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Use of Interdisciplinary Education to Foster Familiarization Among Health Professionals

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ABSTRACT: This paper describes a pilot interdisciplinary experience between the dental hygiene and medical technology programs at Marquette University. It was designed, in part, to familiarize dental hygiene students with the medical technology profession. Comments solicited from students on the final evaluation form indicated that this pilot project was highly successful and met the objectives. Affective, multiple-choice questions on pretests and posttests showed a positive change in attitude, but this change was not statistically significant. Possible reasons for this are discussed. Benefits of this pilot project were an improved understanding of medical technology on the part of the dental hygiene students, enhanced interdepartmental communication, and plans to develop a reciprocal interdisciplinary experience for the medical technology students. It is hoped that this pilot project will serve as a stimulus for similar experiences among other health science programs.

Recent technological advances in medicine have been applauded as being responsible for better patient care. But one major hindrance to quality patient care remains. Health professionals in many cases still do not function as cooperative members of a health care team and know surprisingly little about one another.^{1,2} According to Leininger,³ this lack of knowledge creates social stratification of the professions. To provide truly cooperative health care, Leininger believes these strata must be eliminated.

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Recently, there has been much information about the image problems of medical technologists. A 1980 study in Tennessee ranked the laboratory profession as the fourth most stressful occupation out of the 130 listed.⁴ This profession also ranked first in admission rate to hospitals for stress-related disorders. These data are similar to a 1977 survey in which the laboratory profession ranked as the seventh most stressful occupation.⁵ Fell and Richard determined that a common source of this stress was "a perceived lack of professional recognition, lack of appreciation for their work, and being treated as 'a common unthinking laborer.'"⁴ In a survey of medical technologists, only 36% (177) of 491 respondents felt that other health professionals knew what they do.⁶

Suggestions and approaches for improving the medical technologist's image within the health care community and among the general public have been given. These have included open houses, laboratory tours, participation on hospital committees, and in-services to hospital staff. An organized, nationwide effort has been developing over the last several years. National Medical Laboratory Week (NMLW) is designated for laboratorians to publicize their profession in a variety of imaginative ways. While many medical technologists feel that NMLW is effective, they also state that seven days out of 365 is not enough.⁷

All of these efforts are commendable, and probably have their greatest impact in educating the general public. While they do contribute to educating other health professionals about medical technology, most of these efforts probably occur too late. Leininger predicts that the quality of health care will improve when health disciplines learn to appreciate one another and understand the contributions of each discipline in patient care.³ She contends that this must occur before the student leaves the educational institution, as opinions have already been formed by this time.

Although interdisciplinary education is not a new concept in the health sciences, it has enjoyed only limited use. This is unfortunate since health professionals are expected to work interdependently in the practical setting yet are usually educated within a monodisciplinary system. Interdisciplinary education is not only an important vehicle for teaching skills and knowledge but also a valuable forum for learning about and getting to know fellow health professionals. This type of interaction may help to foster a cooperative approach to health care and at the same time eliminate some of the image problems of the health professionals.

The format of an interdisciplinary experience must be carefully selected to meet not only the general objectives of interdisciplinary education but also the specific needs of the participating health disciplines. Many different formats have been described in the literature. Those which are successful have been well-planned with specific objectives in mind. It is not sufficient to simply schedule students from different disciplines in the same class.⁸ Specific experiences must be designed to help health science students learn to work interdependently while internalizing their feelings and knowledge about one another.

Interdisciplinary education should begin early in professional training. In a study of attitudes of sophomore and senior medical technology students, seniors tended to be more negative than the sophomores.⁹ Only 25% (41) of the 165 seniors felt that other health care professionals knew what they do, in comparison to 63% (68) of the 108 sophomores.

This paper describes a pilot interdisciplinary experience between dental hygiene students, dental hygiene faculty, and medical technology faculty which was designed, in part, to familiarize dental hygiene students with the medical technology profession. Renovations of the physical facility at Marquette University in 1981 brought the health sciences programs closer together. This stimulated informal communication, especially between the dental hygiene and medical technology faculty since offices and laboratories shared the same floor. As faculty became acquainted, a sense of "sameness" developed and the idea of an interdisciplinary experience for students in the two programs evolved. A limited and controllable pilot project was designed for the sophomore preclinical dental hygiene students in hope that this experience would allow the faculty to later expand the project to include physical therapy and nursing students.

METHODS

The director of the medical technology program, two medical technology faculty, and the dental hygiene preclinical course supervisor met numerous times during the one year prior to this experience. As the project developed, the following objectives were identified: (1) improve communications between the dental hygiene and medical technology programs, (2) increase understanding of the medical technology profession, (3) recognize and appreciate the role of the medical technologist in the diagnosis of disease, and (4) reinforce and build upon the dental hygiene students' basic science background. Space and availability of facilities, time, faculty availability, budget for materials, and appropriate interdisciplinary cases were discussed. The final consensus met the needs of both departments.

As planning progressed, the faculty who had previously taught the basic science courses to the dental hygiene students were asked to provide case-relevant course materials and background information. Two junior dental hygiene students were reciprocally consulted and provided valuable input on the teaching methodology.

Thirty-eight sophomore dental hygiene students and three dental hygiene faculty participated in the program. A case study on diabetes mellitus was selected for a variety of reasons, including the high incidence of diabetes in the United States and the dental hygiene students' familiarity with diabetes from previous coursework. In addition, this case study allowed the students to correlate aspects of clinical chemistry, hematology, urinalysis, and microbiology.

One week prior to the interdisciplinary laboratory experience, a pretest was administered to the students. The pretest was of a multiple-choice format and

included five questions in the affective domain, evaluating students on their attitudes toward medical technology, and seven questions in the cognitive domain, testing them on the diabetes disease process and laboratory testing. Following this activity, the dental hygiene preclinical supervisor led a discussion on the dental implications of diabetes mellitus. The students were then given a four-page handout describing all aspects of the scheduled laboratory experience and an assignment to review information received in previous courses on diabetes mellitus.

The students were divided into two groups of 20 and 18. This coincided with their section assignment for the preclinical course and was appropriate for the size of the medical technology laboratory facilities. The laboratory experience was a total of five hours, with one three-hour and one two-hour period.

The three-hour session integrated both lecture and laboratory testing. Forty-five minutes were devoted to a review of the pathophysiology of diabetes and an overview of how a medical technologist evaluates and correlates laboratory data in the diagnosis of disease. Following this introduction, the students were divided into four groups with either a medical technology faculty leader or a volunteer medical technology alumnus leader. The procedures for performing blood glucose and urine dipstick tests were demonstrated. Each student then performed these tests under supervision. Through a microscope, students observed slides showing normal and abnormal blood cells. The significance of the chemistry, urinalysis, and hematology results was discussed in relation to the uncontrolled diabetic patient.

In preparation for the second laboratory session, one of the medical technology faculty gave a 30-minute presentation on medical microbiology. Each student then inoculated culture plates with a prepared specimen of an oral lesion from a diabetic patient. The second session was scheduled two days later. This allowed for incubation of the plates and coincided with the students' regularly scheduled preclinical laboratory period. Most of the two hours was devoted to the morphological and biochemical identification of the pathogenic microorganisms on the inoculated plates.

At the completion of the second session a posttest, which was a repeat of the pretest, was given. The chi-square test was used for statistical evaluation of the affective domain data while the *t*-test was used for evaluating cognitive domain data. Each student was also requested to evaluate the project through the following questions. Was this experience of value to you? Should it be offered again next year? Do you have any comments or suggestions?

RESULTS

Of the 38 dental hygiene students who participated in this project, 36 were present for both laboratory sessions and completed the pretest and posttest.

Five questions on the pretest and posttest evaluated changes in the affective domain. The first question asked whether the performance of laboratory tests was: "easy—anyone can do it," "somewhat complex—some training is required," or "complex—extensive scientific background is required." On the

pretest, 28% (10) of the students chose the answer "complex," and 69% (25) chose "somewhat complex." On the posttest, 36% (13) responded "complex," and 58% (21) answered "somewhat complex." These changes did not reach statistical significance.

Students were then asked, "How important is the clinical laboratory in the diagnosis of diabetes?" Four choices were given ranging from "not important" to "essential." On the pretest, 92% (33) of the students answered "essential." This response rate increased to 100% on the posttest which verified that, after the laboratory experience, all of the students appreciated the importance of the clinical laboratory. The significance of this unanimous response was attenuated by the high initial pretest response.

The third question asked students to complete the statement, "For the correct performance and interpretation of laboratory tests, the medical technologist must have an extensive background in . . ." Four possible choices were given—chemistry, biology, microbiology, and hematology—and the correct response was to mark all four. On the pretest, 72% (26) of the students chose all four answers while on the posttest 83% (30) gave the correct response. While the percentages were high, there was not a significant change in response levels.

The students were also asked to select the type of interplay which might exist between a dental hygienist and medical technologist. The correct response was "medical technologist instructs dental hygienist in correct procedures for the collection of specimens to be analyzed in the laboratory." On the pretest, 58% (21) of the students gave the correct response in comparison to 75% (27) of the students on the posttest. Although this represented an increase, it was not statistically significant.

Finally, students were given a list of ten characteristics of a medical technologist and asked to rank these from most (1) to least (10) important. A tabulation of these rankings can be found in Table 1. There was little change in

TABLE 1

Composite Dental Hygiene Student Rankings of Characteristics Most Important for a "Good Medical Technologist"

Characteristic	Pretest	Posttest
Accuracy and Precision	1	1
Attention to Detail	2	2
Logical Thought Process	3	4
Concern for Patient	4	5
Ability to Organize Work	5	3
Dependability	6	8
Common Sense	7	6
Manual Dexterity	8	7
Ability to Work under Pressure	9	9
Honesty	10	10

ranking between the pretest and posttest. Two students on both the pretest and posttest aptly listed all ten characteristics as being "most important."

Numerous comments were made by the dental hygiene students in their evaluation of this pilot project. All comments indicated that the students had found this to be a valuable experience, and they had indeed gained a better understanding of medical technology. Some representative comments included the following: "It really gave me some insight into what the medical technologist actually does and it led me to have a greater appreciation for (their) work." "I learned how the medical technologist is involved in the role of diagnosis." "It made me realize all of the medical and microbiological background a technologist must have. I was unaware of what a medical technologist even does and now I know."

The comments also indicated that this experience had helped the students recognize and appreciate the interdisciplinary relationship between the dental hygienists and medical technologists. Comments included the following: "We are all concerned with public health in one way or another and it's good to know how other professionals fit in." "It's a good idea for health professionals to know what other members of the team are doing." "I was able to see the hard work that goes into being a medical technologist and how one's profession can be inter-tied with other professions."

Thirty-two students responded to whether or not this experience should be offered to next year's sophomore class. Twenty-four said yes, with no modification; seven said yes, but suggested some modification; and one said no. Most suggestions for modification were to expand the experiments and make them more advanced.

The results of the pretest and posttest responses to the cognitive domain questions have been reported in a separate paper.¹⁰ The cognitive test consisted of seven multiple-choice questions with 17 correct answers and tested students on the diabetes disease process and laboratory testing. The pretest raw score mean was 8.52 with a standard deviation (SD) of 1.99 while the posttest raw score mean was 12.86 with a SD of 1.53. A *t*-test showed this change to be significant at the 0.001 level.

DISCUSSION

Based upon the postevaluation comments, it appeared that the dental hygiene students overwhelmingly thought this experience was worthwhile and taught them about the profession of medical technology. However, while the results of the objective affective domain questions showed an appropriate increase in the number of correct responses, this increase was not statistically significant. Each question was examined in search of an explanation for the discrepancy between student comments and test answers.

While, on the posttest, an increased number of students felt that the performance of laboratory tests was "complex—extensive scientific background is required," the majority still felt that laboratory testing was only "somewhat complex—some training is required." It is apparent from these

answers that the chosen laboratory experiences caused the students to believe that laboratory testing is easier than it actually is.

A more realistic view of a medical technologist's responsibilities would have been realized if each student had performed all the steps of each laboratory procedure himself/herself. However, because of time constraints, some of the more difficult and time-consuming aspects of the procedures were done for them by the medical technology faculty. These included use of an automatic pipetter, presetting curves for reading the spectrophotometer, preparation of hematological slides, and limiting the number and identification choices of the microbial biochemical tests. When designing a hands-on laboratory component, it is difficult to give students a true appreciation of laboratory work and still provide experiments that require minimal background knowledge to successfully complete the work within a limited time frame. In the future, faculty will look at the types of laboratory procedures which were included in this experience to determine if changes can be made to provide a more realistic view of a medical technologist's responsibilities. However, it may be necessary to risk oversimplification of laboratory procedures in order to meet the overall objectives of interdisciplinary education.

The next three questions asked the dental hygiene student about: (1) the importance of the clinical laboratory in the diagnosis of diabetes, (2) the scientific disciplines in which a medical technologist must have extensive background, and (3) the type of interplay which might exist between a medical technologist and dental hygienist. There was no significant change between the students' pretest and posttest answers to these questions. Apparently most of the dental hygiene students were already familiar with a medical technologist's role in diagnosis, educational background, and potential clinical inter-relationship with dental hygienists. Perhaps this is due to the proximity of the two programs. The dental hygiene and medical technology laboratories and faculty offices share the same floor of the Health Sciences Building which gives the students the opportunity to meet and talk with each other between classes. Another, probably more important, factor might be that a high percentage of students, 67% (93) of 138 students for medical technology and 87% (107) of 124 students for dental hygiene, live in campus housing. Connelly states that the physical curricular separation of faculty and students creates a dialogue problem among the health sciences and is a major barrier to collaborative educational efforts.¹¹ Perhaps the close physical location of dental hygiene and medical technology students at Marquette stimulated an informal interdisciplinary dialogue even before the more formal experience was created.

There were no right or wrong answers for the ranking of the ten characteristics of a medical technologist. And it is interesting to note that again there was little difference between the pretest and posttest responses. Most students felt that the most important qualities for a medical technologist to possess were accuracy and precision. This was reiterated in some student comments. The authors found it disconcerting that the dental hygiene students ranked "honesty" as least important on both the pretest and posttest. Speculating on this response, the students may have felt honesty was implied in characteristics

such as "accuracy and precision" and "attention to detail."

In the final analysis, perhaps the affective domain questions used on the pretest and posttest were not the most appropriate for measuring the changes in attitude which apparently occurred as a result of this interdisciplinary experience. The distractors used for these objective-type questions may have prompted students to mark the correct answer on the pretest. It was hard to believe there had been no significant change in attitude when reading comments such as, "I really did not understand and appreciate the role of a medical technologist. Now I have an understanding of what types of things a medical technologist does, in addition to an appreciation of how the medical technologist and dental hygienist work together to accomplish a very like goal."

The pretest and posttest instrument will be reevaluated to see if more operative affective questions can be designed. Perhaps soliciting evaluative comments rather than using objective-type questions is actually a more valid method for determining changes in the affective domain. Open-ended questions would be important in this type of evaluation. How was this experience of value to you? How did this experience change your appreciation for the _____ profession? How did you feel? What did you learn? To be most revealing, questions should be selected which cannot be answered with a simple "yes" or "no" response. Another evaluation format available is the continuum response. Students could be asked to respond to questions (eg, How important is the medical technologist in the diagnosis of disease?) on a continuum ranging from 1 (not important) to 5 (essential). Educators must experiment with different formats to see which is best suited to their individual needs.

The evaluative comments and results of the pretest and posttest indicate that this pilot interdisciplinary experience was successful and met the four objectives. Critical to this success were the comprehensive developmental stages, choice of an appropriate case study, organized presentation and laboratory exercises, and the physical setting (bringing the dental hygiene students into the medical technology departmental laboratories). It was also felt that the dental hygiene preclinical faculty's participation in the groups as students in all laboratory sessions set a positive example for the students.

According to Wieczorek et al, a major obstacle in setting up interdisciplinary courses is the faculty themselves.¹² They are often insecure and unwilling to participate in this form of education due to the territoriality they have established as a result of their own monodisciplinary education. Fortunately that was not a factor in this pilot project. In fact, faculty lines of communication became even stronger and a repeat of this interdisciplinary project is planned for the next school year as well as a reciprocal interdisciplinary experience. Junior medical technology students taking medical microbiology will learn about oral bacteriology during a session in the dental hygiene laboratory facilities.

The possible types of interdisciplinary experiences are endless. For example, at Marquette the medical technology faculty assist in teaching aseptic technique in the nursing skills practicum course. During a three-hour lecture/laboratory the medical technology faculty discuss aseptic technique, sources of con-

tamination, and nosocomial infections. Nursing students have the opportunity to culture their skin and the environment and can see the microbial growth that results. Marquette also has held health awareness days where medical technology, dental hygiene, and nursing students and faculty work cooperatively to provide preventive medicine exhibits and health screenings for university students, faculty, and staff. An attempt is being made to include physical therapy in future projects.

One vehicle for interdisciplinary education that is often overlooked is the videotape. Health science departments can collaborate to produce videotapes which can be used by each when appropriate. For example, dental hygiene and speech pathology departments could design a tape dealing with tongue thrusting that shows the challenges presented to both professions and how the two groups work together to resolve this problem. What is important in this or any interdisciplinary experience is carefully defining the objectives and then designing a format that meets the needs of the participating departments. Most interdisciplinary attempts described in the literature have been formal courses. However, it can be equally effective to have short experiences which show appropriate interrelationships between participating health science disciplines. Even if a formal course is the ultimate goal, first developing more limited experiences may give educators a better foundation from which to build a meaningful course.

Perhaps someday interdisciplinary education will be common among the health sciences and will break down the image barriers which are so prevalent in health care today. As stated by Shumaker and Gross, "We believe that the respect and understanding developed between two novices in a learning situation will transfer to clinical settings in which each are professionals."¹³ This collaboration can ideally lead us to a true team approach to patient care where the ultimate benefactor is the patient.

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