

REPORT FOR ADDITIONAL MEETING OF THE HIPST PROJECT IN BERLIN





UT 4 – Torun Poland

Division of Physics and Astronomy Education Group

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1. National Partners

a) Schools from the surrounding area are represented by the teachers from:

- Lower Secondary Schools: M. Czerwińska, A. Sławińska, M. Sadowska,
 - P. Felski, Izabela Okrzesik Frąckowiak
- Higher Secondary Schools: J. Kosicki, J. Rybicki, K. Rochowicz, E. Pater, J. Chojnacka, Z. Stojecka

b) Museums, Planetariums:

- Regional Museum in Torun
- Nicolaus Copernicus Museum in Torun
- Museum of Warmia and Mazury in Olsztyn
- W. Dziewulski Planetarium in Torun
- Planetarium and Astronomical Observatory in Olsztyn
- Educational Hevelianum Center in Gdansk

c) Other Insitutions:

- National Ministry of Education
- General Teacher Training Center in Warsaw and Regional Training Center



2. Work organization Four working groups were established:

<u>Group 1</u> - working on elaboration of materials and methodology of elements of History and Philosophy in Science Teaching in secondary school teaching (including curriculum development)

Results:

- Report on "The place of HIPST in new Polish Core Curricula" (Eng. version).
- Scenarios of lessons and their realisation in school (pilot lessons).
- Presentations on HIPST case studies.
- Descriptions of Case studies (including questionnaire studies) and publications. Remarks: We have created the common e-mailing list, all materials elaborated by the group members and consecutive actions are discussed and corrected by e-mails and during the face to face meetings (recently 1 per two weeks).

<u>Group 2 -</u> working on elaboration of teachers education and training programme with the History and Philosophy of Science elements Results:

Analysis of the "Philosophy of science" subject existing so far and its adaptation for pre-service science teacher training (Polish version).



2. Work organization

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 Results:

- Design and practical realisation of the "FIAT LUX from Witelo to optical tomography" exhibition in the Regional Museums Torun (29.04-15-09.08), Gdansk (20.10.08-15.02.09), Olsztyn (01.03.09- 01.09.09), Legnica (18.09.09- 30.11.09), where Witelo was born (...). 5 school teachers are collaborating.
- The sustainable network of University, Regional Museum and Planetarium in Torun, Museum in Olsztyn and Educational Hevelianum Center was established.

Group 4 - working on design of historical experiments replicas and materials suitable for the use in school, university and out of school education Results: Reconstruction of the Copernicus Astrolabium, Galileo telescope and Witelo devices: for study the rectilinear propagation of light (including school vesrion) and for ploting conical curves (from our resources).

- Questionnaire studies on: The elements of HIPST in practice were designed, performed, evaluated and published.
- Regional Seminar for science teachers on HIPST and related problems was established. There were the following topics presented: Witelo, the first Polish nature scientist from XIII c, Historical experiments in physics education, Invention of spectacles in Europe, Astonishment in the mathematics and science cognition, The bigraphy of Professor Aleksander Jabłoński, "Practical realisation of interactive exhibition on OPTICS – FIAT LUX" (including the optical historical experiments, eg. Witelo, Copernicus, Galileo, Goethe).





- New Polish physics curricula (obliged from 1st September 2009) for secondary schools have been analysed taking into account the possibility of HIPST elements introduction. *The related report is translated into English*.
- The first list of teaching materials was identified by the Torun Partner Group members and by the Questionnaire answers of science teachers. *Some were described*.
- To improve strategies for the development and implementation of selected materials from optics (related to eg. *Witelo, Copernicus, Galileo, Newton, Goethe experiments, historical microscopes and spectacles*) the teachers are working on scenarios, presentations, and evaluation of the inquiry-based lessons.
- Two groups (one in school and the second at the Institute of Physics) were performing *original Nicolaus Copernicus experiment* on "Sun calendar" by using the sun reflection method.





- Three students science teachers to be collaborated with practising teachers and us on HIPST issue to intensify these activities. There are the topics:
- 1. Active methods for motivation students towards effective learning of physics
- 2. Proposition of physics teaching enriched by History and Philosophy elements implementation
- 3. Development of inquiry- interactive methods of teaching







 The cooperation between schools, university and museums was strengthened, a permanent infrastructure of sustainable networking was established and interactive exhibition "FIAT LUX – from Witelo to optical tomography" was prepared and exposed at the Regional Museum in Torun, Gdansk, Olsztyn and Legnica.





http://dydaktyka.fizyka.umk.pl/FIAT_LUX/html

The following case studies have been selected:

- 1. Witelo studies on rectilinear propagation of light, by Justyna Chojnacka.
- 2. Optical microscopes from the first to the contemporary ones, by Magdalena Sadowska.

3. Glasses as a simple optical instruments, starting from the history,

by Janusz Kosicki.

- 4. *Contribution of Nicolaus Copernicus studies to the world calendar reform*, by Magdalena Czerwińska.
- 5. *Telescopes from Galileo to Hubble and beyond*, by Krzysztof Rochowicz (scenario).
- "Crucial experiment" of Isaac Newton in optics, by Izabela Okrzesik –Frąckowiak, (scenario)



Ad 1: *Witelo studies on rectilinear propagation of light* • Vitelo – Polish scholar from XIII century

His work *"Perspective"* which might seem devoted to optics, is also the basic geometry work. It also deals with human physiology and one chapter is an eye description with its mechanisms. Witelo took into account the subconscious action of mind, its influence on *"seeing"*. There were many interests in Witelo's activities, he was not only the naturalist, but also mathematician and philosopher.



Planning the lesson – scenario (attached)

He was born in 1230

Lesson, has been carried out in the second class of higher secondary school (adolescents of 18 years). Firstly students fulfilled the Questionnaire on "Nature of science" and started to answer on properties of light, including recognition of students' misconceptions.

Ad 1: Witelo studies on rectilinear propagation of light

Execution of Vitelo theory and experiment

Talking over the understanding of light by Vitelo and comparison with contemporary concepts. Execution of experiment providing evidence of rectilinear propagation of light with the use of laser and historical device of Vitelo.

Observations and conclusions

Students were acknowledged with the particular stages of experiment made with the use of inquiry method.

 Aplication of rectilinear propagation of light to everyday phenomena Students worked in groups solving particular tasks related to shadow.





Ad 2: Optical microscopes from the first to the contemporary ones

Target groups

Lesson was given to students from lower-secondary school (16-17), vocational school (18-19), secondary-technical school (19-20).

Historical introduction on development of microscopes.

The main discoverers: Zacharis, Hans Jannsens, Antonie von Leeuvenhoek, Robert Hooke, Richard Zsigmondy, Frits Zernike, Ernst Ruska, Gerd Binnig and H. Rohrer.

Rohrer ing presentation, answering questions placed in the Worksheet.

There was 7 questions to answer with the help of teacher (including historical ones).

- Acquisition of knowledge on construction and operation rules of microscope, carrying out observation of different media, homework.
- Completing questionnaire on "Nature of science" by students.



Ad 3: Glasses as a simple optical instruments

Target groups.

Lesson for students from higher secondary school at the advaced level (16-18).

- Operational aims. Student:
 - 1. applies the concepts of the focus, the focusing ability, the lens focal length,
 - 2. explains the human eye operation,
 - 3. understand how to correct foresight, solves mathematical tasks,
 - 4. knows the history of glasses construction development.
- Historical introduction on glasses discoveries.

Formulationg the title after watching the scrap of the film "Name of the Rose,,. Showing the presentation documenting, creation of glasses in the history.

Fundamental part of lessons showing different sight defects.

With the use drowings eplanation of hyperopia and myopia – solving tasks. Completion of lesson, homework. Teacher's reflection.

Ad 3: Glasses as a simple optical instruments



"Cyrulik", detal - Jan Sanders van Hemessen (1500 - 1566)

"Barber", detail - Jan Sanders van Hemessen "Painter" (about 1565) – Piotr Breughel O



"Malarz" (ok. 1565) Piotr Breughel Starszy (1525 - 1569)



Św. Piotr, detal obrazu "Hugh of St. Cher" - Crivellego (1352)

Saint Peter, detail picture, "Hugh of St. Cher" – Crivellego (1352)

Ad 4: Contribution of Nicolaus Copernicus studies to the world calendar reform

Target groups.

Lesson for students from lower secondary school at the advaced level (13-16).

Operational aims. Student:

knows properties of light – rectilinear propagation and reflection,
understands the function of mirror and reflection gnomonic method,

3. knows the creation of shadow and its everyday aplications,

4. conducts the experiment of N. Copernicus on astronomical table.

Historical introduction on famous Copernicus observations.

Introductory lesson to explain interdisciplinary character of Copernicus experiment (elements of physics, astronomy, geography, history, philosophy). Planning observations, working groups, elaboration of results.

Fundamental lesson - conclusions, reflections, remarks.

The results of students where compared with the Copernicus observations, improvements for the next experiment of finding of equinoxes.

Ad 4: Contribution of Nicolaus Copernicus studies to the world

calendar reform



Experimental setup: mirror



Plot showing results of student observations

The group of observers with teacher



Copernicus place of studies

6. Second National Meeting in Olsztyn

l.p.	Activity	Time	Remarks
1.	Registration, tea/coffee	15.30 - 16.00	Planetarium Hall
2.	Welcome, introduction	16.00 - 16.05	Projection Room
3.	Dr. J. Szubiakowski, "Development of concepts on shape of Earth"	16.05 – 17.00	Projection Room
4.	Dr. J. Turło, "Advancement in HIPST Project"	17.00 – 17.15	Projection Room
5.	Dr. J. Turło, A. Witkowska, "Sun calendar of Nicolaus Copernicus."	17.15 – 17.30	Projection Room
6.	M. Czerwińska, "The contribution of Copernicus observations to the calendar reform."	17.30 – 17.50	Projection Room
7.	J. Chojnacka, "Studies of Witelo on rectilinear propagation of light."	17.50 – 18.10	Projection Room
8.	M. Sadowska, "Optical microskope since the first to the contemporary ones."	18.10 – 18.30	Projection Room
9.	J. Kosicki, "Glasses as a simple optical instrument"	18.30 - 18.50	Projection Room
10.	Dr. K. Rochowicz, "Optical instruments – telescopes."	18.50 – 19.20	Projection Room
11.	Summary, final discussion.	19.20	Projection Room

7. National WWW Page of HIPST

 The most important, selected materials on HIPST Project were placed at Polish web page of HIPST: (http://hipst.fizyka.umk.pl). There are general information and about the main activities within the project: Materials (scenarios, presentations, film), Seminars, Meetings etc.



8. Publications

- Energy historical, interactive and pedagogical path, G. Karwasz, A. Karbowski, J. Turło, J. Kruk, Girep 2008, Nicosia, Cyprus.
- Introduction of history and philosophy of science elements for curriculum development, J. Turło, G. Karwasz, K. Służewski, A. Karbowski, K. Przegiętka, 7th IOSTE Syposium for Central and Eastern Europe Proceedings, 2009, pp. 165-171.
- 3. The solar calendar of Nicolaus Copernicus, Part I, Z.Turło, A. Witkowska, J. Turło, Nauczanie Przedmiotów Przyrodniczych, 29, 2009. pp. 9-17.
- 4. Spectacles as a simple optical device, starting from the history, J. Kosicki, Nauczanie Przedmiotów Przyrodniczych, 29, 2009. pp. 23-27.
- Europejski projekt FP7 History and Philosophy in Science Teaching (HIPST) J. Turło, G. Karwasz, K. Służewski, A. Karbowski, K. Przegiętka, Nauczanie Przedmiotów Przyrodniczych, 30, 2009, pp. 41-48.
- 6. The solar calendar of Nicolaus Copernicus, Part II, A. Witkowska, Nauczanie Przedmiotów Przyrodniczych, 30, 2009. pp. 25-29.
- 7. The solar calendar of Nicolaus Copernicus, Part III, M. Czerwińska, Nauczanie Przedmiotów Przyrodniczych, 30, 2009. pp. 30-40.
- 8. Pozaszkolne strategie edukacyjne- konstruowanie i realizacja wystaw interaktywnych: "Fiat Lux" w Muzeum Okręgowym w Toruniu, G. Karwasz, J. Kruk, M. Karwasz, (in press)
- 9. Edukacja w centrach nauki: wystawa interaktywna "Od Witelona do tomografu optycznego", G. Karwasz, J. Kruk, (in press)

9. Expectations

- We would be intrested in the further development of the exhibition's collection, (to construct replicas of some others historical telescops (Galileo telescope was alredy constructed from our resouces).
- We would like to introduce HIPS element to the Polish curriculum.
- We are planning to establish the Science Center in Torun.



Thank You for the attention!