



EVALUATION OF USING STORIES OF SCIENTIST LIVES BASED ON TEACHER VIEWS

^aSerhad Sadi BARUTUÇOĞLU, ^bAjda KAHVECİ & ^cHayati ŞEKER

^aPh.D Student, Marmara University Ataturk Faculty of Education, serhat1983@gmail.com

^bAssociate Professor, Canakkale Onsekiz Mart University Faculty of Education, ajda.kahveci@gmail.com

^cAssistant Professor, Marmara University Ataturk Faculty of Education, hayatiseker@yahoo.com

Abstract

This study is a part of an ongoing national project aiming to promote the use of HOS in science lessons in Turkey. For the study, educative HOS materials have been developed and prepared for classroom use at secondary level. A section of each material is devoted to stories of scientist lives. The life story of the scientist includes biographical information. Four chemistry teachers received the materials either in electronic or hard copy format and were asked to read, reflect on and use the materials or parts of the materials in their chemistry lessons. During the interviews the teachers were asked to talk about issues such as the general structure of the materials, the content of the stories that they preferred to use, their purposes of using that content, the way that they used it in classroom, and any suggestions that they may have for improvement. We conclude that using stories of scientist lives may serve two pedagogical purposes: preserving student attention in science lessons and humanization of science. For these purposes to be achieved, HOS information such as stories of scientist lives needs to find its place in science curricula and curriculum materials like textbooks.

Keywords: History of Science, Stories of Scientist Lives, Chemistry Education

INTRODUCTION

Using history of science (HOS) is seen as a way of enhancing science education and avoiding the more traditional practices of science teaching. Various studies have been conducted over more than five decades on using HOS and also philosophy of science in science education (Klopfer and Cooley, 1961; Holton & Rutherford, 1970; Leite, 2002). The National Science Education Standards (NRC, 1996) document indicates importance of using HOS in science lessons as following:

“In learning science, students need to understand that science reflects its history and is an ongoing, changing enterprise. The standards for the history and nature of science recommend the use of history in school science programs to clarify different aspects of scientific inquiry, the human aspects of science, and the role that science has played in the development of various cultures” (p. 107).

Objectives such as improving public perceptions of science, changing image of scientists, understanding science as an integral part of the culture are generally defined in science education curricula. Technology use and motivating students to learn concepts that they perceive as difficult are other goals of science curricula (Brush, 1989). Nurturing scientifically literate individuals is an overarching theme in most contemporary reform-based curricula. Using history of science (HOS) in science lessons has been one of the recommended strategies to achieve these goals (Shortland & Warwick, 1989). Using HOS has positive impact in science teaching, thus incorporating HOS content in textbooks is an important strategy to achieve this impact (Heering, 2009). However, science teachers are often dependent on their preferred teaching style and the formal curriculum. This situation makes them picky on using HOS in their lessons (Leite 1986, as cited in Leite 2002). It is emphasized that teachers are highly reluctant to devote additional time for the additional HOS information in their lessons (Kipnis, 2002). However including interesting stories such as lives of scientists, may encourage teachers on using HOS. Utilizing personal lives of scientists in science teaching is considered useful and may attract students' attention to the lesson (Seker & Welsh, 2006). Using stories including scientists' personal lives may also enhance a positive view about science for students (Welsh & Seker, 2003). Historical information emphasizes the personal side of scientists rather than their scientific side.

PURPOSE OF THIS STUDY

This study is a part of an ongoing national project aiming to promote the use of HOS in science lessons in Turkey. For the study, educative HOS materials have been developed and prepared for classroom use at secondary level. A section of each material is devoted to stories of scientist lives. Each material focuses on the most influential scientist in the discovery of a related concept, theory or law. Main purpose is to evaluate HOS information based on teacher views. Each material is revised and distributed to different teachers in order to acquire different views. These revisions include expansion or reduction of HOS information, correction of the content and including additional knowledge. In this study, curriculum materials including stories about scientists' personal lives (approximately half of a page for each material), were evaluated and their educational goals discussed with teachers.

THEORETICAL FRAMEWORK

Seker's (2007) model for the use of HOS was used as theoretical framework. This framework is based on four levels. These levels are hierarchically organized from easy to difficult. The interest level includes interesting parts of scientists' personal lives. Humanization of scientists' images and attracting students' attention to the lesson are main goals at this level. The second level is the socio-cultural level that includes information on science and society relationships. At the socio-cultural level, scientific authorities having impact on the development of scientific information, the scientist-public relations and science-technology relationship are sub levels. The third level is the epistemological level which is concerned with the formation of scientific knowledge. At this level it

is emphasized that there are many ways of improving scientific knowledge. Some of these methods include laboratory experiments, thought experiments, classification, observation, mathematical deduction and modeling. The fourth level in the model is the conceptual level. The conceptual level includes information about changing scientific concepts throughout time with an emphasis on the tentative nature of scientific knowledge. This study focuses on the interest level specifically.

METHOD

Life stories of scientists include biographical information as well as seductive details, which are interesting but unrelated to the subject matter content. In this paper we report chemistry teachers' experiences of using stories of scientist lives in their lessons. The HOS materials that were used by the teachers covered the following units and topics: the first topic of the *Mixtures* unit in Grade 9; the first four topics of the *States of Matter* unit in Grade 10. The names of the scientists associated with these topics are depicted in Table 1. Four chemistry teachers employed in four different high schools in a metropolitan area in Turkey received the materials either in electronic or hard copy format. They were asked to read, reflect on and use the materials or parts of the materials in their chemistry lessons. After the topics were covered, telephone interviews were conducted, audio recorded, and transcribed verbatim. Qualitative data analysis methods were utilized. Open coding followed by focused coding was employed to create meaningful categories in understanding teachers' perspectives. During the interviews the teachers were asked to talk about issues such as the general structure of the materials, the content of the stories that they preferred to use, their purposes of using that content, the way that they used it in classroom, and any suggestions that they may have for improvement.

Table 1. The scientists included in the materials.

Grade	Unit	Topic	Material Title	Scientist Names
9	Mixtures	Classification of Mixtures	Homogenous and Heterogeneous Mixtures	Aristotle
			Solubility and Solution	William Henry
			Mixtures and Physical Properties	François Marie Raoult
10	States of Matter	General Properties of Gases	General Properties of Gases - 1	Michael Faraday
			General Properties of Gases - 2	Thomas Graham
		Gas Laws	Boyle's Law	Robert Boyle
			Charles' Law	Jacques Charles/Joseph Louis Gay-Lussac
		Avogadro's Law	Amadeo Avogadro	
Gas Mixtures	Law of Partial Pressures	John Dalton		
Real Gases	Real Gases	James Clerk Maxwell		
	Joule-Thomson Effect	James Prescott Joule		

TEACHER VIEWS

Student Reaction

This code includes teacher views about students' reaction to stories on scientists' lives. Scientists' lives stories are regarded by teachers as highly attractive for students.

"I had some of the students read the stories, I gave these stories to them. When I read Raoult's life they listen extremely carefully. That Raoult was not a social person, that he was a quiet person... these attract their attention very much. They identify themselves with him. I don't know, but they like the fact that they can, discover lots of things while living this kind of life." (Nergis, Mixtures and Physical Properties)

"Scientists' lives are very good things but fairly, we don't have much time to tell this much detailed things. But a little detail, such as Faraday being an ironmasters' son, I underlined this. This attracts students' attention 'aaa he was poor, and studied later'. Maybe a sentence because they like these kinds of stories." (Aylin, General Properties of Gases-1)

"There was this thing in one of the stories that William Thomson had two birthdays... I mentioned this a little bit and we laughed together, they told me things like 'It is not normal to be normal after all these discoveries.' " (Aylin, Charles' Law)

"His life story... my students loved the part that he found batteries around, gave electroshocks to housemaids and enjoyed that. They couldn't believe to that part... they said 'did he continue experimenting during his honeymoon? Didn't he have any other stuff to do?' Namely, these interesting things attract their attention. " (Nergis, Joule-Thomson Effect)

Content

This code includes teachers' views about the content of these stories. Teachers most often use the interesting parts, especially the ones which may be role modeling in students' lives.

"I found William Henry's life interesting. I can mention about him a little. Trying hard to do things under challenging circumstances is interesting to me, and so is this scientist. The sufferings he faced during his childhood... yet he continued working." (Nilay, Solubility and Solution)

"We came across Boyle here and we liked it actually. It was very interesting to them that Boyle was the 14th child of a wealthy family. Here we read Boyle, then I asked what they recalled. We said he was the father of chemistry. There is pretty nice information here." (Nergis, Boyle's Law)

"Interesting, life stories especially can be very catchy. These are things that are not quite familiar to us and different than usual... I mean different than an ordinary life and it shows their working structures. He comes from a poor family, through tough situations but he comes to a good place by his own effort. These make good examples." (Şenay, Gas Mixtures)

"There I emphasized that part especially... that he was born in a poor family. That he couldn't find a life partner and that he was color blind. I said he used to sell paper and pencils with his father and sister to support family income. Then I said, that this didn't deter him and he made many

contributions to chemistry. Dalton's law of partial pressures then Dalton's atomic theory, law of multiple proportions, I told them that he made many other contributions to chemistry by emphasizing the poverty part of his life." (Nergis, Gas Mixtures)

Utilization Strategy

This code contains teachers' preferred strategies/styles of using these stories in class. Before distributing the materials, the teachers had been informed that they were totally free about deciding to the way of using the materials. Therefore, as expected, the strategy of use differs for every teacher.

"I took this note... there are things about Graham's life in the back page. Here you have a note that it can be used in certain occasions but this story can be used in the beginning of the lesson or when the students get distracted. I thought it can be squeezed in by saying 'Do you know his life story?'" (Halide, General Properties of Gases-2)

"It is ok but as I said I tend not to use it due to time limitations. For instance, you use it page by page, then I use it better when the students get tired." (Şenay, Boyle's Law)

"I would move life stories to the top to attract attention. I tell the stories at the beginning of the lesson; I do not have them read. Then I start the topic. I mean, I start it with the introduction part of the material. I start with the experiments." (Şenay, Charles' Law)

"I took the material home and I underlined what I saw as important. I mean, if I teach Gay-Lussac I used the related part, I had his life story read, I shared what I thought as important. Here is why, time is very limited, only two hours per week. We can't do a lot. Time is spent on joint exams. Sometimes the two hours get used up in the joint exams. That means you could not teach for the whole week." (Nergis, Avogadro's Law)

Utilization Purpose

This code includes teachers' expressions of their intentions about using these stories. Almost all of the teachers in the sample aimed to attract students' attention and to establish positive views about science and scientists.

"There is William Henry's life story. I didn't ask that way but when I tell that they had ordinary life stories, that they had married, had children, engaged in science... they pay attention." (Nergis, Solubility and Solution)

"I think there is benefit in to using these scientists' lives. Because, in what century they had lived, what they had done...it is useful to emphasize that there is this perseverance in doing something." (Halide, General Properties of Gases-1)

"The kids wonder where they were from when we talk about scientists. Does it serve its purpose?... I think interesting points in scientists' lives may enhance the interest in science. But everything in the life story may not be helpful. But they [stories] may tell the kids that scientists

are humans just like us. That may endear science to the kids. Stories may exemplify that it is possible if you work. I think it may be helpful.” (Şenay Boyle’s Law)

“We didn’t focus on the life stories. I particularly have them read those stories because I want them [the students] to see that scientists can have a normal life, they can marry, have kids, have parents, devote themselves to doing science despite all objections. ” (Nergis, Avogadro’s Law)

FINDINGS

The findings suggest that in general, the teachers were willing to use the stories of scientists’ lives. Based on teachers’ views it is possible to conclude that stories about scientists’ lives attract students’ attention. Lack of these kinds of stories in current textbooks and students’ unfamiliarity with scientists’ lives might have contributed to students’ affection.. Teachers use parts of the stories which they find interesting. They prefer to use the parts which can set good examples for students. The strategy for using the stories in class differs for every teacher. Teachers use these stories, or parts of the stories at the beginning, middle or end of the lesson. Some prefer to disperse various story details over the whole lesson. For some, the stories serve to recapture students’ attention when they get tired of the subject matter knowledge. Some teachers prefer to read at the outset while others make summaries during the lesson. Having the students read the stories is another strategy. The main goals for using these stories that emerged were attracting students’ attention and helping to increase interest in science as well as humanizing scientists. There were certain limitations acting as barriers to implement the life stories. Teachers complained about the insufficiency of the lesson hours allocated for chemistry (2 hours per week). Being restricted by the lesson hours on one and an overcrowded curriculum on the other hand, some of the teachers had to very briefly mention or skip the stories.

CONCLUSION

We conclude that using stories of scientists’ lives may be helpful in science lessons. The way of using this information in class differed for every teacher. The teachers were left free to choose their own strategy and methods in integrating the materials. Reading the stories out in class, having students read or make summaries by emphasizing specific important parts were the most common methods used. The teachers were also free to decide if they were going to use the stories in the beginning, middle or end of the lesson. The interesting and uncommon parts of the stories were considered by the teachers as being highly attractive from the students’ point of view. Some of the teachers preferred to use slices from the stories throughout the lesson. These parts served to attract students’ attention in the different phases of the lesson. Incorporating stories of scientists’ lives as extracurricular materials are considered helpful by the secondary level chemistry teachers in this sample. Such a result is one supporting evidence that information under the interest level in the HOS facilitator model integrated in classroom teaching serves its purpose. This study may urge textbook writers to incorporate life stories of scientists into future textbooks.

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