Learning science through drama activities and creative writing in primary and secondary school classes

Dana Crăciun[G]

Abstract

Science and technology play an important role in our modern society. It is important to know the scientific concepts, their usefulness to society, but also the ethical and moral issues related to them. However, science is often perceived as elitist, accessible only to the elect. On the other hand, humanities and artistic activities offer a livelier, non-traditional way of learning and involve the majority of the children in the science class. Children are willing to draw, play or write stories. And so, science and games, drawing or creative writing, are braided to form the scientific thinking of children and to acquire specific concepts. In this study we present the reasons for which drama or creative writing can be applied while teaching science (physics, chemistry) courses at primary and secondary level in Romania, with the aim of changing the attitude of children towards such disciplines. The study also highlights various opinions of current and future science teachers.

Keywords: science education, humanities, creativity, extended intelligence, pre-service teacher training

Introduction

In the last decades, the interest of children in sciences (physics and chemistry) has experienced a constant drop both in Romania as well as in a large majority of European countries (Osborne and Dillon, 2008; Crăciun, 2013).

However, modern society is based on science and technology, which implies the need for knowledge about and understanding of these topics from an early age. Thus, various teaching methods have been designed or modified to be applicable in classrooms aiming to create scientific knowledge and understanding of its impacts on society.

In this regard, we can mention context-based science education, or science, technology and society education-STS (Turner, 2008; Albe, 2008; Wieringa et all, 2011), which also highlights both the social effects of scientific progress as well as the controversies and ethical problems that comes with it. Teaching methods which use dramatization techniques such as debate and role-plays, can be used to develop empathy in children and to make

[*] *Lecturer, PhD. , West University of Timişoara, Teacher Training Department, Blvd. V. Parvan 4, 300223 Timişoara, Romania, email: craciundana@gmail.com*

them aware of the different viewpoints emerged on a given topic. The aim is to develop reflexive competences in children as an answer to current socio-scientific problems (Holbrook and Rannikmae, 2007).The children can either directly play the roles in the proposed dramatization or we can consider science theatre with professional actors, a method developed in some European countries such as UK, Norway, and The Netherlands (Odegaard, 2003).

Authentic learning situations are created in these cases. Theatre plays develop the interest for science of children exposing them to contradictory feelings towards given topics. An open end of the theatre play could also provoke self-reflection.

Furthermore, theatre also enhances the imagination and creativity of children. These two characteristics are considered important components in the learning process (Wieringa et all, 2011; Holbrook and Rannikmae, 2007).

The imagination can also be developed through other activities which imply for example creative writing, drawing, animated drawing, etc.

All these activities that are not specific to science classes can lead to a favourable attitude of children towards such disciplines, researchers and research work in general, especially in the case of elementary and secondary school children for which games, poetry and drawing are still enjoyable activities.

As showed in (Osborne, Simon and Collins, 2003) this favourable attitude presumes:

- the acceptance of scientific enquiry as a way of thought;

- the adoption of 'scientific attitudes';

- the enjoyment of science learning experiences;

- the development of interests in science and science-related activities; and

- the development of an interest in pursuing a career in science or science related.

This increase in interest and a favourable attitude towards science within children in elementary and secondary schools is a necessary condition for a competitive science education at high school and undergraduate level. We highlight that the educational process is cyclic. More children interested in physics offer a larger selection base from which to select university students and future physics teachers respectively. These students in turn could lead to a shift in the attitudes of elementary and secondary school children and can motivate children to study sciences.

This study highlights the reasons for which this type of activities should be applied in elementary and secondary school physics (science) classes. This study presents various ways to apply methods and to use activities that stimulate the imagination and creativity of children expressed through the opinions of current and future science teachers.

Method

The union of science, art and writing around a central scientific focus represents a powerful way of bringing science into the classroom. This approach is based on the imagination, creativity and active collaboration of children in multidisciplinary activities.

The role of imagination and creativity in science education

In his book Cosmic Religion and Other Opinions and Aphorisms, A. Einstein wrote "Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution." (Einstein, 2009).

In education, imagination develops writing, speaking, and creative self-expression of children. It is a necessary component for innovations, inventions and understanding in general. Imagination is a sine qua non condition for scientific creations and its stimulation implies the stimulation of abstract thinking, the generation of mental images, convictions, narrative thinking, etc. (Coskun Samli, 2011).

Creativity, however, is linked to a given problem to which original solutions have to be found. Scientific theories are the creative products of scientists that are based on personal ideas (or that can be based on other scientific ideas and be creatively reorganized) and that determine essential contributions to the domain. Researchers must use their own imagination when they develop their theory. This process can be highly creative; it can be logical/rational or even accidental (Hadzigeorgiou, Fokialis and Kabouropoulou, 2012). Creativity has an applied component linked to solving concrete problems. It implies fluency and mental flexibility along with sensitivity to the problems.

If we refer ourselves to science education we should first make a distinction between scientific creativity and scientific activities through which scientific knowledge can be learned.

Scientific activities can include theatre, art in general or methods specific to humanities like creative writing and poetry which can be a novel way for children to express their ideas and the concepts they learn in school. In order to develop the scientific creativity, children must first know the scientific content for a given topic. The teacher must focus on the development of imaginative thinking, narrative thinking, visual-spatial thinking, all of which should be integrated in a social context. In authentic learning situations, teachers should allow the children to choose their own way of expressing themselves so that they can manifest their creativity.

Drama and science

Drama is a universal form of human expression found in cultures all over the world. Role-plays, mime or creative drama are activities that elementary and secondary school children enjoy doing and thus, can be successfully used in science education (Odegaard,2003).

The following characteristics can be found among the beneficial aspects of applying such teaching methods during science classes:

- it is a form of active learning;

- develops imagination and creativity;

- it is an activity which uses multiple senses at once and which operates with the extended intelligence of the children (analytical, emotional and kinaesthetic intelligence);

- it's an effective strategy to learn scientific content and processes;

- children find role playing memorable and fun;

- increases the motivation of children;

- creative drama can be used to construct knowledge and lead to a deeper understanding of the subject matter;

- children reflect on the experiences and show a greater degree of responsibility for their learning;

- allows the children to define the problem, find solutions to it and apply them;

- creating the play allows the children to use scientific knowledge recently acquired by teaching it to others;

- can teach about ethical and moral issues arising from the science curriculum, etc. (Odegaard , 2003; Dorion, 2009; Wieringa et all, 2011)

We have presented numerous activities that imply this method in a previous study (Crăciun, 2010).

The power of writing

At the opposite pole of the continuum of expression media lie the written communication methods used during the science classes but which also presume student centred activities in which children are actively involved. When a child writes, he (or she) must think about the topic considered, form his (her) own opinions, sort out his (her) uncertainties and connect the newly acquired knowledge to the prior one or to the preconceptions regarding the topic. Written communication is precise; it increases retention and enriches the vocabulary of child.

According to Keys (1999), writing genres used in the school curriculum can be divided into three major categories: poetic genres used to reflect on the personal experiences and emotions (stories, poetry, drawings, lyrics, drama, etc.); expressive genres used to explore ideas (notes, brainstorming, questions, abstracts, descriptions, journals, etc.) and transactional genres used to inform and report (experiment, explanation, report, speech, biography, etc.).

The author considers that writing in scientific genres promotes the construction of new knowledge by creating a unique, reflexive media for the children that are involved in scientific activities (investigations, experiments, systematic observations, etc.). Note that in this case, the written text must be objective, logical and precise.

On the other hand, creative writing encourages the learners to use their imaginations and express their emotions to create written material. It can include any written expression: a novel, short story, drama, play, epic, poetry, lyrics of a song, script of a play, dialogue or non-fiction writings like speech, autobiography, biography, historical writings, memoirs, travelogues, etc.

In this type of creative writing one can use metaphors, allegories which find their correspondent in analogies or abstract theoretical models devised by scientists (Ashkenazi, 2009). It provides the adequate means to develop the emotional intelligence of children and to make them sensitive to current problems in physics and sciences with the implications and controversies these problems generate in modern society (Metaphor is an organizer of ideas and concepts. Metaphor creates similarity).

Last but not least we should mention that written communication using graphical organizers, diagrams, mind maps or drawings can be framed somewhere at the border between writing and art.

Procedure

In this study, we investigate if this type of activities is used when teaching science in primary and secondary school. Furthermore, we are interested in the opinion of current and future teachers about methods that are not specific to science education and their comparison to the traditional ones.

We also want to know if these teachers have acquired the necessary competences for such a teaching activity during their initial teacher training or their specialization studies.

In order to answer these questions, we have applied a questionnaire to a group of 35 primary school teachers, 30 secondary school teachers (of physics and chemistry) and 11 students of the Faculty of Physics which have been also enrolled in the teacher training classes within the West University of Timisoara. The questionnaire have used is the following:

Questionnaire regarding approaching science through drama and creative writing activities in primary and secondary school

Q1. Which are, in your opinion, the best methods for teaching (learning) science in primary/ secondary school? Why?

Q2. Do you consider that these methods allow the majority of students to study and deepen specific themes belonging to top domains of science?

Q3. B. Nicolescu: "In education, transdisciplinarity means operating with an extended intelligence, which reflects the triad: analytical intelligence, emotional intelligence, body intelligence."

Do you consider that the methods usually used in science classes develop this extended intelligence?

Q4. How do you think you can develop emotional intelligence in science classes?

Q5. Do you consider that the use of creative writing, drama or interactive role-plays can develop, during science classes, this type of intelligence?

Q6. Do you consider that top science topics can be studied through such activities specific for humanities?

Q7. Do you consider that creative writing and drama activities, done during the science class, may bring science and less interested students closer together?

Q8. Do you consider that the approach to science through specific humanities activities can lead to

(a) the development of creativity and imagination

(b) holistic approach of science

(c) formation of metacompetences

(d) healthy and harmonic development of the student

(e) development of social skills

Q9. Provide other elements that would, in your opinion, bind science and humanities together, in school.

Q10. During your professional training did you acquire

a. competences in science? b. competencies in humanities ?

Q11. If a programme of studies in this direction would be proposed, would you participate in it?

Q12. Other comments or proposals.

For questions 2, 3, 8 and 11 they have to choose between the following answers:

Yes/ No/ Don't know.

For questions 5-7 they have to choose between the following answers:

I agree/ I partially agree/ I partially disagree/ I disagree/ I don't know.

Results and discussions

The questionnaire has been applied to primary and secondary school teachers in Timisoara, during the academic year 2012-2013. The same questionnaire has then been applied to students which have been enrolled in

the teacher training program from the West University of Timisoara in the academic year 2012-2013 (5 students) and also to students that are currently enrolled in the academic year 2013-2014 (6 students).

Among the methods that are used for teaching science, the participants have enumerated hands-on approaches / experiments and direct observations, team work and various active methods (brainstorming, investigations, etc.). These methods are considered to allow the majority of children to study and deepen specific themes belonging to top domains of science. It has to be noted that methods neither based on written communication nor on role-playing have been mentioned among these methods.

With respect to trans-disciplinary education, over 50% of the participants have considered that these methods do not develop the trilogy: analytical intelligence, emotional intelligence, body intelligence (40 out of 76).

Regarding emotional intelligence, over 70% of the participants have considered that it can be developed through team-work, group activities and assignments, role playing and basically most activities that include working in groups as opposed to individual work (60 out of 76).

The participants have also considered that using creative writing, drama or interactive role-plays could develop the emotional intelligence of the children (95%, or 72 out of 76). Up to question 5, we have not found significant differences between the answers current or future teachers have provided. This highlights the fact that these methods are not related to the initial teacher training, but are rather correlated to the age of the children.

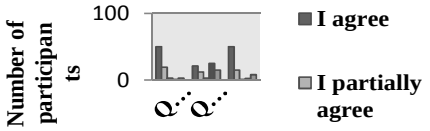

Figure 8. Distribution of teachers answers regarding questions 5,6 and 7

A first major difference of opinions can be observed once we consider the subject of top science topics and the approach of such topics using methods specific to the humanities. Only 10% (4 out of 35) of the primary school teachers have considered that this might be a good idea, as opposed to 60% (20 out of 30) of the secondary school teachers and 80% (9 out of 11) of the future teachers.

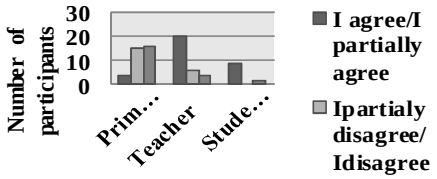

Figure 9. Q6. Classification of responses depending on the category of participants

This result suggests that primary school teachers have only a basic training in the science domain (only a limited number of subjects have been approached during training, most of them being related to the verbalization of science) and are not able to make a correlation adapted to the primary school level between top scientific theories and their impact on society.

Another significant difference in the opinions of the participants has been observed when answering question 7. More than 95% of the current teachers (62 out of 65) have answered positively to this question, as opposed to only 27% of the future teachers (3 out of 11).

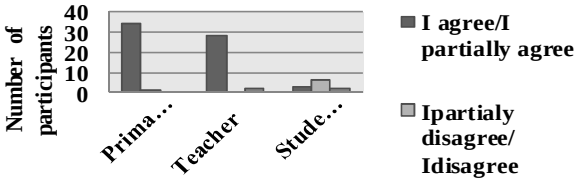

Figure 10. Q7. Classification of responses depending on the category of participants

This result can be explained by the fact that future teachers have a solid theoretical training, but lack the class experience and the interaction with children. In their perception, the teaching process is still based on what the teacher has to do in class and not on the teacher – student interaction.

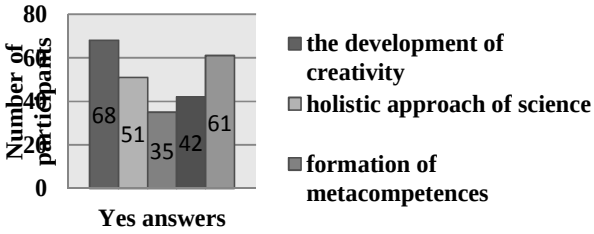

Figure 11. Q8. The frequency of positive answers with respect to humanities activities in science education

Regarding question 8, most teachers who have completed the questionnaire have felt that both creative writing and dramatic activities primarily develop creativity in science approach.

Drama and creative writing develops social skills, a harmonious development of the child and leads to a holistic approach to science.

Secondary school teachers but mostly primary school teachers have found other ways to link science and humanities within the teaching activities. Among the various activities they have proposed we mention: analogies between facts or concepts that are not directly linked to each other; creative experiments proposed by students; journals of observations; free essays; science-fiction storytelling; games; mind maps; crosswords; creative writing

with the aid of drawings or symbols; making analogies to explain various concepts or phenomena through drawings, texts or movements; posters or timeline organizers to detail events and dates.

Teachers have considered that it is important for children to be able the correctly write observation protocols or experiment sheets, but also give them the chance to write essays or stories on a subject they have studied during the science class. Investigative activities can be combined with creative presentations such as student books, or posters.

With respect to their own training in scientific domain and humanities, 95% (34 out of 35) primary school teachers have considered that they did not accumulate sufficient competences during the initial teacher training (except for elementary mathematics) and would like to participate in additional programs in this direction.

However, 95% (39 din 41) of the science teachers are not interested in humanistic training, even if it leads to better communication and interaction with their students.

Conclusions

In this study we have highlighted the need to build a positive attitude in elementary and secondary school children towards sciences in a modern society that is based on science and technology. This attitude can be obtained also through methods such as role-plays, creative writing or other artistic activities which are not specific to science teaching but are loved by the children. Combining such methods with others that are specific to science teaching can lead to an authentic learning of the scientific content as well as the problems and issues scientific research generates in a modern society. The use of such methods in science classes leads to the development of creativity, imagination and reflexive thinking. All these components are necessary for scientific research and technological progress.

The transition from creative writing to the scientific one is much easier if children are taught to report the facts also in a poetic manner. In this way, we can think of crossing from creative activities to scientific creativity, from a science fiction nature of imagination to abstract thinking and from logical intelligence to multi-sensorial activities that operate with the extended intelligence of the children (analytical, emotional and kinesthetic).

References

Albe V. (2008). When scientific knowledge, daily life experience, epistemological and social considerations intersect: Students' argumentation in group discussions on a socio-scientific issue, *Research in Science Education, 38*, pp. 67–90.

Ashkenazi G. (2006). Metaphors in Science and Art: Enhancing Human Awareness and Perception, *Electronic Journal of Science Education, 11*(1), Retrieved from http://ejse.southwestern.edu on 10th January, 2014.

Coskun Samli A. (2011). From Imagination to Innovation, NewYork : Springer Science+Business Media, LLC.

Crăciun D. (2010). Role-Playing as a creative method in science education, *Journal of Science and Arts, 1*(12), pp. 175-182.

Crăciun D. (2013). Direcții interdisciplinare în formarea inițială a profesorilor de Științe, *Journal of Educational Sciences, 1*, pp. 34-45.

Dorion K.R. (2009). Science through drama: A multiple case exploration of the characteristics of drama activities used in secondary science lessons, *International Journal of Science Education, 31*(16), pp. 2247–2270.

Einstein A. (2009). Einstein on Cosmic Religion and Other Opinions and Aphorisms, (pp. 97), Dover Publication, Mineola, New York. (originally published in 1931 by Covici-Friede, Inc., New York)

Hadzigeorgiou Y., Fokialis P. & Kabouropoulou M. (2012). Thinking about Creativity in Science Education, *Creative Education, 3*(5), pp. 603-611.

Holbrook J. & Rannikmae M., (2007). The nature of science education for enhancing scientific literacy, *International Journal of Science Education, 29*(11), pp. 1347–1362.

Keys C., (1999). Revitalizing Instruction in Scientific Genres: Connecting Knowledge Production with Writing to Learn in Science, *Science Education, 83*(2), pp. 115-30.

Odegaard M. (2003). Dramatic science. A critical review of drama in science education, *Studies in Science Education, 39*(1), pp. 75–102.

Osborne J., Simon S. & Collins S. (2003). Attitudes towards science: A review of the literature and its implications, *International Journal of Science Education, 25*(9), 1049–1079

Turner S. (2008). School science and its controversies; or, whatever happened to scientific literacy?, *Public Understanding of Science, 17*(1), pp 55–72.

Wieringa N. F. , Swart Jac. A.A., Maples T., Witmondt L., Tobi H. & van der Windt H. J. (2011). Science Theatre at School: Providing a context to learn about socio-scientific issues, *International Journal of Science Education, Part B: Communication and Public Engagement, 1*(1), pp. 71–96.