



National Meeting No. 1, September 12th 2008

Country: Poland

Location: Nicolaus Copernicus University in Torun

Responsible: J. Turlo, G. Karwasz



After collecting the Questionnaire data on: *Elements of History and Philosophy in Science Teaching* from sample of Polish science teachers, we have organised the first national meeting within the framework of the project HIPST (No. 217805). Meeting was held on September 12th 2008 at the Nicolaus Copernicus University in Torun and was organised by Jozefina Turlo, Andrzej Karbowski and Krzysztof Słuzewski.

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2. Participants

Name and Institution

1. Bieganowski Lech, Dept. of Medicine, Nicolaus Copernicus University, Bydgoszcz
2. Bielski Andrzej, Institute of Physics, Nicolaus Copernicus University, Torun
3. Czerwinska Magdalena, Lower Secondary School 30, Torun
4. Felski Piotr, Lower Secondary School in Zławies Wielka, Torun
5. Gerszberg Liliana, Hihger Secondary School, Olsztyn
6. Karbowski Andrzej, Institute of Physics, Nicolaus Copernicus University, Torun
7. Karwasz Grzegorz, Institute of Physics, Nicolaus Copernicus University, Torun
8. Kosicki Janusz, VIII Higher Secondary School, Torun
9. Mallek Janusz, Dept. of History, Nicolaus Copernicus University, Torun
10. Nowak Wiesław, Institute of Physics, Nicolaus Copernicus University, Torun
11. Pater Ewa, Higher Secondary School with the integration classes, Swinoujscie
12. Plucinska Elzbieta, Planetarium and Astronomical Observatory, Olsztyn
13. Podgorski Zbigniew, , Dept. of Biology and Earth Sciences, NCU, Torun
14. Przegietka Katarzyna, , Institute of Physics, Nicolaus Copernicus University, Torun
15. Rebajn Lidia, Lower Secondary School 3, Torun
16. Rochowicz Krzysztof, V Higher Secondary School, Torun
17. Rybicki Jacek, Higher Vocational School, Torun
18. Słuzewski Krzysztof, Institute of Physics, Nicolaus Copernicus University, Torun
19. Slawinska Arleta, Lower Secondary School 30, Torun
20. Staszal Magdalena, Department of Education, University of Warsaw
21. Strobel Andrzej, Astronomy Center, Nicolaus Copernicus University, Torun
22. Szudy Jozef, Institute of Physics, Nicolaus Copernicus University, Torun
23. Turlo Jozefina, Institute of Physics, Nicolaus Copernicus University, Torun

a. Partners

Name and Institution

- b. Further local experts
1. Broniewicz Lucjan, W. Dziewulski Planetarium, Torun
 2. Gancarz Maria Aleksandra, Kujawsko – Pomorskie Centre of Teacher Education, Torun
 3. Golebiowski Krzysztof, Long Life Learning Center , In – service Teacher Training Center, Torun
 4. Grabowski Marian, Institute of Philosophy, Nicolaus Copernicus University, Torun
 5. Iwaniszewski Jan, Institute of Physics, Nicolaus Copernicus University, Torun
 6. Kawecka Elżbieta, Computer Assisted Education and Information Technology Centre, Warsaw
 7. Kazubski Aleksander, Dept. of Chemistry, Nicolaus Copernicus University, Torun
 8. Klosinski Michal, Nicolaus Copernicus Museum, Torun
 9. Kurek Ewa, School and Pedagogy Publishing House, Warsaw
 10. Rafalski Jerzy, W. Dziewulski Planetarium, Torun
 11. Rubnikowicz Marek, Regional Museum in Torun
 12. Rut- Marcinkowska Maria,
 13. Stojecka Zenona, Higher Secondary School, Wielun
 14. Strobel Michał, IX Higher Secondary School, Torun
 15. Strugała Ewa, Higher Secondary School, Poznan
 16. Urbanska Iwona, Regional Museum in Torun
 17. Zolkiewski Jan, IX Higher Secondary School, Torun

3. Schedule

Seminar on 12th September 2008 Schedule

15:00 – 15:15	Dr. Józefina Turło, Introduction to the Project HIPST.
15:15 – 16:15	Lecture of professor Andrzej Bielski on: „Witelo, the first Polish nature scientist from XIII c., having international reputation.
16:15 – 17.15	Lecture of professor Lech Bieganowski and professor Janusz Mallek on: „Invention of spectacles in Europe”
17:15 – 17:45	Coffee, tea break
17:45 – 18:30	Lecture of professor Grzegorz Karwasz on: „Practical realisation of interactive exhibition on OPTICS” (including the optical historical experiments, eg. Witelo, Goethe).
18:30 – 20:00	Dr. Józefina Turło, Presentation of the science teachers Questionnaire studies on: <i>The HPS elements in science teaching</i> . Research group establishment, discussion in groups, plan of work, summary.

4. Themes

<u>a) Enhancement of Seminar Participants knowledge on historical experiments planned as a case studies in Poland</u>	4.1 Introduction to the Project HIPST
	4.1.1 Essential information on Project SiS-2007-2.2.1.2 – Teaching Methods
	4.1.2 Project Partners
	4.1.3 General Objectives
	4.2 Lecture of professor Andrzej Bielski on: „Witelo, the first Polish nature scientist from XIII c., having international reputation”.
	4.3 Lecture of professor Lech Bieganowski and professor Janusz Mallek on: „Invention of spectacles in Europe”.
	4.4 Lecture of professor Grzegorz Karwasz on: „Practical realisation of interactive exhibition on OPTICS” (including the optical historical experiments, eg. Witelo, Goethe).
	4.5 Dr. Józefina Turło Presentation of the science teachers questionnaire studies on: <i>The HPS elements in science teaching</i> .
	4.6 Research group establishment, discussion in groups, plan of work, summary.

b) National situation regarding history and philosophy in science teaching

4.7 National situation regarding HPS was investigated by the questions Q7 to Q11 of elaborated by us Questionnaire (attached).

Q7. Whether the elements of History and Philosophy of Science(HPS) were implemented to your curriculum of pre-service teacher training course?

Q8. Whether the elements of History and Philosophy of Science were implemented to your curriculum of in-service teacher training courses?

Q9. Do you apply the elements of History and Philosophy of Science in your science teaching?

Q10. If you selected YES, please give the examples of lecture topics, where the elements of History and Philosophy of Science were used and in which way?

Q11. If you selected NOT, please give the reasons why you are not using the elements of History and Philosophy of Science in your science teaching, eg.:

c) Discussion of problems and perspectives on implementing history and philosophy of science in educational fields

4.8 To discuss the problems and perspectives on implementing history and philosophy of science in education we elaborated the questions Q12, Q14, Q15 and Q17 (see Questionnaire).

Q12. What should/can be the aim of the use of History and Philosophy of Science in science teaching?

Q14. Indicate the conditions and factors, which can facilitate (or inhibit) introduction of History and Philosophy of Science (HPS) elements into science teaching, eg.:

Q15. What kind of knowledge and specific skills should teacher possess to succeed in introduction of HPS elements into teaching.

Q17. Please point out the core curriculum subject questions, which teaching could be supported by the elements of HPS.

d) Discussion: New teaching material and techniques, results of evaluations, upcoming collaboration of schools etc.

4.9 As the introduction to this discussion on teaching materials in the working groups we formulated questions Q13 and Q16 in the Questionnaire:

Q.13 Point out the educational resources (source texts and other educational aids, which you are using in your professional practice and which can be used in the project HIPST (eg. during the pilot lessons or during the collaboration of school with museum).

Q.16 What features should characterize educational materials aimed at introduction of HPS elements into science teaching?

e) Further matters

There was also suggestion that as Nicolaus Copernicus was born in Torun, would be interesting to repeat the Copernicus experiment, which He performed nearby in Olsztyn in 1517 on the reflection sun clock . His astronomical table on the wall in Olsztyn castle is still visible and available for educational studies as the introduction for the discussion of calendar history.

5. Outcomes

Ad a)
Enhancement of
Seminar Participants
knowledge on
historical experiments
planned as a case
studies in Poland

Ad. 4.1 As the introduction to the Project HIPST Dr. J. Turło presented the following **information on Project FP7 SIS-2007-2.2.1.2- Teaching Methods:**

Title - History and Philosophy in Science Teaching (HIPST)

Duration - 1 February 2008 – 31 January 2010

Type of Project - Coordination and support actions

Management: Deutsche Gesellschaft für Technische Zusammenarbeit, repr. Ekkehardt Lang, Berlin

Co-ordinators: Dr. Dietmar Hottecke, Bremen University, Prof. Falk Riess, Oldenburg University

Project Partners:

- Gesellschaft für Technische Zusammenarbeit (GTZ), Germany
- Institute for Science Education, Bremen University, Germany
- School of Primary Education, Aristotle University of Thessaloniki, Greece
- Institute of Physics, Nicolaus Copernicus University, Poland
- Department of Physics Education and History and Philosophy of science, University of Oldenburg, Germany
- Faculty of Science and Faculty of Pharmacy, University of Lisbon, Portugal
- Istituto Tecnico Toscano and Fondazione Scienza e tecnica, Florence, Italy
- Department of Philosophy of Science, Budapest University of Technology, Hungary
- Science Teaching Center, Faculty of Mathematics and Natural Science of the Hebrew University, Jerusalem, Israel
- Institute of Education, University of Reading, Great Britain

General Objectives:

1. To increase the inclusion of history and philosophy of science in science teaching for the benefit of scientific literacy.
2. To improve strategies for the development and implementation of domain -relevant materials, teaching and learning strategies into educational practice.
3. To strengthen the cooperation and establish a permanent infrastructure of sustainable networking of all involved stakeholders in the field of scientific literacy and public understanding of science (schools, museums, universities).

Ad. 4.2 Professor Andrzej Bielski gave very interesting lecture on: „*Witelo, the first Polish nature scientist from XIII c., having international reputation*”.

First of all He told us about the facts from Witelo life. Later on he talked over shortly the most famous at that time in Europe Witelo works. There was 10 books written in Latin by him in the years 1269-1279. The first edition of these books was published in 1535.

Ad. 4.3 Professor Lech Bieganowski and professor Janusz Mallek, who are the experts in medicine and history gave the lecture on: „*Invention of spectacles in Europe*”.

They started from the ancient times, proceeded with detailed description of stones for reading in the middle ages (XIII c.), first monocles (XIV c.) and the development of different type of spectacles in Europe and in Poland.

Ad. 4.4 Professor Grzegorz Karwasz has informed participants about the “*Practical realisation of interactive exhibition on OPTICS*” with the titles “*FIAT LUX – from Witelo to optical tomograph*” .

On 29 April 2008 at the Regional Museum in Toruń the interactive exhibition FIAT LUX has been opened. We exhibited there also the optical historical experiments reconstructed due to the collaboration with Prof. Riess Group from University of Oldenburg, as Goethe water prism as well as Witelo historical experiments for presentation of rectilinear transmission, reflection and refraction of light and different type of lenses.

Ad. 4.5 Dr. Józefina Turło presented the results of science teachers questionnaire studies on: “*The HPS elements in science teaching*”.

This results will be report in details during description of the outcomes b) and c) below.

Ad. 4.6 Research group establishment, discussion in groups, plan of work, summary.

Participants of the seminar expressed their wishes to collaborate with us within two working groups:

- I. School science teaching and curricula with the elements of HPS, teacher education and training on HPS issue (supervised by Dr. J. Turlo).
- II. Science museums, prospective science centres, professional research on HPS (supervised by Prof. G. Karwasz).

Ad. b)
National situation
regarding history and
philosophy in science
teaching

Ad. 4.7 28 science teachers, mostly experienced (80% of nominated and diploma) secondary school teachers (45% from them were physics teachers) from different parts of Poland were taking part in Questionnaire investigations on: "The HPS elements in science teaching". National situation regarding HPS was investigated by the questions Q7 to Q11.

Q7. Whether the elements of History and Philosophy of Science(HPS) were implemented to your curriculum of pre-service teacher training course?

Answers:

- yes, there were lectures and/or tutorials on general philosophy (40%)
- no, elements of history and philosophy of science were not implemented at all (25%)
- yes, there were lectures and/or tutorials on philosophy of science (15%)
- yes, there were lectures and/or tutorials on history of science (eg. physics) (12%)
- yes, there were lectures and/or tutorials on elements of history and philosophy of science implemented to the lectures of general subjects (12%)
- others (5%)

Q8. Whether the elements of History and Philosophy of Science were implemented to your curriculum of in-service teacher training courses?

	1	2	3	4	5	
not at all	50%	25%	10%	4%	4%	very often

Q9. Do you apply the elements of History and Philosophy of Science in your science teaching?

	1	2	3	4	5	
not at all	14%	33%	3%	25%	18%	very often

Q10. If you selected YES, please give the examples of lecture topics, where the elements of History and Philosophy of Science were used and in which way?

We got the following answers:

- Archimedes law
- Discussion and analysis of preconceptions
- Nature philosophy, time and motion and their generality and philosophical aspects, forces and Newton's laws of dynamics
- The place of Earth in the Universe, the system of Ptolemaeus, Copernican revolution, astronomical observations from Copernicus, Tycho de Brache, Galileo, Kepler, Descartes, Newton (general gravitation law)
- History of life and discovery of Galileo (the law of free fall, the law of pendulum motion)
- Origin and development of Universe (four elements)
- Travels and geographical discoveries

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- Searching theory of heat, entropy
 - Century of steam and electricity
 - Energy, machines, electric current (film on „Adventure of energy”)
 - Discovery of nucleolus, history of radioactivity applications
 - History of different technological discoveries
 - History of science investigation methods
 - Discovery of DNA
 - Regional geography

Q11. If you selected NOT, please give the reasons why you are not using the elements of History and Philosophy of Science in your science teaching, eg.:

- lack of suitable curricula and teaching standards, textbooks and educational materials,
- which facilitate implementation of this elements to the school teaching (42%)
- there is not enough time in the school curriculum for implementation of the additional contents (58%)
- others

Ad. c)
Discussion of problems and perspectives on implementing history and philosophy of science in educational fields

4.8 To discuss the problems and perspectives on implementing history and philosophy of science in education we elaborated the questions Q12, Q14, Q15 and Q17 (see Questionnaire). There are the questions about the aims of the use of HPS in science teaching, conditions and factors, which can facilitate (or inhibit) introduction of HPS, necessary knowledge and specific skills, which teachers should possess to succeed in introduction of HPS elements into teaching and core curriculum subject questions, which teaching could be supported by the elements of HPS. The answers were as follows:

Q12. What should/can be the aim of the use of History and Philosophy of Science in science teaching?

The answers of respondents have identified that the aims of HPS should be arranged (from the most to the less important) as:

1. to emphasize that knowledge of science and history of science is the important part of our culture
2. to increase interest and motivation of students
3. to understand the applications of science in context (technics, everyday life)
4. to recognize the methods and character of scientific research
5. to include interdisciplinarity in science teaching
6. to increase the students' activity during lessons
7. to achieve the skills of planning and executing of experiments, especially hands-on experiments
8. to raise the science teaching effectiveness
9. to perceive the role of science in personal life (health, diet, saving of energy)
10. to get the ability of information judgement (received from different sources)
11. to gain the skills of discussion on science topics with others
12. to stress the ethical values of science
13. to know the origin of preconceptions and misconceptions of students
14. others

Q14. Indicate the conditions and factors, which can facilitate (or inhibit) introduction of History and Philosophy of Science (HPS) elements into science teaching, eg.:

The teachers taking a part in the investigation stressed that the most important factors, which can facilitate (or inhibit) introduction of HPS into science teaching. There are:

- essential (subject), methodical and technical preparation of teacher – 81%
- accessibility of the high quality educational materials – 78%
- allowance of HPS issues in pre-service and in-service teacher training standards – 52%

The next factors are:

- collaboration of science teachers with experts conducting research in the HPS field – 47%
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- HPS topics included to the school curricula and final examinations – 47%
 - elaboration of general strategy aimed at the use of HPS elements in science teaching – 33%
 - the attitude of teacher and administration support in the use of HPS in teaching – 29%
 - others – 7% Additionally, teachers stress the enthusiasm and great passion of teachers as well as financial resources to buy suitable educational aids, being the factors for an effective implementation of HPS elements into teaching.

Q15. What kind of knowledge and specific skills should teacher possess to succeed in introduction of HPS elements into teaching.

The teachers have mentioned the following skills:

- skill of carry on lessons by active methods, including inquiry method (63%),
- skill of telling interesting stories (58%),
- skill of the use of Information and Communication Technology resources (55%)
- skills of writing scenarios and directing students' historical performances („role playing”) (47%),
- skills of persuading (argumentation) and leading of scientific discussions (47%)
- others (10%). Some teachers are adding the role of personal engagement of teacher and her/his skill of students' inspiration for activity.

Q17. Please point out the core curriculum subject questions, which teaching could be supported by the elements of HPS.

The respondents indicated the following core subject science curricula elements:

- Selected topics from mechanics (statics, studies of motion, motion in history and philosophy, dynamics), Oscillations and mechanical waves,
- Structure of matter, Earth in the Universe, Copernicus Solar System, Astronomical observations, Kepler's laws, Time measurements,
- Evolution of the Universe,
- Physical fields (gravitational, electrical, magnetic, electromagnetic),
- Heat and thermodynamics,
- Relativity, theory of relativity,
- Atomic and nuclear physics, quantum physics elements,
- Acids and bases theory,
- Travels and geographical discoveries,
- World climate phenomena,
- Transformations of matter,
- The role of chemistry in science, technology and environmental protection.

Ad. d)

Discussion:

New teaching material and techniques, results of evaluations, upcoming collaboration of schools etc.

Ad. 4.9

Q.13 Point out the educational resources (source texts and other educational aids, which you are using in your professional practice and which can be used in the project HIPST (eg. during the pilot lessons or during the collaboration of school with museum).

The teachers listed the following resources:

1. Literature:

- A. K. Wróblewski, Historia fizyki, PWN, 2006
- A. K. Wróblewski, Prawda i mity w fizyce, Ossolinum, 1982
- A. Drzewiński, J. Wojtkiewicz, Opowieści z historii fizyki, PWN, 1995
- Ed. J. Turło, Eksperymenty historyczne w nauczaniu fizyki, Top Kurier, 2001
- Leonardo da Vinci, The machines, 1999
- Max von Laue, Historia fizyki, PWN, 1967
- M. Hoskin, Historia astronomii, Uniwersytet Warszawski, 2007
- Publ. ZamKor, Poglądy starożytnych filozofów na budowę materii Wszechświata”,
- A. K. Wróblewski, Filozofia w szkole, ZamKor,
- G. Białkowski, Podręcznik do fizyki dla humanistów
- S. Gołembowicz, Uczenie w anegdocie, Wiedza powszechna, Warszawa, 1962

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- A. K. Wróblewski, *Uczeni w anegdocie*, Prószyński i S-ka, 2004
 - Scenariusze „Szkołnego Święta Nauki” w różnych miejscowościach Polski
 - History and geography atlases
2. Video-cassette, DVD films, computer programmes, Internet
 3. Science and Technology Museums in Europe and in Poland (e.g. Nicolaus Copernicus Museum in Toruń, Maria Skłodowska – Curie Museum in Warsaw).

Q.16 What features should characterize educational materials aimed at introduction of HPS elements into science teaching?

- adjusted to the needs of teacher, as well as the age, capabilities and abilities of students
- „user friendly” (as far as contents and structure (form) is concerned)
- including scenarios of „inquiry lessons” based on HPS elements,
- commonly available
- diverse and adapted to the local conditions
- others - Some teachers insist the real educational aids for reconstruction of the most important science historical experiments in the classroom.

e) Formulated NEEDS and WISHES of the participants

Q.18. Please present the propositions (ideas) of activities, which in your opinion allow to gain success in introduction of HPS into science teaching.

1. Practical investigations (on-line experiments):
 - Study of motion with the use of historical Galileo’s incline plane
 - Measurement of velocity (frequency) of sound by different means
 - Study of electrostatics phenomena with the use of rotational weight
 - Reconstruction of different electrical measurements,
 - Demonstration of the most important in history experiments from optics construction of simple optical instruments by students,
 - The use of bubble chamber for observation of ionising alfa particles
2. Study visits of teachers and pupils at science museums
3. Pre-service and in-service teacher courses (workshops) on HPS
4. Edition of booklets (books) for teachers (with exemplary propositions)
5. The use of inquiry methods concerned with HPS elements combined with „brain storming”, „role playing”, etc.
6. Collaboration of science teachers with teachers of history, literature, philosophy ethics, religion, etc.
7. Dissemination of the project results in different tools (collection of scenarios, journals TV, www, newspapers, etc.).
8. Organisation of competitions:
 - for teachers on: „Proposition of the most effective use of HPS in science teaching” (scenario of lesson or/and historical experiment),
 - for students on: „Construction of simple historical experiment/model with the use everyday materials” and on: „Presentation of performance related to important discoveries in science”.
9. Establishment of periodic Seminars on HPS for science teachers.
10. Founding of Real Science Museum with on-line (including distance) experiments.

f) Division of labor and individual responsibilities

As the result of discussion four main working groups were established;

- *Group 1 - working on elaboration of materials and methodology of elements of History and Philosophy in Science Teaching in secondary school teaching (including curriculum development) –responsible: Jacek Rybicki, Magdalena*

Czerwinska, Dr. Katarzyna Przegiętka, Dr. Józefina Turło,

- *Group 2 - working on elaboration of teachers education and training programme with the History and Philosophy of Science elements- responsible: Prof. A. Bielski, Prof. Grzegorz Karwasz,, Prof. Marian Grabowski, Dr. Józefina Turło,*
 - *Group 3 - working on elaboration of materials and on practical realisation of exhibitions and collaborating with Regional Museums on activities related to History and Philosophy of Science- responsible: Prof. Grzegorz Karwasz, Krzysztof Służewski, Przemysław Miszta, Andrzej Karbowski,*
 - *Group 4 - working on preparation of historical experiments replicas and materials suitable for the use in school, university and out of school education – responsible: Dr. Zygmunt Turło, Krzysztof Służewski, Eng. Tadeusz Robaczewski.*
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6. Future objectives

Please refer to agreed central tasks:

a) “to do’s” until the 2nd National Meeting

- *to analyse the national situation referred to HPS in science education,*
- *to make the list of the existing teaching materials (prepare their description also in English),*
- *to report the results of thematic working groups,*
- *to propose the possibility of introduction of the elements of History and Philosophy of Science into school and out of school education.*

b) Do you recommend the invitation of further experts/partners to the 2nd national meeting?

Please explain why and who

Yes, of course. First of all we would like to invite in our opinion the most experienced researcher in the field of historical experiments in Europe - Prof Dr. Falk Riess from Oldenburg University in Germany. We are sure, that His advice will be of the most valuable for our further work within the HIPST Project.

c) Expectations of the participants regarding the three national meetings

Please aggregate formulated expectations

a) Second National Meeting:

- *Acknowledgement with the achievements of other HIPST Partners*
- *Presentation of case studies*
- *Adaptation of translated materials*

b) Third National Meeting

- *Evaluation of the National HIPST Project results, comparison with the Partners’ results*
- *Dissemination of the HIPST results (lecture, workshop, publications)*
- *Future alike activities*