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The first pilot experiment of Big History in an Italian school class

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Abstract. *The topics of Big History offer stimulating reflections on the national curricula. In Italy, for instance, great attention is paid to the history of the Roman Empire and the broadening of this horizon to the twelve agricultural empires of human history is a great challenge. A similar challenge faces nearly all the scholastic subjects. In this paper we present an experiment carried out over a two year period in a class of 16-18 year old students. In the first year the 23 students worked in groups organized according to the Jigsaw method. They approached the subject by following the Big History Project frame and they used this and other independently found resources to make a documentary: (https://www.youtube.com/watch?v=-1AyJMzNiBw). In the second year they were invited to apply their new vision by studying the Big History of an Italian valley. Still working in groups they use mobile applications to illustrate the history of the valley on different time scales: tens, hundreds, thousands, hundred thousands, and billion years.*

Methodology and Relevance to Big History

The national curricula are very strongly structured systems of ideas and it is not easy to introduce alternative viewpoints. This experiment has been planned to take the first pilot experience involving all teachers of the same class (class board). Using the method of action research (J. Elliott) we have helped teachers to identify the contributions that each subject area can give to build a unified vision of the history of the universe. The class board opened up a pathway into the ordinary school programs, so over the two year lapse, four months per year, two hours per week were devoted to research on big history assisted by teachers of different subjects. Adopting methods of constructivism (E. Morin, J. Novak) the action research began with a survey of spontaneous ideas that students had acquired not only from previous school studies, but also from social networks and the media. Despite the manifest success of the experience, a major limitation in reproducing it on a larger scale is due to the difficulty of supporting and motivating teachers. The complexity of the operations required for the project needs time and resources. Now to strengthen our proposal we are working on linking this educational activity to the Recommendations of the European Parliament and Council of December, 18th, 2006 on key competences for lifelong learning

A pilot experiment involving a class at the "Banfi" High School of Vimercate (Milan) was conducted for two years, in collaboration with a team composed of OPPI trainers and of teachers and students at the Department of Earth Sciences of Milan University. Teaching and learning "Big History""[1,2,3] in an eleventh- and twelfth-grade Italian classroom is possible and feasible without difficulty only when you get the cooperation of all, or nearly all, the teachers of the class board. This experiment led to the formation of a project that is ready to be proposed to school administrators in the future. In fact, the "Big History" provides students with adequate instruments to understand global society from a holistic perspective. Finally,

the complexity involved in both the studies and activities facilitates reflection on each student's skill set.

First off, why start the pilot project in an eleventh-grade class? Then, what were the goals of the project? And what time frame and methods would be used to experiment with the themes of "Big History" in a class? In October 2014, OPPI formed a research group to evaluate "the opportunity to experience in Italian schools, within didactic planning for skills, the working assumptions made by the international academic movement, Big History[4]." Examining the learning resources provided to Italian secondary schools, the group judged that "Big History" issues were not sufficiently addressed in Italian-language texts, while projects like the "Big History Project," "Cosmic Evolution," "Cronozoom," and a vast body of literature addressed them in English. Those texts require a proficiency in English of at least the B1 level, which in Italian schools is reached at the eleventh grade. Therefore, the project was proposed to a board of eleventh-grade teachers who had already taken a methodological training with OPPI. The project objectives were to "guide students, organized into working groups, to build a shared representation of the modern idea of the universe, through the study of documents already published on the web in English and other texts," to "engage students in a public presentation of the results of their studies," and finally to "engage teachers in the observation and assessment of the skills acquired by students during the research." Altogether, the project took about seven months. Meetings were held from October to April, involving teachers and tutors from OPPI, about once a month. From February until April students spent two hours every week, for twelve weeks, studying the issues of Big History, assisted by their teachers. The final product, a thirty-minute documentary film [5], was created by the students mainly in time outside of the regular lessons. The project involved two main relationships: one between tutors and teachers, the other between teachers and their students. The interaction between tutors and students was kept to a minimum in order to ensure the reproducibility of the experience with other classes. The action research method[6,7,8] was applied in governing the cooperative relationships between tutors, teachers, and students, always keeping in mind that each of the three groups had different motivations and objectives.

What activities did the students participate in? Firstly, the students filled out a questionnaire in which they could freely answer the question, "What does the universe mean to you?" They could employ keywords, phrases, drawings, formulas, symbols and so on. This

type of questionnaire[9,10] is used to collect spontaneous ideas that students have already gained through family tradition, personal experiences, and previous studies on the subject. Each questionnaire was used to construct a conceptual map to represent how each student thinks about the topic, taking into account academic knowledge, as well as his/her emotional attitudes, beliefs, and impressions from the media. Conceptual maps are thus used to represent the knowledge of the research topic. In fact, the constructivist approach[11,12] shows how using conceptual maps leads to a reflection on learning and helps its consolidation. These maps were used to form five groups with similar interests. Each group was assigned a threshold of complexity in the history of the universe: the origins of the universe, the formation of the solar system, life, humans, and modernity. The groups studied the assigned themes using online lessons from the "Big History Project." The English subtitles that are provided for each lesson were a great help in overcoming the language barrier and encouraged a deeper comprehension. A field trip to the Geological Observatory of Coldigioco[13,14] and lessons from its director, Sandro Montanari, completed the study and preparation phase. The students had the task of presenting to an audience of their peers, in the form of their choice, the new view of the history of the universe that they had acquired in their study of the "Big History Project." They decided on a very ambitious goal: a documentary film. The members of the study groups divided themselves into the work groups that would be typical for the production of a documentary film, spontaneously using the Jigsaw method, which promotes "autonomy, competence, and social relatedness as posited by self-determination theory of learning."[15] In an atmosphere of enthusiasm and hard work, the documentary was finished and published on Youtube.[16] The project ended with a reflection on their acquired knowledge: new groups, assigned under rigorous use of the Jigsaw method, were asked to create a conceptual map of how their view of the universe had grown during the four months of study and work. In a two-hour session, the groups used large pieces of paper and Post-it notes in different colors to create four conceptual maps representing the views of the universe that the students had reached. The maps where hung up in class. Since individual contributions were recognizable by the colors of the Post-its, the students were encouraged to reflect on the collectively constructed view of the universe, as well as to self-evaluate their own contributions, in relation to the idea of the universe that they had had at the beginning of the experience. On April 23, 2015, the students presented the documentary to numerous students from other classes in the presence of the Chair of the IAA SETI Permanent Committee,[17] Claudio

Maccone, who gave a speech that expanded the students' vision and motivated them to continue their research the next year.

In the second year students' interest was oriented to apply the general vision of the big history in the study of an Italian alpine valley suggested by teachers and students at the Department of Earth Sciences of Milan University. Earth sciences and Big History share a time scale that spans billions of years, and hence Earth sciences' disciplines are an optimal starting point for the application of Big History in a specific context. Once the Earth sciences were chosen as the core of the second year of the project a specific area had to be chosen. First of all, the target area was focused in on the Alps, as the complex history of this mountain range offers the best opportunities for diverse applications of Big History. After considering several areas, the Ossola Valley, in the northeast of the region of Piedmont, was chosen. This valley is one of the longest within the Alps and hosts a great geodiversity, which offers the best conditions for the project. In specific Ossola was chosen because of the following advantages:

- It crosses the entire southern side of the Alps and offers a perfect cross section of the geologic history that led to the formation of this range[18].
- It hosts several outcrops of rocks much older than the Alps, covering the last 400 million years of Earth's evolution[19].
- It was profoundly shaped by glaciers during the last glacial eras, providing a framework on the scale of hundreds of thousands of years[20].
- It contains important archeological sites showing the relationships between man and the geologic and geomorphologic evolution on the scale of thousands of years.
- It has been a major quarrying and mining site since the Middle Ages, providing a framework on the scale of hundreds of years till the present[21].
- It hosts a UNESCO Global Geopark, providing a framework of environmental protection on the scale of years to decades.

Two other specific aspects of Ossola Valley are an important plus for the application of Big History. Firstly, Candoglia and other minor quarries in the valley are the places from which marble was taken for the construction of the renowned Milan Cathedral and other monuments, thus providing an important link with history and the arts. Secondly, the valley is crossed by the "Frontiera Nord," a fortified line built at the beginning of the twentieth century as a defensive system with the beginning of World War I in sight.

A preliminary step was carried out with the help of two undergraduate students in Earth sciences who were in charge, for their BS thesis, of identifying and describing geological aspects of the valley relevant to the Big History project and suitable for excursions with high school students. The results of this work were used to plan a two-day excursion with "Banfi" students to apply, in the field, the concepts of Big History that they had studied. In the two days of the excursion, the students visited the main sites of the valley, taking advantage of one of the teachers of the Department of Earth Sciences as a guide, as well as local guides. One of the most important moments was the visit to a marble quarry that had been abandoned for economic reasons, and the reconstruction of the history of the miners through the gathering of anecdotes. The students also shot footage using a drone provided by the Department of Earth Sciences. The information gathered during the excursion was used to create an app for smartphones and tablets. In fact, the students had decided that the product of their studies of the valley should be a searchable travel guide and, in their computer sciences class, they had learned to use the appropriate software. Organizing themselves in groups as they had the year before, they studied the history of the valley on different time scales. Including such a notable amount of material in the app involved working in a variety of groups based on the technical expertise necessary to develop that specific product. A particularly creative solution was found to allow the electronic guide to link the places in the valley to their own time scales. On May 10th, 2016, the students publicly presented the app, which they had created in the atmosphere of personal and group empowerment that had grown during the course of the activities.

In the two years in which the action research was conducted, the group of teacher trainers from OPPI followed the teaching and learning activities of the teachers and students. The group was composed of eight experts in teacher training who were also specialists in many of the disciplines necessary for a multidisciplinary study of the history of the universe. When necessary, the OPPI group also used outside contributors. From its formation, the group met every other month, initially sharing reference texts from the Big History movement, then identifying appropriate avenues to conduct the pilot project. Once a school and class were chosen as the subject of the project, the group gave instructions to the teachers, as well as study materials and suggestions for class activities. They also looked at and discussed the projects that the students had done in the past. From a methodological point of view, it is important to note that a member of the OPPI training team is also a teacher in the class that

conducted the research. This fact certainly facilitated the success of the pilot project, but also poses problems for its reproducibility, which were carefully considered in the formulation of a proposal aimed at all schools, based on the results of the pilot project. Observing the activities that took place in class, the group devised and tested teaching materials to simplify the work of the teachers on the class board. Particular attention was given to explaining the contribution that each of the subjects currently taught in secondary schools can provide to a construction of the unified vision of the history of the universe. We are speaking of topics that are already taught at different times in the scholastic curriculum in different ways according to each subject matter. In the context of the curriculum, the study of these topics is an end, while in the students' research it has become a means to understand and interpret the history of the universe. From this change in mindset arises the motivation and enthusiasm of the students. To facilitate this delicate operation, the OPPI group created a chart with two axes on which the thresholds of complexity identified in the history of the universe intersect, for reference, with topics taught in the relevant secondary schools. The same OPPI group was surprised by the intersection of the topics of different fields and by the new importance that some of these gained through the new mindset. Consider, for example, nucleosynthesis, creation myths and their representation in art, the diverse philosophies on nature found in the Greek classics, the formation of cellular and then multicellular organisms, plate tectonics, collective human learning, the similarities and differences between agricultural empires, literary texts that directly and indirectly deal with the condition of mankind in the cosmos, the temporal and spatial orders of magnitude of the universe. Such a strong and innovative intersection of subject matters which until now have been studied separately could raise concerns and reservations: the entire system of the national curriculum could almost seem called into question. Nonetheless, the experience of the pilot project and the results of the final satisfaction survey completed by students and teachers suggest that a proposal for the study of Big History can be successful if the objectives and timeline for the project are shared with teachers and students.

What are the key elements that can be derived from the pilot project to formulate a proposal for the study of Big History for any eleventh grade class? First of all, the students must recognize the responsibility of creating, in work groups, one or more projects to present after they have studied the Big History lessons in Big History project and in other documents available online. Secondly, the teachers on the class board must assume the role of tutors in a

situation typical of a flipped classroom. The most sensitive moment is in the initial phase, in which all the participants jointly decide on the schedule of the topics and the structure of the lessons. The preliminary analysis of interests, attitudes, and prior knowledge facilitates the initial composition of the study groups. Another important moment is in the choice of the project or projects to create and the manner of public presentation. The students make these choices as they continue their study of Big History. The Jigsaw method provides information that can be useful in successively composing the work and study groups to best meet the objectives. The experience can also be combined with class excursions with a Big History approach to a particular area. The teachers need a method of evaluating the work of the students, in particular each of their contributions to the studies, the group work, and the creation of the final project. The complexity of the activities asked to the students lends itself to an evaluation of the key competences for lifelong learning expressed in the recommendations of the European Parliament and Council of December 18th, 2006: communication in the mother tongue; communication in foreign languages; mathematical competence and basic competences in science and technology; digital competence; learning to learn; social and civic competences; a sense of initiative and entrepreneurship; and cultural awareness and expression. The group from OPPI maintains that observation of the students in the course of the activities facilitates a reflection on each one's competences and skillset. To facilitate this sensitive activity, observation charts were developed with indicators that help note the abilities of the students while they work in groups, make decisions, work on the project, and present it to the public. These charts were conceived as tools not so much to form judgements on the students, but rather to facilitate discussion and awareness of the strong and weak points of their skillsets when the time comes, at the end of high school, for the students to make a fundamental choice about their futures. The study of Big History can be helpful in this.

In conclusion, the analysis of the pilot project demonstrated that introducing the Big History viewpoint into high schools is possible and can obtain interesting results when matched with the widespread need for innovation in teaching methods. This can be done starting in the eleventh grade by dedicating two hours a week for at least four months to the study of the topic. The complexity of the subject cannot be addressed with traditional teaching methods. It involves a commitment from the students to work in groups and take on decisions to jointly present the results of their studies. The teachers are called to take on the role of

tutors and to observe the students' activities. To promote a unified vision of the history of the universe, it is necessary to review and reinforce topics that have already been studied separately, which can fuel a renewed interest in the students and give new meaning to the materials taught in school. The following year, the students can, with the same work method, deepen the Big History approach by studying and depicting the history of an area on different time scales. This second activity can happen through collaboration with regional educational and cultural agencies. The complexity of the subject promotes the commitment, collaboration, and creativity of the students and can lead to projects worthy of being put in a portofolio. These portfolios can be further enriched with a profile of the key competences for lifelong learning that emerges from the observation of the students' activities as they are engaged in group study and work.

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[1] Gell-Mann, Murray. 1994. The Quark and the Jaguar: Adventures in the Simple and the Complex. New York: W.H. Freeman

[2] Christian, David. 2004. Maps of Time: An Introduction to Big History. Berkeley: University of California Press.

[3] Spier, Fred.2011. Big History and the Future of Humanity. Oxford: Wiley-Blackwell.

[4] From the document approved by the scientific committee of OPPI

[5] https://www.youtube.com/watch?v=-1AyJMzNiBw

[6] Elliott J., 1991, Action Research for educational change, Philadelphia, Open University Press

[7] Elliott J., Giordan A., Scurati C.1993. La ricerca-azione Metodiche, strumenti, casi. [Action research. Metodologies, instruments, cases]. Torino, Bollati Boringhieri Patrizia.

[8] Patrizia Magnoler. 2012. Ricerca e formazione La professionalizzazione degli insegnanti [Research and training. The professionalization of teachers].. Lecce, Pensa Multimedia 2012.

[9] Cappucci, G., A. Codetta and G. Cazzaniga. 2001. Lo zero e il senso comune [Zero and common sense]. Armando ed. Roma.

[10] Codetta A. 2002. Survey on the Temporariness of Disciplinary Learning. CIEAEM 53 (Commission Internationale pour l'Etude et l'Amelioration de l'Enseignement des Mathematiques) proceedings. Ghisetti e Corvi Editori, Milano. http://www.codetta.it/mat_fis/index.htm.

[11] Novak, E. 1984. Learning How to Learn. Cambridge and NY: Cambridge University Press

[12] Morin, E. La Tête bien faite. [The head well made]. 1999. Le seuil. Paris.

[13] Alvarez W. 2009. The Mountains of Saint Francis.WW Norton&Company. New York London.108-109

[14] http://coldigioco.org

[15] Hänze M., and R. Berger. 2007. Cooperative Learning, Motivational Effects, and Student Characteristics: An Experimental Study Comparing Cooperative Learning and Direct Instruction in 12th Grade Physics Classes." Learning and Instruction 17: 29–41.

[16] Liceo Banfi Vimercate 3a N. “Big History Italia—La Grande storia del nostro universo [The big history of our universe].” Youtube video, 30:32, https://www.youtube.com/watch?v=-1AyJMzNiBw

[17] http://avsport.org/IAA/index.html

[18] Zingg A., Handy M.R., Hunziker J.C., Schmid S.M., 1990. Tectonometamorphic history of the Ivrea Zone and its relationship to crustal evolution of the Southern Alps

[19] Bonin B. (coordinator) et al. 1993. Late Variscan magmatic evolution of the Alpine Basement. In von Raumer J.F. ed. Pre Mesozoic geology in the Alps, Sperling-Verlag. 171-201.

[20] Giaccone E., Colombo N., Acquaotta F., Paro L., Fratanni S. 2015. Climate variations in high altitude Alpine basin and their effect on a glacial environment Italian Western Alps. Atmosfera, 28, 2, 117-128.

[21] Dino G.A., Cavallo A. 2014, Ornamental stones of the Verbano Cusio Ossola quarry district: characterization of materials, quarrying techniques and history and relevance to local and national heritage. Geological Society, London, Special Publications, 407, 187-200