DOCUMENT RESUME

ED 319 605 SE 051 415

AUTHOR Dori, Yehudit
TITLE Attitudes toward a Simulation Based Chemistry Curriculum for Nursing Students.
PUB DATE 89
NOTE 8p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (62nd, San Francisco, CA, March 30-April 1, 1989).
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Attitude Measures; *Chemistry; *College Science; Course Content; Course Descriptions; *Course Evaluation; Foreign Countries; Higher Education; Nurses; *Nursing Education; *Science Curriculum; *Student Attitudes
IDENTIFIERS *Israel

ABSTRACT

Chemistry anxiety exists among nursing students as well as other allied health professions. The causes for this anxiety may be attributed to three variables. Chemistry: (1) is perceived as difficult; (2) involves a multitude of facts; and (3) is not connected to reality. A curriculum with a simulation format has been developed to help Israeli nursing students cope with the obstacle of learning chemistry. It is enhanced by intensive written exercises and manipulative teaching aids. Examples include revival of a patient hurt in a traffic accident, and the diagnosis of metabolic acidosis by testing the pH of the blood. Analysis of open attitude questionnaires showed the development of more positive attitudes towards chemistry. The attitude change was attributed to the following: (1) the curriculum applied principles considered as essential by health care professionals and educators; (2) the textbook was written in Hebrew, thus removing the psychological barrier against using English textbooks; and (3) the approach established a link between the abstract ideas presented by pure chemistry and the real, everyday life of the nursing students' future profession. (Author/YP)

Attitudes Towards a Simulation Based Chemistry Curriculum for Nursing Students

Yehudit Dori

Manipulable Computer Architecture
The University of Kansas, Lawrence, KS 66045

Abstract

"Chemistry anxiety" exists amongst nursing students as well as other allied health professions. The causes for this anxiety may be attributed to three factors: chemistry is perceived as difficult, involves a multitude of facts, and is not connected to reality. There is no miraculous solution to this cognitive and motivational anxiety problem. Nevertheless, a curriculum with a simulation format has been developed, that helps Israeli nursing students cope with the obstacles of learning chemistry. It is enhanced by intensive written exercises and manipulative teaching aids. A careful selection of only those topics that are necessary for understanding the principles in the more advanced courses, e.g. pharmacology, diminishes the number of facts involved in the study of chemistry to a minimum. Relevance to nursing is obtained by introducing a varied selection of medical and nursing case studies, i.e. simulations of real life situations. Examples include revival of a patient hurt in a traffic accident, and the diagnosis of metabolic acidosis by testing the pH of the blood.

Pre and post open attitude questionnaires were used to assess the students' feelings towards chemistry before and after they studied chemistry using the simulation based chemistry curriculum. At the end of the course students also responded to a questionnaire consisting of seven Lykert type items aimed at assessing their perceptions regarding the curriculum according to which they had studied.

Analysis of the open attitude questionnaires has shown that most students welcome the project. The number of positive items in the post test was greater than in the pre test, while the number of negative items was smaller, indicating an increase in the positive attitude towards chemistry. According to the Lykert type items, most students indicated that the learning material was clear to a great extent and helped them understand the various subjects. The simulated case studies embedded in the curriculum were reported by most students to have a significant contribution to their understanding of the relation between chemistry and nursing. The majority of students thought that the textbook was both interesting and enjoyable. Students were also asked to evaluate the degree of difficulty of each chapter in the book. For most of the chapters the findings were coherent with the results of their achievement post test. The positive attitude towards the curriculum can be attributed, at least in part, to the fact that the approach establishes the link between the abstract ideas presented by the "pure" chemistry and real, everyday life of the nursing students' future profession.

A paper presented at the *62nd NARST Annual Meeting*, San Francisco, March 30-April 1, 1989.

Attitudes Towards a Simulation Based Chemistry Curriculum for Nursing Students

Yehudit Dori

Manipulable Computer Architecture
The University of Kansas, Lawrence, KS 66045

"Chemistry anxiety" which exists amongst nursing students as well as other allied health professions is an instance of recently recognized math and science anxiety (1). The causes for chemistry anxiety may be attributed to three factors: chemistry is perceived as difficult, involves a multitude of facts, and is not connected to reality. There is no miraculous solution to this cognitive and motivational anxiety problem. Nevertheless, a curriculum with a simulation format has been developed (2), that helps Israeli nursing students cope with the obstacles of learning chemistry. It is enhanced by intensive written exercises and manipulative teaching aids. A careful selection of only those topics that are necessary for understanding the principles in the more advanced courses, e.g. pharmacology, diminishes the number of facts involved in the study of chemistry to a minimum. Relevance to nursing is obtained by introducing a varied selection of medical and nursing case studies, i.e. simulations of real life situations. Examples include revival of a patient hurt in a traffic accident, and the diagnosis of metabolic acidosis by testing the pH of the blood.

Background

During the past three decades, increasing interest has been shown in the United States and elsewhere in the teaching of chemistry in the context of allied health sciences, as reported by Schomer (3). As a result of this interest, syllabi and chemistry courses for allied health professionals in general, including nursing, have been developed. Although these courses differ in length and mode of presentation, most of those reported in the literature try to present basic concepts in chemistry in a manner that is relevant to problems of health or disease. Courses for nursing students, which combine inorganic and organic chemistry, as well as some aspects of biochemistry, are reported by Gratz (4), Stolarski and Sears (5), and Frechette and Farina (6). One interesting course proposed by Jones (7), is entirely based on a patient's clinical laboratory chart.

Genyea and Callewaert (8) have emphasized that while chemistry courses should be interesting and intellectually challenging, they should not be an excessive burden, and certainly not demanding, since most nursing students do not have a strong background in science and mathematics. Daly and Sarquis (9) encouraged chemistry teachers to interact with local members of the various health professions in order to gain information regarding new techniques and to prepare the students for their career in the 1990's. Reporting on the

A paper presented at the *62nd NARST Annual Meeting*, San Francisco, March 30-April 1, 1989.

Task Force on Chemical Education for Health Professions, whose main goal was to design a syllabus for a one- or two-semester course in chemistry for health professions, Treblow et al. (10) list the following goals: (a) the laying down of chemical foundations for microbiology, physiology, nutrition, and pharmacology. (b) limiting the topics to be covered to a one-term course. (c) avoiding the traditional compartmentalization of inorganic, organic and biological chemistry by emphasizing the integration of basic concepts, and (d) reducing the anxiety of students toward studying chemistry.

Several chemistry textbooks designed for health professions have been published in the past decade, but Scherz et al. (11) have found that students in Israel have a psychological barrier against using science textbooks in their science courses, since they are written in English, a second language for most students, in which they lack fluency. This probably applies to all students in non-English speaking countries.

The Simulation Based Chemistry Curriculum

A chemistry curriculum for nursing schools in Israel, abbreviated **ChNS**, has been developed, in which the topics were selected very carefully, taking into consideration limits of time (up to 50 lessons), while providing an interesting, challenging course. The weak mathematics and general scientific background of the student population was taken into consideration, but a degree of self study ability and the development of the ability to think at an academic level was required. The topics included in one of the chapters of the textbook are listede in Table 1.

Main Topics	Concepts	Case-Studies
**Alcohols*	Isomerism in alcohols.	Uses and toxicity of alcohols,
**Oxidation - Reduction*	Oxidation of primary and	Uses and side effects
**Inter-molecular Forces*	secondary alcohols.	of sulfa drugs.
**Carboxylic Acids in Medicine*	Van der Waals and hydrogen bonds,	PKU - cause and effects.
**Esters*	Salicilic and fatty acids.	Aspirin as an analgesic.
**Amines and Amino-acids*	Soap, fats and oils.	Sickle-cell anemia as an
**Proteins*	Peptide bond and protein structure.	example of a genetic disease.

Table 1. Contents, purpose, and the case studies in the chapter "Chemistry of Carbon Compounds"

The course was studied by 400 students in ten nursing schools in Israel, using, for the first time, a specially designed chemistry textbook written in Hebrew. The differences between teachers' attitudes and personalities, as well as the orientation of the schools' directors, yielded three types of teaching modes: teaching mode 1 – teachers who implemented the program intensively during 40-50 hours, teaching mode 2 – teachers who

cooperated partially, and teaching mode 3 – teachers who used the book only as auxiliary material.

Analysis of the Attitude Questionnaires

Pre and post open attitude questionnaires were used to assess the students' feelings towards chemistry before and after they studied chemistry using the simulation based chemistry curriculum. The items which were collected from the open pre and post questionnaires are grouped into seven categories: understanding, affection, interest, difficulty, knowledge, enjoyment, and importance. Each one of the items (except for enjoyment) has both positive and negative items.

Examples for positive items are:

* *I like chemistry.* in the affection category, and
* *Chemistry is an interesting subject.* in the interest category.

Examples for negative items are:

* *Few people understand chemistry.* in the understanding category, and
* *I forgot chemistry because I don't practice.* in the knowledge category.

A χ^2 test was conducted on the distribution of items among the three populations which studied according to the three different teaching modes. Since the questionnaire was open, there were many missing cases in the χ^2 test, and therefore it might not be valid. In order to diminish the number of missing cases, teaching mode 2 and 3 were joined.

	Pre-test		Post-test	
Item	Mode 1	Modes 2+3	Mode 1	Modes 2+3
understanding	5.5	1.5	13.5	2.8
affection	3.8	1.5	11.1	2.2
interest	13.1	1.5	12.6	7.2
difficulty	3.3	0.0	2.4	0.6
knowledge	22.4	22.6	7.7	11.1
enjoyment	2.7	0.0	5.3	2.2
importance	49.2	73.0	47.3	73.9
Items Total	183	137	207	180
N (students)	125	98	125	98

Table 2. Comparison between pre- and post-test positive items

Table 2 lists the column percentage of positive items written by students in the pre-test and in the post-test.

The result of the χ^2 test on the difference between **teaching mode 1** and **teaching mode 2+3** students in the positive items of the pre-test was χ^2=33.73 (df=6, p<0.0001). The result of the χ^2 test on the difference between **teaching mode 1** and **teaching mode 2+3** students in the positive items of the post-test was χ^2=43.74 (df=6, p<0.0001).

These results suggest that the difference in pattern of distribution between **teaching mode 1** and **teaching mode 2+3** students has increased after studying the **ChNS** course. The number of positive items in the post-test has increased relative to the pre-test, indicating the increase in the positive attitude towards chemistry. The number of negative items in the post test has decreased relative to the pre test, indicating the decrease in the negative attitude towards chemistry.

Yager (12) has also found an increase in positive attitudes toward biology courses, called "applications" courses (i.e., related to real world phenomena), developed and conducted in the University of Iowa.

At the end of the course students also responded to a questionnaire consisting of seven Lykert type items aimed at assessing their perceptions regarding the curriculum according to which they had studied. Each item was answered according to the following Lykert-type scale:

1 = to a very small extent

2 = to a small extent

3 = to a great extent

4 = to a very great extent

The results of item 1, which was: *I read the* **ChNS***textbook* ..., are listed in the following table.

Source	df	Sum of Squares	Mean Square	F	Significance	Teaching Mode	N	Mean	S.E.	Duncan
Teaching Mode	2	78.70	39.35	65.85	p<0.0001	1	137	3.16	0.06	μ_1
						2	119	2.87	0.07	μ_2
						3	64	1.83	0.09	μ_3
Error	317	189.43	0.60							

Table 3. ANOVA and Duncan test for post-test Lykert-type item 1 mean scores

The results in table 3 confirm the partition of the students population into three distinct groups according to the three teaching modes; one of the main factors in this partition is the extent to which the **ChNS** book was used as a main textbook as reported

by the teachers. The Pearson correlation coefficient between this question and the post-test score for the entire population was r=0.32 with $p < 0.0001$ (N=302). This correlation establishes the connection between reading the book and success in the post-test.

According to the Lykert type items, most students indicated that the learning material was clear to a great extent and helped them understand the various subjects. The results obtained for item 6, which refer to the case studies and examples typical of the nursing profession, confirm one of the basic assumptions underlying the **ChNS** curriculum. Item 6 was: *The case studies and the examples in the* **ChNS** *textbook contributed to my understanding of the relationship between nursing and chemistry ...*

Source	df	Sum of Squares	Mean Square	F	Significance	Teaching Mode	N	Mean	S.E.	Duncan
Teaching Mode	2	11.15	5.57	8.98	p<0.0002	1	135	3.00	0.06	μ_1
						2	114	2.98	0.08	μ_1
						3	60	2.52	0.10	μ_2
Error	306	189.94	0.62							

Table 4. ANOVA and Duncan test for post-test Lykert-type item 6 mean scores

The simulated case studies embedded in the curriculum were reported by **teaching mode 1+2** students to contribute to their understanding of the relation between chemistry and nursing to a great extent, as shown in Table 4. The majority of students thought that the textbook was both interesting and enjoyable. Students were also asked to evaluate the degree of difficulty of each chapter in the book. For most of the chapters the findings were coherent with the results of their achievement post test (13).

Conclusions

The positive attitude towards the curriculum can be attributed to the following facts: (a) the curriculum applied principles considered as essential by health care professionals and educators, (b) the textbook was written in Hebrew, thus removing the psychological barrier students in Israel have against using English textbooks in science courses, and (c) the approach establishes the link between the abstract ideas presented by the "pure" chemistry and real, everyday life of the nursing students' future profession.

Both teachers and student nurses indicated that the new curriculum fulfilled a need for a chemistry course for nursing schools, contributed significantly to the improvement of the image of chemistry, and, last but not least, diminished the anxiety often caused by the study of chemistry.

References

(1) Tobias, S., Dealing with Math/Science Blocks, *Liberal Education* **74**, 20-31, 1988.

(2) Dori, Y., Hofstein, A., and Samuel, D., Development and Evaluation of Chemistry Curriculum for Nursing Schools in Israel, *Proc. 61st Annual National Association for Resarch in Science Teaching Conference*, 159-160, 1988.

(3) Schomer, C., A Chemistry Course for Prenursing tudents: an Application of Task Analysis, *Ph.D. thesis, University of Illinois at Chicago*, 1984.

(4) Gratz, P., Integration - an Interdisciplinary Approach to Science Teaching, *Nursing Outlook*, **11**, 194-197, 1963.

(5) Stanitski, C.L. and Sears, C.T., Making Chemistry Activities Meaningful to Nursing Students, *Journal of College Science Teaching*, **3**, 263, 1974.

(6) Frechette, M., and Farina, J., Introductory Chemical Education of Health Professionals: an Integrated Clinical Approach, *Journal of Chemical Education*, **56**, 597-598, 1979.

(7) Jones, T., Providing Relevance in Chemistry for Nursing Students, *Journal of Chemical Education*, **53**, 581-583, 1976.

(8) Genyea, J. and Callewaert, D.M., Chemistry for Health-Science Students: What is an Appropriate Balacne between Basic Chemical Concepts and Health-Related Application?, *Journal of Chemical Education*, **60**, 471-473, 1983.

(9) Daly, J. and Sarquis, J., A Syllabus for a Two-semester Chemistry Course for Health Professions, *Journal of Chemical Education*, **64**, 699-702, 1987.

(10) Treblow, M., Daly, J. and Sarquis, J., A Syllabus for a One-semester Chemistry Course for Health Professions, *Journal of Chemical Education*, **61**, 620-621, 1984.

(11) Scherz, Z., Michman M. and Tamir, P., Preparing Academically Disadvantaged Students, *Journal of College Science Teaching*, **14**, 395-401, 1985.

(12) Yager, R. E., Approaching Scientific Literacy Goals in General Education Science Courses, *Journal of College Science Teaching*, **18**, 273-275, 1989.

(13) Dori, Y., Development, Implementation and Evaluation of Chemistry Curriculum for Nursing Schools in Israel, *Ph.D. thesis, The Weizmann Institute of Science, Rehovot, Israel*, 1987.