Second International Conference on Stories in Science Teaching

Deutsches Museum, Munich, Germany
July 14-18, 2008

Theme: *Stories from the History of Science: Knowledge Translation for the Science Classroom*

Organizing and Program Committee

Dr. Stephen Klassen, Department of Physics, University of Winnipeg, Winnipeg, Canada

Prof. Dr. Jürgen Teichmann, Ludwig-Maximilians University and former Director of Education at the Deutsches Museum, Munich, Germany

Assistant Sessions Moderator: John Murray, University of Manitoba, Winnipeg, Canada

Introduction

The *Second International Conference on Story in Science Teaching* brings together researchers, scholars, and educators from twelve countries to focus on stories relating to history of science and their effective use in the science classroom at all levels. The conference is guided by the question "*How should historical narratives be constructed, how can they be integrated into instruction, and how can they contribute effectively to student learning in science and mathematics?"*

Conference Purpose and Organization

The conference is a gathering of 25 academics who will present and discuss ideas and examples of and plans for constructing teaching units and cases that contain well–written, peer–validated stories. Conference participants will be privileged to participate in a guided tour of the Deutsches Museum.

Conference accommodations have been booked with the *Kerschensteiner Kolleg* at the Deutsches Museum, which is also the venue for the conference sessions.

Conference Sponsorship

The *Second International Conference on Story in Science Teaching* is grateful to the Deutsches Museum for hosting the conference, thereby making the wonderful facilities available and for providing coffee during the sessions. A special note of thanks is due to the Maurice Price Foundation under the umbrella of the University of Manitoba CRYSTAL grant for providing significant funding to the conference.

Presentations

A maximum of 30 minutes will be allotted for each presentation, with an additional 10 minutes for questions and discussion. The committee recommends that presentations consist of an introduction, a summary of the paper, and a conclusion, only, so that there may be sufficient time for serious discourse at the end of each presentation.

Conference Location

The *Second International Conference on Story in Science Teaching* takes place inside the Deutsches Museum in Munich, Germany, which is one of the world's leading science and technology museums, drawing about 1.3 million visitors each year. The museum's immense collection is spread out over 19 kilometers of corridors, six floors of exhibits, and 30 departments.

Conference Website

Information about the Conference may be obtained at the website www.sci-ed.org .

Conference Daily Schedule

❖ Monday, July 14, 2008

7:45 – 8:30 Breakfast at the Museum restaurant

Session 1: 9:00 – 9:15 Official Conference Opening
9:15 – 10:00 Ian Winchester
10:00 – 10:45 W. Gerhard Pohl

10:45 – 11:15 Coffee

Session 2: 11:15 – 12:00 Georgio Dragoni, Luisa Fiandri, & L. De Pasquale

12:00 – 13:30 Lunch on your own

Session 3: 13:30 – 14:15 Stephen Klassen
14:15 – 15:00 Brigitte Van Tiggelen

15:00 – 15:15 Break (Coffee available)

Session 4: 15:15 – 16:00 Kevin De Berg
16:00 – 16:45 Rick Wiebe & Art Stinner

Evening: Free

❖ Tuesday, July 15, 2008

8:00 – 8:45 Breakfast at the Museum restaurant

Session 5: 9:15 – 10:00 Jürgen Teichmann
10:00 – 10:45 Peter Heering

10:45 – 11:15 Coffee

Session 6: 11:15 – 12:00 Zofia Golab-Meyer

12:00 – 13:30 Lunch on your own

Session 7: 13:30 – 14:15 Yannis Hadzigeorgiou & Vassilis Garganourakis
14:15 – 15:00 Pierre Lauginie

15:00 – 15:15 Break (Coffee available)

Session 8: 15:15 – 16:00 Sarah Dietrich & Stephen Klassen *
16:00 – 16:30 Martin Panusch, Rajinder Singh, & Peter Heering *
16:30 – 17:00 Stefan Wolff

Evening: Free

❖ Wednesday, July 16, 2008, Free Time in Museum

❖ Thursday, July 17, 2008

8:00 – 8:45 Breakfast at the Museum restaurant

Session 9: 9:15 – 10:00 Panagiotis Kokkotas
10:00 – 10:45 Fanny Seroglou, Vassilis Koulountzos, Paris Papadopoulos & Odysseas Knavas

10:45 – 11:00 Break (Coffee available)

11:00 – 11:30 Conference Business

11:30 – 13:00 Lunch on your own

Session 10: 13:00 – 13:45 Agustín Adúriz-Bravo
13:45 – 14:30 Herbert Gerstberger

14:30 – 14:45 Break

Session 11: 14:45 – 16:30 Museum Tour and Presentation (leaves from Kerschensteiner Kolleg)

Evening: 19:00 – Conference Dinner (participants' expense)

❖ Friday, July 18, 2008

8:00 – 8:45 Breakfast at the Museum restaurant

Session 12: 9:15 – 10:00 John Murray
10:00 – 10:45 Andre Dagenais

10:45 – 11:15 Coffee

Session 13: 11:15 – 12:00 Fritz Kubli
12:00 – 12:30 Closing Discussion

* Shorter presentation

Conference Program of Sessions

❖ *Session 1: Monday, 9:00*

Opening and Introductions
Jürgen Teichmann, Stephen Klassen, and John Murray

Collingwood telling the story of the Idea of Nature
Ian Winchester, University of Calgary, Canada

Plus Lucis
W. Gerhard Pohl, Linz, Austria

❖ *Session 2: Monday, 11:15*

Joule's Electrical Generator and Its Special Educational Interest
Georgio Dragoni, and Luisa Fiandri, Bologna University; L. De Pasquale, Teacher of Physics, Bologna, Italy

❖ Session 3: Monday, 13:30

The Photoelectric Effect: Rehabilitating the Story for the Physics Classroom
Stephen Klassen, University of Winnipeg, Winnipeg, Canada

Telling the story of atoms: Do we have to get bo(h)red?
Brigitte Van Tiggelen, Louvain-la-neuve, Belgium

❖ Session 4: Monday, 15:15

The Arrhenius story: More than a legend from the past
Kevin De Berg, Avondale College, Australia

Using Story to Improve Student Understanding of Gas Pressure
Rick Wiebe and Art Stinner
University of Manitoba, Winnipeg, Canada

❖ Session 5: Tuesday, 9:15

Scientific anecdotes can tell stories—How? And what is good and what is bad about such stories?
Jürgen Teichmann, Ludwig-Maximilians University, Munich, Germany

False Friends: What makes a story inadequate for teaching situations?
Peter Heering, Carl-von-Ossietzky Universität, Oldenburg, Germany

❖ Session 6: Tuesday, 11:15

History of science in stories and dramas: Dilemma between "story telling" and professional precision
Zofia Golab-Meyer, Jagiellonian University, Kraków, Poland

❖ Session 7: Tuesday, 13:30

Using Nikola Tesla's story and his experiments, as presented in the film "The Prestige", to promote scientific inquiry
Yannis Hadzigeorgiou and Vassilis Garganourakis, University of the Aegean, Rhodes, Greece

Light: Which velocity? Directing a movie about historical measurements of the velocity of light
Pierre Lauginie, Université Paris-Sud, France

❖ Session 8: Tuesday, 15:15

Physics Comes to Winnipeg: The 1909 Meeting of the British Association for the Advancement of Science
Sarah Dietrich and Stephen Klassen,
University of Winnipeg, Canada

How Millikan got the Nobel Prize
Martin Panusch, Rajinder Singh, and Peter Heering,
Carl-von-Ossietzky Universität,
Oldenburg, Germany

Max Planck – aspects of his scientific career and political life
Stefan Wolff, Deutsches Museum,
Munich, Germany

❖ Session 9: Thursday, 9:15

Story telling as a strategy for understanding concepts of electricity and electromagnetism
Panagiotis Kokkotas, National and Kapodistrian University of Athens, Athens, Greece

Restructuring science stories in films and role-playing: Teaching science concepts in their social and cultural context
Fanny Seroglou, Vassilis Koulountzos, Paris Papadopoulos and Odysseas Knavas, Aristotle University of Thessaloniki,
Thessaloniki, Greece

❖ Session 10: Thursday, 13:00

The use of short stories in research-informed design, implementation and evaluation of science narratives
Agustín Adúriz-Bravo,
Universidad de Buenos Aires (UBA), Argentina

Linguistic Remarks on Newton's Opticks: Transitions to Nominalization
Herbert Gerstberger, Pädagogische Hochschule Weingarten, Germany

❖ Session 11: Thursday, 14:45

Museum Tour

❖ Session 12: Friday, 9:00

Begriffskontinente - Early 20th Century Contributions from the German Geological Community in Global Tectonics: The pre-Plate Tectonics Revolution
John Murray, University of Manitoba,
Winnipeg, Canada

High School Physics with a Story-line
Andre Dagenais, Sanford School, USA

❖ Session 13: Friday, 11:15

Do we need a Philosophy of Science Education? Some Arguments and a Vision
Fritz Kubli, Zurich, Switzerland

Closing
Art Stinner, Jürgen Teichmann,
Peter Heering, and Stephen Klassen

Program of Abstracts

The use of short stories in research-informed design, implementation and evaluation of science narratives

Agustín ADÚRIZ-BRAVO, Universidad de Buenos Aires (UBA), Argentina.

Abstract. In this presentation, I will discuss a research and innovation project (around what is called *cognitive-linguistic abilities*) in which I have been involved for the last three years with my group GEHyD (formed by teachers and researchers). As a result of a commission of the Ministry of Education of Argentina, I was the author of two little books (of 8 pages each) containing 'science stories' (*Valachian vampires* and *The ghastly stew*) that were aimed at an audience of students aged 12 to 14. Both the content and format of those stories were based on previous research along the line known as *nature of science* (NOS); the stories aimed at constructing a more robust image of science presenting it as a *profoundly human activity*. These books constituted the written material for the project, in which I wanted to investigate how *science narratives* are used (read, told, re-written…) by different target audiences (students, teachers, general public). The key aspects of the project were: using narratives in collaborative work; identifying and using different higher-order scientific procedures (hypothesis, argumentation, explanation, modelling…); re-textualising (i.e., transforming text typologies) science stories; testing semiotic resources and linguistic tools when 'talking science'; and identifying core NOS ideas. I will discuss both the theory and methodology behind our interventions and some results and conclusions obtained.

High School Physics with a Story-line

Andre DAGENAIS, Sanford School, Hockessin, Delaware, USA

Abstract. High school physics curricula are designed to meet a number of goals, all of which compete for classroom and homework time. Some of these goals are process-oriented goals: develop problem-solving skills, develop measurement skills, be able to analyze data, and develop research skills in this world of internet-based unfiltered information. On the other hand, there are content goals that insist on mastery or at least exposure to kinematics, dynamics, geometrical and physical optics, fluid dynamics, electric and magnetic fields, circuits, electromagnetism, nuclear physics, relativity and quantum mechanics. Infusing history and nature of science topics into an already packed agenda is a challenge for even the most gifted of teachers.

Thirty-five years of experience in the classroom has given me some insight as to which stories to include in my course. I look for stories with roots, stories with social and economic

consequences that are essential to helping students understand the scientific principles behind our technological world. I use what I call my history-of-science filter to suggest which content topics to include and which to omit. I select stories that can build skills and yet maintain student interest and keep them focused on the broader picture of science as a dynamic, creative, and engaging field of human endeavor. I string these stories together to construct a BIG story with a beginning, a middle and an end. The BIG story is that physics is one strand in the tapestry of human intellectual development. In this presentation, I will share my own story of how stories from history have enriched my teaching experience and given me a different perspective on my role as a science educator.

The Arrhenius story: More than a legend from the past

Kevin DE BERG, Avondale College, Cooranbong, NSW, Australia

Abstract. Svante Arrhenius (1859–1927), the blonde-headed, red-faced, blue-eyed, rather stocky Swedish scientist, was known for his love of speculation, theory, discussion and controversy. Famous for the electrolytic dissociation theory, his career had a number of ironic twists to it. His research dissertation on the electrical conductivity of aqueous organic acids and inorganic salts received such a cool reception by the examiners that a future research and teaching career at university level was considered to be out of the question. Yet he ultimately became a central figure in the development of physical chemistry research. Arrhenius always considered himself to be a physicist but it was in the area of chemistry which yielded him the Nobel Prize in 1903. His belief that all electrolytes are completely dissociated only at infinite dilution was accepted in the case of the organic acids, the so-called weak electrolytes, but rejected in the case of the inorganic salts, the so-called strong electrolytes which were considered to be completely dissociated even at finite dilutions. In this case the assumption of complete dissociation led to the development of correction factors for strong electrolytes to account for non-ideal behaviour. However, recent developments in 1:1 strong electrolyte chemistry suggest that Arrhenius' original idea of partial dissociation at all concentrations other than infinite dilution is a better explanation of the behaviour of 1:1 strong electrolytes than that assuming complete dissociation. This paper attempts to explore this irony and colorful history in a way that is instructive for tertiary level chemistry students in both the content and processes of scientific investigation.

Physics Comes to Winnipeg: The 1909 Meeting of the British Association for the Advancement of Science

Sarah DIETRICH and Stephen KLASSEN, University of Winnipeg, Winnipeg, Canada

Abstract. The 1909 meeting of the British Association for the Advancement of Science in Winnipeg took place with a great deal of fanfare and public attention. The Mathematics and Physical Sciences Division met in Wesley College which is now the University of Winnipeg. Although original documents of the meeting exist, the event has never been studied, formally. Several of the Nobel Laureates, among them Rutherford, Thompson, Hahn, and Millikan attended the conference. Some of the prominent themes will be discussed.

Joule's Electrical Generator and Its Special Educational Interest

Giorgio DRAGONI, and Luisa FIANDRI, Bologna University; L. DE PASQUALE, Teacher of Physics, Bologna, Italy

Abstract. According to the original James Prescott Joule (1818–1889) papers, it was possible to reproduce two replicas of his famous apparata on the existence of an equivalent relation between heat and the ordinary forms of mechanical power: The Paddle wheel driven by falling weights and The Generator: rotating coil surrounded by water. The latter will be illustrated in detail according to its special educational interest. In fact, the Generator (or Rotor) can be used for the illustration of the following physical concepts: electromagnetic induction, Joule's law of electrical heating, conservation principle, etc.

Linguistic Remarks on Newton's Opticks: Transitions to Nominalization

Herbert GERSTBERGER, Pädagogische Hochschule, Weingarten, Germany

Abstract. The significance of Newton's Opticks is not only founded on its epochal discoveries, theorems and claims but it's also remarkable for its language. Linguistic means are obviously chosen in order to support the methodological and philosophical conviction which Newton calls experimental philosophy as opposed to the axiomatic-deductive school of the Cartesians. Special attention seems to be given to gradual transitions from an expressive and narrative style to a more formalized and rigid professional language which, among other features, can be characterized by the use of nominalization. Following the approach of Functional Grammar, I consider nominalization as a case of grammatical metaphor. For the analysis of processes of further formalization I introduce the concept of algebraic metaphor.

History of science in stories and dramas: Dilemma between “story telling” and professional precision

Zofia GOLAB-MEYER, Institute of Physics, Jagiellonian University, Kraków, Poland

Abstract. The knowledge of history of science not only provides an often better understanding of crucial notions of physics, but also gives a better insight into the understanding of our history of civilization as well as the understanding of who are we, and how it happens that our world is as it is now. In teaching of history of science one has to cope not only with students’ limited knowledge of physics, but also with their limited knowledge of history—a subject that students are often not interested in. Activities such as story telling, playing dramas attract students and increase their interest toward physics and history of science. Students expect entertainment and a clear message from it.

The question I want to raise is about necessary simplifications that we have to resort to, while introducing to students the history of physics. What do we consider as acceptable, what do we admit as useful indoctrination, and what as a cheating? Can stories about scientists’ private life replace stories about their scientific achievements? What messages will we pass through histories where science was involved in politics? As examples, I will discuss the cases of Galileo, Einstein, Heisenberg and Oppenheimer.

Using Nikola Tesla's story and his experiments, as presented in the film “The Prestige”, to promote scientific inquiry

Yannis HADZIGEORGIOU and Vassilis GARGAN-OURAKIS, University of the Aegean, Rhodes, Greece

Abstract. Cinema movies are indisputably one of the most popular media among young students. Many ambitious projects use popular movies to improve student understanding of the basic principles of physical science and promote scientific inquiry. The vast majority of movies, though are lacking in famous scientists’ personal stories and the social conditions wherein their great inventions have been made. This presentation provides a comprehensive analysis of the film “The Prestige” (2006), which provides an opportunity to unveil Nicola Tesla’s personal story. The use of fascinating electromagnetic experiments to the limits of science fiction stimulates scientific inquiry about what is true. Moreover, elements of the social conditions and scientific controversy between Tesla and T. Edison raises students’ doubts of how, sometimes, science progresses.

False Friends: What makes a story inadequate for teaching situations?

Peter HEERING, Carl-von-Ossietzky Universität, Oldenburg, Germany

Abstract. Recently, an emphasis on the potential and advantages of stories and narratives in teaching situations can be observed in discussions on science education. From this, one might conclude that just starting to use stories in science classrooms is a good thing per se. Yet, as I will argue in my paper, things appear to be not that easy. From my understanding, it is necessary to select the stories to be told in teaching situations with care—and also to select those stories not to be told. With respect to such a selection, different criteria can be employed, depending on the aims of the instructional episode. In doing so, my criterion of selection will be based on an education which does not focus solely on the communication of scientific knowledge but which emphasizes topics from the nature of science as relevant criteria for structuring the teaching . With this intention, one can identify constructions of narratives that are misleading with respect to the nature of science and which may lead to the development of an understanding of what science and scientific practice are that has to be seen as inappropriate.

The Photoelectric Effect: Rehabilitating the Story for the Science Classroom

Stephen KLASSEN, University of Winnipeg, Winnipeg, Canada

Abstract. The photoelectric effect is commonly used as the introductory topic for the study of quantum physics. However, there are various indicators that some instructional materials and approaches to the topic contain deficiencies and even factual errors. A major aspect of instruction is the historical and scientific / factual background for the photoelectric effect. In this paper I outline the key elements of the history surrounding the discovery of the photoelectric effect, Einstein's light-quantum theory, and the ultimate acceptance of the theory, that are necessary for developing sound instructional materials.

Story telling as a strategy for understanding concepts of electricity and electromagnetism

Panagiotis KOKKOTAS, National and Kapodistrian University of Athens, Athens, Greece

Abstract. In current educational practice, dealing with scientific concepts seems to be rather complex and there is need for humanizing the teaching and learning of science, in order to make science more appropriate for pupils. Storytelling has been an accepted way of constructing reality throughout human history. It can be considered that it humanizes the teaching and learning of science and has the potential to both motivate and facilitate learning. In this presentation we attempt to introduce storytelling as a strategy in teaching scientific concepts concerning the units

of electricity and electromagnetism. The research concerns intervention in the classroom by forming worksheets that take advantage of story telling and analysis of discussions that take place in student groups using appropriate tools of discourse analysis in order to observe to what extent story telling can affect pupils' engagement in the activities of worksheets and especially how students' language function is depicted in group discussion.

Do we need a Philosophy of Science Education? Some Arguments and a Vision

Fritz KUBLI, Zurich, Switzerland

Abstract. A sound knowledge of science is a necessary, but not a sufficient condition for successful teaching, as we all know. The reflection of 40 years of science teaching on secondary school level in the light of modern epistemology leads to the strong suggestion that a theory of science education should be based on arguments emanating from insights into the process of a meaningful communication, as it has been developed in Bakhtin's theory called "dialogism". This theory shows that the teacher's personality and engagement for his or her subject is a major source of interest and devotion of students who try to understand and support the presented ideas. An analysis of the conditions that allow one to make this engagement meaningful for students might lead to a kind of vision for a future understanding of the teaching process, especially in science teaching.

Light: Which velocity? Directing a movie about historical measurements of the velocity of light

Pierre LAUGINIE, Université Paris-Sud, Paris, France

Abstract. We are presently directing a movie about historical measurements of the velocity of light, a collaboration between the GHDSO for the historical and scientific aspects, and the SCAVO for the film and production. The final format will be a DVD which is intended to be distributed among secondary schools, universities and science museums.

The movie starts on Foucault's rotating mirror experiment in 1862, the repetition of which was a part of our experimental approach of history of science. Then, the previous historical measurements will be evoked: Fizeau and his toothed wheel, of course, but also Galileo's (unsuccessful) trial, together with the main other protagonists of this enlightening story—Roemer, Huygens and Bradley. The motivations and the signification of a measuring process in Physics should emerge from the context.

The DVD is expected to be ready by the end of 2008. However, though yet under way, the shooting is now sufficiently well advanced in order to explain in my presentation our pedagogical

aims, how the screenplay has been conceived, our choice of historical sequences, shooting places and actors, and the difficulties and successes until now.

Begriffskontinente - Early 20th Century Contributions from the German Geological Community in Global Tectonics: The pre-Plate Tectonics Revolution

John MURRAY, University of Manitoba, Winnipeg, Canada

Abstract. The latter half of the 20th century witnessed a dramatic shift in the guiding assumptions in our understanding of the dynamics of Earth's crust, culminating in the broad acceptance of the plate tectonics model. Historically, the debate in global tectonics subsisted in a rivalry between two competing conceptual systems – a paradigm collision of fixism and mobilism. The geographical, linguistic and political isolation of the German geological community in the years 1900 – 1950 will be described as an instance of moving *Begriffskontinente, or "conceptual continents"*, that were intellectually displaced from movements among the geological establishment. This impeded the dissemination of alternative geophysical models contrary to those holding acceptance in the Americas and the United Kingdom. The rejection of Alfred Wegener and his continental displacement hypothesis by American geologists in 1926 was a crucial event in maintaining the isolation of the *geologische Gemeinschaft*, which then was to embrace a radical new hypothesis in the field of global tectonics – that of expansion of the Earth. The German expansionists, led by the seminal work of Ott Christoph Hilgenberg (1896-1976), and his publication in 1933 of *Vom wachsenden Erdball*, were working on ideas considered too extreme even for Wegener's supporters.

The contributions of the German geological community to the foundations of the plate tectonics revolution - beyond those of Wegener himself - remain essentially unknown. Here I will outline how the motions of *conceptual geological continents* provides a richer, more authentic science story of how the imaginative ideas of European geologists collided with the established thinking of the day, and laid the early foundations of the new views of a dynamic Earth.

How Millikan got the Nobel Prize

Martin PANUSCH, Rajinder SINGH, and Peter HEERING, Carl-von-Ossietzky Universität, Oldenburg, Germany

Abstract. In 1923, R.A. Millikan was awarded the Nobel Prize in Physics "for his work on the elementary charge of electricity and on the photoelectric effect". Recently, historical research had a focus on Millikan's publication practice as well as on the role of his assistant, Harvey Fletcher. Several studies have raised doubts whether Millikan can actually be taken as a role model for scientific practice. However, what has not been discussed yet is the question how the Nobel

committee came to the decision to award Millikan's work. Based on archival material from the Nobel committee, we will discuss in our presentation the nomination procedure as well as the evaluation process of Millikan's work.

Plus Lucis (more light)

W. Gerhard POHL, Linz, Austria

Abstract. A historical narrative will tell the story of the invention of the incandescent gas light and the electrical metal wire lamp. Both methods for artificial light sources were invented by the Austrian chemist Carl Auer von Welsbach (1858-1929). This year we celebrate his 150th birthday. After studying chemistry in Vienna Auer obtained his Ph.D. under the guidance of Robert Bunsen in Heidelberg. He then returned to Vienna and rented a private laboratory in the Chemical Institute of Professor Adolf Lieben at the University of Vienna. There he invented the incandescent gas light in 1885. He sold his patents for a high price and became very wealthy. Later he moved to Althofen in Carinthia where he built his own castle with a private laboratory. He used spectroscopy, a powerful analytical method, which he had learned in Bunsen´s laboratory for isolating four new elements in the group of the rare earths.The priority of these findings were challenged by Bohuslav Brauner in Prague and George Urbain in Paris.Later Auer became his own competitor when he invented the first metal wire lamp in 1898, which was a great improvement compared to the Edison lamp. Unfortunately Auer used Osmium as material for the wire, because he had found in the literature that it should be the metal with the highest melting point. Other inventors found tungsten to be a better material and Auer´s Osmium-patent became worthless. Some additional scientific and industrial activities of Auer von Welsbach in connection with his personality will be presented in my contribution. The question will be discussed if a scientist and inventor of our days could be as successful as Auer von Welsbach was at the end of the 19^{th} and beginning of the 20^{th} century.

Restructuring science stories in films and role-playing: Teaching science concepts in their social and cultural context

Fanny SEROGLOU, Vassilis KOULOUNTZOS, Paris PAPADOPOULOS and Odysseas KNAVAS, Aristotle University of Thessaloniki, Thessaloniki, Greece

Abstract. Four different short films about the life and work of Galileo, Michael Faraday, Maria Sklodowska Curie and Albert Einstein have been used in a set of workshops with pre- and in-service teachers that have been carried out by the ATLAS research group (ATLAS is an acronym for A Teaching and Learning Approach for Science).

Pre- and in-service teachers who attend the workshops:

a) watch the film
b) discuss and comment on the way the science concepts, the scientist's work, the contemporary social and cultural background, as well as the implied values and attitudes are presented in the film and elaborated by the director, the narrator and the specialists (historians and philosophers of science) who contribute in the film
c) develop their own role-plays inspired by the film
d) perform the developed role-plays
e) discuss on the way science concepts, the scientist's work, the contemporary social and cultural background, as well as the implied values and attitudes have been presented in the performed role-plays.

The performed role-plays are video-taped, studied, analysed and also used as short films in new workshops for pre- and in-service teachers' professional development courses that are either face-to-face or by distance.

Both the films and the role-plays provide a dynamic environment for restructuring the science stories and bringing forward the elements of those stories that are really important and interesting for pre- and in-service teachers. This image of science concepts and theories and of scientists interconnected to their cultural and social background offers to teachers a friendly, stimulating and multi-levelled context for science learning and teaching.

Scientific anecdotes can tell stories—How? And what is good and what is bad with about stories?

Jürgen TEICHMANN, Ludwig-Maximilians University, Munich, Germany

Abstract. An anecdote is a short narrative, a "tall tale" that is interesting, amusing, often based on a biographical incident, commonly acting out a specific historical situation. It is aimed to reveal a truth that is more general than the tall tale itself. The word anecdote comes from Prokopios, 6th century a.d., a historian who wrote a biographical work about the Eastern Roman emperor Justinian I, called "Anecdota" (commonly translated as "unpublished memoirs" or "secret history"). Its content primarily consisted of indiscreet short stories about the Byzantine court.

For historians, however, anecdotes are distorted reductions of history and therefore not deemed worthy to be included in a scholarly work. For writers, in contrast, anecdotes can be a very important stylistic device. How is it with science teachers? I think historians should prepare for them a more profound access to this device than until now existing.

Telling the story of atoms: Do we have to get bo(h)red?

Brigitte VAN TIGGELEN, Louvain-la-neuve, Belgium

Abstract. Introducing atoms to students in the science class is a classical opportunity teachers take advantage of to provide some historical context for science: they hardly let the opportunity pass by to give a full length story of atomism spanning over more than two millennia. Whereas the teachers themselves do take much pleasure in researching the history of atomism, and finding documents to tell the story, the story itself is boring and without any suspense:

- students think they know in advance the end of the story and are not genuinely interested in where and how it began
- students are not clearly enough introduced to the pivotal milestones that led to their worldview and hence the story goes uneventful
- students do not see how it connects to the science curriculum

Furthermore, the story unfolded by the teachers is most of the time very linear and sketchy, and lacks contextualization. Eventually, Democrites appears like a lonely hero who had it all correct long before everybody would listen to him, and Aristotle or XIXth century chemists are blind fools. Most importantly, the use of history does not add to the scientific formation since the arguments exchanged during controversies or the reasons for accepting or not accepting a worldview are, most of the time, not explicated, not to mention debated. A great opportunity to see how science and scientists work is thus missed.

This paper will thus focus on two questions: what do the teachers have to know, and how can historians of science help them, to tell a story on atomism that has a scenario and makes sense?

Using Story to Improve Student Understanding of Gas Pressure

Rick WIEBE and Art STINNER, University of Manitoba, Winnipeg, Canada

Abstract. Students tend to have a poor understanding of the concept of gas pressure. Usually, gas pressure is taught in terms of the various formulaic gas laws. The development of the concept of gas pressure according to the early Greeks did not include the concept of a vacuum. It was not for another 2000 years that Torricelli proposed that a vacuum can exist and that he was able to produce a vacuum above a column of mercury. However, the existence of a vacuum continued to be a contentious issue for at least another 100 years. During this time the behaviour of gases was studied by Boyle, Amontons, Gay-Lussac, Daniel Bernouli, Charles, and Dalton. In the 19th century gas behaviour was revisited and studied from the molecular level through the work of Graham, Maxwell, Boltzmann, and van der Waal. The stories of conflicting theories and the

development of the concept of gas pressure gives students an increased appreciation for the nature of science and helps them with conceptual understanding of the concept of gas pressure.

Collingwood telling the story of the Idea of Nature

Ian WINCHESTER, University of Calgary, Calgary, Canada

Abstract. Collingwood's "The Idea of Nature", continuously in publication since 1945, is a relatively unknown but highly original piece of Collingwoodiana and potentially a centrepiece in story in science teaching. In it Collingwood demonstrates his picture of history, published shortly afterward as "The Idea of History" as well as his view of the relationship between history, philosophy and natural science, especially physics. I shall describe how I am attempting to edit it for a new publication and what new materials will potentially be added to it from as yet unpublished manuscripts. I will also try to say why I think the picture Collingwood offers of the phases through which the idea of nature has gone since Thales is important and relevant to science teaching today.

Max Planck – aspects of his scientific career and political life

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Abstract. Max Planck has a unique place in the history of German science. He had not only been an eminent physicist who became the founder of quantum physics but also a man in the public understanding of science by his general and philosophical lectures. Moreover he was a central person in science management as a president of Kaiser Wilhelm Society between 1930 and 1937. In his private life he had to live with the tragedy of the death of 4 of his 5 children. So there are a lot of stories which can be told about Planck. We shall cover two subjects of his biography. First we describe his way in physics from his dissertation to the discovery of the quantisation of the harmonic oscillator in 1900. Then we shall discuss aspects of his political attitude in the period between German Empire and National Socialism.