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Introducing Science Teaching in Early Years Education: Practical Insights of SciLit Project

Ruta Grigaliunaite[1], Jelena Mazaj[2]

Abstract

Improving science education has been a relevant objective of the policies of EU countries from 1990s; many programmes have been created since then. Their main task has been to promote the study of science and to support a positive image of science education improving public knowledge on it and fostering interest in science careers. This paper presents Erasmus+ KA2 Strategic Partnership for School Education project "Scientific literacy at the school: improving strategies and building new practices of science teaching in early years education - SciLit" (2016 -1- ES01- KA201- 025282), whose main aim is to develop innovative tools to facilitate the teaching of science in early years education. The project is based on the consideration that science teaching is a basis for the overall development of the child as well as a fundamental element in the scientific literacy, therefore training and innovative materials to support teachers to deliver high quality science education are needed. The paper gives insights into the project's objectives, rationale, state of the art of science education and introduces project's main outputs.

Keywords: *Science education, early-years education, teachers' engagement, European project;*

1. Introduction to the SciLit project

SciLit is a 2-year project (2016-2018) co-funded by the Erasmus+ Programme, Key Action 2 Strategic Partnerships for school education. The project aims to go one-step ahead on the way science is taught in the early stages and to develop necessary tools to facilitate the teaching of science. SciLit brings together scientists, educators and experts in the non-formal education field, not only to transmit scientific knowledge, but also to discuss and investigate how to present this knowledge in early education paying attention to the needs and psychological developments of children. As so, eight EU partners represent the project: Spain (The Spanish National Research Council CSIC, teachers center CPR Gijon, primary school San Francisco), Poland (Kindergarten P34, teacher education center KPCEN), Estonia (Asunduse kindergarten), Lithuania (Kindergarten "Zilvitis") and Italy (NGO CESIE).

1.2 Aims of the Project

The most important feature that characterises the philosophy of SciLit is the consideration of science teaching as a tool for the overall development of children and a basic element in the scientific literacy of citizens. Therefore, the project aims to foster transformation of science education from the early years.
The project has the following objectives:

- To improve achievement in relevant and high-level basic and transversal competences by teaching to teach Science.
- To promote training of educators in science from a multidisciplinary point of view.
- To introduce science contents in the classroom, both in kindergartens and primary schools.
- To create and to consolidate a network of cooperation for the implementation of innovative practices on science education.
- To produce innovative materials that support educators to deliver high quality teaching adopting new methods and tools in the classroom.

The Consortium being aware that it is necessary to keep abreast of the new paradigms that are reorienting educational practice, seeks to develop more scientific training assuming it in a spirit of educational research to achieve the solution to the problems in the teaching-learning process. These approaches support the achievement of quality-learning outcomes for educators as well as benefits for schools and kindergartens.

[1] CESIE, Italy
[2] CESIE, Italy

1.3 Context and rationale

The quality of science education has been the focus of a number of research projects internationally [1]. These studies consistently report that there is a decline in student engagement with science across the middle years of schooling, and that, in the early years of education, science is often approached in a manner that is disconnected from the lives of students [1], [2]. Additionally, different social, cultural and economic factors are identified explaining why youths have limited interest in STEM [7].

According to the movement that began with Richard Feynman and was later followed by Georges Charpak and Norman Lederman, regarding that how the way of thinking is formed, values and ideals are acquired forming the personality of the individual starts in the early stages of education [3]. The teaching of science in the early years presents special features, therefore providing mastery experiences alone is not sufficient if meaningful understanding of science teaching/ learning is to be achieved [4]. In particular, there are indications that a large proportion of primary teachers have low levels of confidence and background knowledge in science, which impacts both their willingness and ability to teach science effectively [1]. In the case of teaching adults is enough that teachers are trained in knowledge and methods; however, in the case of the early years of education, teachers must have a detailed knowledge of cognitive moments of the child, regarding children's ability to conceptualise and special training on how to teach science education.

2. The State of the Art of science education in Europe

Improving science education has been a key objective of European countries since the end of the 1990s, and a considerable number of initiatives have been set up to address it [5]. Such initiatives are based on developing STEM skills and improving career choice to ensure better integration into the labour market [7]. One more objective has been to encourage more students to study science, promote a positive image of science and improve public knowledge on it. To this end, a wide range of measures, starting in the earliest years has been introduced to improve student interest in science. Within the measures there are: implementing curriculum reforms, creating partnerships between schools and companies (providing a context for science, organising site visits, participation in curricula development, etc.) [7].), scientists and research centres and initializing projects focusing on continuing professional development of teachers.

2.1 Teacher training in science education

Studies show that development of children's understandings is fundamentally tied to the quality of teaching [6], highlighting the need for significant improvements in current and future teachers' attitudes, personal efficacy and ability to teach science effectively. Nowadays roles of teachers are changing, and expectations about them: teachers are asked to teach in multicultural classrooms, integrate students with special needs, use ICT for teaching, engage in evaluation and accountability processes, involve parents in schools; but the most important competence addressed in teacher education at European level is knowledge and ability to teach the science curriculum [8].

Educators nowadays have to deal with different situations, like teaching a various range of students, taking into account different interests of boys and girls, avoiding gender stereotypes when interacting with students. These are complex but necessary competences to be addressed in European programmes. Past European evaluations of science promotion strategies have shown that strengthening teachers' competences is a central concern [9]. As a matter of fact, countries with a strategic framework for promotion of science education normally include the improvement of science teacher education as one of their measures. As far as the teaching approach is concerned, in project countries, policy efforts concern with the issue of social inclusion while in the other countries there is an emphasis on identifying and nurturing talented students. This condition is reflected also in the priorities of initial teacher training depending on the settings of various national education systems [9]. These systems have started science promotion activities, often promoted by school partnerships that provide strong support for teacher professional development. The field is complex since science teachers teach at different educational levels, are often educated in different subjects, and belong to various cultures, educationally and socially. Not very frequent are, however, specific national initiatives for initial science teacher education.

3. The SciLit tools and impact

Considering the State of Art of Science education across Europe and the necessity to support teachers in the delivery of science education in early years' education, the SciLit partnership has been developing materials for educators for teaching science education.

Firstly, the Guide for policy makers, scientists, education professionals and national, regional,local authorities involved in science education is being develped. It proposes an educational itinerary to facilitate understanding of scientific concepts and provides explanations of how to introduce science in the classroom from early years of education.

Secondly, the Guide for teachers and classroom materials "What is the world made of" related to natural sciences are being elaborated. The content of the guide is dealing with matters such as atoms, molecules, crystals; matter organisation; water molecules; electricity laws and its relation with forces. This guide supports teachers to bring students from the macroscopic world to the microscope: investigating on what our eyes cannot see taking into the consideration special features for education in early stages.

Thirdly, the materials "Archaeology in the classroom" for teaching social and human sciences bringing archaeology closer to the students are being developed. Main chapters of the toolkit deal with matters such as stratigraphy, the importance of cultural heritage and cultural landscape, as both are the product of human and environment interaction; the educative values of archaeology and its application in the classroom; how to measure time and context in archaeology.

The staff of the education organisations will benefit from the materials developed by this partnership acquiring a high level of competences necessary to foster science education based on modeling and experimentation in the classroom.

Students in early years of education will benefit directly from the results of SciLit:they will broaden their horizons gaining knowledge of science. This will promote their desire to explore the world (making them more active). They will be able to understand better the mechanisms of cause and effect relationships that occur in their environment (more critics). They will gain the confidence to challenge the reality, which will result in their further cognitive development. Through experimentation, they will learn to join the different and distinctive groups of European multicultural society as well as being encouraged to improve language and ICT skills.

Finally, the project gives an added value to the activity of the education organisations that are using and going to use the developed materials, as the level of the schools will be improved by integrating innovative materials in the educational curricula.

4. Conclusions

For almost twenty years, EU countries have promoted the study of science, however different challenges such as: increasing poverty, growing changes in the digitalisation sector, labour market stagnation or internationalisation, etc. make science education even more important these days. Therefore, we need to continue working through an active co-operation on common policies addressed to the improvement of strategies and to the building of new practices for science teaching.

The project was designed to establish critical success factors that are necessary to put the most appropriate means to ensure the teaching performance of teachers in the application of the new processes of science teaching in early years education. Mentioned materials that can be used universally will support elementary and primary teacher initial and continual training contributing to national policies and the priorities of teacher training.

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