Views of second chance schools science teachers on scientific literacy curriculum

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Abstract

The institution of Second Chance was established as an effort to combat the social exclusion of adults who were unable to complete their basic education and do not have the necessary qualifications and skills to adapt to the requirements of modern society (IDEKE, 2003). Scientific literacy is a significant aim for the drop-out adults who decide to complete their compulsory schooling attending second chance schools. In this context, science teachers face the challenge of developing science curricula suitable for the needs of their students. The present study aims to investigate the views of science teachers on the meaning of scientific literacy in this context and the development of a curriculum to achieve this goal. For this purpose, eleven semi-structured interviews of science teachers (designers of science curriculum for their schools) were conducted. The analysis shows that most science teachers consider scientific literacy as a literacy in scientific principles to explain everyday situations. Neither students' sociocultural level nor the aim of developing students' sociopolitical awareness through socioscientific issues is taken into account.

1. Introduction: The context of second chance schools

Second Chance Schools (SCSs) were created under the auspices of the European Union as an experimental program for dropout adults. It was in the mid 90's when European Commission in the "White Paper on Education and Training" report acknowledged the risk of a rift in a contemporary scientific and technological society:

"It is a rift between those that can interpret; those who can only use; and those who are pushed out of mainstream society and rely upon social support: in other words, between those who know and those who do not know." (White Paper on Education and Training, 1995)

One of the proposals to confront that rift was the establishment of Second Chance Schools. In this context SCSs was launched in 2000 in Greece aiming to promote new literacies and competences associated with real-life situations and workplaces as an effort to combat the social exclusion of adults from socially vulnerable populations (such as women, unemployed, elders, minorities -Romani people and Muslims-, prisoners etc) who have not finished basic education. For the institution a literate person is the one who "is capable of participating in cultural, political and economic life in society but also enables them to change it" (IDEKE, 2003). Scientific literacy is a fundamental factor in achieving this goal.

Because of the variety of the school contexts it has been decided that each educator is responsible for the development of the curriculum for his/her lesson. For this purpose the educators must bear in mind the special personal or social needs and the variety of interests of the population referred.

2. Theoretical backgrounds: The term "scientific literacy" in international literature

The term "scientific literacy" most probably appeared for the first time in 1958. Paul Hurd used it to express the need of public support for science in USA in order to respond vigorously to the Soviet launch of Sputnik (Laughksch, 2000). Since then scientific literacy has become to be considered an essential part of general education and culture all over the world (Popli, 1999) and nowadays stands for "what the general public ought to know about science" (Durant, 1993). Nevertheless this definition is far more complex and that involves a variety of reasons: a) different meanings and interpretations of the term associated with the ideological position of the person who determines what the public ought to know about science and b) different implications based on who "the public" is (Laughksch, 2000).

As a consequence, within the last five decades, science education suggested a variety of goals for teaching science and a wide range of meanings of scientific literacy (Laughksch, 2000). According to DeBoer there is no need to look for consensus on how to define scientific literacy. Instead the term should be conceptualized broadly enough for local school districts and individual classroom teachers to set the goals that are most suitable for their particular situations along with the content and methodologies that are most appropriate for them and their students (DeBoer, 2000). This view is consistent with the operation of second chance schools but presupposes the ability of teachers to recognize the educational needs of their students and the skills needed to transform scientific knowledge into content knowledge about the different cultural contexts which schools are referred to.

To support teachers, science education communities design curriculum or general guidelines that set frameworks indicating the social demands for the education of science. After all, as

Aikenhead argues, scientific literacy is nothing more than a slo-gan used by educators worldwide to guide curriculum develop-ment and classroom practice (Aikenhead, 2000).
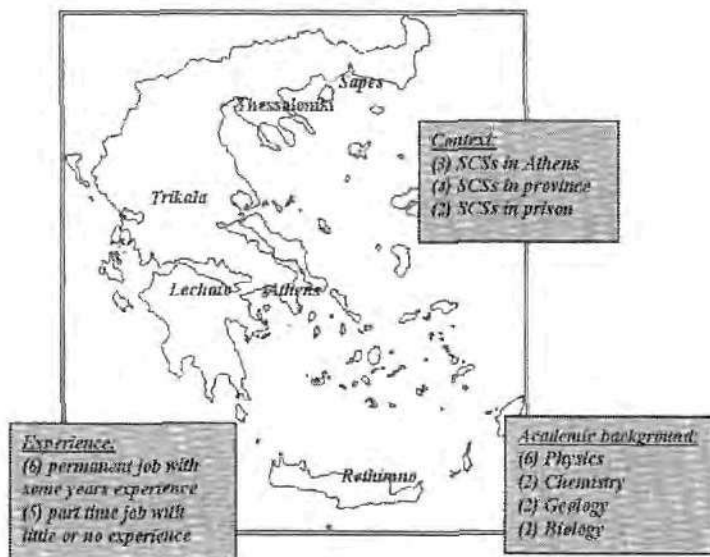
Roberts reviewed a large number of curriculum aiming scien-tific literacy. As a conclusion he identified two visions of the term in literature (Roberts, 2007): a) Vision I (science literacy) gives meaning to SL by looking science itself and b) Vision II (scientific literacy) derives its meaning from the character of situations with a scientific component, situations that students are likely to en-counter as citizens (literacy about science-related situations).

According to Bulte (2007) the debate can be interpreted in terms of the need of transition from Science Literacy to Scien-tific Literacy (a shift from Vision I to Vision II). Roth and Barton who worked with marginalized persons argue that this shift is not enough. It is the realness of the situations and the partici-pants' experience that raise questions about science curriculum policy and planning (Roberts, 2007). Layton introduced the term science for specific social purposes (SSSP) to capture the point that the context or situation of a socioscientific issue (or even an explanation) has a strong influence on the knowledge people bring to bear on it (Layton, 1986). At a more radical approach of scientific literacy, Dos Santos adopts the approach of Paolo Freire and highlights the political purpose of transforming op-pressive conditions in society. For this purpose it is necessary to stress the contradictions in the society and to establish a di-alogical process in classroom aiming to develop sociopolitical action (Dos Santos, 2008).

Considering the target group of Second Chance Schools the desired framework would approach the views of Roth and Bar-ton about the importance of context based curriculum designing and it would have implications on social and political issues from the perspective of the students' lives.

3. The study

This study aims to trace the views of second chance schools' science teachers on what scientific literacy means in this context and how to develop a curriculum to achieve this goal. For this purpose eleven semi-structured interviews of science teachers (designers of science curriculum for their schools) were conducted. The participants were from all over Greece (two of them worked in prison SCSs), had different academic backgrounds and different experiences in adult and typical education (some of them were inexperienced and working just a few hours every week in SCSs).

Context:
(3) SCSs in Athens
(4) SCSs in province
(2) SCSs in prison

Experience:
(6) permanent job with some years experience
(5) part time job with little or no experience

Academic background:
(6) Physics
(2) Chemistry
(2) Geology
(1) Biology

The content analysis of the interviews was based on the Grounded theory of Glaser and Strauss, which is a method of generating a theory inductively from a corpus of data (Strauss & Corbin, 1990). Through this method the educators' profile was correlated with the kind of curriculum they design. To create educators' profile three factors were taken into consideration: (a) their academic background, (b) their experience and (c) ability to understand the living conditions, the difficulties, the social or personal needs and the interests of their students. The latter

-(c)- was measured by counting how many times those parameters were mentioned as factors helping them to set goals and design their curriculum.

To identify the kind of curriculum that educators design we used a categorization of curriculum emphasis introduced by Roberts (Roberts, 1982). These categories had to be modified to reflect better on science teachers' views. Categories used in the present study are shown in the table bellow.

Curriculum Emphasis (Roberts' categories)	Content	Categories transformation generated by educators curriculums in SCSs	Vision
1. Everyday coping	Knowledge to control and to explain natural world	1 Solid foundation. Knowledge (by changing current conception into scientific if needed) to continue his studies in high secondary school (Cur. Emp. 7, 5)	Vision I
2. Structures of science	The conceptual and procedural aspects of science	2 Scientific skill development. Developing skills related with scientific thought and method (Cur. Emp. 4)	
3. Science-Technology decisions	Must become intelligent citizen who makes decisions about science and technology and societal issues	3 Nature of science. Understanding the conceptual and procedural aspects of science as well as the influences on scientific thought (Cur. Emp. 2, 6)	
4. Scientific skill development	Scientific explanations result from the correct use of inquiry processes	4 Everyday coping. Knowledge to control and explain everyday life and natural world (Cur. Emp. 1)	Vision II
5. Correct explanations	Current conceptions need to be changed to scientific concepts	5 Personal decisions. Logical thought and skills for decision making in everyday personal life problems (Cur. Emp. 4)	
6. Self as explainer	Conceptual system influenced by historical moments and the intellectual freedom gained by understanding the influences on scientific thought	6 Science-Technology decisions. Develop skills to become intelligent citizen who makes decisions about science and technology and societal issues (Cur. Emp. 3)	
7. Solid foundation	Must have a good beginning for a life of scientific study		

4. The results

The results show that there are three major categories of curriculum in SCSs.

1) The first category includes curriculum aiming science itself. Knowledge to continue studies, scientific skill development or nature of science are the choices of the science teachers that imply the Vision I point of view.

2) The second category includes curriculum providing the knowledge needed and developing the kind of thinking to cope with everyday personal life situations and problems.

3) The third category involves the ability of the learner to make choices related with socioscientific issues.

The second and third categories indicate the Roberts' Vision II about scientific literacy, however in this study they are considered as consisting two different approaches and levels of curriculum designing.

Curriculum aiming science itself

In the first category aiming science itself all educators are either inexperienced or experienced with young students (assuming they will continue their studies in high secondary school). When they were asked what meaning they give to scientific literacy considering their students, most of them stated:

"To acquire basic knowledge of science" or "To deal with concepts that will meet in high secondary school"

Clearly it is not the culture of their students they take into account as they design this kind of curriculum for Romani people or prisoners. Furthermore most educators don't even know how many students will actually continue in high secondary school. So it's their own teaching experience and the way they were taught that guide them to design curriculum that focuses in several concepts and methods. Their benchmark to choose the most appropriate content is the curriculum of the typical low secondary school. Influenced by the academic background they focus in Physics and Chemistry teaching measurement units, mechanics, structure of matter, periodic table, chemical reactions and related exercises. Through this content and the acquisition of the required scientific concepts, they believe they will provide their students the opportunity to continue their studies, identifying in essence the needs of their students and the combat of their social and economical exclusion with the degree of SCSs.

In the same category there were few educators setting the goal of scientific skill development and some others aiming to stress aspects of nature of science. The goal of scientific skill development is reflected in the above statement:

"To get in touch with the scientific method and scientific thinking"

The development they seek is served by applying the sequence of observation, hypothesis, experiment and conclusion.

The goal related with nature of science is stressed by educators with relevant studies and it is expressed in these statements:

"To understand the functioning of the natural world" or "To have an opinion about how things have evolved into what we believe today or how we have conquered those technological achievements"

To serve that goal they present the unity of the natural world from the macrocosm to the microcosm and provide examples of historical moments that changed the way we interpret the natural world.

Those views reveal a very positivistic view of scientific method, scientific thinking and the way scientific enterprise evolves.

Curriculum aiming to provide familiarity with science-related everyday personal life situations

Educators of this category, aiming the interpretation and management of daily life, are experienced educators or inexperienced ones who have high sensitivity and understanding of their students'culture. The most experienced try to set a meaningful context for the science topics by using science-related media articles. They choose to teach topics as the human body, earthquakes, solar eclipse, radiation etc. This approach for serving the goal of literacy implies strongly Vision II but still ignores the

part of citizenship that Roberts highlights in his definition of that Vision. The less experienced ones believe that providing knowledge for interpreting real life situations presupposes teaching scientific concepts. Consequently they develop a curriculum grounded on concepts to obtain the desired interpretations. This approach lacks of the necessary context to bring meaning to scientific knowledge.

The two educators working in prison had a high level of understanding of students living conditions and as a consequence they both set a goal of developing the kind of thinking to cope with everyday personal life problems.

"To organize their thinking through scientific kind of reasoning (causal reasoning) as an effort to master daily problems and to find a job when they are released from prison"

To serve that goal they introduce and highlight the way students should use scientific knowledge to think and interpret natural phenomena. What they are really interested in is helping their students to acquire of the process of creating arguments. Although this is a different and interesting approach none of them tried to apply this kind of thinking and argumentation in real life situations or socioscientific issues.

Curriculum aiming for decision making in socioscientific issues

At the last category there were just two educators trying to include socioscientific issues in their curriculum. They both had a high level of understanding of students living conditions and had a great deal of experience. In this case the main goals were:

"To be able to make decisions about science and technology related issues" or "To deal with matters of everyday life through the eyes of an active citizen "

Whilst those educators set such goals, only at the last topic of their curriculum they integrate relevant themes. The first one

approached this vision through energy, alternative energy sources, nuclear energy and arguments for and against and the second one through technology (pros and cons). This result reveals that even if educators are experienced and try to understand what should be a desirable goal for this target group, they don't know how to serve that goal through the content they choose.

5. Conclusions

To sum up most educators envision literacy through everyday life situations, although many of them are serving it by primarily setting the scientific concepts needed. Moreover many educators express the view that the main way to fight against the exclusion of these adults is the degree and the acquisition of some basic knowledge in different fields. This view may not be consistent with findings from the literature however in some cases actually scientific knowledge is a valuable tool for these people (e.g. knowledge about the human body or geography etc). The problem lies in the fact that only a few adopt and serve another aspect of scientific literacy, through developing social and personal skills to make pupils active citizens.

The culture of the students is rarely taken into account and there is a lack of social issues from the perspective of the problems and living conditions of students. Thus even those few situations that are stressed are not meaningful and critical for their lives. In other words the freedom given to those educators to design their own curriculum and the responsibility to take in mind their students needs and conditions is lost by serving narrowly the concept of scientific and technological literacy. Many of them have the sensitivity needed to understand the perspectives of this freedom, but maybe they don't know how to apply those perspectives school practice.

6. Discussions

To conclude, some of the educators' views could be highlighted. When George tried to describe why those people come back to school and what their aspirations are, he said:

"Most of them are afraid at first. It is a very big step for them to come back to school after so many years. Many do not even tell at their children about this decision. They have aspirations to enrich themselves, get a degree that will help them professionally and feel confident in their social life. It is a school that deals with people. SCSs offer social work, help people to join again the social structure and make them active citizens again, to stand on their feet and to participate in social processes. The cognitive aim is secondary. At fist there is the aim of developing skills, sometimes even changing their own beliefs."

Another one, Theodoros, commented on the influence of these studies on students' future lives:

"Look, sometimes I feel a joy when I accomplish some goals even for a few students. But this success is a reality or an illusion? Truth to be told, I do not think we accomplish many things for their future. Other factors, much more powerful, influence them much deeper. That is very difficult. Not much can be done."

Clearly for many of them there is no question about their intentions. It is the context and the conditions of the work of those educators that make the results of this study just a reproduction of something already known. So which is this context? The state itself envisions the integration of the students of SCSs through their degree hence their professional training. It is no coincidence that from this year the institution is under the Ministry of Employment and not from the Ministry of Education. Furthermore these educators have no support in changing their approaches in order to serve the needs of drop-out adult education. Therefore is it possible for educators who, at their ma-

jority, just work a few hours for little money and are hired in the middle of the school term to make themselves the transitions needed in curriculum designing and teaching strategies?

On the other hand is it a realistic goal within 2 years to make such a shift in the lives of people who experience for years the oppression and the exclusion of the society. Is it possible to acquire that kind of literacy that could to make those people take sociopolitical action and try to change their living conditions?

This institution and the people it refers to identifies a field that no other education than critical education could take place. However in order to have meaningful existence, the institution should provide some kind of support to the educators and real opportunities to the students to close the gap between the discussed theoretical critical and humanistic approaches in education and the reality of the school practice.

Note

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