Teacher Education and ICT on Thermal Phenomena

Lidia Cerasela FARCAS, Ovidiu Florin CALTUN

Alexandru Ioan CUZA University, Faculty of Physics and CARPATH Center, Bd. Carol I nr. 11, 700506, Iasi, Romania

Marisa MICHELINI

Research Unit in Physics Education, University of Udine, Via delle Scienze 208, 33100 Udine, Italy

Abstract. Traditional methods of teaching – learning – assessment are replaced in modern classroom by new strategies based on new technologies and new devices. Research in physics education can contribute to the design of educational tools responding to teachers needs and students expectation. An example of such devices is a USB interconnected four gauges thermometer (Termocrono) realized by URDF at University of Udine. Based on URDF experience was decided the transfer of knowhow from Italy to Romania at Alexandru Ioan Cuza University in M. Ed. programme Science Didactics to improve in service and future teachers training.

Introduction

USB interfaced on-line sensors allow teachers and students to experiment on physical process in an efficient way and saving time. [1] In order to initiate and familiarize Romanian teachers with the Termocrono system a teachers' training program was carried out at Alexandru Ioan Cuza University of Iasi. The teacher education was design based on research on thermal phenomena developed by the Physics Education Research Unit (URDF) of the University of Udine [2]. The intervention module involved 15 teachers of different backgrounds: Mathematics (1), Biology (8), Chemistry (3) and Physics (3). The module was carried out in three stages in two days training at University and included a series of classroom activities.

Teacher education programme

In the first stage, lasting for 6 hours, the teachers were introduced in an interdisciplinary approach on thermal phenomena. The teaching intervention module was designed as interactive lectures and workshops for teachers to discover the Termocrono (4 probe computer sensor on line system) and associated software facilities. During the workshops, seventeen basic experiments were carried out. Tutorial used for every situation provided feed back to the teachers concerning awareness of the teaching – learning pathway suggested. In the end of the one day program in a half hour debriefing the teachers and trainers discussed strengths and weakness of using Termocrono in classroom. Knots for teaching paths was exemplified by teachers involved in activity: thermal equilibrium, thermal sensation and temperature, heat transfer, heat capacity and specific heat, thermal interaction of different systems, thermal conductivity, phases transformation, etc. In the end of the activity, the teachers were asked to prepare for the next training session idea of implementation of similar experimental activities adapted to the school environment and students' level using resources that they have for hand on activities in their labs.

On the second meeting participants shared in interdisciplinary groups their intention on implementation of experiments in the classroom at school. Similar or alternative experiments to those demonstrated ones in the intervention session were discussed. In groups were analyzed

classes level, main characteristic of the classes, level of performances and schools labs facilities and resources. In every group some experiments was performed with Termocrono but also using classical thermometers based on liquid dilation or simple electronic thermometers instead of the online thermal sensors. Every experiment was detailed with advantages and disadvantages, sensibility, time response, precision and errors, expected results and activity impact.

In the end of 5 hours experimental workshops the participants drafted the pathway of teaching – learning, milestones and assessment instruments, students tasks and learning products, students feedback forms.

With drafted project in the third stage the teachers had classroom intervention according with the planed strategy. They implemented the activities and documented all steps in the portfolio.

In the last meeting of the programme every teachers reported how they implemented the teaching of thermal phenomena. They presented the portfolio of images, experimental data, students plots and laboratory forms, and students feedback on effectiveness of activity and results of the analyses of students satisfaction form. Participants reported in a final document the main professional gain as contents, methods and pedagogical issues.

Conclusions

Data analysis on the progress in the different steps shows that the teachers involved in the programme demonstrate high commitment and interest in using new instrument allowing new pedagogical approach of thermal phenomena in classroom in different environment and in teaching – learning different scholar topics or subjects. The analysis of initial and final questionnaires show a change of perspective of participants in representation of thermal phenomena and strategies to transfer the knowledge to the students in interdisciplinary approaches. Many of Biology teachers chosen to experiment on thermal sensation, thermal equilibrium and thermal conductivity. Some Chemistry teachers decided to practice on phase transformation or specific heat. Some Physics teachers developed activities focused on sensors, response time, thermal equilibrium or transfer of heat.

Experimenting with Termocrono in training sessions was a good opportunity for teachers to discover new pathways for learning activities involving thermal processes in the classroom. The analysis of portfolios shown that majority of the teachers was ready to implement in a creative way new activities using sensors for temperature measurements.

References

[1] M. Michelini, L. Santi, A. Stefanel (2010) *Thermal sensors interfaced with computer as extension of senses in kindergarten and primary school,* in Multimedia in Physics Teaching and Learning, Michelini M, Lambourne R, Mathelisch L eds, SIF, Il Nuovo Cimento, 33 C, 3, NIFCAS 33(3) pp.171-179

[2] C. Daffara, M. Michelini, F. Monti and A. Stefanel *Sensori on-line per un approccio termodinamico ai fenomeni termici nella formazione iniziale degli insegnanti* (2016) Didactica pp. 1-4.