

History and Philosophy of Science on Stage

"The Life of Galileo", B.Brecht

1st International Summer School for Sciences, History and Philosophy of Sciences, Technology and Science Education
June 22nd - 26th, 2015, MESHS Lille, France

C.Stefanidou, Dept. Physical Sciences, Technology and Epistemology of Science, Faculty of Primary Education, University of Athens, 63rd Lyceum of Athens, Greece.



The play

The Life of Galileo, by Bertolt Brecht, was worked and presented in three versions. The third, which is known as the German one, is the post-Hiroshima version, where science's irrational and harmful potential had become far more apparent. Brecht proposes that a play should not cause the spectator to identify with the characters but should instead adopt a critical perspective in order to recognize social injustice and exploitation and to be moved to go forth from the theatre in the world outside.

Synopsis: Galileo is short of money. A prospective student tells Galileo about a novel invention, the telescope ("a queer tube thing"), being sold in Amsterdam. Galileo replicates and uses it to substantiate Copernicus' heliocentric model of our solar system, which goes against both popular belief and church doctrine, and which he publishes in vernacular Italian, rather than traditional scientific Latin, so that it is accessible by the common people.

Galileo is brought to the Vatican for interrogation. Upon being threatened with torture, he recants his teachings. His students are shocked by his surrender in the face of pressure from the church authorities.

Galileo, old and broken, living under house arrest, is visited by one of his former pupils, Andrea. Andrea now believes Galileo's actions were heroic and that he just recanted to fool the ecclesiastical authorities. However, Galileo insists his actions had nothing to do with heroism but were merely the result of self-interest.

Seven scenes, numbered 2, 5, 6, 8, 10, 11 and 15 of the original version, after read and discussed, were omitted from this edition of The Life of Galileo to reduce it to manageable length for students. Spectators can follow the theme of the play clearly enough without them. The omitted scenes needed stage presentation, even more than most of the other scenes, for their full effect (Wikipedia 2015).

Introduction

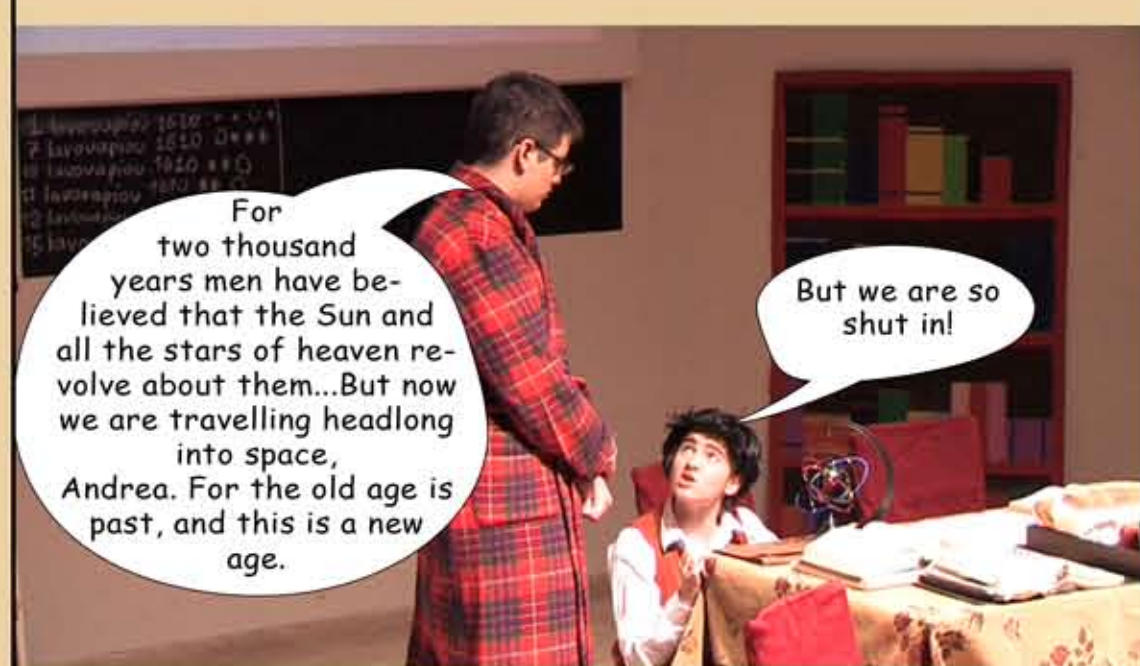
In Greek High School science curricula, Physics is included systematically in a rather elevated level. Students encounter a lot of mathematics during their Physics lessons and are required to cope with demanding concepts, exercises and problems. Average and low performance students usually cannot meet their obligations ending to a dislike of the very discipline of Physics, believing that they cannot succeed. The dominant perception among students is that able students are those that can learn by heart the formulas and successfully handle the mathematical equations needed to solve the exercises.

In Physics classes, little or no attention is given to the cultural aspects of science, namely the aspects including history, philosophy and sociology of science. Cultural characteristics of science are closely related to what is called Nature of Science (NoS) (Lederman 2006). NoS is an integral part of scientific literacy which is the aim of science education worldwide (Holbrook & Rannikmae 2007).

In the present project, students were actively involved in learning about NoS through dramatization. There is evidence that interdisciplinary practice is possible for theatre arts and science in science education (Tselves & Paroussi 2009). This was accomplished experientially, through role play and dramatization of "The Life of Galileo", by Brecht. The author addresses the relationship between science, society and religion and the power exercised on science by the dominant ideology. Such topics are in the hard core of NoS, which students had to critically encounter and learn by playing.

"We need a type of theater which not only releases the feelings, insights and impulses possible within the particular field of human relations in which the action takes place, but employs and encourages those thoughts and feelings which help transform the field itself" (Brecht 1953).

Galileo Galilei, teacher of mathematics at Padua determines to prove the new Copernican system.



Worldview is changing.

A prospective student, Ludovico, tells Galileo about a novel invention, the telescope ("a queer tube thing"), being sold in Amsterdam.



The unnatural Nature of Science: Scientific explanations against common sense.

By means of the telescope Galileo discovers phenomena in the sky which prove the Copernican system. His friend Sagredo warns him against the possible consequences of his researches.



Religious commitments during scientific research.

Galileo has exchanged the Republic of Venice for the Florentine court. His discoveries with the telescope meet with disbelief among the savants there.



Philosophical commitments in science.

1616: The Collegium Romanum, the Vatican's institute of research, confirms Galileo's discoveries. But the inquisition puts the Copernican teachings on the index.



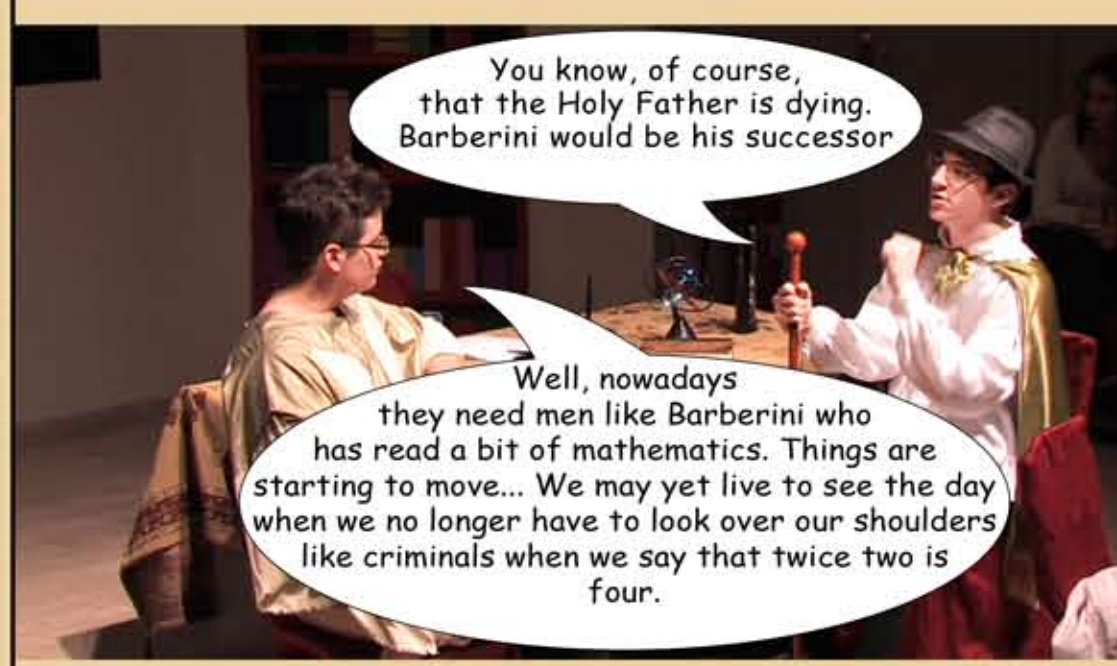
Science is dominated by the ruling class.

Eight years of silence. Galileo was working on topics other than astronomy.



Scientific research needs courage.

The enthronement of a new Pope, himself a mathematician encourages Galileo to resume his researches into the forbidden subject of sunspots.



Patience and persistence in science.

The new Pope, formerly Cardinal Barberini has received Cardinal Inquisitor in order to make a decision on whether to send Galilei to the Holy Inquisition



Science in the service of material interests.

In 1633, before the inquisition Galilei recants his teaching about the movement of the Earth.



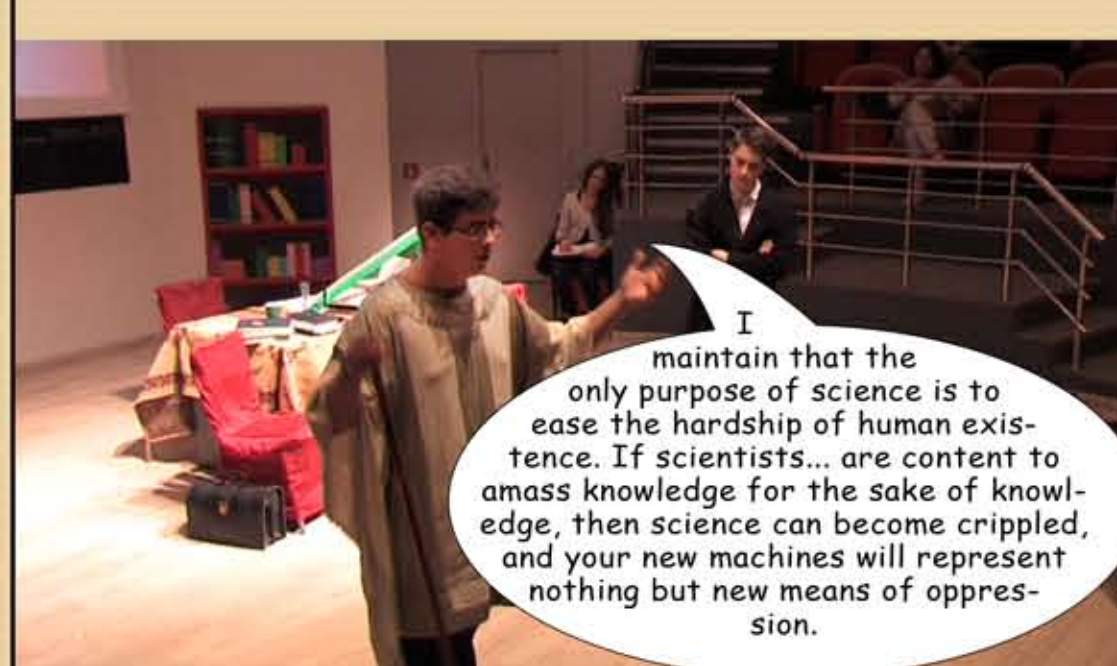
Scientists embody human weaknesses.

1633 - 1642: Galileo Galilei lives in a country house near Florence, a prisoner of the inquisition until his death. The Discorsi.



Scientific research surpasses the difficulties.

Galileo's advice to future scientists.



Science in the service of humanity.

The 63rd Lyceum of Athens team:



Actors Alexoudis Valantis Alla Giorgos Dalamarini Georgia Dimitriou Eftymis Kaimenopoulou Antigone Karagiannis Giannis Karmiri Dimitra Ketikidis Konstantinos Lougia Fiametta Mihali Roubina Michalopoulou Teti Bariami Laura Bertodoulou Katerina Pappa Katerina Strinaki Markella Tsouni Eleni Hike Violetta	Support Iliopoulou Katerina Kiousi Stamatia Koliou Konstantina Megalou Nicoletta Chandolia Margarita Siderakis Achilles	Teaching - Editing - Directing Constantina Stefanidou	Headmaster Nikos Sagias
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Conclusion

The project supported the educational dimensions of "The Life of Galileo" by B.Brecht. Upper Secondary students found concrete ideas about science and its relation with society, history and philosophy. They engaged with issues the play raises, about scientist's responsibility towards society and human kind, and had the opportunity and the ability to adopt a critical stance toward these issues, which are still up to date. Students came to close contact and had an opportunity to debate on ideas about science as described in the captions of the comic strip.

The project was not evaluated by means of standard evaluation but only through informal observations during the process. All students developed an advanced way of thinking and formulating opinion about science. They expressed positive views about their participation despite the personal time they had to invest. Their involvement with topics about NoS improved their stance towards science classes and increased their interest on typical science education. All of them declared their eagerness to go on with another performance to communicate their knowledge about science to fellow students and lay people alike.

The main body of the spectators constituted of parents most of who never came into contact with similar matters. However the play's social references had an impressive impact on them, which mixed with pride for their children, could be considered a positive contribution of the play to the "open public".

Similar efforts could be incorporated into a general plan including science, art and society in order to convey values such as equality and social justice through the plays of great writers.

Methodology

The project

"The Life of Galileo" project started in November 2014, in the context of "Cultural Activities Programs", undertaken by the 63rd High School in Athens, Greece. It is a transdisciplinary cooperative project at the interface between science and the arts. It combines ethical and social aspects of science – as they are presented during the staging of "The Life of Galileo" by Brecht.

The aim

The aim of the project was students to actively construct certain aspects of Nature of Science (NoS) as reflected in the play. The historical background of the scientific revolution of the late 16th –early 17th centuries is adequate for every reader to embody the philosophical and political conditions of science "in the making" (Kuhn 1962, Matthews 2000). In this project not every aspect of Nature of Science was actively taught, but only those aspects that were depicted in the play.

Time - Place - Participants

Twenty three students, both boys and girls, participated absolutely voluntarily in the project. Meetings were held at the school, once or twice a week at times other than school hours, such as weekends and holidays.

The phases

We started working in December 2014. In the first (geocentric) and the Copernican (heliocentric), then proceeded to deepen in the obstacles that Galileo encountered during his effort to prove and establish the Copernican model.

In the second phase, we distributed the roles and responsibilities depending on students' interests and abilities. Rehearsals started in January 2015. Some students had difficulties in comprehending, either Galileo's scientific ideas, or the problems he met with the philosophers and the inquisition. Theatre has the ability to instruct, while entertaining. Students who had certain roles in the project have reached a level of understanding of the scientific notions and the socioscientific context of the play. During the rehearsals, they were gradually constructing their views on the historical and philosophical context of science.

In the third phase, students had to work on stage sets and costumes. Through this process the students had the opportunity to learn about the clothes, habits and practices of people in the 17th century and in particular of various social classes. Students found it striking that Galileo lived and studied without electricity, using candlelight. Furthermore the students realized that technology was not developed as compared to today's technology, at least in terms of telescopes and time measuring devices.

Finally, in the 5th of May 2015, students gave the performance, in Radio Station 9.84 Amphitheatre, Technopolis, Gazi, Athens. The interpretations were very satisfactory, reflecting the extent to which students have experientially grasped ideas of NoS, particularly the historical and philosophical ones. They gave their best to convey their knowledge and impressions to the public. The pictures of the comic strip are screenshots of the play.

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Constantina Stefanidou studied Physics in the University of Athens where she also got an MSc. in Environmental Science, an MEd. in Science Education and her PhD in History, Philosophy and Didactics of Science. She works as a Science Teacher in Upper Secondary Education (63rd Lyceum of Athens). Her research interests include History and Philosophy of Science in Science Education and Critical Science Education. She can be contacted via e-mail: sconstant@primedu.uoa.gr