the first element/topic to start off our workshop?”</i></p> <p>Give time to each participant to freely answer addressing the entire group.</p> <p>Note: <i>There are no “correct answers”. Please remember that every time the facilitator asks all participants something, he/she must just collect the different opinions so as to make everybody free to express themselves, with no fear of judgments. In this case, in fact, all opinions are “correct”: our goal (the one of the facilitator) is to stimulate group reflection and sharing.</i></p> <p>Once the answers have been collected, just leave “the topic of the pen” aside, to introduce another topic: the Theatre. Key concepts to be transferred are, for example:</p> <p><i>Theatre is open to everybody; it allows everyone to find a personal way of communicating, expressing, “playing” a role in the social context.</i></p> <p><i>Theatre can be an opportunity to gain life experience, to build one’s own character and identity, to learn how to communicate to oneself and to others.</i></p> <p>Let’s now ask trainees the experiences they have had with the theatre world – if they have had one, personal or not – and/or other experiences (in the artistic, social, communication fields...). In this case too give them the time to answer back freely.</p> <p>Following, the facilitator starts introducing the drama workshop methodology. It is important to stress that to write “for theatre” it is necessary to get to know specific techniques and principles and to give oneself a challenge, in order to gradually find out and experiment one’s own creative skills and potentialities.</p>	
Exercise 1 – “Let’s play I was ...”	≈10 minutes
<p>All trainees are invited to recall a game they used to play during their childhood (<i>who has never played a game during which he/she was supposed to be somebody else?</i>) and to write it down in their notebooks. The time available is not much, but in this way trainees learn that an essential aspect of the world of theatre is the <u>focusing ability</u>.</p> <p>To think and write, all participants are free to move where they like: to choose a corner of the room, to lie down, etc.</p> <p>The facilitator must ensure that everybody keeps silent while making the exercise.</p> <p>Note: <i>since this is the first exercise, suggestions on the part of the facilitator – just to make the trainees feel at ease – are possible. For example, the facilitator can say: “have you never transformed yourself into a monster putting on your bike helmet or brandishing an umbrella as if it were a sword? Have you never put on mum’s shoes to become a charming princess?”</i></p>	

When making these examples, use your face and voice to mime gestures and characters, so as to make trainees enjoy and overcome uneasiness and shyness.

Once the time is over, each participant will read to the others his/her text.

Now it's time to approach our "gym"....leave aside all chairs and **let's start with some games!**

Note: *games are divided into categories representing the main aspects of theatre/drama work to be experimented and trained: body, voice, rhythm, concentration (focusing), dramatization. Obviously each exercise includes the use of more than one of these aspects, simultaneously. For example, an exercise on the voice could also imply the use of the body or of improvisation (dramatization); an exercise on rhythm must also imply the ability to focus, etc.*

As facilitator, just remind that games – and "to play" in general - are important to make trainees acquire technical elements and act using their creativity.

Game 1 – game of knowledge: "Name/gesture"	⌚ 20 minutes
---	---------------------

Note: *to work in group it is important to know each other. In this way it will also be possible for the facilitator to understand the potentialities and the limits of the group: strengths and weaknesses of each single participant and of the group in general, the strengths that the group must benefit from and the weaknesses that the group must "soften". When we talk about "knowledge" we don't have to forget also the knowledge of self: the theatre practice teaches participants to find out, master and unveil personal aspects they are not yet fully aware of.*

Ask participants to stand in a circle, so as to see each other.

Each one must say his/her name and choose a gesture linked to the name. The gesture must be clearly showed to all trainees (*please remind trainees that they must always speak loudly, so as to be heard by everybody. In this way we also stimulate trainees to overcome shyness and unease*).

Every time each participant does the action "name/gesture", the other trainees have to repeat it in order to memorize it.

Note: *After the first lap, it is very probable that a second one will be necessary to make sure that everybody has learned all names and gestures. This game also gives the facilitator the opportunity to explain that when approaching and experimenting theatre it is always necessary to pay attention to what is happening around us and always be ready (and willing) to hear and feel what the people around us are doing. Essentially, this game introduces the use of the concentration/focusing ability, and helps participant to know each other better, starting from their names.*

At this point, the facilitator starts calling each participant's name: for each name called by the facilitator all trainees have to repeat loudly the name and perform the relative correct gesture.

Now let's make some background music and ask trainees to freely and naturally walk around. After two laps, ask them to keep on walking but – this time – to look at each other every time they meet and cross. After some time, let's make another game.

Game 2 : The raft	⌚ 10/15 minutes
--------------------------	------------------------

While walking, all participants must move like they were on a raft: in order not to make it sink, they have to take up the whole room available (in general, they will tend to place themselves in the centre of the room).

The plot is the following: *we are castaways on a raft. We stand still until a wave arrives and - to avoid falling down - we have to move and take different positions in space to balance the raft.*

The warning indicating that the wave arrives is given by the facilitator. Trainees will keep on moving until the facilitator gives another signal.

Trainees must move following the rhythm given by the facilitator clapping his/her hands.

Note: *This is a good exercise for "group coordination", since it implies moving within a delimited space. The game is useful to experiment concepts such as order and rhythm and to stimulate each participant to "feel" and pay attention to the others. Further, this game also teaches trainees to be aware of the space in which they are and move, to respect the other's space and to consciously take their own place. Finally, the use of "a plot" to introduce the game make participants familiarize with*

drama and scene, characterized by the use of symbols and expressiveness.

At the end of the game, ask participants to freely move in the space, following whatever pace/rhythm they like while focusing on their own body and breath.

During the game music is always in the background.

Now let's ask everybody to stop and sit down, if they like.

Note *Always make simple questions: How is going? Are you tired? Joke about how the exercises have been made so as to encourage a sense of irony and exchange in the group. It is always important to call participants with their names, so as to show concern for each one of them.*

At this stage we can start to combine the focusing ability with the listening ability.

The facilitator now explains that communicating and interacting with others is based on our listening ability. In order to learn how to speak and communicate, it is necessary to understand what it means to be a good/bad listener. So, it is important to exercise our listening skills.

Game 3 - "To count all together"

⌘ 15 minutes

Participants are asked to sit down in a circle - shoulders towards the centre of the circle - with eyes shut and silent.

What are we going to do? Just count to 10!

Someone in the circle starts from "1", someone else will say "2" and so on...Participants do not have to respect the circle order. The group, in fact, stops every time two or more persons simultaneously call the same number, and starts again from "1".

The game ends when the group succeeds in counting from 1 to 10 without ever stopping (it is possible that after 15 minutes the group has not succeeded in correctly doing the game. No problem, it's normal, just stop the game, some other time in the future they will do it!)

Note *This game is not as easy as it may appear. Trainees will understand how much difficult it can be to do something as ordinary as counting without overlapping, if they are not focused on the group and willing to listen to each others. That's why we give them 15 minutes to play the game, irrespective of the result they reach. It's important to make them keep silent and focused. In general trainees find this game fun, because they find it more difficult than their initial expectation. (Obviously, if participants are – for example - 15 in total, they will have to count from 1 to 15).*

Game 4 - Games of imaginative improvisation: "The crazy language!"

⌘10/20 minutes

Participants sit down in circle - faces towards the centre of the circle - and start speaking to the partner on their right using an invented language with specific sounds and rhythm.

While "speaking", they are asked to use consciously breaks and intentions, as if they were really talking about something. In other words, through the conscious use of breaks and intentions, they have to provide sounds with a "meaning". Let's make them do a lap of "crazy chatting".

It is advisable that the facilitator starts the crazy conversation, so as to provide participants with the right inflection.

At the end the facilitator asks trainees about what they were talking. Then, he/she explains that they have just performed an exercise of imaginative improvisation, useful to stimulate creativity, attention, listening and focusing and to make them understand the importance of giving the right intentions to words and sounds they use when they talk.

Note: Imaginative improvisation

Theatrical performance is therapeutic because it helps people to negotiate boundaries between daily life reality and imaginative life, between internal and external world, it helps in finding out ways to live positively amidst conflicting pressures. To encourage spontaneity the facilitator should avoid censoring spontaneous reactions caused by specific stimuli and pre-arranging actions: the more the subject will be taken up by what it is happening during an improvisation, the more they will find it easy to face with simplicity and immediacy the situation taking shape on stage. Only after reaching a good level of concentration and spontaneity, students are in the optimum condition to stimulate their imagination, starting with the analysis, conducted previously, of the five senses: after feeling a sensation, they can

play or describe it or link it with something else, through a free association of the moment. To expand their imaginative activity, actors cannot omit the observation of things, events and real people: they must then use the elements resulting from this careful creative research, to create new ways to use common objects within imaginative spaces and situations and thus create real neo-narrative situations.

The first session is going to an end: **ask participants to take their notebooks and read aloud - one after the other - what they wrote at the beginning of the day about the event of their life linked to “the pen”.**

In this case, the facilitator is not going to make remarks and comments.

Before closing the day session, the facilitator tells participants to write in their notebook about their experience that day (they can simply describe it or comment it even using a single sentence or word to express their own feeling/thinking).

Now, let's stand in a circle, each one repeating his/her name and then all together let out a liberating scream!

The facilitator thanks everybody for the work done.

Table 2 - SECOND MEETING – first part	
Title: “Persons and characters”	⌘ 2,5 h
<p>The approach to the second session must be extremely communicative: the facilitator will joyfully say hello to everybody, asking them how they feel and if they have exchanged impressions about the first day of work. Let them freely express.</p> <p>Now, the facilitator introduces the programme of the day: we will talk about "persons and characters", repeat the game of the raft (with some changes), start discovering the "world of the spoken words", since it is the main element (and tool) of theatre and drama writing.</p> <p>Let's ask everybody to sit down and read what they have written in their notebook about the previous session. This time the facilitator can make comments or ask questions or even joke.....then we start....</p>	
Variation of Game 2 “The raft”	⌘ 10 minutes
<p>Background music. Ask trainees to walk about the space/raft.</p> <p>The facilitator explains that this time a variation will be added: he/she will call numbers from 1 to 5. To each number is associated a rhythm (from the slowest to the fastest walk): by clapping his/her hands, the facilitator will make trainees understand the different rhythms associated with each number (make them experiment the differences while they keep on walking about).</p> <p><u>The game starts:</u> the facilitator first calls the numbers from 1 to 5 in sequence (1=very slow; 5=very fast....but not running!), than alternating them.</p> <p>Note <i>This game is useful to make trainees learn how to freely move their body in a restricted room paying attention (focusing ability) to rhythmical variations and to the balance of the raft. In addition, it helps participants to develop their perception of others (they all have to follow the same rhythm) and in general they also enjoy the situation (the amusement helps everyone to overcome his/her own hesitancy, embarrassment, worry).</i></p> <p>After 10 minutes trainees keep on freely walking - keeping silent - slowly inhaling and exhaling.</p> <p>Now, let's form a circle, to repeat the game of knowledge with some variations.</p>	
Variation of Game 1 “Name/gesture”	⌘ 10 minutes
<p>First, trainees make a first lap of the game as they did during the first meeting (see Table 1), then the facilitator asks each participant to add the <u>call of an animal</u>.</p> <p>Each time one of the trainees makes the action "name/gesture/call", the others have to repeat it to</p>	

memorize it.

After the first lap, the facilitator calls the names of the trainees - one after the other - and all have to immediately answer back with the proper gesture and call.

Once all names have been called, trainees are asked to walk together about the space but following the same rhythm, for at least two minutes. Then, they repeat the exercise "name/gesture/call" but always following the same walking-rhythm (it's always the facilitator who calls the names).

After two laps, we add another variation: do you remember Game 3 - "To count all together" (see table 1)? Now, always walking and following the same pace, trainees are asked to call the names. Obviously for each name spoken, all people have to answer back with the associated gesture and call. If two or more persons overlap in calling the names, participants have to stop and start again, until all names are called without interruptions.

As already indicated, irrespectively of the result, the time fixed to make the exercise must be of **15 minutes**.

Note: this game implies the use of different abilities and aspects: the knowledge of the other, the listening/feeling of the group, focusing and attention, the perception of the body moving through the space, the sense of rhythm.

It is also possible to make other variations: walking on the raft, increasing/decreasing the pace (the order is given by the facilitator), starting from the call of the animal instead of names.

We are gradually getting to know each other. But it's not enough. It is necessary also to gain the confidence of others and to be self-confident.

The facilitator explains that mutual trust is essential to work and cooperate in a group. And theatre is based on team work, since all persons involved are asked to expose themselves. So, it is necessary for everyone to trust their colleagues and feel at ease with them, with no fear of their judgments. Each weakness must be supported by the entire group the same way as each strength must positively influence the group.

Mutual trust is essential to personal improvement/growth and to achieve - as a group - unexpected results.

Exercise 2 - "This inspires me safety"

⌚ 30 minutes

Ask trainees to take their pen and notebook and write - as a title - "This inspires me safety".

They all have to list everything that comes to their mind, for example: my hands, my older brother, keen eyesight, agility, my father, etc. (10 minutes)

After this, starting from the list just made, participants have to make other two lists: one of things that depend just on themselves and one of things that depend on others. (5 minutes).

Now the facilitator asks trainees to form groups of three and talk about what they wrote and what they found out (15 minutes).

Some questions:

Did I like this game?

Who inspires me more safety?

What inspires me more safety?

Who do I feel safer within this group?

When do I feel unsafe?

Note During this game, participants can experience how much they are self-confident and how much it depends on all the others. It is a simple game, very suitable to introduce the topic of trust in oneself.

Game 5 – game of trust: "Leading mates"

⌚ 10 minutes (for each pair)

Let's form pairs (it is advisable that pairs are made by the facilitator, in order to match people that do not know each other very well), and experience how much we trust "the other".

One of the members closes his/her eyes, the other (the leading one) puts one hand on the back of the partner and through a light pressure leads him/her about the room. Every time the leading partner wants to stop the "blind" partner, he/she just takes their hand off the other's back.

All couples work at the same time.

It is advisable to start with very simple movements and then add new and more difficult ones (for example: to go back, to go down, to jump, etc.).

After 5 minutes, roles must be exchanged.

Note *This exercise is funny and useful at the same time: each person forming the pair is - in turn - responsible for the other's survival. So, if on one side the "blind" partner will have to trust his/her "leader", on the other, the leading partner will have to deserve this trust.*

Game 6 – game of knowledge: "Pleased to meet you"

⌚ 30 minutes (depending on the total number of participants)

The same pairs involved in the previous game are now asked to sit down wherever they like: it's time partners get to know each other better.

Each couple starts "chatting": the aim is for each member to share information about his/her self (for example: what I like/dislike, where I live, etc.).

When the time is over, all participants sit in a circle and one after the other tell/read what each one has learnt about his/her partner.

Timings

A collects information about B (5 minutes).

B collects information about A (5 minutes).

A and B write on the notebook the information collected (5 minutes).

In circle, each one reports about their partner.

Note: *The working in pairs and the "chatting" modality are advisable in order to avoid embarrassments: to tell about oneself is difficult and could be more difficult in front of a group of people, if one is not used to talk to an audience. For the same reason each partner of the couple is going to tell the group about the other. This game is useful not only to reinforce mutual acquaintance and familiarity, but also it exercises the use of attention, listening and memory (How much information was I able to memorize?). Further, the fact that somebody else tells information "about me", causes a pleasant feeling (I pay attention because I am curious to know what the other focused/grasped about me).*

Variation to Exercise 1 – "Let's play I were ..."

The facilitator invites each participant to choose a character and take on the related identity (*the character can be either a "real" or a fantasy one - e.g. Cleopatra, Michael Jackson, Peter Pan, Ulysses, Batman, etc.; but also: a coffee maker, an animal, a beam, etc. The character may also represent what we are or what we would like to be*).

Then, the facilitator asks everybody to tell the group who their chosen character is. Today participants (facilitator included) will call each other with the name of the character.

Once characters have been chosen and shared, participants are asked to write on their notebook the name of the character and the reason of the choice.

Note: *The act of choosing a character for oneself is aimed at stimulating trainees to enter the world of role playing: on stage there are characters interpreting and expressing persons. As Pirandello said: "a character can always ask a man who he is, since a character has his/her own life and features, a character is always 'someone'. A man, instead, a man in general can be 'no-one' ".*

In circle. In group (sitting). Each trainee introduces his/her character, also providing a physical description, nature and disposition, way of speaking, clothes, way of moving, gestures, etc.

Then, everybody writes down his/her own character description in the notebook. (15 minutes)

Please remind participants that from now on everybody (facilitator included) will call each other with

the name of their character.	
Exercise 3 – Narrative improvisation	⌚ 20 minutes
<p>During this exercise, participants must play the role of their chosen character.</p> <p>In circle. In group (sitting). One trainee starts telling a story where his/her character is the protagonist. At a certain point of the story the protagonist meets another character (choose one among the ones of the group).</p> <p>The trainee performing the character that has just being involved keeps on telling the story. At a certain point he/she will include another character in the story, who will have to keep on telling it, and so on until all characters of the group have joined the story.</p> <p>The story must be developed up to its end.</p> <p>Then the facilitator asks trainees to write down (at home) in the notebook the story that has just been told.</p> <p><i>Note This exercise has embedded in it an expressive process: each trainee has the opportunity to express him/her self "through" a character. So, on one side he/she takes on another identity but on the other - through a creative process - this new identity mirrors his/her expectations and feelings. The making of a story while working in group helps each trainee to use, experiment and develop his/her own imagination and to experience the process implied in the creation of a plot. If the story told by the group is not too complex, it is possible - after its transcription - to give the trainees the chance to "perform" it, as an exercise of acting-improvisation.</i></p>	

Table 2 - SECOND MEETING – second part	
Title: “LET’S LEARN TO SPEAK”	⌚ 1,5 h
<p>It is now the time to work on and with voice. Voice is an essential tool, since drama language is mostly spoken rather than written.</p> <p>Within a theatre context, everything we write must be shared with the audience: that is why the voice becomes necessary.</p> <p><u>To breathe and speak properly increases our self-control and self-confidence skills.</u></p> <p>In general we are used to taking care of our look while we ignore our way of speaking. We forget too often that communication implies the use of words and voice and so the way we speak is important, it's our "business card".</p> <p>Therefore, most of us are unaware of how breathing should be managed, how inflections or regional/local dialects should be corrected. These aspects on one side typify our way of speaking, but on the other may impede clear communication.</p> <p>It is to be stressed that to learn "accurate" speaking does not mean to renounce our characteristics and origins, but, instead, to valorise our potential.</p> <p>So, Let's start from breathing. An accurate respiratory capacity allows us to easily master our vocal emission and therefore, to speak and read in a more proper way. In general we underuse this capacity: athletes only are able to fully use their respiratory capacity, which is why they can face intensive and extended efforts.</p> <p>In this sense, we can say that the actor is an athlete and so he/she must know the general features of respiration and be aware of his/her own limits and potentialities, in order to use breathing to the best of his/her ability.</p> <p>Let's see now some basic features of respiration.</p> <ol style="list-style-type: none"> 1. Males use mainly abdominal breathing; while females the thoracic one. 2. The abdominal respiration is more correct, since it allows us to use all our pulmonary capacity, totally filling and emptying lungs. 3. To check the quality of our respiration we just have to lie down on our back and naturally 	

inhale and exhale. If we put one hand on our abdomen - exactly under the rib cage - we should feel the belly swell and relax, with or without the support of the diaphragm.

4. We can exercise this respiration lying down on the bed and putting on our abdomen a dictionary.
5. After some time (and exercise...) this respiration will get natural. In this case, you will just have to consciously use it two/three times a week, in the morning in front of an open window, for about five minutes. It is not only a good "gym", but also it ensures good oxygenation.
6. To increase our respiratory capacity apnoea is a good exercise: inhale deeply and then hold your breath clocking your endurance. Repeat this exercise and record your improvements....but remember that our aim is only to better master our respiratory ability.

Exercises of breathing and vocal emission

(to be made in group and repeated individually at home)

First we perform an exercise to check our pulmonary capacity: *inhale deeply and then read a text without ever stopping for breath. You will discover your respiratory endurance.*

And now, let's start the workout! Standing, legs slightly opened. Shoulders relaxed. Concentrate on the diaphragm. Inhale thinking that the air you're breathing comes from a point very far from you. Then exhale very slowly. Repeat it 10 times, imaging you are a balloon slowly inflating and deflating. During this actions, try to focus your diaphragm, thinking on how it slowly lifts and lowers.

Now a game of apnoea. *Inhale as you have done before but while exhaling count loudly. Do not stress/force your breath. Repeat 3 times (all together) and then individually (one trainee after the other).*

Let's try now to pronounce the vowel "A".

Inhale and exhale pronouncing "A": pay attention, your voice (the sound "A") does not have to vibrate! Repeat it 5 times.

Again using the vowel "A", let's try now to start with a low volume and make it gradually rise. While exhaling don't stop and don't inhale: the volume modulation must be mastered within the same vocal emission. Repeat it 5 times.

Now, again, we check our respiration capacity reading a text.

The facilitator provides trainees with a text (no more than 5/6 lines) without punctuation.

Then, he/she asks each participant to read the text using one - and only one - vocal emission (again it means that each one has to inhale and then read the text without ever stop and/or inhaling).

Obviously, trainees do the exercise one after the other.

Very probably, trainees will stop in the middle of one or more of these exercises, because they feel breathless or make a mistake in reading the text. This is an opportunity to remind them that besides proper respiration, it is very important also to clearly articulate words and their sounds. To achieve a good ability of respiration and articulation of the words, "regular training" is necessary.

To improve our words articulation we have to exercise moving and using our lips more. We have to feel and perceive what we say not only with our ears, but also through our lips.

Further, one of the easiest ways to exercise our vocal apparatus is to use **tongue-twisters**.

The facilitator will propose to participants 5/6 tongue-twisters, so that each can choose one and repeat it loudly many times and every time as fast as he/she can.

Then, each participant will have to read the tongue-twister using only one vocal emission.

Note: *Trainees in general find these exercises fun, competing against each other. It's important to stress that these exercises are useful only if regularly/periodically done. Furthermore, the mastery of respiration and words articulation impacts positively also on trainees' daily life: they acquire self-confidence before an audience and it may help them to better face, for example, an oral test or a job interview.*

Exercise 4 - Improvisation exercise: "Interpretation beyond words"

In pairs. Let's imagine engaging in a conversation, using numbers instead of words.

Each pair agrees upon the circumstance (e.g.: a meeting of two old friends, a seller persuading the customer, a teacher shouting against a student who was late, etc...)

The facilitator gives participants 5 minutes to decide.

Let's start!

Each pair takes place at the centre of an imaginary stage and starts the conversation, using numbers instead of words. The two partners will have not only to communicate and understand each other but also to make the audience understand what is happening...

At the end of each performance, the facilitator asks the audience "what was the situation about" and the pair that has just performed will have to answer back.

Note *It's the first time we ask trainees to perform before an audience. This exercise is useful not only to make trainees experiment their creative and interpretation abilities, but also to introduce them to the "stage" dimension without "traumas", since their attention will be focused not on the audience observing them but on the oddity of a conversation conducted using numbers.*

Before closing the session the facilitator reminds everybody to write in the notebook the impressions about the work done (at home).

Standing, in a circle, each one repeats his/her name (the one of the character chosen) and then all together let out a liberating scream (this time using respiration accurately).

The facilitator thanks everybody for the work done.

Table 3 - THIRD MEETING

Title: "Stories to be told, stories to be written, stories to be performed"

⌚ 3 h

At this stage of the work, participants have got to know each other, but there is still a long way to go....

Drama/theatre context and the "theatre game" do not expect participants to be ashamed or shy: each one must be willing to show his/her own feelings and emotions, because everyone contributes to the achievement of a final, shared result. But, especially at the beginning, the body can be a reason for embarrassment and unease. That is why it is important to grant participants some time to get to know and manage their own body, so as not to feel embarrassed every time they will have to mutually "touch" or relate to each other.

Body and contact exercises are therefore important because they support participants in developing and improving their personal drama expressiveness and - most of all - help them (both young and adults) to grow up/become self confident and calm, and to trust, respect and care the others.

Game 7 – Games of contact: "The bubble"

⌚ 10 minutes

Participants gather at a corner of the room, sitting close to one another. The facilitator points out another corner of the room which the united group heads for. Trainees should move "as if they were all in the same bubble", each looking towards the destination. They are focused on finding a collective rhythm, the same pace, the same breathing. It is important to keep balance and to feel safe within the group, in order to let the whole group keep balance and move safely.

Soft background music can help.

Note *This exercise encourages the concentration of the whole group, the contact among participants, and the search for a collective rhythm.*

At the end the facilitator asks participants to say what they have felt (for example, if they perceived themselves as a part of the group, if they felt hesitations or discomfort, etc.)

Let's now go back to what the group had done during the second meeting.

The facilitator asks trainees to take their notebook and read - one after the other - what they have written about the story created while working in group (see second meeting - part 1 exercise 3

"narrative improvisation").

Note As you will see, even if everyone was asked to write down the same story, very probably each story will differ in something. This gives the facilitator the opportunity to introduce trainees to the topic of "the point of view".

Once all versions of the story have been read, the facilitator asks trainees to choose one. Then, he/she invites each participant to read the story (only the version chosen) using the point of view of his/her own character (the character chosen by each participant).

In reading the story, each participant must pay attention to:

- the character's way of speaking (e.g. intonation/inflections of the voice, accents, etc.);
- the articulation of words and sounds and the use of respiration (as learnt during the previous workshop session).

At the end.....Applause!

Exercise 5 – exercise of improvisation: “The train coach”

⌚ 30/40 minutes

In this exercise the interpretation/performance of the character is very important.

Place chairs in two rows, so that participants sit one in front of the other, as in a train coach.

The facilitator gives to each participant a piece of paper where a character is described that he/she has to "perform" (e.g. a man that is going to work, he is worried because it's late; a student who skived off of the school; etc.). Participants do not have to tell each other the role they have to play.

Before starting, participants have 5 minutes to find some objects/accessories necessary to perform their own characters (e.g. a bag, a hat, a book, etc.). Then they all sit down. The performance starts. It is morning, each one must act and move consistently with the character assigned. At a certain point an announcement is heard (the voice is the one of the facilitator): "DIN DON - Attention please, for technical reasons, this train will leave with about 30 minutes delay".

From now on the situation changes: each character re-acts differently and interacts with the others.

The participants' performance (and the exercise) stops when another announcement is heard "DIN DON, attention please, we inform passengers that the trains is now leaving the station".

The facilitator asks trainees to list in the notebook the characters that - in their opinion - were involved in the performance: *it is not a question of being "good in guessing" but to be "good in performing", so good as to make the others understand "who my character was".*

Note This exercise provides the facilitator with the opportunity to explain that drama writing implies not only the creation and narration of a story: authors must be aware that they write a story that will be told and performed by others (the actors). That is why techniques and principles of performance and interpretation must be known also by authors.

Game 8 – Game of body improvisation: “The king and the jester”

⌚ 5 minutes (for each pair)

Note Body expressiveness is crucial to playing a role/character. Through our body we communicate, send messages, convey feelings and emotions. This game helps trainees find their own ways to make their body express something and helps them discover the potential of body expressiveness.

In pairs. One trainee plays the role of the king, the other that of the jester. The King walks before the jester with a stern walk, suiting his rank. The Jester follows him by making all the grimaces and gestures as possible without emitting a sound. When the king turns, the jester should remain unmoved, by putting on a neutral expression and assuming a composed position (standing, arms along the body). If the jester is caught by the king in an improper position, they change roles.

Note Through the physical performance of two classic and opposite characters, one staid, serious, elegant, and the other extravagant and rough, trainees start to understand how gestures, position and walk can draw the idea of a character.

Now let's go back to emotions.

To play a role/character, it is important to be willing to fully expose oneself. The "actor", in fact, must

succeed in feeling and communicating the emotions that the character feels, so that the audience can perceive and believe in them. If the actors themselves do not believe in the character's emotional world (that is, if he/she feels "detached" from the character's world), nobody in the audience will. So, the actor is asked to find in him/her self the emotions that the character feels.

Game 9 - game of emotional improvisation: "The chair"

⌚ 3 minutes (each)

The facilitator places a chair at the end of the room and chooses a sentence which will be the same for everyone (e.g. "Today I have eaten a slice of pizza"). Then, each trainee must associate each sentence with a feeling (fear, happiness, anger, etc.).

In turn, each trainee must:

- *sit on the chair and say the sentence in a neutral way (without expressing any feeling);*
- *get up, move the chair a little forward, sit down again and say the sentence with a minimum of intention/feeling/emotion;*
- *get up, move the chair a little forward, sit down again and say the sentence intensifying the intention/feeling.*

In total each participant must repeat the sentence 4 times, gradually achieving the maximum intensity of the feeling.

Background music is advisable.

Note *This game is useful to make trainees understand the intensity level and inflection that can be given to a feeling. The feeling should be understandable and believable even when it is just hinted at, but one must be able also to express it at its best intensity. Music helps participants to feel "not alone" and more comfortable.*

After all participants have done the exercise, the facilitator invites each one to tell everyone the difficulties he/she encountered.

This game, in fact, can be difficult for them, since it forces everyone to show his/her personal expressive modalities and potentialities.

The aim is to make the group experience what "acting and writing" implies: the ability of thinking and feeling as the character does, in order to make the audience believe that the character is "true".

Exercise 6 – Short story using the third person

⌚ 20 minutes

Let's now take our notebooks to do the last exercise for today.

Again we will work on "characters". But, this time, each trainee must think of somebody he/she knows only by sight (e.g. *someone we meet every day on the bus going to school or to work, etc.*).

Ask participants to imagine his/her name, personality, life style, etc. Then, ask them to imagine what this person wishes.

First, trainees must write in their notebook some quick information about the person chosen, as if they were making his/her identity card; then, using the third person, they have to write a story about "a regular day" or "a particular day" in the life of the person chosen.

Stories will be read next time.

The facilitator thanks everybody for the great work done.

In circle. Applause.

Table 4 - FOURTH MEETING

Table 4 - FOURTH MEETING	
Title: "Exercises about styles"	⌚ 3 h
<p>Today we start jumping on our raft and facing the waves.</p> <p>Background music.</p> <p>Ask participants/castaways to move.</p> <p><i>Referring to the "Variation to the game 2 - The raft" (see Table 2 - SECOND MEETING – first part), make participants increase and decrease the velocity of their pace, this time calling numbers from 1 to 10.</i></p> <p>(5 minutes)</p>	
Exercise 7 – "Stop and go"	⌚ 5 minutes
<p><i>On the raft. Start walking freely within the raft space. Then, in turn, when a person of the group stops the whole group stops, when a person starts walking, the whole group walks.</i></p> <p>Note: <i>This exercise helps to develop attention to what happens around us, to what others do and where they are.</i></p>	
Exercise 8 – "Stop and go 2"	⌚ 5 minutes
<p><i>Variation to the previous exercise: when a person stops the whole group stops, then a person of the group starts walking <u>in a particular way</u> and the whole group starts walking <u>imitating it</u>.</i></p> <p>Note: <i>This exercise builds on the previous one, since participants are asked to use their creativity and since they start experiencing that "on stage" and when working in group, the action made by a single person influences the whole group. Further, as we have already stressed, concentration and improvisation is a very useful mix: it means that we should set free our ego to express and to create, but still keeping under control where we are and within which context we are moving, so as not to do things out of place.</i></p>	
Exercise 9 – "Stop and talk"	⌚ 10 minutes
<p><i>Variation to the previous exercises: when a person stops the whole group stops. Then, the person who stopped points out <u>another person of the group who will have to say out loud 10 different words</u>. Then the group starts walking again.</i></p> <p>Note: <i>This variation of the preceding exercises is useful to stimulate trainees not to centre on a single topic but to learn - through improvisation and concentration - how to create and act paying continuously attention to what happens and is around us, to what we see and feel around and inside ourselves.</i></p>	
<p>And now let's go back to words. But before going on, just stop and breathe.</p> <p>Come back to vocal training (<i>Have you done your exercises at home?</i>)</p> <p>Standing. In circle. Repeat 5 times the basic respiratory exercise with vocal emission (that is, <i>Inhale and exhale pronouncing "A"</i>).</p>	
Exercise 10. Vocal exercises	
<p>Legs slightly flexed and open</p> <p><u>In pairs:</u></p> <ul style="list-style-type: none"> • Say your name to your partner, staring at his/her eyes and thinking that "the name" is a ball. • Say your name to your partner, staring at his/her eyes and thinking that "the name" is an arrow. <p><u>All together:</u> Make the same exercise but using first vowels and then consonants.</p>	

LET'S USE OUR VOICE AS A "TOOL"

Voice is a part of our body, so we need to learn how to master and manage it. **Make some exercises imagining that our vocal emission is an action having an impact on different objects, for example:**

- *to punch a hole in the wall;*
- *to knock down a chair;*
- *to switch off a candle;*
- *to caress an animal;*
- *to wrap up an object;*
- *to sweep;*
- *to cut something with scissors.*

Imitation and impersonation are specific of the drama action. **Let's now use the voice to reproduce unusual sounds, such as:**

The water flowing, the twitter of birds, the rumble of a car, the whistle of a locomotive.

Now, let's try to speak using linguistic codes unusual for us, making a parody of:

- *Women's voice;*
- *Old men's voice;*
- *Children's voice;*
- *A teacher's voice.*

Once all the exercises have been done, **try to read texts of different typology**, as: *a letter, a nursery rhyme, a news item, an sms text message, a drama dialogue.*

LET'S GO BACK NOW TO THE WRITTEN WORD

Ask participants to take their notebooks and read what they have written (feelings, opinions, etc.) about the last lessons made.

In case, let them free to exchange opinions for some time.

Then, ask participants to read the story they wrote at the end of the previous session (see *Table 3 - THIRD MEETING Exercise 6 – Short story using the third person*).

Exercise 11 – The monologue

⌘ 15 minutes

Each participant has to re-write the short story wrote at the end of the previous session (see *Table 3 - THIRD MEETING Exercise 6 – Short story using the third person*), **using the 1st person: it means that it is the character who tells his/her story.**

To make this exercise, trainees must pay attention to the following aspects:

- *where the character is while he/she is telling the story,*
- *the context of the story,*
- *the language used by the character (his/her way of speaking),*
- *the character's mood,*
- *what the character wants to express.*

Unlike the narration made using the third person, when an author decides to tell a story using the 1st person (that is, the character itself is speaking, telling the story from his/her point of view), the character's feelings and emotions have to be stressed.

So, recalling the exercises made to better use the voice, when trainees re-write the story from the character's point of view, they also have to imagine the inflections of his/her voice, the character's breathing, his/her breaks.....

Note: *Once the exercise is finished, the facilitator explains to trainees that they have just written a "monologue", using also the following words of Edoardo Erba:*

"[...] A monologue on my own, must always be justified by anything occurring on stage. Canonical situations of the justified monologue: the phone rings. The character answers and says: Hello - then pauses - No, look, here there is no Giuliana - another pause - Yes, I think you got the wrong number.

Here I, imaginary audience, guess that the imaginary interlocutor of the imaginary character asks: Can I speak with Giuliana? And soon after: I guess I got the wrong number. In these cases the character has the same behaviour as a parrot, because to make the audience understand what the imaginary interlocutor said, he repeats all lines. [...] Apart from the phone, to justify a monologue a character may talk to... let's see. ... a goldfish. [...] Or the actor may be a lawyer preparing a hearing for the next day. [...] Another way to justify a monologue is to place a character alone in a room. Someone alone in a room recites a monologue. Stop. It's as if he was saying: let me recite this monologue and don't ask many explanations. I am alone in a room, what the hell do I have to do, a dialogue? [...]"

Then, each participant chooses a colleague amongst the group, in charge of reading his/her monologue.

All monologues must be read out loud, one after the other.

Let's now approach the wide world of **"narration styles"**.

Note *There are lots of narrative styles that can be used - and even mixed - to tell a story: "fiction" (fantasy genre), "documentary", "scientific essay", "reportage", "touristic/cultural guide", etc. It is possible to tell the same story "ad infinitum", but, if you tell the same story every time changing its style, each story will sound different from the other. As an example, Raymond Queneau in his book "Exercices de style" tells 99 times the same "banal" story...*

Exercise 12 – The narration styles

⌘ 30 minutes

Participants sit where they like. They work in pairs: each partner tells the other a story, then each one writes in his/her own notebook the story told by the partner, choosing a narration style (fantasy, historical, journalistic, dramatic, autobiographical, poetical, etc.)

Consistently with the narration style chosen, when writing the story trainees must pay attention also to the linguistic register they use.

Note: *Language provides us with many and different expressive possibilities, that can be grammatically correct but not properly communicative. The choice of a word or of a syntactic structure depends on the context/circumstance of the communication. The spoken language is the most used and known "linguistic ability". Therefore, it's quite natural - for "beginners" - to use it also when writing a text. On the other side, beginners may choose to use an "affected" style, because it gives them the impression of sounding "smart". This exercise - which is quite difficult and challenging - gives trainees the opportunity to approach the world of language and communication in a more critical and analytic way, so as to stimulate them to reflect on its complexity and importance.*

Exercise 13 – POPROCKRAP TALE

⌘ 40 minutes

In connection with what was mentioned above, this exercise is useful to train participants to jointly use narration styles and linguistic registers/codes.

Trainees must work individually. They can choose whatever story they like (even the one used in the previous exercises, or a new one).

Let's make three versions of the same story:

1. *Pop, the original one, written as any other story;*
2. *Rock, the rocking version of the pop story (use spoken language, slang, dialects/jargons);*
3. *Rap, the rap version of the pop story ("rap" refers to the music style and rhythm, so write the story thinking of a rhythm).*

Note *The youth culture related to the musical world enables us to use other forms and techniques to stimulate creativity and writing. Rapping is of course a way of expressing a story using up-to-date language and music (as "rocking" is more familiar to adults...). The sense of rhythm and time in rapping can turn any story into a real theatre performance. It is the musical nature of these types of stories that restore words to their ancient place of oral communication and therefore of theatre. These stories should be read aloud, assuming an audience, even if behind a screen. The use of certain forms of art, enable people - young and adults - to let proceed together spoken and written word, narration and the music of the voice. Some stories, often dramatic ones, are offered to others through a musical tempo which captures the attention and requires a study of the written language, by developing assonance, rhyme, verses.*

Before closing the session, trainees can start reading loud - one after the other - their stories. Probably most of them will need more time to finish the work: they can do it at home and be ready for the next meeting session.

The facilitator thanks everybody for the work done. Applause!

Table 5 - FIFTH MEETING

Title: "From images to words ...the collective tale"	⌘ 4 h
Game 10 – Rap-presentation	⌘ 1 h
<p>Before trainees arrive, the facilitator and the team have arranged the space with percussions (if you do not have instruments, you can also use common tools), a suitcase full of different accessories (clothes, objects, etc.) and a (digital) camcorder.</p> <p>Time has come to perform!</p> <p><i>Today, in fact, the session is focused on trainees' performances. Let's start from the rap tales produced during the last session: trainees have to divide into groups in order to make real "bands". Each member of the band must have a specific role (singer, drummer, etc.). Obviously they perform before an audience (the other colleagues) and the camcorder records them. Since every band has a "look", make trainees choose the accessories they need from the ones in the suitcase.</i></p> <p><i>Up to today we have approached the voice, the body, the space....it is now the time to practise, making trainees experience what they have learnt.</i></p> <p>Note <i>This activity must be "a surprise" for participants. So don't reveal it in advance. When introducing the "day-programme" explain to them that on stage everything contributes to the "narration": the scenery, the costumes, etc. everything is important and must be accurate, since it helps on one side the dramatist to express his/her message and, on the other, the audience to "join" the performance and the story. Theatre is "drama" (from Greek: "action").The camcorder will be useful to make trainees see their performance, stimulating their critical-analytical skills.</i></p> <p>So, give time to trainees to create their bands, choose their look and agree upon the performance to be made....and just start!</p> <p>After all performances have been made, the facilitator makes the proper and necessary remarks.</p> <p>Note <i>Very probably you will need more time than the one indicated (1 hour). It's not important, give trainees all time they need: this work is very important to strengthen and gratify the group.</i></p> <p><i>Recordings of the performances will be shown in another session (to be agreed on with trainees).</i></p>	
Exercise 14 – The collective tale	⌘ 1 h
<p>Sitting in a circle, trainees must create a "collective" story, starting from 7 photos. At this stage, the exercise is merely "oral". <i>The facilitator can decide to ask participants to bring some photos or he can bring them him/her self.</i></p> <p><i>Looking at the 7 photos selected, one of the trainees starts telling a story. Then, one after the other, all participants must develop the story, starting each time from the point where the previous colleague stopped.</i></p> <p><i>It is very important to develop the story always considering:</i></p> <ul style="list-style-type: none"> • <i>who I am,</i> • <i>where I am,</i> • <i>why do I act.</i> <p><i>Further, it is also important to remember that is necessary to have a clear idea in one's mind about "where the story started from and what I want the story to drive at", without restraining the imagination.</i></p> <p><i>Once the story reaches its end, let's all together write down the plot and list all characters implied, indicating for each one of them: name, look, personality, way of speaking/moving, etc..</i></p>	

Exercise 15 – From the collective story to the monologue	⌚ 30 minutes
<p><i>Starting from the collective story just created - and related characters - let's now work in pairs.</i></p> <p><i>Each pair writes down for each character of the story (or, if they are too many, some of them) a monologue. Obviously each monologue must be coherent with the character's role in the story. In approaching the writing of the monologues, remember to pay attention to: who I am, where I am, why I act.</i></p> <p>The facilitator must also remind trainees to also include in the texts they are writing the "captions", that is the stage directions that authors generally provide to support actors in their performance (e.g. <i>John sits. He is extremely nervous. He moves his hands over and over again...</i>). In addition, they also have to describe the place where the character is and/or the action develops (e.g. <i>John enters the room of the boss. A big desk full of papers is there. The boss is half-hidden behind all papers, he stands up, looks at John and turn back to his papers...</i>).</p> <p>Note <i>From a literary point of view, the drama/play text/script must necessarily imply: stage directions and dialogue lines. <u>Stage directions</u> are very short indications provided by the author about, for example: place and time of the story development; characters' way of speaking, moving on the stage, gesturing, dressing; etc. In general, one can find them in the text because they are printed in "italics" or are in brackets "()" when in the middle of lines. The author can use a few words or a sentence.</i></p> <p><i>As far as <u>dialogue lines</u> are concerned, they represent most of the play script. The plot development, in fact, is displayed through the characters' words: the telling of present and past events, the profile and feelings of each character; the recall of events linked to the story but not performed on the stage, etc.</i></p>	
Exercise 16 – From the narration to the dialogue	⌚ 30 minutes
<p>Let's now focus on "the dialogue".</p> <p><i>Participants work in small groups.</i></p> <p><i>The facilitator shows trainees two photos, from which each group must create a story.</i></p> <p><i>Give time to each group to observe the two photos and agree upon a story.</i></p> <p><i>First, trainees have to write down the story (25-40 words max) and then they have to re-write it using dialogues (around 5 dialogue lines for each character).</i></p> <p>Once they have finished, the facilitator asks trainees how many monologues (see exercise 15) and dialogues they have written: now they have to perform them!</p> <p>Each group decides who has to perform monologues and who dialogues (<i>they can also read them: the important aspect is to give the right inflections to the spoken words: that is, they have to interpret the text as if they were on stage</i>).</p> <p>Note: <i>Through this exercise trainees experiment what it means to "perform" one's own work and/or make somebody else perform it.</i></p> <p>The facilitator asks now everybody to comment upon the "performances" made, to exchange opinions and points of view.</p> <p>The facilitator thanks everybody for the work done.</p> <p>Applause!</p>	

6. SCIENCE-THEATRE EVENTS: THE IMPLEMENTING PROCESS

As has been said previously, the main goal of the SAT method is to use the theatrical language to transmit scientific knowledge through a performance. Different specific objectives can be identified with respect to the beneficiaries involved.

Passive beneficiaries, that is, the audience of the performance: students/young whose age ranges between primary school and high school. The goals are:

- to transfer scientific knowledge;
- to promote curiosity towards the subject;
- to foster interest towards science in general.

Active beneficiaries: the students/young involved in the writing of a script, in the set up of a performance and in acting it out. Apart from the goals mentioned above, there are others closely linked to the experience of working in a group focused on creating a Science-Theatre event:

- to strengthen/develop inter-personal abilities;
- to improve self-esteem.

6.1 CONSTRAINTS AND RESOURCES.

It is obviously necessary to evaluate the context in which the project is being developed and the resources that are available: these characteristics will condition the project choices.

a) *Material resources*

- *Time*. The timescale of the project must be evaluated. A year-long project can be prepared with more detail than a three-month-long one. Consequently even the final result will be proportional to the effort. The available time depends generally on the context and objectives around which the project develops. As an example, in a school one can think of a year-long project that involves various sectors of the school (theatre club, science teachers...), or, alternatively, three brief performances through the year, on three different scientific subjects, that are very lean and can be prepared quickly in a few weeks.
- *Money*. The budget determines the people and materials available for the project. The budget will be the most referred-to information when planning the project and the performance, so it should be clearly defined.
- *Spaces (rehearsals and performance)*. The planning of the show must take into account the characteristics of the space where it will be performed. Even assuming the money were available, it is useless to design a performance which requires big sets and set changes if the available space is a small stage that can barely accommodate the performers.
- *Scientific and teaching materials*. These are resources that, if already available, can be used to lower costs and enrich the performance. For example, a school that owns materials for scientific experiments might use them in the play.

b) Human resources

It is necessary to evaluate the abilities, competence and number of the tutors involved in the project and to keep this in mind when developing it. Moreover it is necessary to evaluate the abilities of the boys and girls who participate in it if they are the ones who are going to perform the play. This means that each person's abilities must be carefully assessed prior to actually realising the project.

- *Tutors/facilitators.* It is necessary that they be evaluated by the project coordinators. It is mandatory that the coordinator create a team with the necessary theatrical and scientific competence and that the coordinator be sure of the integration of the tutors into one single cohesive and close-knit team, which is capable of operating efficiently in a coordinated manner. The lack of coordination, synergy and harmony in a team of tutors can bring irretrievable damage to the success of the project.
- *Active students.* If boys and girls are to perform the play, the tutors must get to know them. It is essential, during the first meetings, to understand who we are interacting with, talking with them and using improvisation exercises and group techniques and activities as described in chapter 5. Once they have been assessed it will be clearer to the tutors what objectives can be pursued and with what means, and care will be taken to develop and give value to each participant's individual talents, creating a well-knit group.

c) Type of experiments/experiences

Unlike a laboratory experience in a chemistry or physics class, an experiment or an experience that is brought into the theatre must be **comprehensible** and **spectacular**.

- **Comprehensibility:** the spectator must immediately understand what is being done and what is happening; the underlying concept of the experience should be grasped with a single intuition or association; deductive chains that are so long as to lose the attention of a spectator or of the majority of spectators should be excluded.
- **Spectacularity:** the experiment/experience must capture the attention of the spectator; it must be remembered that we are not in a school laboratory but in front of a theatre audience: to pass the message the attention of the spectator must be captured and we must leave a strong impression on him/her of the idea being presented.

d) Recipients

These are the people to whom the project is addressed: first of all the audience, but also the actors, if these are young people and not just the tutors themselves. The language and the experiences must be chosen and developed keeping in mind who the beneficiaries are, aiming for intelligibility and clarity. Most of all, careful consideration must be given to age and previous knowledge of the recipients.

6.2 THE PROCESS: A LIST OF HINTS

We shall now give a general outline of a work plan to prepare and execute a performance.

1) Creation of the team of coordinators and tutors

- The team must comprise at least a person with theatre experience and a person who is expert in the scientific matter to be treated.
- The team of tutors must have the necessary expertise to correctly develop the project.
- The people involved must have will and enthusiasm towards the project, so as to support it during the inevitable difficult moments.
- The team of tutors must get on well and be cohesive. All the team members must be clear about the common objectives and strategies and must work together to obtain them.
- The team members must be complementary. It is fundamental that they be able to divide tasks among themselves and that they be ready to communicate to each other the different (theatrical and scientific) needs and problems that arise and solve them quickly and efficiently.

2) Preparation of the project

- Choice of the scientific argument.
- Analysis of constraints and resources: project recipients, available time, monetary budget, available material and human resources.
- Choice of the presentation form (actual theatre play, "theatricalised" lesson, etc.).
- Definition of the timetable: number of meetings, rehearsals, show dates, etc.
- Definition of the space in which the show will be done (school room, theatre, etc.); an on-site inspection must be performed to accurately assess the available space and installations: this will determine many of the choices when writing the script.

3) Development of the text

As seen in 6.3 this can be made either starting from the story or starting from the experiences, but the process really is one of successive iterations, until a result is reached that is acceptable to all.

If those who will be acting out the play are a group of children or young boys and girls, it might be desirable to involve them in the script-developing process. In this case activities to improve group cohesion should precede this phase.

- Brainstorming session to define the main outline of the story.
- Choice of the experiments/experiences to insert in the story.
- Development of the script.
- Choice of choreographies (optional).
- Choice of scenery and props (optional).
- Choice of costumes (optional).
- Choice of music and video (optional).
- Choice of lighting (optional).

4) Revision of the script

This is the process of reviewing critically the script to identify any fault and correct it. At the same time all the extra aspects (costumes, sets...) get better defined.

Clarity of narration: this is not only valid for the audience (the text must be appropriate for the audience) but also for the actors (a text that must be performed by children must be suited to their acting capabilities).

Clarity and communicative efficacy of the experiments: comprehensibility and spectacularity.

Continuity and integration of the experiments in the narration.

Stage timing: set changes, costume changes, movement of objects and props on the stage, execution of the experiments, etc. are all things that require *time*. While developing the script this must be taken into account and the script must be fashioned accordingly. For example, during a scene change, it is possible to have part of the action happen in front of the closed curtain, while behind it, on stage, the next scene is being prepared. It is fundamental to try the movements live, even if using temporary materials or costumes, to check that the timing has been correctly assessed.

Choreographies: care should be taken that the choreographies are actually executable by the actors and/or include someone with the necessary skills to manage them. Choreographies need not be an actual ballet (a difficult assignment to perform) but can also be simple scenic movements performed elegantly and chorally.

Costumes: make sure that costumes are feasible, i.e. compatible with available resources (both economic and human); allow time to prepare them: the greater the number, the greater the cost and the longer the time to make them; consider the possibility of searching for used or already available materials or clothes.

Scenery/props: make sure the scenic elements are compatible with the available resources (both economic and human); make sure they fit into the space where the performance will be held; if it is necessary to transport them to the place where the show will be performed, make sure the elements are transportable with the available means: this includes not only making sure they fit into a car/van, but also that they fit through doors and passageways all the way to the stage!

Audio/video: assess what sound system is necessary (adequate PA, CD/MP3/PC players, cables, etc.); evaluate if additional resources are needed (microphones, mixers, etc.); evaluate what resources are needed to project video.

Lighting: verify the possibility of having a lighting design (again, depending on available resources); check if a lighting rig is already available (as part of a theatre, for example).

5) Preparation of the actors

- Group acquaintance.
- Group exercises and drama workshop exercises to create harmony and cohesion.
- Reading of the script.
- Explanation of the scientific concepts in the text: never forget that transmission of scientific knowledge is the goal of the project; the boys and girls that are performing the play have to have a clear idea of what they are passing on.

- Rehearsals. A fundamental phase, in which work is done on the acting: expression, diction, etc. In this phase much of the work done with the drama workshop comes to fruit.
- Preparation of choreographies.
- Rehearsal of the experiments/experiences. If the project requires actual experiments, it is necessary for the actors to rehearse with the equipment.

6) Preparation of the costumes

- Make a list of the necessary costumes. It is useful to prepare two worksheets/tables: one pairs the characters of the play with their costumes and the other the actors with their costumes. In this way one can always check that all characters in the play have their costumes accounted for and that every actor has all of his costumes.
- Measure the actors and list their sizes in the table above.
- Search for/make the costumes.
- Try the costumes on the actors. Correct eventual mistakes.

7) Preparation of set/props

- Make the set design.
- List the props.
- Search for the materials for the set.
- Search for the props.
- Build the set.

Be very careful to the time factor: it is necessary that the scenery be ready for tech rehearsal or at the very least for dress rehearsal; already having the props during rehearsals is a great help to the actors who get used to using them and interacting with them.

8) Preparation of audio/video

- List all audio/video necessities: diffusion of music, use of microphones, screens, video-projectors, etc.
- Evaluate what the needs really are: if it is only necessary to play some music in a small room, even a portable stereo with a CD player can be perfectly sufficient; if it is necessary to use one or more microphones and reproduce music then a mixer is needed; if the room/hall is big, then an adequately sized PA will be necessary; etc.
- Remember that if the audio setup is quite complex, operating it will require the skills of a dedicated technician/sound engineer: the coordinators must determine in advance if it is possible to have the services of this/these people.
- Make a list of all the audio tracks that are needed and obtain them.
- Convert the audio tracks to one common format, according to the chosen reproduction system (CD, MP3, etc.).
- Make a list of all the video clips that are needed and obtain them.

- Convert all video clips into a common format, according to the chosen reproduction system (PC, DVD player, etc.).
- Obtain the necessary video/sound system: PA (speakers/amplifiers, mixer, etc.), CD reader, PC, screens, video-projectors, etc. Be especially careful of cable lengths: you must know the venue and know where cables can be run; cables running uncovered across a passageway will inevitably be tripped on and maybe disconnected; a safe cable run might be longer than a short but unsafe one, and hence require more/longer cables.
- Make sure you have all the necessary equipment: in this phase it is fundamental to remember all necessary connectors, adapters and cables to connect the different parts of the system. Most common errors stem from not having considered some connection. For example: if a video clip is projected onto a screen, and that video has sound, the component playing back the video (a PC, for example) must not only be connected to the video-projector (images) but also to the sound system (sound); a cable will be needed to connect the PC to the mixer of the sound system.

9) Preparation of lighting

In these situations, the lighting design is often the most basic possible, usually limiting itself to the idea "just make sure it's visible". The available resources are commonly limited and only in the luckiest cases can the lighting rig of a theatre be used. The few suggestions we will make are therefore absolutely generic.

- If there is the possibility of using a more complex lighting design, for example if the performance will be held in an actual theatre, it must be remembered that, especially when experiments are being performed, *visibility* is the most important thing: the audience must be able to see the experiment to understand it.
- If there is a richer lighting rig, it must be remembered that preparing it (focusing lights, inserting colour gels, programming cues) is an operation that requires *a lot of time*, during which it is not possible to use the stage. This must be taken into account when making a schedule of rehearsals in the theatre.
- Creating a lighting design and preparing the rig are operations that require the skills of a dedicated lighting designer/technician. The coordinators must determine previously if it is possible to have the services of this/these people. Planning the lighting design *takes time*, especially if done on the day when everything is set up: allow for it.

10) Communication and dissemination

Organise and execute the dissemination of the performance to all potential audiences: schools, students, parents, etc.

Allow enough time to permit those subjects (schools, for example) that need more time to organise an outing to be able to do it.

11) Preparation of the show

- The last rehearsals must be performed in the space where the performance will be held.

- Carefully organise the timetable in advance: be careful of the days and hours the space is available (opening hours of the theatre or of the school in which the performance is held).
- Organise transport of materials. Be careful of fragile elements (for example, scientific apparatuses).
- Organise the timetable for setting up the scenery, audio/video systems and the lighting.
- Organise the arrival of the actors and the rehearsal timetable.
- Check there are enough/suitable people for all support roles: are people needed to help the actors to dress? Who opens and closes the curtain? Is help needed for set changes? Who takes care of ushering the audience (it is difficult, on the day of the show, to be behind the stage taking care of last minute things and to simultaneously be at the entrance ushering in the audience)? Etc.

12) Final rehearsals and performance

Most often, the steps described below must be compressed. It will be up to the organisers to manage the situation according to necessities.

- Scenery, audio, video, lighting setup.
- Preparation of costumes in their allotted spaces.
- Preparation of the scientific material.
- "Space" rehearsal: the actors are shown the stage where they will move, the wings, the spaces offstage; they are made to accustom themselves with the stage.
- Technical ("tech") rehearsal: a run through of the performance is done taking care of entrances and exits, set changes, costume changes, the execution of experiments, the right timing of sound and video cues, etc. A tech rehearsal is halted when necessary to correct eventual errors; often it is not necessary to deliver all the lines: it is instead important to deliver all those parts that involve a scene change, an audio cue, etc. The tech rehearsal is often very long exactly because it is constantly halted to find solutions to problems that had not been considered. For this reason the greater the care with which the show is developed during its conception and rehearsals, the fewer the hitches and obstacles that will present themselves on stage at the last moment (when it is often too late to do anything about it).
- Dress rehearsal: the performance is executed as it will be, with all elements and no stops.
- Before the show: make the actors come early enough; have a check-list of costumes, props, scientific materials, etc.; check everything is in its place; deploy the people that take care of ushering the audience.
- Just before curtain rises: all the actors in a circle holding hands; motivate them, compliment them for what they have achieved, encourage and calm them. Be positive.
- Showtime!