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**Editors: Paweł Cieśla, Wioleta Kopke-Putąła, Anna Baprowska**

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**Editors:**

Paweł Cieśla, Wioleta Kopek-Putała, Anna Baprowska

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# Self-Reported Czech and Slovak Students' Feedback on Performing Activities in Computer Based Science Lab

Petr Šmejkal<sup>1</sup>, Marek Skoršepa<sup>2</sup>, Eva Stratilová Urválová<sup>1</sup>

*<sup>1</sup>Department of Teaching and Didactics of Chemistry, Faculty of Science, Charles University in Prague, Prague, Czech Republic*

*<sup>2</sup>Department of Chemistry, Faculty of Natural Sciences, Matej Bel University, Banská Bystrica, Slovakia*

*psmejkal@natur.cuni.cz, marek.skorsepa@umb.sk, urvalkov@natur.cuni.cz*

## Introduction

Microcomputer based laboratory (MBL), also called Probeware, is a prospective tool for more efficient and more interesting teaching of variety of themes attributed to all science branches and well reflects the increasing ratio of employment of instrumental devices and various probes in lab practice and in common life. In fact, the MBL (Probeware) is a set of various sensors which can be connected to and controlled by various kinds of computer systems (datalogger, PC, smart device, calculator etc.). For the particular MBL system, a common way of connection of individual parts of the system and control of the system is characteristic. In addition to that, the parts of the system are designed with respect to school application, which means user-friendly software, small and robust construction etc. Benefits of MBL were discussed by many authors (Lavonen et al, 2003, Hamne & Bernhard, 2001, Thornton & Sokoloff, 1990, Tinker, 1996), for example, the enhancement of scientific competencies and development of abstract thinking were proved. Although implementation of MBL can bring a variety of advantages and well demonstrate some aspects and themes of the science branches over the experiment made “traditionally”, there are still obstacles which hinder the implementation into Czech and Slovak schools. One of them is a lack of well-designed research based MBL materials (lab worksheets, technical sheets, etc.) and a lack of technical support to teachers implementing the MBL systems into their school practice. There is also a question whether attitudes of students to MBL and sensors are positive or they are oversaturated by computer systems or whether the work with MBL is too complicated. With respect to the mentioned obstacles, in the framework of European project COMBLAB, a new set of inquiry based laboratory activities has been developed and implemented in laboratory courses for secondary school students. The concept of the activities and the activities were already presented during DidSci 2012 conference by Stratilová Urválová et al. (2012) and they are available at [www.comblab.eu](http://www.comblab.eu). This contribution deals with self-reported Czech and Slovak students' feedback on performing activities in computer based science (MBL) lab and compare the

attitudes and opinions of Czech and Slovak students on work with MBL systems and the presented activities.

## Methods

The attitudes and opinions of the students participating the courses were collected through newly designed questionnaire and statistically evaluated. The courses attended totally 664 Czech and Slovak secondary school students (mean age 16.97; SD 1.20) from 15 participating schools (11 in the Czech Republic, 4 in Slovakia). The most of the implementations (919) were realized in the university laboratories (Charles University in Prague, Czech Republic and Matej Bel University in Banská Bystrica, Slovakia). Totally, 1408 (476 SVK + 932 CZE) evaluations have been performed as part of the students participated and evaluated more than one activity). In the questionnaire, students evaluated quality of the activity and work with MBL system. For evaluation purposes, a special tool (a 20-item questionnaire) has been administered to the students after performing each activity (implementation). For this study, seven following questionnaire items were selected to be discussed in more detail: (Item 1) *I found the activity interesting and motivating*; (Item 2) *The instructions were clear to me*; (Item 3) *Overall, how satisfied were you with the activity*; (Item 4) *It was easy to set up the experimental equipment*, (Item 5) *It was easy to work with the computer system*; (Item 6) *I needed my Teacher's help to perform the experiment* and (Item 7) *I would appreciate more frequent use of MBL in my classes*. All the items are positive declarative clauses where students expressed their level of agreement on 4-point Likert scale – items 1, 2, 4 - 7 (1 = I totally agree, 2 = I agree, 3 = I disagree, 4 = I totally disagree) or 6-point Likert scale – item 3 (☺☺☺ - ☺☺ - ☺ - ☹ - ☹☹ - ☹☹☹). The data were processed by several statistical methods, such as descriptive statistics, analysis of frequencies and comparative analysis. The significance was determined by non-parametric Mann-Whitney U test or Kruskal-Wallis H test at 0.05 level.

## Results

The results showed that majority of the students considered the activities to be interesting and motivating (> 93%) with clear instructions (> 88%). More than 88% stated that work with the MBL system and a set-up of the system was simple, on the other hand, more than 50% of participating students needed some help of teacher. More than 90% of students also consider MBL beneficial for their personal knowledge development and over 70% mentioned that knowledge from the lab course is well applicable in other science courses. This statement was typical independently on the fact whether the MBL system was implemented for the first time or more times. Nevertheless, the significant differences between Czech and Slovak students were identified. Slovak students showed more

positive attitudes to activities (ITEM 1:  $U = 155\ 207.000$ ;  $z = -9.569$ ;  $p = .000$ ;  $MR_{CZE} = 757.50$ ,  $MR_{SVK} = 564.57$ ; ITEM 2:  $U = 136\ 844.000$ ;  $z = -12.386$ ;  $p = .000$ ;  $MR_{CZE} = 777.79$ ,  $MR_{SVK} = 525.99$ ; ITEM 3:  $U = 110\ 398.000$ ;  $z = -14.757$ ;  $p = .000$ ;  $MR_{CZE} = 772.92$ ,  $MR_{SVK} = 470.43$ ) and to work with MBL system (ITEM 4:  $U = 150\ 359.000$ ;  $z = -10.126$ ;  $p = .000$ ;  $MR_{CZE} = 760.12$ ,  $MR_{SVK} = 554.38$ ; ITEM 5:  $U = 149\ 312.000$ ;  $z = -10.562$ ;  $p = .000$ ;  $MR_{CZE} = 762.65$ ,  $MR_{SVK} = 552.18$ ). The Slovak students also reported less need of help from teacher (ITEM 6:  $U = 284\ 984.000$ ;  $z = 10.531$ ;  $p = .000$ ;  $MR_{CZE} = 612.40$ ,  $MR_{SVK} = 837.21$ ) and they more support wider implementation of MBL into schools (ITEM 7:  $U = 165\ 585.000$ ;  $z = -8.683$ ;  $p = .000$ ;  $MR_{CZE} = 700.11$ ,  $MR_{SVK} = 586.37$ ). On the other hand, in overall, the results show that students of both countries positively evaluated the activities as well as work with MBL systems and designed activities and consider their implementation in science courses as meaningful and useful.

## Conclusions

The developed and tested activities were evaluated in overall very positively as interesting and motivating; comparing two countries: the activities were evaluated more positively by Slovak students than by Czech students. The Slovak students also considered the setup as well as work with MBL system as easier and they also reported less need of help from teacher than the Czech students. In addition to that, Slovak students would appreciate more frequent use of MBL in lab classes and in overall, they showed higher motivation and more positive attitude than the Czech students. As a consequence, the implementation of MBL and the activities in the Czech Republic could be more complicated for Czech teachers. On the other hand, attitudes of the Czech students are still very positive and majority of students support implementation of MBL and performed activities are considered to be of high quality by both, Czech and Slovak students.

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