

Perceived Problems in using Microscale Chemistry Experimentation

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Abstract— This study focuses on the perceived problems in using microscale chemistry experimentation in teaching General Chemistry course by the participant teachers of the “Workshop on Microscale Chemistry” last October 19-21, 2009. The self-made questionnaire includes perceived problems in using microscale chemistry experimentation in terms of materials/resource, values and skills and results of the experiments. Most of the participants agreed on the presented problems in the questionnaire since 13 items out of 15 have a mean value of 2.55-3.32, e.g. they agreed that materials/resources are not readily available and its precision and accuracy are difficult to attain.

Index Terms—Experimentation, General Chemistry, Inorganic Chemistry, Laboratory apparatus, Microscale

1 INTRODUCTION

LABORATORY experiments have been a cornerstone of the scientific method. The American Chemical Society has stated: “To learn chemistry, students must directly manipulate chemicals, study their properties and reactions, and use laboratory equipment and modern laboratory instruments” [1]. But laboratory experiments generate diversified wastes although the volume is not large compared to industrial operations. Microscale experiments are specifically designed to scale down the volumes of chemicals used in laboratory experiments and generate less hazardous waste [2].

The Commission on Higher Education, Department of Science and Technology, University of Santo Tomas and Kapisanang Kimika ng Pilipinas sponsored a three-day workshop entitled “Workshop on Microscale Chemistry” last October 19-21, 2009 held at University of Santo Tomas Manila, Philippines. The workshop objectives were to familiarize the participant teachers with microscale approach in teaching chemistry laboratory courses, to provide the participant teachers hands-on experience on using microscale chemistry laboratory experiments, and to present a platform for the sharing of experiences in the teaching of the chemistry laboratory courses in various programs.

2 METHODOLOGY

This study made use of descriptive method of research in determining the perceived problems in using microscale chemistry experimentation of the participant teachers. The respondent of the study are the participant teachers who attended the workshop last October 19-21 at UST, Manila. The researcher used a validated self-constructed questionnaire composed of perceived problems in using microscale chemistry experimentation in terms of materials/resource, values and skills and results of the experiments. The researcher electronically mailed the questionnaire to 39 participant teachers and 23 of them mailed back their filled out questionnaires.

3 RESULTS AND DISCUSSIONS

As shown in table 1.1, the participant teachers agreed

that the following problems can be encountered in using microscale chemistry experiments in terms of materials were; microscale materials are not readily available; the accuracy and precision of the measurements are difficult to attain, the students cannot observe exact measurements due to very small volume or amount of chemicals utilized in the experiments; and Materials and improvised apparatus may not be calibrated/properly calibrated.

The participant teachers believed that the size of the microscale materials or apparatus will not affect the skills of the students as shown by the weighted mean of 2.45 with a verbal interpretation of *disagree*. This means that learning skills of the students will not be sacrificed when apparatuses or materials are in microscale.

Table 1.1
Perceived problems in Using Microscale Chemistry Experiments in terms of Materials/Resources

Problems		Weighted Mean	Verbal Interpretation
Materials/Resource			
1.	Microscale materials are not readily available.	3.14	Agree
2.	The materials or apparatus are too small to enhance the skills of the students.	2.45	Disagree
3.	The accuracy and precision of the measurements are difficult to attain.	2.64	Agree
4.	The students cannot observe exact measurements due to very small volume or amount of chemicals utilized in the experiments.	2.55	Agree
5.	Materials and improvised apparatus may not be calibrated/properly calibrated.	2.91	Agree

As shown in the Table 1.2, the participant teachers agreed to the following problems; proper handling of apparatus may not be practiced by the students; students may not be able to practice proper chemical waste disposal thinking that their waste are in very small, most experiments are designed for 2-3 students in a group therefore the experiments

are not suited for large groups; and Students may not be able to correctly evaluate the result of qualitative test. The teachers and administrators must proposed waste management for microscale experiments.

Table 1.2

Perceived Problems in Using Microscale Chemistry Experiments in terms of the Values and skills to be learned by the students

	Problems	Weighted Mean	Verbal Interpretation
Values and Skills			
1.	The microscale chemistry experiments may not evaluate all the skills needed by the students.	2.45	Disagree
2.	Proper handling of apparatus may not be practiced by the students.	2.95	Agree
3.	Students may not be able to practice proper chemical waste disposal thinking their waste are very small.	2.73	Agree
4.	Most experiments are designed for 2-3 students in a group therefore the experiments are not suited for large groups.	2.77	Agree
5.	Students may not be able to correctly evaluate the result of qualitative test such as: color test, odor test, etc.	2.64	Agree

Table 1.3

Perceived problems in Using Microscale Chemistry Experiments in terms of the Result of the Experiments

	Problems	Weighted Mean	Verbal Interpretation
Results of the Experiments			
1.	It will be hard for the students to collect samples during filtration and other separation techniques.	3.09	Agree
2.	Students will experience loss of analyte due to very small amount generated from the experiment.	2.95	Agree
3.	Loss of small amount of reagent or presence of small amount of contaminants will cause significant change in the percent yield.	3.32	Agree
4.	Students may encounter chemical contamination frequently since apparatus may not be cleaned thoroughly.	2.55	Agree
5.	More waste will be generated since some materials are disposable like syringe, plastic cups, paper box, batteries, etc.	2.82	Agree

As shown in the table 1.3, the participant teachers agreed that there will be problems regarding the results of the experiments in using microscale chemistry experimentation. The percent yield of the experiments must be properly reported to account for the small amounts of loss in the sample. The laboratory manufacturers must design a cleaning device/apparatus for the microscale experiments. The choice of materials to be used in the experiments must consider waste minimization and reusability of the apparatus.

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REFERENCES

- [1] <http://www.chymist.com/Laboratory%20Experiments.htm>
- [2] Research and Educational Laboratory Waste Reduction. <http://www.p2pays.org/ref/04/03852.pdf>