EXAMINING STUDENTS' AND TEACHER'S PERCEPTIONS OF MICROCOMPUTER BASED LABORATORIES (MBLs) IN HIGH SCHOOL CHEMISTRY CLASSES

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Many educators are advocates of the potentials for enhancing learning with new instructional technologies (e.g., Settlage, 1995; Edelson, 1998; White, 1998; Linn & Hsi, 2000). In this sense, adapting MBLs for use in school science curricular activities may alter the traditional ways of doing experiments by students and teachers (McRobbie & Thomas, 1998). Yet, many science educators support the use of MBLs to enhance the learning of science concepts, graphing skills and problem solving skills (e.g., Nakhleh & Krajcik, 1993; Edelson, 1998; Linn & Hsi, 2000). However, the effective implementation of microcomputer technology into the classroom has always been a great challenge for teachers. Some teachers have been excited and motivated by the integration of technology into their classroom, whereas others seem to be intimidated due to lack of technical training and personal interest.

As a result of integration of technology into schools, many in-service teachers are being asked to involve many new tools into their instruction. In addition, in a technology-enhanced classroom where teaching and learning may be dramatically changing, the needs of those most affected, the students and teachers, are critically important. Their perceptions of using MBLs are crucial for gaining a better understanding of the educational impact of MBL technology on teaching and learning. Learning more about their perceptions will be an important point of departure for investigating any proposed change. Due to the broad range of perceptions indicated by both the teacher and the students, in this paper I mostly focused on the teacher's perceptions of using MBLs in High School Chemistry classes.

SOME IMPACTS OF "NEW" VERSIONS OF MBLS ON INSTRUCTIONAL PRACTICES

Thirty-three students from two high school level AP Chemistry 2 classes and their teacher participated in this study. The students involved in this study were 11^{th} and 12^{th} grade students. For the purpose of this study, I selected four students as the focus group for more intense study than others. The teacher involved in this study, was a very experienced teacher. He had over 20 years of teaching experience in almost all disciplines of science.

The teacher informed me that he started using "old" versions of MBLs with the "old" models of Apple II Es back in 1996, however quit one year later because of the difficulties he confronted in manipulating them. He stated that his students got so confused with setting up those "old" versions of MBLs that they lost sight of the experiment and what they were trying to do. He indicated that old versions of MBLs did not have much of a variety of sensors that he could use in varied experiments.

The teacher was amenable to incorporating "new" versions of MBLs into his teaching again, given his knowledge of the new developments in computers

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and MBL technology. He thought that advancements in MBL technology would enable him to do labs that he was not able to before. He reported:

> I think the selection of probes has increased the availability of labs to do, which you could not measure before, not easily. The gas pressure probe, the colorimeter, and all those things definitely they are going to expend the possibility of measuring different parameters. It was very difficult to do before. I was trying to find conductivity type meters and they were basically usually just series of lights (Teacher interview, Fall 2000)

However, the teacher appeared to be skeptical about the possible instructional gains associated with using MBLs. Although he acknowledged the potential benefits of using MBLs, he insisted on doing some labs in traditional ways. He stated that he would not use MBLs for some labs especially when introducing new science concepts because he seemed to think that whether "old or new," MBLs were reducing student concentration on the scientific concept being taught. He believed that while the MBL was collecting the data, students would be less challenged; therefore they might get bored and detached from the activity. In order to keep the students engaged in the activity, he suggested challenging the students by modifying the labs in a way that students would be busy with other related materials while the MBL was collecting data. He reported:

> By introducing the MBL, you introduce more possibilities for problems. They [students] are having problems manipulating. MBL is collecting all the data, so what are they [students] doing? You have got to make sure you have something for them to do while it is collecting data. They are not going to sit there and watch that thing collect data. So, you have got to modify your labs so that if it [MBL] is collecting all the data. I think you need to be doing something else, you know.(Teacher interview, Fall 2000)

In order to increase the effectiveness of MBLs for lab activities, the teacher suggested finding a “healthy mix” of blending traditional methods and MBLs. He seemed to believe that, too much use of MBLs might be an overkill of technology. He thought MBLs were no good for the activities that do not involve repetitive tasks. Also, he did not seem to prefer using MBLs while introducing new concepts because he seemed to think that minor difficulties in manipulating MBLs would negatively affect student concentration on the concept being taught.

The teacher’s above perception was consistent with some students’ statements. One of my focus students, for example, thought that using MBLs in investigations would be more beneficial to him “if he already had a good understanding of what he was doing”. Otherwise, he thought, using MBLs would not contribute to his learning. He stated, “If the students have no idea about the whole experiment, it is just like copying the numbers off the calculator.” Regarding use of MBLs in science labs, he also raised his concerns that understanding or interpreting the graph did not necessarily mean understanding the connection between the graphs and the science concepts being investigated.

Moreover, from the teacher’s perspective, one of the things that could be done to get the students more involved into the experiment rather than the MBL was to explain to them how the probes were working. He seemed to believe that

explaining how the probes works would enhance student understanding of what it is they were doing:

> Teacher: I think you could overcome that by explaining to them how the probes are working. The next time I use those MBLs, I will use the pH probe for sure, but I think I will spend a little more time explaining how the probe works. I think another thing I will do is have them calibrate it. So, I think that would be better just to get them used to what it is they were doing. (Teacher interview, Fall 2000)

Based on the data provided in this paper, it seems to me that full integration of existing technology into science instruction could be actualized when teacher and students do not perceive these technologies as a complicated way of doing science. As indicated in this paper, advancements in technology may cause science teachers' perceptions to change over time especially when they see potential benefits of using that technology. Solid gains of incorporating MBLs and other technology into curriculum, such as decreased student labor and/or increased number of ways of doing science, will ultimately help science teachers develop new strategies in their transition to technologically enhanced classrooms. In this sense, provided enough time and necessary technical training, science teachers would better serve students in developing a higher level of understanding of the science content by using MBLs.

REFERENCES

Edelson, D. (1998). Realizing authentic science learning through the adaptation of science practice. In B. J. Fraser & K. G. Tobin (Eds.), *International Handbook of Science Education*. Dordrecht: Kluwer, 317-331.

Kelly, G. J., & Crawford, T. (1996). Students' interaction with computer representations: Analysis of discourse in laboratory groups. *Journal of Research in Science Teaching, 33*(7), 693-707.

Linn, M.C, Hsi, S. (2000). *Computers, Teachers, Peers*. Mahwah, NJ Erlbaum

McRobbie, C. J., & Thomas, G. P. (1998). *The use of microprocessor-based learning in senior chemistry Does technological innovation always result in improved learning?* Paper presented ad the annual conference of the Australian Association for Educational research, Adelaide.

Nakhleh, M.B., & Krajcik, J.S. (1993). A protocol analysis of the influence of technology on students' actions, verbal commentary, and thought processes during the performance of acid-base titrations. *Journal of Research in Science Teaching, 30*, 1149-1168.

Rogers, L. T. (1995). The computer as an aid for exploring graphs. *School Science Review, 76*, 31-39.

Settlage, J., Jr. (1995). Children's conceptions of light in the context of a technology-based curriculum *Science Education, 79*(5), 535-553.

White, B. (1998). Computer microworlds and scientific inquiry: An alternate approach to science education. In B. J. Fraser & K. G. Tobin (Eds.), *International Handbook of Science Education*. Dordrecht: Kluwer, 295-315.