Proceedings
GIREP-EPEC Conference 2011
August 1 – 5, Jyväskylä, Finland

Physics Alive

Editors:
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ISBN 978-951-39-4801-6
Proceedings GIREP-EPEC Conference 2011, Physics Alive
JYFL Research Report no. 10/2012
University of Jyväskylä

PREFACE

This book brings together the selected papers presented in the international GIREP-EPEC 2011 conference, which was held in Jyväskylä, Finland 1st-5th August 2011. Each paper was blind reviewed by members of the scientific committee. Papers were subsequently revised by authors according to reviewers' comments. These versions have finally been reviewed by the editors to improve consistency of style and language.

Most of the contributions incorporate the theme of the conference, Physics Alive. The collection of papers emphasizes the efforts toward increasing student motivation in Physics and teaching the lively and developing field of Physics in lively manner. As an outcome of a conference of diverse topics and audience, the articles vary in objectives and methodology - and that is why they make a unique collection of interesting research questions, methods and results to improve teaching of Physics. We hope that you will find this book as a valuable resource of information and new ideas.

This book and electronic publication constitute a single product. When referring to any of the papers, whether in the book or in the online content, the reference should be: [Author(s)](2012).[Paper title]. In A. Lindell, A.-L. Kähkönen, & J. Viiri (Eds.), Physics Alive. Proceedings of the GIREP-EPEC 2011 Conference, (page numbers). Jyväskylä: University of Jyväskylä.

Finally, we acknowledge all the authors for their contributions and the assistance of the reviewers and the International Scientific Committee:

Carl Angell, Norway; Constantinos P. Constantinou, Cyprus; Leos Dvorak, Czech Republic; Ton Ellermeijer, Netherlands; Claudia Haagen-Schuetzenhoefer, Austria; Ismo Koponen, Finland; Robert Lambourne, UK; Ian Lawrence, UK, Matti Leino, Finland; Jukka Maalampi, Finland; Leopold Mathelitsch, Austria; Juha Merikoski, Finland; Marisa Michelini, Italy; Nicos Papadouris, Cyprus; Wim Peeters, Belgium; Gorazd Planinsic, Slovenia; Dimitris Psillos, Greece; Lorenzo Santi, Italy; Antti Savinainen, Finland; Laurence Viennot, France.

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University of Jyväskylä,
Jyväskylä, Finland
June 2012

Statistics of the conference

Participants		144
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Armenia	1	
Austria	4	
Belgium	2	
Brazil	1	
Croatia	2	
Cyprus	1	
Czech Republic	12	
Finland	26	
France	1	
Germany	3	
Greece	2	
Iran, Islamic republic of	1	
Israel	1	
Italy	14	
Japan	4	
Korea, Republic of	4	
Latvia	2	
Malta	1	
Mexico	4	
Netherlands	6	
Norway	2	
Poland	6	
Portugal	3	
Singapore	2	
Slovakia	2	
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An Inquiry Based Approach to the study of energy exchange by thermal radiation

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A teaching-learning sequence regarding the investigation of energy exchange by thermal radiation, conduction and convection is under development within the context of "Establish", a FP7 European Project aimed at promoting and developing Inquiry Based Science Education in European Secondary Schools. Here we present some relevant laboratory activities of this inquiry-oriented teaching/learning sequence for secondary school level students (or even first-level university ones), aimed at investigating the physics of energy transmission by thermal radiation. In traditional laboratory work, the focus of students activities is mostly dedicated on verifying information previously transferred by the teacher. Our teaching-learning sequence is instead organized by firstly engaging students by scientifically oriented questions about real life situations, such as thermal insulation of houses and the use of energy saving materials. This introductory phase of topic exploration, mainly based on students' prior knowledge, is followed by a discussion about the relevant physical quantities which should be taken into account in a contest of a laboratory activity of measurements. A scientific investigation on the energy exchange between a powered resistor and its surrounding environment during the heating and cooling processes is proposed. Students are stimulated to design and carry out their own laboratory activity by collecting, processing and analysing data, in order to discover new concepts or laws and obtain more meaningful conceptual understanding of the physics underlying the process of energy exchange by thermal radiation.

1. Introduction

Inquiry Based Science Education (IBSE) is a functional way of considering teaching and learning activities, developed to cope the need of today economic, environmental and social realities that demand new science skills and higher-order thinking abilities from our students (Rocard et al., 2007). IB approaches to science education focus on student constructed learning as opposed to traditional teacher-transmitted information. Inquiry based curriculum and teaching techniques have emerged as a combination of several theories such as constructivism, multiple intelligences (Gardner, 1983) and accelerated learning (Burnaford et al., 2009), with the aim of enhance learning based on increased student involvement, multiple ways of knowing and sequential phases of cognition. Furthermore, by stimulating the development of students' multiple intelligences, more types of students achieve a successful contribution, while others are engaged on more than one level of knowledge. This process leads to more complete cognition by building on previously learned knowledge. Science education carried out by following an inquiry-based approach appears to be more effective to develop independent and critical thinking skills, positive attitudes and curiosity toward science (Shymansky, 1984; Kyle et al, 1988; Hall & McCurdy, 1990; Beerer and Bodzin, 2003; Campbell et al., 2010).

A quantitative study on the effectiveness of an IB approach applied to laboratory activities during an introductory course of biology has shown that students achieved 6% higher grades on biology content exams as opposed to the control group, which completed a more traditional information-transmission modelled laboratory (Leonard, 1983). Student derived investigations brings about a more relevant and meaningful knowledge (Polman, J.L., 2000, Stephens and Clement, 2010).

In this view, we are developing a teaching-learning sequence regarding the investigation of energy exchange by thermal radiation, conduction and convection, within the context of “Establish”, an FP7 European Project aimed at promoting and developing IBSE in European secondary schools. Our teaching-learning sequence is organized by firstly engaging students by scientifically oriented questions about real life situations, such as thermal insulation of houses and the use of energy saving materials. Students are invited to design and build by themselves a scale model of an energy-efficient house, through the understanding of relevant concepts regarding the energy flow in thermal systems. Students are directly involved into modelling and practical activities and they are stimulated to carry out their own experiments.

As a part of this inquiry-oriented teaching/learning sequence, here we present some relevant laboratory activities for secondary school level students, or even first-level university ones, aimed at investigating the physics of energy transfer by thermal radiation. A scientific investigation on the energy exchange between a powered resistor and its surrounding environment during the heating and cooling processes is proposed. Students are stimulated to plan and carry out their own laboratory activity by collecting, processing and analysing data, in order to learn new concepts or laws and obtain more meaningful conceptual understanding of the physics underlying the process of energy exchange by thermal radiation. Our approach is different from structured inquiry, in which students are guided through some laboratory activities where the end result of an experiment is often useful to validate a true-false hypothesis [Nottis et al., 2010]; here we propose a learning path based on active exploration and the experimental results are always object of discussions.

This paper is organized as follows: in Sect. 2 we present the experimental procedure and a description of the inquiry-lab learning path; the results are shown in Sect. 3 and the discussion and concluding remarks are given in Sect. 4.

2. Method

The classroom activities are introduced through a phase of topic exploration, mainly based on students’ prior knowledge, is followed by a discussion about the relevant physical quantities which should be taken into account in a contest of a laboratory activity of measurements. From their previous studies, students should know that the energy exchange between an emitting body and its surrounding is caused by the processes of conduction, convection and radiation. By discussing between each other, students should gather that, in the absence of a medium, as in a vacuum system, the conduction and convection cannot take place. Students are initially left free to design their own experiments to study the emission of thermal radiation. Then, they are introduced to the laboratory and invited to adapt their plans about conducting the experiments with the available measurement facility for the study of energy exchange by thermal radiation.

Guide to the experimental activity

The temperature of a powered resistor inside a vacuum tube can be measured during the heating and cooling process with the equipment shown in Fig. 1. The system is composed by a vacuum pump which is connected to a vacuum tube containing the resistor; the pump can lower the pressure inside the tube up to 0.01 bar. The temperature of the resistor is measured by mean of a thermocouple which is placed inside the vacuum tube and whose tip is in contact with the resistor surface. The thermocouple is externally connected to an amplifier module and interfaced to the lab computer. The resistor is a ceramic-type with the following physical

characteristics: 11 W, 150 Ω. The temperature of the external surface of the vacuum tube can also be measured by using a surface temperature sensor connected to a LabQuest module. A power management system is required to drive the electric current into the resistor.

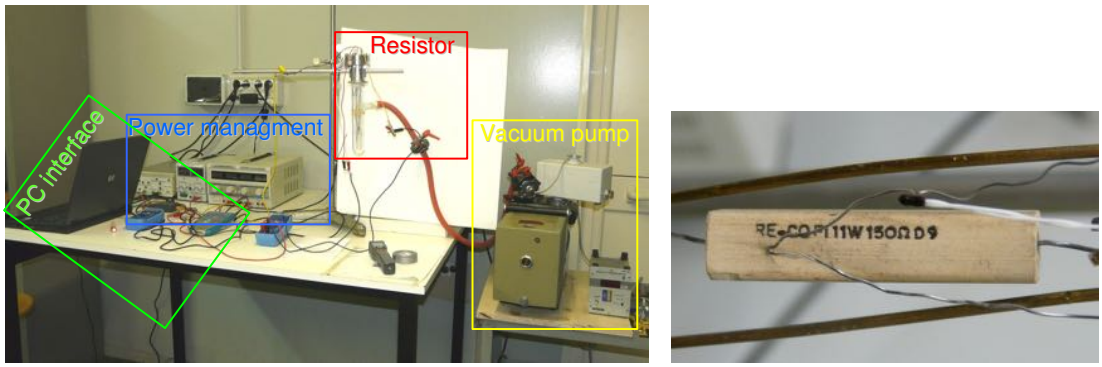

Figure 1: Left: Measurement facility for the study of energy exchange by thermal radiation. Right: details of the ceramic-type resistor and the thermocouple.

The first experiment is carried out by the measuring the temperature of the resistor during the heating and cooling process. In the next section we will show the details of the results. In this section we want to focus on the inquiry-based approach to be adopted by the students to carried out a scientific investigation on the topic of energy exchange by thermal radiation. Once students collect the data, they should stop to measure for a while and start to discuss about what is actually known and published on literature on the specific problem under investigation (as, for example, the research article written by Besson, 2010). This activity stimulates the students to work together towards the research of theoretical findings regarding the thermal emission by radiation. They find the physical law describing the cooling of a radiating source in vacuum, the Stefan law, and they try to make a comparison between the law previsions and the collected data. Students discuss the result of the comparison in terms of agreement or not between theory and experimental findings, by questioning about the observed disagreement and on what could affect the data during the experiments. The discussion is a fundamental activity to facilitate students to become active learners. Diagnosing problems, critiquing experiments, researching alternatives, searching information, constructing models and planning alternative investigations are the basic processes of an inquiry-based approach. Students continue their scientific investigation by observing and measuring other physical quantities that they believe could have a significant role affecting the experimental results, such as the temperature of the air in the laboratory and the temperature of the external surface of the vacuum tube containing the resistor. A new theory is suitably developed in order to take into account the new observations and compared with the previously collected data. A final comparison between theory and experimental findings stimulates students to drawn their own conclusions.

3. Results

Our inquiry-lab activity on thermal radiation is developed across a learning path which comprises both collecting data via experiments and the research of a suitable theory explaining the observations. In the first experiment, the students investigate the cooling process of a body emitting thermal radiation, by measuring the temperature of a resistor, initially heated up to the saturation regime, just after the power supply has been switched off. Students discuss about the collected data (red

dots in Fig. 2a) and compare their experimental findings with the theory of thermal emission of radiation expressed by the Stefan law (red line in Fig. 2a). Students find that their experimental data do not meet the theory and start a questioning activity about possible explanations of the observed disagreement. In Fig. 2a, the Stefan law has been traced by numerically solving the equation:

$C\, dT/dt = - e\sigma S(T^4 - T_b^4)$

where T is the temperature of the emitting object, C the heat capacity, e the emissivity, σ the Stefan constant, S the object surface and T_b the temperature of the surrounding ambient. Both the heat capacity and the emissivity are assumed to be equal to the constant values C=1.5 J/K and e=0.9, respectively. Students can try to change these parameters in order to match the theory with the experimental data, but a satisfactory agreement is not obtained. The problem needs further investigations. Students are stimulated to discuss about which relevant physical quantities should be taken into account in their research activity. By observing the expression of the Stefan law, students may note that in the comparison between the data and the theory (Fig. 2a), the temperature of the environment, surrounding the resistor, is always considered constant, as already assumed in similar experiments conducted within a vacuum bell jar (Twomey et al. 2009). In our experiment, however, the vacuum tube is closer to the resistor and, having also a lower heat capacity, it could enhance its temperature and affect the results. Thinking-aloud reasoning can bring the students to understand the importance of boundary conditions; they plan a new set of measurements, by tracking, at the same time, the surface temperature of the vacuum tube. The results of this second experiment are shown in Fig. 2b, in which we plot the temperature of the resistor (red dots) and the temperature of the surrounding environment (green dots) vs. time. Students have the confirmation that the assumption of a constant ambient temperature is not valid in their experiments. At this point, students think on how to modify the theory by including the effect of a changing ambient temperature. The Stefan law can be numerically solved by including in the computation a T_b changing as experimentally observed (green dots in Fig. 2b). The curve calculated by applying the "new" theory (black line in Fig. 2c) is significantly higher than that traced by the Stefan law with the usual approximation of a constant ambient temperature (red line in Fig. 2c) and now matches the data. The students can further discuss the final reached agreement between the experimental data and the theory.

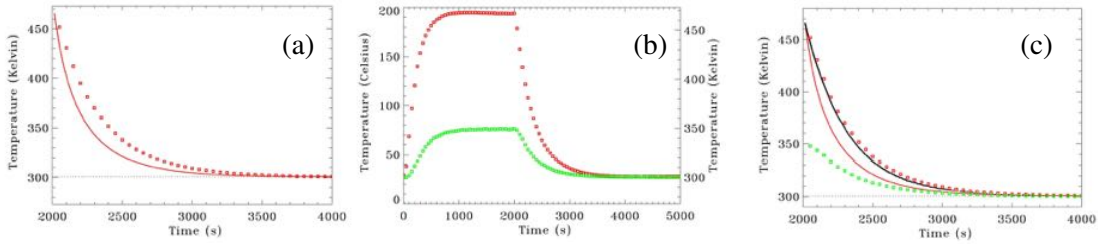

Figure 2: (a) Temperature vs. time of the resistor initially heated until the saturation and then disconnected from the power source; the red dots indicate the collected data in the laboratory and the red line is used to draw the Stefan law with constant T_b. (b) Comparison between the temperature of the resistor (red dots) during the heating and cooling process and the temperature of the external surface of the vacuum tube (green dots). (c) Cooling process: dots represent the experimental data (red is used for the resistor and green for the environment); red line represents the Stefan law with constant T_b; black line shows the Stefan law, with the inclusion of a changing surrounding temperature.

4. Discussion and conclusions

In this paper we present a teaching/learning path based on a set of inquiry-laboratory activities aimed at driving students to the understanding of the physics underlying the process of thermal radiation. Students are engaged by questions regarding their every-day experience that lend themselves to scientific investigations and they are stimulated to design their own experiments. Such experiments are discussed in the classroom and adapted to the equipments at disposal. Students collect, process and analyse the data of a previously heated resistor, cooling in a vacuum system. The experimental findings are compared with the available theories and students discuss about the results of the comparison. “Do our experimental data meet the theory?” This is the question. If the answer is “yes”, everything is fine. If the answer is “no”, as usual, students should check their experiment and think which physical phenomenon could affect the data. Then, they can turn back to the theory, eventually modifying the previous one, and conduct a new comparison. In this way, students are involved into a real scientific research that can bring up to results unexpected even for the teachers, such as the importance of the temperature of the surrounding environment into the study of the energy exchange by thermal radiation. If the agreement between theory and collected data is still not completely satisfying, as the most usual case, students could guess that maybe they used a not perfectly correct value of heat capacity and/or emissivity in the numerical solution of the Stefan law and perform further investigations on how the accordance between data and theory can be improved by changing these parameters.

Traditional methods of teaching physics, mainly based on transmission of information and laws, bring about a not lasting and effective learning. Inquiry based physics education represents a valid alternative to traditional teaching. The main goal of a physics effective teaching path should be the improvement of the reasoning skills of the students, who become brain-trained to observe and understand the natural phenomena. Our teaching-learning path by mean of an inquiry lab on the topic of energy exchange by thermal radiation has been presented to groups of secondary school physics teachers, in order to assess its feasibility and pedagogical potential effectiveness. Preliminary results have shown a positive feedback from involved teachers, which have considered this inquiry-based learning path an open way of scientifically investigating the physics of thermal emission by radiation; they also have evaluated the opportunity to easily extend this inquiry lab in order to include many different and interesting experimental paths on the energy exchange by conduction and convection. The experimentation of this inquiry-lab learning path on high school students is under implementation and the results will be the subject of a forthcoming paper.

Acknowledgement

This work was developed within the context of “Establish”, an FP7 European project, grant agreement n. 244749.

References

Besson, U. (2010). Cooling and warming laws: an exact analytical solution. European Journal of Physics 31, 1107-1121

Beerer, K. and bodzin, A. M. (2003). Promoting Inquiry Based Science Instruction: the validation of the Science Teacher Inquiry Rubric (STIR). Journal of Elementary Science Education 15, 2, 39-49

Burnaford, G.E., Fischer, J., Hobson, D. (2009). Teachers doing research: The Power of Action Through Inquiry (2nd ed.). Mahwah, New Jersey: Lawrence Erlbaum Associates. ISBN 0-8058-3589-X.

Campbell, T., Abd-Hamid, N. H., & chapman, H. (2010). Development of Instruments to assess Teacher and Student Perception of Inquiry Experiences in Science Classrooms. Journal of Science Education 21, 13-30

Gardner, H. (1983). Frames of Mind: The Theory of Multiple Intelligences. New York: Basic Books.

Kyle, W.C., Jr., Bonnstetter, R.J., & Gadsden, T., Jr., (1988). An implementation study: an analysis of elementary students' and teachers' attitudes toward science in process-approach vs. traditional science classes. Journal of Research in Science Teaching 25, 103-120.

Hall, D. A. and McCurdy, D. W. (1990). A comparison of a biological science curriculum study (BSCS) laboratory and a traditional laboratory on student achievement at two private liberal arts colleges. Journal of Research in Science Teaching 27, 625-636.

Leonard, W.H. (1983). An experimental study of a BSCS-style laboratory approach for university general biology. Journal of Research in Science Teaching 20, 807-813.

Polman, J.L. (2000). Designing Project-Based Science: Connecting Learners Through Guided Inquiry. New York: Teachers College Press, Columbia University.

Nottis, K.E.K., Prince, M.J., Vigeant, M.A. (2010). Building an understanding of heat transfer concepts in undergraduate courses. US-China Education Review, 7, ISSN 1548-6613, USA.

Rocard, M., Csermely, P., Jorde, D., Lenzen, D., Walberg-Henriksson, H., Hemmo, V. (2007). Science Education Now: A renewed Pedagogy for the Future of Europe. EU Research Report, ISSN 1018-5593.

Shymansky, J.A. (1984). BSCS programs: just how effective were they? The American Biology Teacher 46, 54-57.

Stephens, A.L., Clement, J.J. (2010). Documenting the use of expert scientific reasoning process by high school physics students. Physical Review Special Topics – Physics Education Research 6, 020122.

Twomey, P., O'Sullivan, C. and O'Riordan, J. (2009). An experimental investigation of the role of radiation in laboratory bench-top experiments in thermal physics. European Journal of Physics 30, 559-566.

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