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Teachers' Feedback Expressed in a Training Course Organized in a MOOC Environment

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Abstract

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The concept of Responsible Research and Innovation (RRI) became more and more visible in the last few years and is one of the new pillars in the European Commission policy, in particular within the European Commission's Science in Society programme, framed within the EU Horizon 2020 initiative. Taking into consideration the presence of this concept into the FP7 Programme priorities, a big number of European projects have been approved and financed by EU, in order to bring closer the research and innovation results to the people. One of those projects is the FP 7 ENGAGE Project ("Equipping the Next Generation for Active Engagement in Science Equipping the Next Generation", www.engagingscience.eu). The partnership of the project proposed to come with interesting continuous development programmes for teachers, organized through face-to-face workshops or on-line courses, where different interactive-participatory teaching strategies are presented and many examples of applying these strategies are discussed. These examples start from identifying a problematic situation (dilemma) that students may face in their real life and they need to find rational solutions, by using their scientific and socio-moral knowledge. The paper presents our findings based on the analysis of the Romanian teachers' feedback after they finished the 1st edition of the on-line course "*Methods of promoting RRI dimensions in Science Education*", organized by Valahia University Targoviste in 2015. Our analysis was focused on the Science teachers' replies to an initial and final questionnaire and to the teachers' reflections collected during the on-line course duration.

Keywords: Interactive-participative teaching strategies; on-line courses; investigation; dilemma lessons; ENGAGE project.

1. Introduction

We are living in a world full of research and technology. In each day we are surrounded by new and tiny but very powerful devices that use new materials and sophisticated technology. A big number of companies invest a lot in area of nanomaterials or new technologies, based on the new research and discoveries, together with very innovative results. We are forced to keep up the line with the technology development and sometimes it is really difficult to make it. This is because a lot of researchers put their efforts to lead us forward, to a new world of science and technology. But in this context, using new materials with unknown properties or facing a huge number of the challenges and risks during the development of new technologies, the overall risk of research and innovation to the society became a topic more and more discussed. People are willing now to discuss and understand the science policy and to transform this policy in order to have more benefits from the research area. This involves a paradigm change from the scientific freedom to expectation of socially-beneficial impact, precisely a change from the Science in Society to the Science for Society. This means that people want not only to read about new discoveries in science or technology, but also to hear what benefits are brought by those innovations for their lives.

In this respect, it was proposed the concept of *Responsible Research and Innovation* (*RRI*) which is still insufficiently clarified even in the scientific literature, although it is more commonly used in the European Union policies and programmes related to Science and beyond.

In fact, at the moment, RRI underpins several European projects and it represents the current image of the connection between Science and Society in the European Commission vision (European Commission Decision, 2015).

The mean of the RRI concept is any action of research and innovation which must be developed by a researcher in the context of assuming of the social and individual responsibilities. In this respect, research and innovation must meet a series of social, moral and ethical principles, has to be benefic for the society as a whole and for each individual. In addition, RRI must take into consideration the ratio of benefits and risks, to contribute to human progress and to be subordinated to positive purposes.

Since RRI concept is one of the priorities of the European Commission policy, being emphasized in the frame of *European Commission's Science in Society* programme, numerous FP7 projects were financed by EU to promote the research and innovation dimensions to the general public.

2. The ENGAGE Project

The ENGAGE Project (*Equipping the Next Generation for Active Engagement in Science Equipping the Next Generation*) is a three years FP7 Project approved by EU Commission in 2014 that was devoted to emphasize the RRI dimensions and introduce them into the Science lessons. The partnership of the project is formed by 14 institutions from 13 countries that are trying to make Science lessons more attractive, by promoting different interactive - participatory teaching strategies, based on involvement and investigation of the reality, identifying and testing alternative solutions, which allows students to think and apply their knowledge and consequently to make responsible decisions. In this context, the partnership proposed a 3 stage model for the teachers' development, to represent how teachers typically

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absorb an approach like RRI-teaching (Dwyer et al, 1991) adapted by Rogers and Twidle in 2012. According to this model, the teachers has to pass three steps of personal development (Fig. 1). The 1st Step (*Adopt*) is devoted to give the teachers the ability to use teaching materials promoted by ENGAGE partnership, which embed RRI-based teaching to achieve productive outcomes. In the 2nd Step (*Adapt*), the teachers have to go to a transitional stage, in order to promote RRI based teaching, with less prescriptive support. In the 3rd Step (*Transform*) the teachers understand the RRI philosophy and undergo a shift in their professional self-image for RRI teaching to be part of their repertoire.

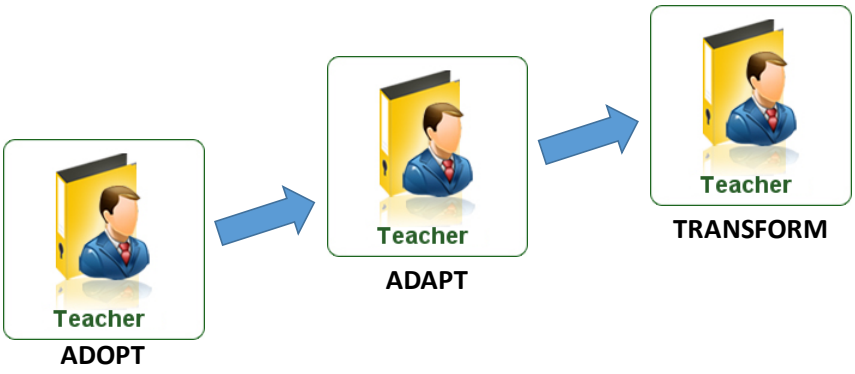
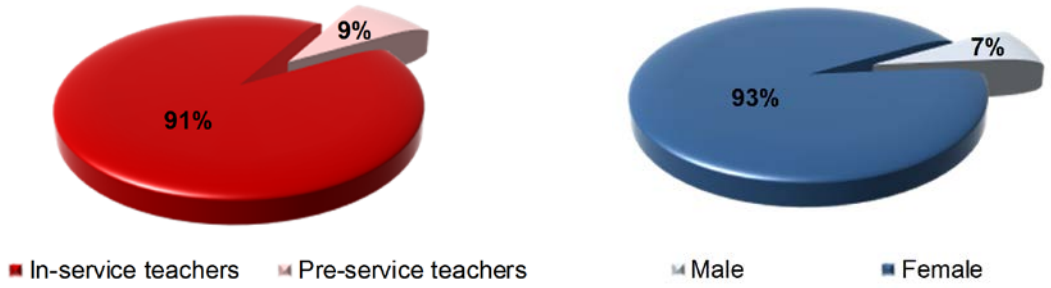


Fig. 1. 3 Steps Transformational CPD Model

In order to help teachers to understand easier the RRI philosophy and how the materials proposed by ENGAGE partnership can help them to introduce RRI dimensions in their regular Science lessons, in the frame of the project each partner had to organize face to face workshops and on-line courses in a *MOOC environment*. Valahia University Targoviste (VUT) team organized face-to-face workshops with Science teachers (Chemistry, Physics and Biology) from different counties and promoted also the on-line course entitled *"Methods of promoting RRI dimensions in Science Education"* to the level of the Science teachers' community. The first edition of the on-line course was organized on the *edX platform* during Nobember-December 2015.

3. Results and Discussions

The Romanian on-line course was carried out for seven weeks and comprised two stages (*Adopt* and *Adapt*) undertaking the three-stage path, towards achieving expertise related to RRI. The course aimed to teach the skills related to understanding and learning RRI, and also implementing ENGAGE materials in the classroom. A number of 58 participants were registered (in-service science teachers and university students involved in chemistry/chemical engineering bachelor study programme) and started the course. The distribution of the target group is illustrated in Figure 2.



(a) (b)

Fig. 2. Distribution of the participants who started the Romanian on-line course by: (a) Education Level; (b) Gender

The experience of the pre/in-service teachers related to participation to on-line courses was different, function of their age and teaching experience (Fig. 3).

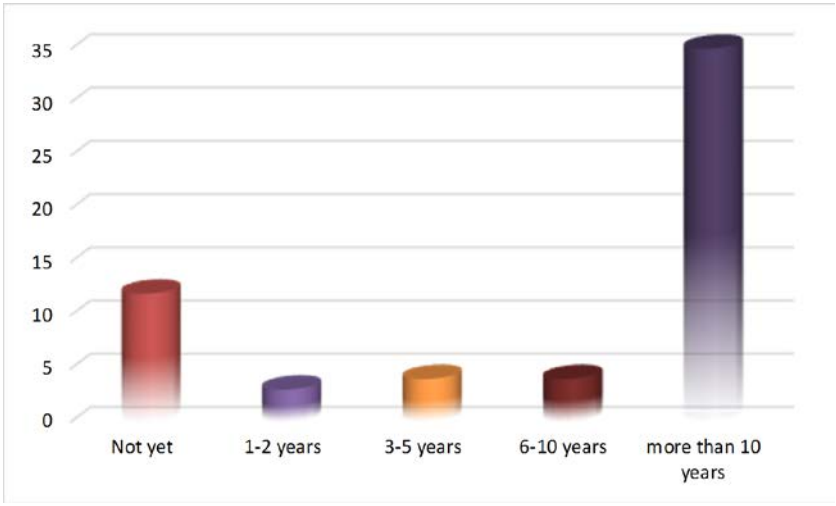


Fig. 3. Participants' experience in Science teaching

Figure 3 illustrates that VUT team tried to involve teachers with different level of experience in teaching Sciences, in order to ensure the possibility of creating an active community on *edX environment*, where in-service and even pre-service teachers can meet and change opinions about the topics presented during the on-line course and discuss about the possibilities to implement in the Science lessons the ENGAGE materials. As it was expected, rich discussions were developed weekly on the on-line course, in relations with the topics and established assignments.

During the on-line course the VUT team had three tutors who kept contact with participants and gave them details of how to solve the tasks. A total number of 44 participants achieved the tasks and finished the Romanian on-line course, their distribution concerning the teaching area is illustrated in Fig. 4.

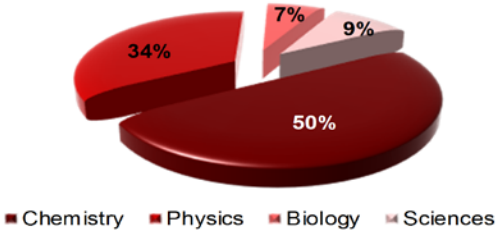


Fig. 4. Participants' distribution based on their actual/future area of teaching

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In order to make some connections between the *Inquiry based science education* (*IBSE*) strategy and "*Productive Dilemma*" teaching method, the tutors introduced a question related to teachers' previous experience about teaching Science through interactive teaching methods like problem-based learning or IBSE. The obtained data, illustrated in Fig. 5, show that those interactive methods are still not a regular practice for Romanian teachers, being used by them only "*sometimes*". Only few teachers reported that they frequently use those methodologies in their regular Science lessons. This is one of the reasons why such kind of on-line courses focused on presenting new and modern teaching methods and give examples on how to use them during the regular classes of Sciences have to be organized much often in order to convince the teachers to start to use these methods as regular teaching practice.

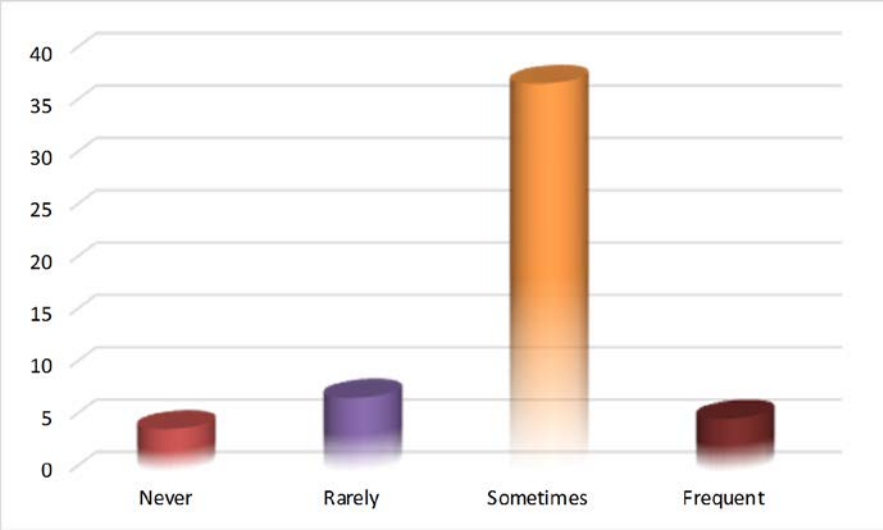

Fig. 5. Teachers' answers concerning their previous experience on using IBSE during the regular Science lessons

From the answers given by the teachers, it can be noted that they use frequently in their Science lessons teaching methods like: discussion, conversation, problem solving and scientific argumentation. If we take into consideration that one of the most interactive teaching strategy is dilemma, because it creates the premises for students to make a difficult choice between two or more alternative, equally controversial, one of the questions introduced in the questionnaires addressed to the teachers was related to their previous experience to use this teaching strategy in teaching different scientific topics. Regarding the use of socio-scientific dilemma in teaching Science, most of the teachers' answers were "*sometimes*", "*rarely*" or "*never*" (Fig. 6).

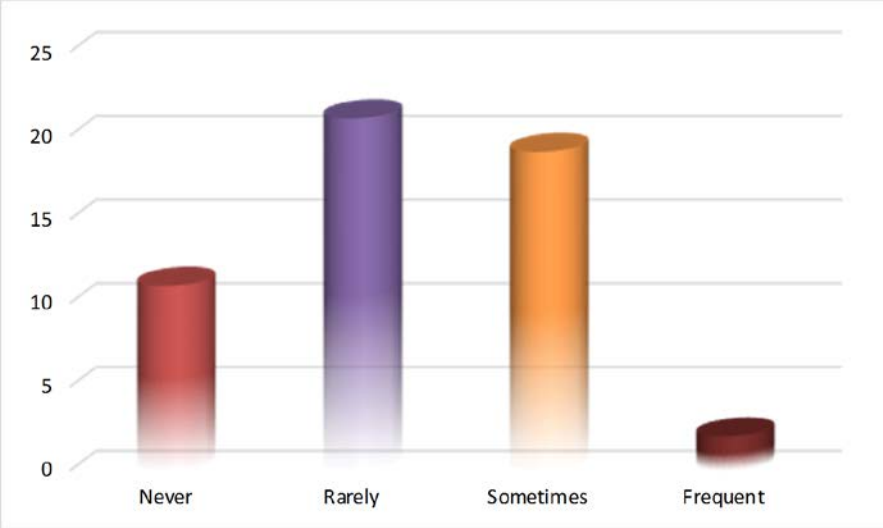

Fig. 6. Teachers' answers concerning their previous experience on using socio-scientific dilemma in teaching Science

In the frame of Science Education, dilemma refers to the socio-scientific controversies relating to the applications and implications of Science (Ratcliffe, 1997). It also includes a productive learning context and facilitates a better understanding of scientific topics, developing the students' skills and attitudes. It also strengthens the decision making and problem solving (Koballa, & Tippins, 2000).

Trying to stress the benefits of using the interactive teaching strategies in Science lessons, it was introduced in the questionnaire addressed to the teachers the question "*Which of the following objectives you achieved in this course?*", with multiple choice answer:

a) Motivating students to learn science in a fun way;
b) Development of students' investigative skills;
c) Increasing students' interest for scientific topics;
d) Assessing the way that modern science can engage students to think and talk;
e) Using the 5E model in Science lessons to develop RRI investigation/skills.

Teachers have the possibility to weigh the level of achieving of those objectives by using a 4-steps Likert scale (0 - indifferent, 1- low, 2 - medium, 3 - high). Their answers are illustrated in Figure 7 (a-d).

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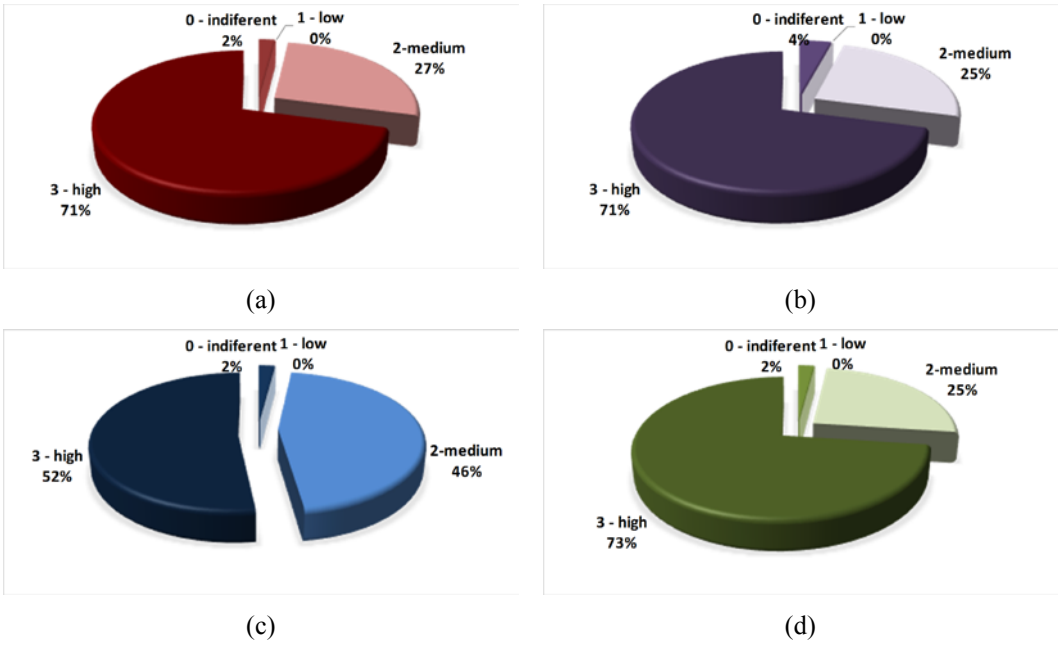

Fig. 7. Teachers' answers concerning the achievement of the following objectives at the end of the course:

(a) Motivating students to learn science; (b) Development of students' investigative skills; (c) Increasing students' interest for scientific topics; (d) Assessing the way that modern science can engage students to think and talk

Starting from the idea that the "5E Model" (Bybee et al, 2006) (Fig. 8) is a 5-steps teaching scenario in which the teacher creates a stimulating learning environment focused on investigation, research, experimentation, discovery, that places the student in the position of a responsible researcher, it can be appreciated that such an approach facilitates the relevant, sustainable and high quality learning, objectified in the formation / development of solid expertise needed for an optimal socio-professional insertion of each individual.

In fact, the use of 5E Instructional model of teaching involves the development of responsible research and innovation dimensions in Science lessons. Thus, it can be said that the "5E model" ensure the implementation of RRI in teaching Science.

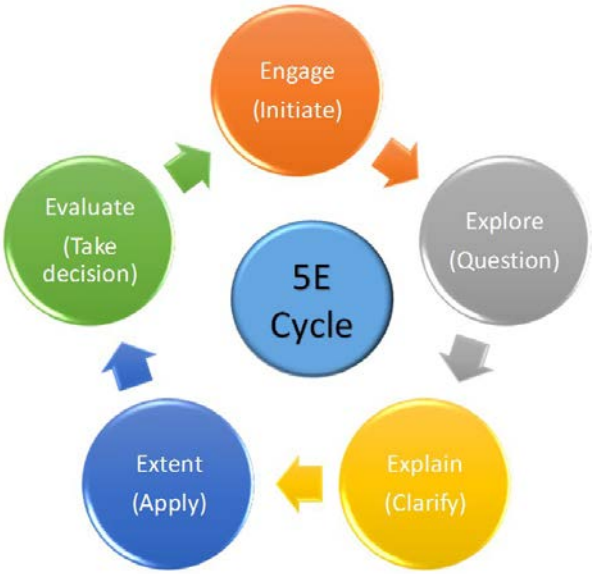

Fig. 8. Teachers' answers concerning the achievement of the proposed objectives at the end of the course

Trying to see the teachers' feedback related to the level of understanding on how to use this model and how it is correlated with the development of RRI investigation/skills, one of the questions introduced in the questionnaire was: "*After this course, do you think that you can organize alone a Science lesson by applying 5E Model to develop the RRI dimensions?*". The teachers' answers were again framed in a 4-steps Likert scale (0 - indifferent, 1- low, 2 - medium, 3 - high) and are illustrated in Fig. 9.

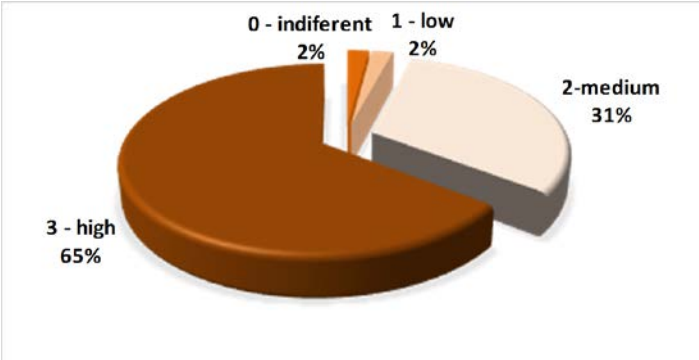

Fig. 9. Teachers' answers concerning the applying of 5E model during a regular Science lesson

A short analysis of the teachers' answers show that a big part of the teachers realized the relation between responsible research and innovation and the 5E model in Science teaching and understood that the "5E model" can be a good teaching strategy for increasing students' motivation in learning Science. At the same time, the teachers appreciate that they can use the "5E model" during their regular lessons after participating to the on-line course *"Methods of promoting RRI dimensions in Science Education"*.

4. Conclusions

Our investigative approach was based on the replies of a representative sample of Sciences teachers from Dambovita county who were involved in the 1st edition of the on-line course *"Methods of promoting RRI dimensions in Science Education"*, organized in the frame of ENGAGE project.

The data presented in the present paper demonstrates that the involved teachers appreciated the course content, the ways of presenting the selected topics and most of all the examples of dilemma lessons uploaded on the ENGAGE website and translated in Romanian language. All participants appreciated that they have learned a lot, even some of them were very experienced teachers, who were involved in a big number of CPD programs organized in the frame of national/ international projects related to new teaching strategies and tools for increase the young generation interest for Science and Technology.

It was concluded by the teachers that ENGAGE project proposes an interesting way to show students that science and contemporary technology is often based on uncertain evidence and argumentation and their point of view is important. The main conclusion of the target group was that ENGAGE materials are designed in a creative way that make students talk and think, involving them in moral, ethical and social reasoning, based on the analysis of benefits and risks (Petrescu, Gorghiu & Dumitrescu, 2015).

Acknowledgements

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References

Bybee, R.W., Taylor, J.A., Gardner, A., Van Scotter, P., Carlson Powell, J., Westbrook, A., & Landes, N. (2006). The BSCS 5E Instructional Model: Origins and Effectiveness. A Report Prepared for the Office of Science Education National Institutes of Health. BSCS 5415 Mark Dabling Boulevard. Colorado Springs, CO 80918, www.bscs.org, (719), 531-5550.

Dwyer, D.C., Ringstaff, C., Sandholtz, J.H. (1991). Changes in Teachers Beliefs and Practices in Technology - Rich Classrooms. Educational Leadership, 48(8), 45-54, http://www.ascd.org/ASCD/pdf/journals/ed_lead/el_199105_dwyer.pdf, accessed 2016-05-12.

European Commission Decision (2015). HORIZON 2020 Work Programme 2014-2015. Science with and for Society. https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-swfs_en.pdf, accessed 2016-05-12.

European Union (2014). Responsible Research and Innovation. Europe’s ability to respond to societal challenges. https://ec.europa.eu/research/swafs/pdf/pub_rri/KI0214595ENC.pdf, accessed 2016-05-12.

Koballa, T., Tippins, D. (2000). Cases in Middle and Secondary Science Education: The Promise and Dilemmas, 2nd Edition. Upper Saddle River. NJ: Pearson Merrill Prentice Hall.

Petrescu A.M.A., Gorghiu, L.M., Dumitrescu, C. (2015). The ENGAGE Project - A Facilitator Context for Promoting Responsible Research and Innovation in Science Lessons. Central & Eastern European LUMEN Conference: LUMEN NASHS 2015: Chisinau, Republic of Moldova: 11-13 September 2015.

Ratcliffe, M. (1997). Pupil decision-making about socio-scientific issues within the science curriculum. International Journal of Science Education, 19(2), 167-182.