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INTEGRATING COMPUTERS INTO THE HIGH SCHOOL CHEMISTRY CLASSROOM

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Our project began in 1987 with a grant from the Indiana Department of Education to increase the use of technology in the chemistry classroom. Our purpose was to use technology to enhance traditional instruction and to increase learning opportunities for students. The project, "Classroom Without Walls," was comprised of Thomas Adams, then a doctoral candidate from Purdue University, and Dolores Handy and William Sondgerath, chemistry teachers at Harrison High School. There follows an outline of how we use computers and related technology in our classroom today.

We have the following hardware available:
In the classroom:
8-IBM Model/25
4-IBM Proprinter II
4-ESM Corporation printer switch boxes
1-IBM Model/30 (Mostly for teacher use.)
1-Sharp QA-50 Liquid Crystal Display
Outside the room:
1-Local Area Network (in media center)
30-IBM Model/25 (in media center)

Used extensively for tutorials in beginning chemistry is "Introduction to General Chemistry" by Stan Smith from the University of Illinois, published by Compress. Fifty-five lessons in twenty instructional days are used, covering such topics as nomenclature, writing formulas, per cent composition, solutions, the gas laws, and acid-base chemistry. KC? Discoverer by Journal of Chemical Education Software is used extensively during our study of periodicity. We have found in our experiences that it is essential for student learning to have teacher-prepared

LAB SPREADSHEETS PREPARED FOR THE FOLLOWING IN HEATH CHEMISTRY: D. C. Heath, 1987)

Experiment 1C: Analysis of Experimental Results
Experiment 2B: The Law of Definite Composition
Experiment 3A: Thickness of an Aluminum Sheet
Experiment 3Y: The Relationship Between the Mass & Volume of Cu
Experiment 2B: The Law of Definite Composition (Students use data in Ch4 to find Emperical Formula)
Experiment 6A: Mole-Mass Reaction
Experiment 7B: The Molar Volume of a Gas
Experiment 17A: Heat of Reaction
Experiment 17B: Heat of Fusion

Spreadsheets for Other Labs:

Calorimeter Constant
Specific Heat of Unknown Metal
Enthalpy of Neutralization Reaction
Acid-Base Titrations: Standardization of NaOH with KHP
Acid-Base Titrations: Citric Acid in Grapefruit Juice
Acid-Base Titrations: Acetic Acid in Vinegar

worksheets or guidelines to accompany these tutorials; otherwise, students proceed as if playing computer games!

Another important component is the liquid crystal display (LCD), used to project concepts which are being taught to the total class when software is not available or appropiate for small group or individual instruction. The LCD is used for introducing technology or equipment that the students will be using, such as spreadsheeting and graphing. The graphics program which is used to design "concept stories" is IBM's Storyboard Plus. Included is a list of teacher-made concept stories which have been developed with the project. Pictures, diagrams, definitions, and descriptions in a series of frames teach the following concepts.

1\Bonding
2\Density
3\Exo- and Endothermic
4\History of Atom
5\Mass Spectrometer
6\Forming Sodium Ion
7\Phase Diagrams (CO2 and H2O)
8\Colligative Properties
9\Molecular Model
10\Use of Buret
11\Heating Curve
12\Simple Orbitals
13\Part 1 Equilibrium (Qualitative)
Part 2 Equilibrium (Quantitative)

The concept stories can be utilized by the individual student, but usually they are used in large group instruction because they are not interactive.

Harrison High School has Microsoft Works on its network. Students use word processing for lab reports and summary reports on current topics in chemistry, but students are not required to word process throughout the course. Using/making spreadsheets and graphing is the aspect from Microsoft Works that is most used in our chemistry classes. Included is a list of spreadsheet templates which have been developed with the project.

One advantage of spreadsheeting is that students can readily relate a large collection of data to the concept the lab is teaching. Initially students enter individual data for the spreadsheet; they also have access to all other students' data as well. This allows them to understand the experiment more clearly. Eventually they construct the spreadsheet and learn to graph the data from it. The spreadsheet also makes it easier for the instructor to check the students' lab results.

Another feature of our technology is the purchasing of Personal Science Laboratory, which has improved the laboratory interfacing capabilities. The thermistor is used to determine such concepts as heating curves, heat of fusion, and heat of reaction. One major use of the pH probe is to plot the neutralizaion curves involving various combinations of strong/weak acids and strong/weak bases.

For the instructor the Excelsior Grade Book is a most useful and powerful management tool. Keeping students informed of their continual progress, whether for eligibility for extra curricular activities, or for their own curiosity, is most efficient. Questions on attendance can be answered quickly. Statistics on graded material can be determined instantaneously.

Through our project we have gained a better insight of how the tools of technology can enhance traditional instruction, providing still another method of teaching. A second advantage is that "Classroom Without Walls" increases students' opportunities to work with technology that many will face in future education and/or employment.

Sources of Software

Storyboard Plus from IBM
Microsoft WORKS for IBM PC's and Compatibles
PSL(Personal Science Laboratory) from IBM
COMPRESS(tutorials)
P.O. Box 102 Wentworth, NH 03282

(KC? Discoverer)
Journal Chemica Education Software University of Wisconsin-Madison, Dept of Chemistry 1101 University Avenue Madison,WI 53706

Excelsior Software, Inc.(grades)
P. O. Box 3416
Greeley, CO 80633

Can the Organic Laboratory be Computer Assisted?

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This is the question I posed at the 12th Biennial Conference on Chemical Education in August. It is the question I want to pose now to the readers of this newsletter.

In this brief paper, I would like to suggest some ways computers have been or could be used to make the Organic Laboratory experience more effective. My examples are drawn mostly from software available for the Macintosh®. If readers have suggestions or comments, I would like to hear from them and will prepare a future column summarizing such comments in this newsletter.

Some possible uses and software are given in Table I.