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A study to determine the factors involved in the development of students' attitudes toward chemistry and anatomy and physiology.

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A STUDY TO DETERMINE THE FACTORS INVOLVED
IN THE DEVELOPMENT OF STUDENTS' ATTITUDES
TOWARD CHEMISTRY AND ANATOMY AND PHYSIOLOGY

By

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CHAPTER ONE

INTRODUCTION

Science instructors in schools of nursing have frequently been heard to express concern over the apparent degree of resistance they encounter while teaching students in the areas of the biological and physical sciences. Other science instructors argue against such a generalization. This second group maintains that the students are naturally receptive to the basic sciences because of the interest of the students in nursing and the applications and relationships of the basic sciences to the practice of nursing.

It was felt by the writer at the time of this study that the attitudes of students toward the biological and physical sciences could best be determined by seeking the information from the students themselves.

Statement of the Problem

The present study was conducted in order to determine some of the factors involved which lead students to develop particular attitudes toward chemistry and human anatomy and physiology in the school of nursing.

The main purpose of the study was to encourage students to identify their attitudinal positions to these basic sciences and to express, as well as they could, the reasons for their responses.

Justification of the Problem

Recent emphasis has been placed upon the improvement or total
revision of the units of subject matter in the basic sciences. Little has been studied from the viewpoint of student opinions in relation to these courses. It has been assumed that the courses could be set up to improve student learning and, then, an analysis could be made of the effectiveness of the courses in relation to student achievement at the termination of the specific courses. However, it is myopic to focus upon evaluation of the learning by students on the basis of achievement on tests which have been constructed by teachers. Some students have expressed viewpoints about this situation which are similar to the following commentary made by Albert Einstein:

"...I soon learned to scent out that which was able to lead to fundamentals and to turn aside from everything else, from the multitude of things which clutter up the mind and divert it from the essential. The hitch in this was, of course, the fact that one had to cram all this stuff into one's mind for the examinations whether one liked it or not. This coercion had such a deterring effect (upon me) that after I had passed the final examinations, I found the consideration of any scientific problems distasteful to me for an entire year."¹

Is it any wonder that students of nursing heave a sigh of relief after completion of the basic sciences which are covered in a relatively short period of time?

After the basic sciences have been studied, the students concentrate their efforts in the clinical areas. The present writer, as an instructor in medical nursing, had frequent occasion to re-introduce scientific principles in the care of patients. The students

seemed to resist this type of review, reinforcement and expansion of science information. Because of possible ramifications into all clinical areas, the writer felt that it would be beneficial to explore some of the reasons for the development of resistance toward the basic sciences by some students. Identification of the reasons for the generation of negative attitudes could help educators to increase their understanding of their roles in the prevention and treatment of the disorganizing factors.

Scope and Limitations

This study was concerned with two hospital schools of nursing in a metropolitan area in the northeastern section of the United States. The schools were of similar size and each conducted a three-year program. Standards for admission of students were comparable. In the two schools, chemistry was taught as a course of study separate from human anatomy and physiology.

The sample which was provided by the two schools included students in their first year and students in their senior year of the programs. All had completed the study of chemistry and anatomy and physiology and were assigned, at that time, to the clinical areas.

The main concerns of this investigation were:

1. To determine attitudes of students in relation to liking, difficulty and usefulness of their science courses in high schools and in the schools of nursing.
2. To identify the existence of any significant correlations between the ratings of the three types of attitudes expressed by students who had studied
   a. A specific course in high school
   b. A specific course in the schools of nursing included in this study
   c. A specific course in high school and its counterpart in each of the schools of nursing studied

It was not within the scope of this study to investigate methods of teaching and testing, laboratory facilities and the personalities of the instructors. Although these factors have an amalgamated effect upon student attitude, it was felt that the relative weight of each could not be measured readily.

One of the limitations of this investigation may be focused upon the validity and reliability of student opinion. The only means available for acquiring such information necessitated the use of a questionnaire. Although the students were requested to respond as frankly as possible to all questions, some may have responded in what they considered to be the acceptable or expected way. It is also questionable whether students are consistently able to make mature judgements about their courses. It is recognized by the writer that these attitudes may fluctuate from day to day or from week to week.

Another limitation which could alter the nature of the findings in the study was that the students had to recall how they had felt
about courses which they had studied some time before the questions were posed. The result of this lapse of time may have caused some distortion of recall.

Preview of Methodology

A questionnaire was formulated and distributed to the sample. The purpose of this tool was to elicit the students' opinions by their ratings of liking, difficulty and usefulness of the science courses they had studied in high schools and the schools of nursing.

Sequence of Presentation

In Chapter Two is found a review of the literature which is pertinent to the study. The bases for the hypothesis stems from a review of relevant research and the writer's experiential background. Chapter Three contains a more detailed discussion of the methodology used in the study. The presentation and analysis of the data are contained in Chapter Four. A summary of the findings, conclusions and recommendations are found in Chapter Five.
CHAPTER TWO

REVIEW OF LITERATURE

Much has been written in the field of psychology which relates to the development of attitudes. There is great variability in the definitions of attitudes in many texts. Among these, Allport's definition is closest to the views of the writer: i.e.

"..... a mental or neural state of readiness, organized through experiences, exerting a driving or dynamic influence upon the individual's responses to all objects and situations with which it is related."

Kingsley\(^2\) proposed the following methods for the acquisition of attitudes. The first is by imitation which is the result of the tendency on the part of the individual to do and feel as others in the group. The second is by emotional experiences which cause a person to like or dislike, become interested in or avoid some personal contact with the object or individual under consideration. The third method is by informative experiences wherein a person hears, reads about or contacts an object or person. The last method involves deliberate cultivation by the individual of a specific attitude towards an object or person.

No studies have been found which deal solely with the development of attitudes toward chemistry and anatomy and physiology by students

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of nursing. Two studies have been conducted which relate to the attitudes of students toward courses studied in high school and college. Although these do not pertain to sciences alone, they help to identify students' opinions about courses which they judged to be difficult, to be preferred or to be of value.

Perry conducted a study at the University of Nebraska in which she investigated the feelings of students about the courses which they had studied at the high school and college levels. She formulated questionnaires and presented them to students who were enrolled in introductory courses in educational psychology and in methods of teaching in secondary schools. Of the sample, 52 per cent of the total respondents had attended city high schools. The remaining 48 per cent had attended town or consolidated high schools. The investigator's main purpose was to identify the attitudes which accompany the early achievement of students who feared possible failure in specific courses. Based upon the assumption that there is an element of dread which exists for some subject areas, the experimenter set out to identify the following: 1) what particular subjects were dreaded most? 2) did an attitude of like, dislike or indifference exist toward the dreaded courses? 3) what attitudes served to develop a desire to study more extensively in these subjects after completion of the courses?

The sources of data were the responses made by the college students to sixteen subject questionnaires. Nine of these pertained to subjects the students had studied in high school and seven pertained to college subjects they had studied or were studying at the time of the investigation. Of all the courses which were explored, only those which are relevant to the present investigator's study will be noted.

In high school, 14 per cent of the students feared biology whereas 35 per cent of the same sample of students feared biology in college. Chemistry was feared by 31 per cent of the students in high school whereas 55 per cent of the same sample feared the course in college. It is of particular interest that chemistry at the college level received the highest percentage of all the "dread" tallies and that it was second only to geometry in the high schools. The second most dreaded course at the college level was biology.

Once it was determined what courses were dreaded the most, the next step was to analyze the data which pertained to the students' degree of liking, disliking or indifference to the courses. Perry found that after the students had completed a semester of the dreaded subjects, those students who had dreaded them developed dislike for them more frequently than either liking or indifference toward them. Further, these same students did not elect to take advanced courses in the dreaded areas of biology or chemistry.
Sartain\textsuperscript{4} explored the relationship between the student's judgement of his interest in a college course and his judgement of its value and difficulty. In addition to this, he sought to uncover how the characteristics previously cited were related to the grades received at the end of the courses. He developed a questionnaire which contained a scale for interest, difficulty and value of the general psychology courses offered in college. This was then administered to 118 students in the first and second year psychology courses. The net result of the responses indicated that there was a negative correlation of .329 between the grades achieved and expression of difficulty. A positive correlation of .652 existed between interest and the degree of value which was expressed by the students in the courses.

Statement of the Hypothesis

The hypothesis adopted for this study is that students of nursing develop particular attitudes toward chemistry and biology in high schools and that factors present in the schools of nursing serve to reinforce these attitudes toward chemistry and anatomy and physiology.

\textsuperscript{4}A. Q. Sartain, "Relation of Marks In College Courses to the Interestingness, Value and Difficulty of the Courses," Journal of Educational Psychology, XXXVI (September, 1945), pp. 561-56.
CHAPTER THREE

SELECTION AND DESCRIPTION OF SAMPLE

One hundred and twenty-one students from two hospital schools of nursing in the Boston area participated in the study which was conducted in the summer of 1957. The two schools were selected on the basis of comparable requirements for student admission, similar size and sequence of instruction in chemistry and anatomy and physiology. All of the students had completed the courses and were assigned to the clinical areas of nursing education.

Of the 121 students who participated in the study, eighty were freshmen students and forty-one were senior students. The first group consisted of the entire freshman class, or sixty-nine students, who were enrolled in the school. Eleven of the thirty-nine seniors in the same school also participated. In all tabulations, this group was identified as School A.

The second group consisted of eleven freshmen from a class of fifty-four students. The entire senior class of thirty students in this school participated. In all tabulations, this group was identified as School B.

The selection of students in the two schools was not predetermined. It was possible to obtain the entire freshman class in School A and all of the senior class in School B during class sessions. The remaining students were provided on the basis of
availability from the clinical areas at the time the investigator was present in both schools. This accounts for the smaller sample of freshmen from School B and seniors from School A.

Description of Tool

The device which was used to obtain the data for this study was a questionnaire. It was felt that its use was warranted since there was no alternate means of obtaining the selected information from the groups. A sample of the tool appears in the Appendix.

Two rating scales were constructed. The first included descriptions of liking, difficulty and usefulness of the biological and physical sciences while the students were studying them in high school and in the school of nursing. The second scale included descriptions of liking, difficulty and usefulness of the same biological and physical science courses after completion of study by the students.

The descriptions of each rating appeared above the scale and were numbered from 1 - 5. The lower numbers, one and two, indicated the more favorable descriptions. Number three indicated an indifferent rating. The higher numbers, four and five, represented the unfavorable ratings.

It should be noted that the descriptions for ratings of difficulty appear in reverse order on the questionnaire. This was done to avoid possible confusion. It was felt that the students might inadvertently misread the description if "less" and "least" appeared out of sequence. The proper adjustments were made in the tabulations in order that, as
interpreted by this investigator, the more favorable ratings for
difficulty were in the same rank order as were the favorable ratings
for liking and usefulness of the courses.

Finally, two questions were included which requested that the
students give some explanation for the particular ratings they had
assigned to all the courses. No examples were offered on the question-
naire about how these might be answered.

Procurement of Data

Each class in both schools was seen separately by the investigator.
The same procedure was followed in the two schools and with all four
classes. Thirty minutes of class time or the same amount of clinical
time was allocated for the students to respond to the questionnaire.
The investigator was introduced to each group of students by an
instructor. Each instructor left immediately after this introduction.

The purpose of the study was explained to the students. Partic-
ular emphasis was placed upon the fact that their individual responses
would be known only to the investigator. Following this, the question-
naires were distributed and the directions found on the top page were
read aloud by the investigator. When the investigator inquired if
further clarification might be necessary, no questions were posed.

The students were then instructed to assign a number to the top
of the page of the questionnaire. The student selected this figure
from a list which was distributed during the time she was responding
to the questionnaire. She was requested to sign her name opposite to
the number she had selected from the list. This was done in order to provide the investigator with some means of identifying students in order that additional information might be obtained from students' records if needed.

No time limit was set for responding to the questionnaire. All students responded in less than twenty-five minutes. The questionnaires were then collected from each student and the top page checked for the code number and expected year of graduation.
CHAPTER FOUR

FINDINGS

The data which were tabulated for this study included the following:

1. Ratings which were checked by all the students in relation to liking, difficulty and usefulness of
   a. Biology and chemistry in high schools after the study of these courses had been completed
   b. Chemistry and anatomy and physiology in the two schools of nursing after completion of these courses

2. Favorable and unfavorable comments offered by the students in relation to ratings of liking of the courses listed above

The biology and chemistry courses in high schools were selected in preference to the other science courses listed in the questionnaire because it was felt by the investigator that the subject matter studied in these courses was more nearly related to the chemistry and anatomy and physiology courses studied in the schools of nursing than was the subject matter of other science courses in high school. Accordingly, any attitudes which may have developed toward chemistry and biology in high schools might be reflected in the related courses in the schools of nursing.
The comments which were made by the students about chemistry, biology and anatomy and physiology included six areas which were categorized on the basis of the following criteria adopted by the investigator:

1. Content
   a. Remarks which reflected the informative nature of the subject matter of the courses.
   b. Statements which referred to the technical or detailed nature of the content of the courses.
   c. Comments which focused upon repetition or duplication of the subject matter.

2. Value in nursing
   a. Statements which specifically indicated the practical application of the courses to clinical nursing.

3. Teacher presentation
   a. Comments which referred to organization of lectures by the teacher.
   b. Remarks which alluded to teaching methods employed by the instructor.

4. Aptitude
   a. Statements which indicated that the students could or could not grasp the material because
of intellectual proclivity for, or deficiency in, the courses.

5. Laboratory experience
   a. References which reflected opinions about laboratory facilities which included:
      i. Equipment
      ii. Specimens
      iii. Space
   b. Remarks about the nature of experiments conducted in the laboratory.

6. Time in courses
   a. Comments which referred to the length of time allocated to classroom coverage of the courses in the over-all curriculum.
   b. Remarks which stressed the amount of time devoted to actual study of the courses outside the classroom.

The data which were collected but were excluded from the study were the following:

1. All ratings of science courses other than chemistry and biology which were studied in high school and the comments which were associated with them.

2. All ratings checked in relation to microbiology and the comments associated with this course.
3. Ratings which involved recall of opinions held by students while they were studying chemistry, biology and anatomy and physiology in high schools and the schools of nursing.

Microbiology was omitted in the study because of the lack of any comparable course in the high schools. Attitudes which developed in relation to this course, therefore, must have originated in the schools of nursing.

Data on opinions held by students while they were studying the courses were omitted because it was found that there was no substantial change in the opinions reported by the students about all the courses while they were studying them and after completion of the courses.

Liking, Difficulty and Usefulness of Chemistry - Freshmen

Seventy-seven of the eighty freshmen in the two schools of nursing who participated in the study had taken a chemistry course in high school. Of the freshmen who had taken chemistry, sixty-six were from School A and eleven were from School B. Graphs 1 - 6 represent the distribution of ratings which were assigned by the two groups in relation to liking, difficulty and usefulness of the chemistry courses in high schools and the two schools of nursing.

It is evident that the students in School A rated liking and usefulness of chemistry in high schools more favorably than they rated the chemistry course in the school of nursing. The majority of the group indicated that chemistry in the high schools was more
GRAPHS 1 - 6

DISTRIBUTION OF RATINGS CHECKED BY FRESHMEN STUDENTS IN RELATION TO LIKING, DIFFICULTY AND USEFULNESS OF CHEMISTRY IN HIGH SCHOOL (HS) AND IN TWO SCHOOLS OF NURSING (SON)

Liking

Graph 1

Difficulty

Graph 3

Usefulness

Graph 5

School A

N = 66

School B

N = 11

Graph 2

Graph 4

Graph 6

Rating Scale; for interpretation of meaning of ratings, see Appendix
difficult than its counterpart in School A. In general, it can be seen that this group of freshmen registered greater indifference towards the course in School A.

A possible interpretation of this increased rating of indifference towards chemistry in School A may be related to the nature of the questionnaire. Perhaps the students who selected the middle category (rating 3) were forced to check it since the alternatives appeared either too favorable or too unfavorable. It is the feeling of the investigator that many of the students who checked the middle category were tempted to select the unfavorable ratings but hesitated to do so. Data which will be discussed later under the reasons for the selection of ratings lend support to this view.

The sample of freshmen students in School B was extremely small. (see Graphs 2, 4 and 6) Consequently, it is difficult to make generalizations since this group of eleven students is not necessarily representative of the freshman class of fifty-four students in this school. It would seem that over one-half of the group who did respond liked the chemistry courses equally well in high schools and School B. This same group apparently considered the course in the school of nursing to be less difficult and less useful than the high school course. Only a slight increase was found in the middle rating which may indicate a small increase in indifference towards chemistry in School B.

It was of further interest to determine if a linear relationship existed between the different ratings which were assigned by the
freshmen for the courses in high schools and the comparable courses in
the schools of nursing. Therefore, Pearson product-moment coefficients
of correlation were computed between the ratings which were checked
by each student in relation to liking and difficulty, difficulty and
usefulness and liking and usefulness of chemistry in high schools and
chemistry in the schools of nursing. In addition, correlations were
computed between the ratings of liking of chemistry in high schools
and liking of chemistry in Schools A and B. The same procedure was
followed for the ratings of difficulty and usefulness. The results
of the computations appear in Table 1.

The attitudinal ratings of freshmen for chemistry in School A
which showed positive correlations at the 1 per cent level of confidence
are listed in rank order:

Liking in high school and liking in School A
Liking and difficulty in School A
Liking and usefulness in School A
Usefulness in high school and usefulness in School A

Only one area related to chemistry in School A showed positive
correlation at the 5 per cent level:

Liking and usefulness in high school

In School A, there was a significant negative correlation at
the 1 per cent level of confidence between difficulty and usefulness
of chemistry in high school.

A somewhat different picture was evident in School B. The
TABLE 1

COEFFICIENTS OF CORRELATION OF LIKING, DIFFICULTY AND USEFULNESS OF CHEMISTRY IN HIGH SCHOOLS AND TWO SCHOOLS OF NURSING AS INDICATED BY FRESHMEN STUDENTS

<table>
<thead>
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<th>School B N = 11</th>
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<tr>
<td></td>
<td>High Schools</td>
<td>School of Nursing</td>
</tr>
<tr>
<td></td>
<td>Liking</td>
<td>Difficulty</td>
</tr>
<tr>
<td>High School</td>
<td>Liking</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Difficulty</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Usefulness</td>
<td>.30</td>
</tr>
<tr>
<td>School of Nursing</td>
<td>Liking</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Difficulty</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Usefulness</td>
<td>--</td>
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</tbody>
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*Significant at the 5% level of confidence
**Significant at the 1% level of confidence

areas related to chemistry which showed positive correlation at the 1 per cent level of confidence in rank order were:

- Liking and difficulty in high school
- Usefulness in high school and usefulness in School B
- Liking and usefulness in high school

No correlations were significant at only the 5 per cent level. There were no significant negative correlations.

A comparison of the attitudinal ratings of the freshmen students in Schools A and B shows that the students in School A indicated positive correlations of greater magnitude between liking and difficulty and liking and usefulness of the chemistry course as given in the school of nursing than did the students in School B. Because both groups of students came from a variety of high schools, the correlations in School A might be related to the nature of the teaching of the chemistry course in this school as compared with School B.

Sixty of the sixty-six freshmen in School A who rated the chemistry courses studied in high schools offered reasons for their selection. Eight students made both positive and negative comments. Six students did not comment.

Fifty-nine of the same sample of freshmen in School A gave reasons for the ratings they had selected for the chemistry course in the school of nursing. Three students offered both positive and negative reasons for their choices. Seven students did not respond.
The frequency of all comments made about chemistry by the freshmen in School A appear in Tables 2 and 3. Further, the comments were cross-tabulated under the ratings of liking selected by the students. This rating was selected arbitrarily because it was felt by the investigator that it could be used as effectively as any other rating. As is evident from the footnotes under Table 2, some students made more than one negative comment about their chemistry courses. While this is noted for the two totals to show discrepancy with the total N, no attempt was made to identify which areas or ratings of liking were responsible for multiple responses.

Examination of Tables 2 and 3 indicate that the unfavorable comments made by freshmen exceed the favorable comments made about chemistry in the high schools and School A. The unfavorable comments about the course in School A surpass those made in relation to chemistry in high schools. It is interesting to note the differences and similarities in emphasis of the comments which were made about both courses.

Table 2 indicates that presentation of the subject matter by the teacher appeared to be of primary concern in the high school chemistry courses; whereas, it ranked second in the school of nursing. It may be that this group of students hesitated to make as many unfavorable remarks about the teacher in School A because of the threat of identification by the instructor. It might be argued that the students approved of the presentation by the teacher in School A and therefore
### Table 2

**Areas of Negative Comments Made by Freshmen Students in School A in Relation to Degree of Liking for Chemistry in High Schools and School A**

N - High School (HS) = 42; School A (SON) = 46

<table>
<thead>
<tr>
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<th>Degree of Liking</th>
<th>Totals per Area</th>
</tr>
</thead>
<tbody>
<tr>
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<td>HS</td>
<td>SON</td>
</tr>
<tr>
<td>Teacher presentation</td>
<td>1</td>
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</tr>
<tr>
<td>Value in nursing</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>Student's aptitude for learning</td>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td>Content</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Laboratory experience</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Time in courses</td>
<td>---</td>
<td>1</td>
</tr>
<tr>
<td>Totals per rating</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

**High Schools**

*25 students made 1 negative comment
*12 students made 2 negative comments
*5 students made 3 negative comments

**School A**

*20 students made 1 negative comment
*19 students made 2 negative comments
*6 students made 3 negative comments
*1 student made 4 negative comments
**TABLE 3**

**AREAS OF POSITIVE COMMENTS MADE BY FRESHMEN STUDENTS IN SCHOOL A IN RELATION TO DEGREE OF LIKING FOR CHEMISTRY IN HIGH SCHOOLS AND SCHOOL A**

* N - High School (HS) = 26; School A (SON) = 16

<table>
<thead>
<tr>
<th>Areas of Comments</th>
<th>Degree of Liking</th>
<th>Totals per Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Content</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Value in nursing</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Teacher presentation</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Student's aptitude for learning</td>
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<td>--</td>
</tr>
<tr>
<td>Laboratory experience</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Totals per rating</strong></td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

* High Schools

*19 students made 1 positive comment
* 6 students made 2 positive comments
* 1 student made 3 positive comments

* School A

*10 students made 1 positive comment
* 6 students made 2 positive comments
omitted negative comments. This interpretation was not borne out when it was noted that only four favorable comments were offered for the teacher in School A by the entire sample of freshmen.

Students indicated that they placed less value upon the chemistry course in School A than they did upon the comparable courses in high schools. It was evident that the expressions of lack of value of the chemistry course in School A were closely related to the content of the course.

Expressions of the students' lack of aptitude for learning chemistry ranked third in high schools and School A. However, fewer comments were made in this area by the larger number of students responding about the course in School A. This was consistent with the ratings assigned to difficulty of the course in School A. (see Graph 3)

Finally, Table 2 indicates that the largest number of unfavorable comments were offered by students who had selected the less favorable categories of liking for the chemistry courses in both schools. This might well be expected. However, it should be noted that the students who had indicated indifference toward chemistry in School A offered approximately 40 per cent of the total unfavorable comments in the school of nursing. For this reason, it was felt that these particular students had more pronounced negative feelings about the course in School A than their ratings on the questionnaire tended to indicate.
Ten of the eleven freshmen students in School B offered comments to support the ratings they had selected for the chemistry courses in high schools.

Nine of the same sample of freshmen expressed reasons for their selection of ratings for the chemistry course in School B. Two students made no comments. One student made both positive and negative comments.

The frequency of all comments made by the freshmen in School B appears in Tables 4 and 5. It is apparent that the number of reasons offered by this limited sample of students are too few for comparative purposes.

Liking, Difficulty and Usefulness of Chemistry - Seniors

All of the seniors who participated in the study had studied chemistry in high schools. Of the total number, eleven students were from School A and thirty were from School B. Graphs 7 - 12 represent the distribution of ratings which were assigned by the two groups in relation to liking, difficulty and usefulness of the chemistry courses in high schools and Schools A and B.

The sample from School A was extremely small and, therefore, the ratings which were checked were not necessarily indicative of the opinions held by the entire senior class in that school. It can be said of the seniors who did respond, however, that they considered the high school course to be more useful than the chemistry course
**TABLE 4**

**AREAS OF NEGATIVE COMMENTS MADE BY FRESHMEN STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR CHEMISTRY IN HIGH SCHOOLS AND SCHOOL B**

N - High School (HS) = 7; School B (SON) = 5

<table>
<thead>
<tr>
<th>Areas of Comments</th>
<th>Degree of Liking</th>
<th>Totals per Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td>Content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student's aptitude for learning</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>&quot;Value in nursing&quot;</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Teacher presentation</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Time in courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals per rating</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

High Schools

*4 students made 1 negative comment
*2 students made 2 negative comments
*1 student made 4 negative comments

School B

*3 students made 1 negative comment
*2 students made 2 negative comments
TABLE 5

AREAS OF POSITIVE COMMENTS MADE BY FRESHMEN STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR CHEMISTRY IN HIGH SCHOOLS AND SCHOOL B

N - High School (HS) = 3; School B (SON) = 5

<table>
<thead>
<tr>
<th>Areas of Comments</th>
<th>Degree of Liking</th>
<th>Totals per Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>2</td>
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<tr>
<td>Content</td>
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<td>1</td>
</tr>
<tr>
<td>Value in nursing</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Teacher presentation</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Student's aptitude for learning</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Totals per rating</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

High Schools

*3 students made 2 positive comments

School B

*3 students made 1 positive comment

*2 students made 2 positive comments
GRAPHS 7 - 12

DISTRIBUTION OF RATINGS CHECKED BY SENIOR STUDENTS IN RELATION TO LIKING, DIFFICULTY
AND USEFULNESS OF CHEMISTRY IN HIGH SCHOOLS (HS) AND IN TWO SCHOOLS OF NURSING (SON)

Rating Scale; for interpretation of meaning of ratings, see Appendix
in School A. The same group also indicated that they liked the
course in high school better and found it less difficult than
the course in School A.

The seniors in School B also rated the high school chemistry
courses as having been more useful and better liked than the course
in the school of nursing. In general, the students in this group
registered greater indifference towards the chemistry course in
high schools. Again, this may have been due to the permissiveness
of the questionnaire which did not force the students to take a
definite stand between the more favorable and less favorable ratings.
Data to be discussed later tend to indicate that a few of this sample
of students held more pronounced opinions than they indicated on the
rating scales.

Coefficients of correlation were computed between the ratings
which were assigned by the senior students in relation to the chemistry
courses in high schools and Schools A and B. These appear in Table 6.

The attitudinal ratings of the seniors in School A for chemistry
which showed positive correlations at the 1 per cent level included
the following:

Liking in high school and liking in School A
No other significant correlations existed.

In School B, there appeared to be more areas of positive
correlation at the 1 per cent level of confidence. These included
the following in rank order:

Liking and usefulness of chemistry in high school
# TABLE 6

## COEFFICIENTS OF CORRELATION OF LIKING, DIFFICULTY AND USEFULNESS OF CHEMISTRY IN HIGH SCHOOLS AND TWO SCHOOLS OF NURSING AS INDICATED BY SENIOR STUDENTS

<table>
<thead>
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<th>School B N = 30</th>
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<td>School of Nursing</td>
</tr>
<tr>
<td>Liking</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>.02</td>
<td>.85</td>
</tr>
<tr>
<td>Difficulty</td>
<td>-.22</td>
<td>-.22</td>
</tr>
<tr>
<td>Usefulness</td>
<td>.38</td>
<td>.37</td>
</tr>
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</table>

**Significant at the 1% level of confidence**

Liking and usefulness of chemistry in School B
Liking of chemistry in high school and liking in School B
Difficulty and usefulness of chemistry in high school

No other correlations were significant.

A comparison of the attitudinal ratings of the senior students in Schools A and B reveals that there was a greater degree of consistency which existed between the ratings of liking and usefulness for the chemistry course in high schools and the course in School B. A possible interpretation may be that the seniors in School B persisted in their opinions about liking and usefulness of the chemistry course because of the nature of the subject matter in School B which tended to duplicate the content covered in the high school course.

Eight of the eleven senior students in School A gave reasons for the ratings they had checked for the chemistry course in high schools. One student expressed both positive and negative reasons for her selection of ratings. Three students did not respond.

Nine of the eleven seniors in School A expressed unfavorable comments about the chemistry course in the school of nursing. Three students offered both positive and negative comments to support their ratings.

Examination of Tables 7 and 8 indicates that the small group of seniors in School A had a fairly positive attitude towards the chemistry course studied in high schools. Lack of clinical value and content appear to have been the factors which served to alter the group's attitude toward chemistry in the school of nursing.
TABLE 7

AREAS OF NEGATIVE COMMENTS MADE BY SENIOR STUDENTS IN SCHOOL A IN RELATION TO DEGREE OF LIKING FOR CHEMISTRY IN HIGH SCHOOLS AND SCHOOL A

N - High School (HS) = 2; School A (SON) = 9

<table>
<thead>
<tr>
<th>Areas of Comments</th>
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<th>Totals per Area</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Content</td>
<td></td>
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<tr>
<td>High Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student's aptitude for learning</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Value in nursing</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Teacher presentation</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Totals per rating</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

High Schools
*1 student made 2 negative comments
*1 student made 3 negative comments

School A
*7 students made 1 negative comment
*2 students made 3 negative comments
### Table 6

**Areas of Positive Comments Made by Senior Students in School A in Relation to Degree of Liking for Chemistry in High Schools and School A**

N - High School (HS) = 6; School A (SON) = 4

<table>
<thead>
<tr>
<th>Areas of Comments</th>
<th>Degree of Liking</th>
<th>Totals per Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Content</td>
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<tr>
<td>Teacher presentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value in nursing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals per rating</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Schools</th>
<th>School A</th>
</tr>
</thead>
<tbody>
<tr>
<td>*2 students made 1 positive comment</td>
<td>*2 students made 1 positive comment</td>
</tr>
<tr>
<td>*2 students made 2 positive comments</td>
<td>*2 students made 2 positive comments</td>
</tr>
</tbody>
</table>
| *2 students made 3 positive comments | }
Twenty-eight of the thirty seniors in School B expressed reasons for their choice of ratings for the chemistry in high schools. One student made both positive and negative comments. Two students made no responses.

Twenty-eight of the same sample of seniors gave reasons for their selection of ratings for the chemistry course in School B. Of this number, two students made both favorable and unfavorable comments. Two students did not respond.

Tables 9 and 10 indicate that the negative comments expressed by the sample of seniors in School B exceed the positive comments about the chemistry courses in the high schools and the school of nursing. It is significant that the rank order of the areas of negative responses remained the same in both schools. Apparently, this group of seniors persisted in the opinions they had adopted towards chemistry in the high schools. Another possibility may be that the sample was so far removed from both courses that they found it easier to reiterate the comments which they had made about the high school courses.

It is of further interest to note that the students who had checked the indifferent rating under liking of the chemistry courses in high schools and School B contributed approximately 50 per cent of the total favorable and unfavorable comments which were made about the courses. It is possible that this group of students actually had mixed feelings about the courses or that the tool which was used was not sufficiently flexible to elicit accurate responses.
TABLE 9

AREAS OF NEGATIVE COMMENTS MADE BY SENIOR STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR CHEMISTRY IN HIGH SCHOOLS AND SCHOOL B

N - High School (HS) = 18; School B (SON) = 17

<table>
<thead>
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<th>Areas of Comments</th>
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<th>Totals per Area</th>
</tr>
</thead>
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<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>HS</td>
<td>SON</td>
</tr>
<tr>
<td>Content</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Student's aptitude for learning</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Value in nursing</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Teacher presentation</td>
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<td>Time in courses</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>--</td>
<td>3</td>
</tr>
</tbody>
</table>

High Schools

*13 students made 1 negative comment
* 3 students made 2 negative comments
* 2 students made 3 negative comments

School B

*11 students made 1 negative comment
* 5 students made 2 negative comments
* 1 student made 3 negative comments
### TABLE 10

**AREAS OF POSITIVE COMMENTS MADE BY SENIOR STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR CHEMISTRY IN HIGH SCHOOLS AND SCHOOL B**

N - High School (HS) = 11; School B (SON) = 13

<table>
<thead>
<tr>
<th>Areas of Comments</th>
<th>Degree of Liking</th>
<th>Totals per Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HS</td>
<td>SON</td>
</tr>
<tr>
<td>Content</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>Value in nursing</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Teacher presentation</td>
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<td>--</td>
</tr>
<tr>
<td>Student's aptitude for learning</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Laboratory experience</td>
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</tr>
</tbody>
</table>

**Totals per rating**

<table>
<thead>
<tr>
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<th>HS</th>
<th>SON</th>
<th>HS</th>
<th>SON</th>
<th>HS</th>
<th>SON</th>
<th>HS</th>
<th>SON</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>4</td>
<td>10</td>
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<td>4</td>
<td>4</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**High Schools**

*4 students made 1 positive comment

*7 students made 2 positive comments

**School B**

*9 students made 1 positive comment

*4 students made 2 positive comments
The ratings which were assigned by the freshmen and seniors to the chemistry courses in high schools and the two schools of nursing are contained in Tables 11 and 12. In general, the freshmen and seniors rated the high school course in chemistry as having been more useful and better liked than the chemistry courses in Schools A and B. It is also evident that the seniors registered greater indifference under all categories for chemistry in high schools and the two schools of nursing. It is possible that the seniors had some difficulty recalling exactly how they had felt about the courses due to the lapse of time which had intervened since experiencing these courses as students.

Liking, Difficulty and Usefulness of Biology and Anatomy and Physiology - Freshmen

Seventy-nine of the eighty freshmen students who participated in the study had studied biology in high schools. Of this sample of students, sixty-eight were from School A and eleven were from School B. Graphs 13 - 18 represent the distribution of ratings which were assigned by the two groups in relation to liking, difficulty and usefulness of the biology course in high schools and the anatomy and physiology course in the two schools of nursing.

The freshmen in School A rated biology quite favorably. However, it is apparent that this same group rated anatomy and physiology more favorably in relation to liking and usefulness than they rated the high school courses. It was felt that this apparent increase in
TABLE 11

RATINGS FOR LIKING, DIFFICULTY AND USEFULNESS OF THE CHEMISTRY COURSES IN HIGH SCHOOLS AND SCHOOLS A AND B AS INDICATED BY 77 FRESHMEN STUDENTS IN THE TWO SCHOOLS OF NURSING

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<tr>
<th>Category</th>
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<td></td>
<td>1 and 2</td>
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</tr>
<tr>
<td>Liking</td>
<td>N</td>
<td>Per cent</td>
</tr>
<tr>
<td>N</td>
<td>32</td>
<td>41.6</td>
</tr>
<tr>
<td>Difficulty</td>
<td>N</td>
<td>Per cent</td>
</tr>
<tr>
<td>N</td>
<td>17</td>
<td>22.1</td>
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<tr>
<td>Usefulness</td>
<td>N</td>
<td>Per cent</td>
</tr>
<tr>
<td>N</td>
<td>37</td>
<td>48.0</td>
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</table>

For interpretation of meaning of ratings, see Appendix
TABLE 12

RATINGS FOR LIKING, DIFFICULTY AND USEFULNESS OF THE CHEMISTRY COURSES IN HIGH SCHOOLS AND SCHOOLS A AND B AS INDICATED BY 41 SENIOR STUDENTS IN THE TWO SCHOOLS OF NURSING

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<td>39.0</td>
</tr>
<tr>
<td>Difficulty</td>
<td>4</td>
<td>9.7</td>
</tr>
<tr>
<td>Usefulness</td>
<td>21</td>
<td>51.2</td>
</tr>
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</table>

For interpretation of meaning of ratings, see Appendix
GRAPHS 13 - 18

DISTRIBUTION OF RATINGS CHECKED BY FRESHMEN STUDENTS IN RELATION TO LIKING, DIFFICULTY AND USEFULNESS OF BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN TWO SCHOOLS OF NURSING

Liking

Graph 15

Difficulty

Graph 15

Usefulness

Graph 17

Rating Scale; for interpretation of meaning of ratings, see Appendix
positive attitude towards anatomy and physiology resulted from the content of the course which proved to be of greater practical value to the students. Data to be discussed under areas of comments offered by this group reinforced this view.

The small sample of freshmen from School B indicated that it liked the biology course better than it did anatomy and physiology. A possible reason for this may be that the group rated biology as having been slightly less difficult than anatomy and physiology.

Coefficients of correlation were computed between the ratings checked by each freshman student in relation to the biology courses studied in high schools and anatomy and physiology studied in Schools A and B. The results appear in Table 13.

The attitudinal ratings of the freshmen in School A which showed positive correlation at the 1 per cent level of confidence include the following in rank order:

Liking and usefulness of biology in high schools

Usefulness of biology in high schools and usefulness of anatomy and physiology in School A

Liking and difficulty of biology in high schools

One area showed positive correlation at the 5 per cent level of confidence:

Liking and difficulty of anatomy and physiology in School A

Only one area of negative correlation existed:

Difficulty and usefulness of anatomy and physiology in School A
TABLE 13

COEFFICIENTS OF CORRELATION OF LIKING, DIFFICULTY AND USEFULNESS OF BIOLOGY IN HIGH SCHOOLS 
AND ANATOMY AND PHYSIOLOGY IN TWO SCHOOLS OF NURSING AS INDICATED BY FRESHMEN STUDENTS

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<tr>
<th>Categories</th>
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<th>School B N = 11</th>
</tr>
</thead>
<tbody>
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<td>Biology in High Schools</td>
<td>Anatomy and Physiology in School of Nursing</td>
</tr>
<tr>
<td></td>
<td>Liking</td>
<td>Difficulty</td>
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<tr>
<td>Liking</td>
<td></td>
<td>** .34</td>
</tr>
<tr>
<td>Difficulty</td>
<td>** .09</td>
<td>--</td>
</tr>
<tr>
<td>Usefulness</td>
<td>** .70</td>
<td>--</td>
</tr>
<tr>
<td>Liking</td>
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</tr>
<tr>
<td>Difficulty</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Usefulness</td>
<td>** .26</td>
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</tbody>
</table>

*Significant at the 5% level of confidence
**Significant at the 1% level of confidence

In School B, the attitudinal ratings which showed a positive correlation at the 1 per cent level of confidence included:

- Difficulty of biology in high schools and difficulty of anatomy and physiology in School B

One area showed positive correlation at the 5 per cent level of confidence. This included the following:

- Liking and usefulness of biology in high schools

A comparison of the attitudinal ratings of the freshmen students in Schools A and B indicated positive correlations between liking and usefulness of the biology course in high schools. Significant by its absence is any correlation between the same two ratings for the courses in anatomy and physiology. For the students in School A, liking of the course had more to do with estimates of difficulty of the subject matter. However, ratings of difficulty and usefulness were negatively correlated. This may indicate that this group of students could readily appreciate the value of the subject matter in nursing practice. This may have been the result of the influence of a more dynamic science teacher than may have been evidenced in School B. Another possibility may be that the clinical instructors in School A helped these freshmen students to identify relationships between previously learned subject matter and patient care.

Sixty-four of the sixty-eight freshmen in School A who had rated the biology course in high schools offered reasons for their selections. Of the total number who had responded, three offered both positive and negative comments. The areas of comments made by
this group appear in Tables 14 and 15. Four students did not comment.

All of the freshmen in School A expressed reasons for the ratings they had checked for anatomy and physiology in the school of nursing. Three of the total number made both positive and negative responses.

A comparison of Tables 14 and 15 indicates that the favorable comments made about biology and anatomy and physiology greatly exceed the unfavorable comments. As might be expected, the greatest number of favorable comments were made by students who had registered a greater liking for biology and anatomy and physiology in high school and the school of nursing. However, more than one-half of the unfavorable comments were offered by students who had registered indifference to liking of the biology course. It would appear that this opinion was largely due to the lack of usefulness of the course which had been rated by this group.

It is also interesting to note that the areas of favorable comments about biology and anatomy and physiology appear in the same rank order. It can be seen that there was a close relationship between content of the courses and expressions of value.

Ten of the eleven freshmen in School B gave reasons for the ratings they had chosen for the biology course in high schools. The areas of comments appear in Tables 16 and 17. One student did not respond.

All of the freshmen in School B offered reasons for the ratings they had assigned for anatomy and physiology in the school of nursing.
# TABLE 14

**AREAS OF POSITIVE COMMENTS MADE BY FRESHMEN STUDENTS IN SCHOOL A IN RELATION TO DEGREE OF LIKING FOR BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN SCHOOL A**

N - High School (HS) = 46; School A (SON) = 68

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TABLE 15
AREAS OF NEGATIVE COMMENTS OFFERED BY 18 FRESHMEN STUDENTS IN SCHOOL A IN RELATION TO DEGREE OF LIKING FOR BIOLOGY IN HIGH SCHOOLS

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<tr>
<td>Totals per rating</td>
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<td>8</td>
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</table>

*6 students made 1 negative comment
*7 students made 2 negative comments
*5 students made 3 negative comments
TABLE 16

AREAS OF POSITIVE COMMENTS MADE BY FRESHMEN STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN SCHOOL B

N - High School (HS) = 5; School B (SON) = 9

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<td>Totals per rating</td>
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High Schools

*5 students made 2 positive comments

School B

*7 students made 1 positive comment

*2 students made 2 favorable comments
**TABLE 17**

**AREAS OF NEGATIVE COMMENTS OFFERED BY 5 FRESHMEN STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR BIOLOGY IN HIGH SCHOOLS**

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<td>1</td>
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<tr>
<td>Totals per rating</td>
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<td>2</td>
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</tbody>
</table>

*4 students made 1 unfavorable comment
*1 student made 2 unfavorable comments
The favorable comments which were made by nine students appear in Table 16. The remaining two students expressed lack of aptitude in the course.

There is little of a revealing nature which can be said about the freshmen's opinions of biology since one-half responded favorably and one-half responded unfavorably about the course. However, Table 16 reveals that most of the freshmen in School B had favorable comments to make about anatomy and physiology. This was consistent with the ratings of usefulness checked by this group since over one-half of the total comments focused upon value of the course.

It is evident that the freshmen in Schools A and B had fairly positive attitudes toward the biology course in high schools in relation to liking, difficulty and usefulness of the course. These favorable attitudes appear to have been transferred and reinforced in both schools of nursing in relation to liking and usefulness of anatomy and physiology.

Liking, Difficulty and Usefulness of Biology and Anatomy and Physiology - Seniors

All of the seniors who participated in the study had studied biology in high school. Of this number, eleven were from School A and thirty were from School B. Graphs 19-22 represent the distribution of ratings which were assigned by the two groups in relation to liking, difficulty and usefulness of the biology course in high schools and anatomy and physiology in the two schools of nursing.
DISTRIBUTION OF RATINGS CHECKED BY SENIOR STUDENTS IN RELATION TO LIKING, DIFFICULTY AND USEFULNESS OF BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN TWO SCHOOLS OF NURSING

Rating Scale; for interpretation of meaning of ratings, see Appendix
The small group of seniors in School A is not necessarily representative of the entire class. However, the students who did respond rated biology quite favorably in relation to liking and usefulness of the course. There appears to be no appreciable change noted under the same ratings for anatomy and physiology in School A. As might be expected, the same group rated anatomy and physiology as having been more difficult than biology.

The seniors in School B also rated biology quite favorably in relation to liking and usefulness. However, greater usefulness as well as greater difficulty were assigned to anatomy and physiology.

Coefficients of correlation were computed between the ratings checked by each senior student in relation to the biology course studied in high schools and anatomy and physiology studied in Schools A and B. The results appear in Table 18.

The attitudinal ratings of the seniors in School A showed no significant positive correlations at either the 5 per cent or 1 per cent levels.

In School B, the attitudinal ratings which showed positive correlation at the 1 per cent level of confidence in rank order were:

- Liking and usefulness of biology in high schools
- Difficulty of biology in high schools and difficulty of anatomy and physiology in School B
- Liking and usefulness of anatomy and physiology in School B
- Liking of biology and liking of anatomy and physiology in School B
TABLE 18

COEFFICIENTS OF CORRELATION OF LIKING, DIFFICULTY AND USEFULNESS OF BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN TWO SCHOOLS OF NURSING AS INDICATED BY SENIOR STUDENTS

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</table>

**Significant at the 1% level of confidence

Usefulness of biology and usefulness of anatomy and physiology in School B

The seniors in School B showed greater consistency in their attitudes about biology and anatomy and physiology than did the smaller group of students in School A. Significant by its absence is the lack of correlation between the ratings of liking and difficulty, and difficulty and usefulness of biology and anatomy and physiology in both Schools A and B. This tends to indicate that this group of seniors could like and appreciate the value of the courses in spite of the difficulty of the subject matter.

Eight of the eleven seniors in School A offered reasons for the ratings they had assigned to the biology course studied in high schools. The areas of comments made by the group appear in Table 19. The three remaining students did not respond.

All of the seniors in School A expressed reasons for the ratings they had checked for anatomy and physiology in the school of nursing. Table 20 represents the unfavorable comments which were made by nine seniors. The two remaining students offered favorable comments about the content of the course.

Examination of Table 19 reveals that the seniors in School A reinforced the ratings they had selected for the biology courses by making favorable comments about them.

The data contained in Table 20 seem to contradict the favorable ratings the students had chosen for anatomy and physiology. It may be, however, that there were no actual reversals of opinions. Perhaps
TABLE 19

AREAS OF POSITIVE COMMENTS OFFERED BY 8 SENIOR STUDENTS IN SCHOOL A IN RELATION TO DEGREE OF LIKING FOR BIOLOGY IN HIGH SCHOOLS

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<td>Totals per rating</td>
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</table>

*1 student made 1 favorable comment
*4 students made 2 favorable comments
*2 students made 3 favorable comments
*1 student made 4 favorable comments
TABLE 20
AREAS OF NEGATIVE COMMENTS OFFERED BY 9 SENIOR
STUDENTS IN SCHOOL A IN RELATION TO DEGREE OF
LIKING FOR ANATOMY AND PHYSIOLOGY IN SCHOOL A

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<tr>
<td>Totals per rating</td>
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<td>9</td>
</tr>
</tbody>
</table>

*3 students made 1 negative comment
*6 students made 2 negative comments
the students simply found it easier to identify specific factors which had displeased them about the course. These factors seemed to center around teacher presentation and lack of student aptitude. Concern about the science teacher may have resulted from a comparison of the teacher with other non-science or clinical instructors.

The sample of thirty seniors in School B expressed reasons for the ratings they had assigned to the biology course studied in high schools. The areas of comments appear in Tables 21 and 22.

All but one of the same sample of seniors expressed specific comments about the course in anatomy and physiology. Two students made both positive and negative comments. The totals for the five categories of areas of comments appear in Tables 21 and 22.

The seniors in School B made more favorable than unfavorable comments about biology and anatomy and physiology. However, the favorable remarks about biology surpassed those made for anatomy and physiology. It would appear that the areas of comments gave biology more weight than the ratings tended to indicate. A possible interpretation is that the students had been exposed to a greater number of biology teachers who had had more positive effects upon them than had the teacher in School B (see Table 21). Also, it might be expected that additional comments about ease of learning would be forthcoming for the biology course as opposed to the course in anatomy and physiology. This was consistent with the ratings checked for difficulty of the courses. However, it should be noted that the greatest number of favorable comments were made about the clinical
TABLE 21

AREAS OF POSITIVE COMMENTS MADE BY SENIOR STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN SCHOOL B

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</table>

High Schools

*10 students made 1 positive comment
*12 students made 2 positive comments

School B

*18 students made 1 positive comment
*5 students made 2 positive comments
### TABLE 22

**AREAS OF NEGATIVE COMMENTS MADE BY SENIOR STUDENTS IN SCHOOL B IN RELATION TO DEGREE OF LIKING FOR BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN SCHOOL B**

N - High School (HS) = 8; School B (SON) = 8

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<th>4</th>
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<th>Totals per Area</th>
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<tr>
<td></td>
<td>HS</td>
<td>SON</td>
<td>HS</td>
<td>SON</td>
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<tr>
<td>Value in nursing</td>
<td></td>
<td></td>
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<td>Content</td>
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<td>1</td>
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<td>Teacher presentation</td>
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<td>Student's aptitude for learning</td>
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<td>Time in courses</td>
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<td>7</td>
<td>4</td>
<td>1</td>
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</table>

High Schools

*4 students made 1 negative comment
*3 students made 2 negative comments
*1 student made 3 negative comments

School B

*5 students made 1 negative comment
*2 students made 2 negative comments
*1 student made 3 negative comments
value of anatomy and physiology. This, too, indicates consistency with the ratings of greater usefulness for the course as opposed to the biology course.

The ratings which were assigned to biology and anatomy and physiology by the total sample of freshmen in Schools A and B appear in Table 23. Table 24 represents the ratings which were chosen for both courses by the sample of seniors in Schools A and B.

The ratings for liking of biology in the high schools appear to be the only consistent expression of opinion between the freshmen and seniors. In general, the seniors registered greater indifference to all other ratings related to biology and anatomy and physiology. Also, fewer seniors than freshmen rated anatomy and physiology as having been useful. This difference may have been due to the more recent exposure to the course by the freshmen students. Thus, they may have been able to recall more of the content of the course which they felt they utilized in clinical practice. Another equally plausible explanation may be that the seniors had not had their previous learning reinforced by the instructors in the clinical areas.

Summary of Data

For the purpose of this summary, the ratings selected by the freshmen students in the two schools of nursing were combined. Further, ratings of liking and usefulness, which had shown a fairly consistent positive correlation were also combined. The ratings of difficulty were recorded separately because they tended to slant the other ratings quite markedly.
TABLE 23
RATINGS FOR LIKING, DIFFICULTY AND USEFULNESS OF BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN TWO SCHOOLS OF NURSING AS INDICATED BY 79 FRESHMEN STUDENTS

<table>
<thead>
<tr>
<th>Category</th>
<th>Biology in High Schools</th>
<th></th>
<th>Anatomy and Physiology in Schools of Nursing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 and 2</td>
<td>3</td>
<td>4 and 5</td>
<td>1 and 2</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Per cent</td>
<td>N</td>
<td>Per cent</td>
</tr>
<tr>
<td>Liking</td>
<td>55</td>
<td>69.6</td>
<td>17</td>
<td>21.5</td>
</tr>
<tr>
<td>Difficulty</td>
<td>35</td>
<td>44.3</td>
<td>25</td>
<td>31.6</td>
</tr>
<tr>
<td>Usefulness</td>
<td>45</td>
<td>57.0</td>
<td>18</td>
<td>22.8</td>
</tr>
</tbody>
</table>

For interpretation of meaning of ratings, see Appendix
TABLE 24

RATINGS FOR LIKING, DIFFICULTY AND USEFULNESS OF BIOLOGY IN HIGH SCHOOLS AND ANATOMY AND PHYSIOLOGY IN TWO SCHOOLS OF NURSING AS INDICATED BY 41 SENIOR STUDENTS

<table>
<thead>
<tr>
<th>Category</th>
<th>Biology in High Schools</th>
<th>Anatomy and Physiology in Schools of Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 and 2</td>
<td>3</td>
</tr>
<tr>
<td>Liking</td>
<td>N</td>
<td>Per cent</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>70.7</td>
</tr>
<tr>
<td>Difficulty</td>
<td>11</td>
<td>26.8</td>
</tr>
<tr>
<td>Usefulness</td>
<td>26</td>
<td>63.5</td>
</tr>
</tbody>
</table>

For interpretation of meaning of ratings, see Appendix
The procedure previously described was also followed for summarizing the ratings obtained from the senior students. 

Chemistry - Freshmen students

A. Liking and usefulness

1. Favorable ratings
   a) High schools .......... 44.2%
   b) Schools A and B .... 18.9%

2. Unfavorable ratings
   a) High schools .......... 34.4%
   b) Schools A and B .... 40.2%

3. Indifferent ratings
   a) High schools .......... 21.4%
   b) Schools A and B .... 40.9%

B. Difficulty

1. Favorable ratings
   a) High schools .......... 22.1%
   b) Schools A and B .... 36.4%

2. Unfavorable ratings
   a) High schools .......... 58.4%
   b) Schools A and B .... 32.4%

3. Indifferent ratings
   a) High schools .......... 19.5%
   b) Schools A and B .... 31.2%

As these figures indicate, less than one-half of the freshmen sampled had indicated favorable ratings for liking and usefulness.
of the chemistry courses taught in high schools. There was a sharp drop in favor for these same ratings for the courses in Schools A and B with a subsequent rise in the ratings of indifference.

There was a considerable drop in the ratings for greater difficulty of the chemistry courses in Schools A and B accompanied by a rise in the ratings of indifference to the courses.

The ratings chosen by the freshmen were reinforced by comments about the chemistry courses which indicated the following:

1. Negative comments exceeded the positive comments in relation to the chemistry courses studied in high schools and the two schools of nursing.

2. Schools A and B received more negative remarks and fewer positive comments about the chemistry courses than did the high school courses.

3. Negative comments about the courses in high schools focused upon their lack of value and presentation by the teachers.

4. Negative comments about the courses in Schools A and B emphasized the repetitious nature of the content and its lack of value in clinical nursing.

Chemistry - Senior students

A. Liking and usefulness

1. Favorable ratings
   a) High schools .......... 45.1%
   b) Schools A and B .... 21.9%
2. Unfavorable ratings
   a) High schools ..........19.5%
   b) Schools A and B .....28.1%

3. Indifferent ratings
   a) High schools ..........35.4%
   b) Schools A and B .....50.0%

B. Difficulty

1. Favorable ratings
   a) High Schools ..........9.8%
   b) Schools A and B .....14.4%

2. Unfavorable ratings
   a) High schools ..........46.3%
   b) Schools A and B .....31.7%

3. Indifferent ratings
   a) High schools ..........43.9%
   b) Schools A and B .....53.9%

Less than one-half of the total sample of seniors selected favorable ratings for liking and usefulness of the chemistry courses studied in high schools. There was a marked drop in these favorable ratings for the courses in Schools A and B which was accompanied by a substantial rise in indifference.

The same group of seniors indicated that the chemistry courses in Schools A and B were less difficult than the high school courses. However, better than one-half the sample indicated indifference to the difficulty of the courses in the two schools of nursing.
The comments offered by the seniors about chemistry indicated the following:

1. The high school courses received an equal number of positive and negative comments.

2. Chemistry in Schools A and B received a greater number of negative comments and fewer positive remarks than did the chemistry courses studied in high schools.

3. The courses in Schools A and B received a slightly greater number of unfavorable comments than they did favorable comments.

4. All comments offered for the chemistry courses in high schools and Schools A and B emphasized content and value in clinical nursing.

Biology and anatomy and physiology - Freshmen students

A. Liking and usefulness

1. Favorable ratings
   a) High schools ........ 63.3%
   b) Schools A and B .... 84.8%

2. Unfavorable ratings
   a) High schools ........ 13.9%
   b) Schools A and B .... 3.2%

3. Indifferent ratings
   a) High schools ........ 22.8%
   b) Schools A and B .... 12.0%
B. Difficulty

1. Favorable ratings
   a) High schools ....... 49.4%
   b) Schools A and B ..... 17.7%

2. Unfavorable ratings
   a) High schools.......... 16.4%
   b) Schools A and B ..... 57.0%

3. Indifferent ratings
   a) High schools .......... 34.2%
   b) Schools A and B ..... 25.3%

It is evident that this sample of freshmen had fairly favorable opinions about liking and usefulness of the biology course in high schools. It can be seen that there was an over-all increase in favorable ratings for the courses in anatomy and physiology in the two schools of nursing.

The foregoing figures also indicate that there was a sharp increase in the ratings of greater difficulty for anatomy and physiology in Schools A and B.

The comments which the freshmen made about biology and anatomy and physiology indicated the following:

1. Favorable comments exceeded unfavorable comments about the biology courses in high schools and anatomy and physiology in Schools A and B.

2. Anatomy and physiology received more positive remarks and fewer negative statements than biology.
3. The favorable comments made about biology and anatomy and physiology occurred in the following rank order:

a) Content of courses
b) Value in nursing
c) Teacher presentation

Biology and anatomy and physiology - Senior students

A. Liking and usefulness

1. Favorable ratings
   a) High schools ........67.1%
   b) Schools A and B .....75.2%

2. Unfavorable ratings
   a) High schools ........4.8%
   b) Schools A and B .....3.6%

3. Indifferent ratings
   a) High schools ........28.1%
   b) Schools A and B .....23.2%

B. Difficulty

1. Favorable ratings
   a) High schools ........26.8%
   b) Schools A and B .....22.0%

2. Unfavorable ratings
   a) High schools ........26.8%
   b) Schools A and B .....39.0%
3. Indifferent ratings
   a) High schools ........46.4%
   b) Schools A and B ......39.0%

   The figures indicate that the sample of seniors had favorable feelings about liking and usefulness of the biology courses they had studied in high schools. These same ratings increased for the courses in anatomy and physiology in the two schools of nursing.

   There was a moderate increase in the ratings for greater difficulty of anatomy and physiology as opposed to the biology courses studied in high schools.

   The comments offered by the seniors in relation to the ratings they had assigned to the courses in biology and anatomy and physiology indicated the following:

   1. Positive comments exceeded negative statements about biology and anatomy and physiology.

   2. Biology received the greater number of favorable remarks and fewer negative comments.

   3. The most frequently occurring comments about biology and anatomy and physiology were in the following order:

      a) Subject matter of courses
      b) Value in nursing
      c) Teacher presentation
CHAPTER FIVE

SUMMARY

An attempt was made to determine some of the factors which were involved which led 121 students to develop particular attitudes toward chemistry and anatomy and physiology in two hospital schools of nursing in the Boston area. A questionnaire was devised which included a rating scale ranging from 1 - 5 under the categories of liking, difficulty and usefulness of the biology and chemistry courses studied in high schools and chemistry and anatomy and physiology studied in the schools of nursing. In addition to the rating scales, two questions were included which requested that the students elaborate upon the specific reasons why they had assigned the ratings they had for each of the courses. The questions allowed the students complete freedom of expression in relation to the courses without benefit of suggestion by any outside source.

The ratings and comments which were reported in the study were those associated with the courses in chemistry and biology in high schools and chemistry and anatomy and physiology in the schools of nursing. It was felt that the attitudes which were developed toward the two science courses in high schools could be traceable to the related courses in the schools of nursing.

The ratings were condensed and reported in the following manner: more favorable, indifferent and less favorable. The spontaneous
comments were sorted according to positive and negative comments. These were then subdivided into specific areas of comments which were cited by the students and included the following:

1. Comments associated with content of the courses.
2. Comments associated with the value of the courses in clinical nursing.
3. Comments in relation to presentation of the material by the teachers.
4. Comments which related to the students' expressions of aptitude in the courses.
5. Comments about laboratory experience associated with the courses.
6. Comments about the amount of time devoted to the study of the courses.

Summary of Findings

The data which were collected indicated the following:

1. Approximately 40 per cent of the freshmen and seniors liked high school chemistry as opposed to 22 per cent for the same courses in Schools A and B.
2. The same sample rated the high school chemistry courses as having been more difficult than the courses in Schools A and B.
3. Approximately one-half of the total sample indicated that the high school courses were useful as opposed to 20 per cent for the courses in Schools A and B.
4. There was an over-all increase in indifference to liking, difficulty and usefulness of the chemistry courses in Schools A and B. The indifference was more marked among the senior students.

5. The unfavorable comments exceeded the favorable comments which were made about the chemistry courses studied in high schools and Schools A and B.

6. The most frequently occurring negative comments made by the total sample about the chemistry courses in Schools A and B, centered around the repetitious content and its lack of value in clinical nursing.

7. Biology was liked by approximately 70 per cent of the total sample as was anatomy and physiology in the schools of nursing.

8. Approximately 25 per cent of the total sample found biology difficult as opposed to 48 per cent for anatomy and physiology.

9. Approximately 60 per cent of the total sample found biology useful as opposed to 68 per cent for anatomy and physiology.

10. There was a greater degree of indifference registered by the seniors to all ratings for the courses in biology and anatomy and physiology.

11. Favorable comments exceeded the unfavorable comments which were made for the courses in biology and anatomy.
and physiology: the latter courses received the greatest number of favorable remarks.

12. The most frequently occurring comments about biology and anatomy and physiology centered around content of the courses and their value in clinical nursing.

Conclusions

The data which were collected provided the investigator with information concerning some of the problem areas encountered by students in the study of the selected science courses. In general, it was found that the negative attitudes which the students had developed toward chemistry in the high schools were reinforced in the two schools of nursing. It was also discovered that the more positive attitudes which the students had developed in relation to biology had been transferred to the course in anatomy and physiology in the schools of nursing. The above findings support the hypothesis which had been proposed.

Recommendations

As an outcome of the findings of this study, a few recommendations are indicated.

1. Chemistry courses offered in schools of nursing should be explored from the viewpoint of content. This could lead to the exclusion of material which has been studied in the high schools and the inclusion of topics which may best be utilized by students of nursing.
2. The psychological implications of learning are apparent when it is recognized that students have established negative attitudes toward chemistry in high schools. Therefore, chemistry teachers in schools of nursing must put forth greater effort to make their courses more dynamic and rewarding for the students.

3. Every effort should be made to coordinate the content of the chemistry and anatomy and physiology courses with some related experiences in the clinical areas.

4. Particular emphasis should be placed upon the reinforcement of previous learning by the seniors in the clinical areas since they obviously indicate that they are more indifferent to both chemistry and anatomy and physiology than are the freshman students.

5. Further studies should be done in which the opinions of a larger sample of pre-nursing students could be obtained in relation to the science courses in high school. Follow-up studies of the same sample in the schools of nursing would doubtless result in more accurate findings than were possible in this study.
The following tables are designed to learn your opinions about the science courses you have had to date. Your responses will be kept confidential and will in no way reflect upon you, your teachers or the school. You are urged to complete the tables and to answer the questions frankly and to the best of your ability.

When assigning ratings for the courses taken in high school, compare the science courses with all other courses taken in high school.

When assigning ratings for the courses taken in the school of nursing, compare the science courses with all other courses taken in the school of nursing.
**Description of Ratings**

**LIKING**
1. Liked more than other courses
2. Liked better than most other courses
3. Like neither more nor less than other courses
4. Liked less than most other courses
5. Liked least of all courses

**DIFFICULTY**
1. More difficult than other courses
2. More difficult than most other courses
3. Neither more nor less difficult than other courses
4. Less difficult than most other courses
5. Least difficult of all courses

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<tr>
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<td>3. Physics</td>
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<td>6.</td>
<td></td>
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Rate the basic sciences in the school of nursing
1. Anatomy and Physiology
2. Chemistry
3. Microbiology (Bacteriology)
## OPINIONS AFTER COMPLETION OF COURSES

<table>
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<th>USEFULNESS Description of Ratings</th>
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<td>1. Liked more than other courses</td>
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<td>1. More useful than other courses</td>
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<td>2. Liked better than most other courses</td>
<td>2. More difficult than most other courses</td>
<td>2. More useful than most other courses</td>
</tr>
<tr>
<td>3. Like neither more nor less than other courses</td>
<td>3. Neither more nor less difficult than other courses</td>
<td>3. Neither more nor less useful than other courses</td>
</tr>
<tr>
<td>4. Liked less than most other courses</td>
<td>4. Less difficult than most other courses</td>
<td>4. Less useful than most other courses</td>
</tr>
<tr>
<td>5. Like least of all courses</td>
<td>5. Least difficult of all courses</td>
<td>5. Least useful of all courses</td>
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### SCIENCE COURSES

<table>
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<tr>
<th>Biological and Physical sciences taken in high school. Add any others not listed in spaces provided. Rate courses.</th>
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<th>2</th>
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</thead>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
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<td>3. Physics</td>
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<td>3. Microbiology (Bacteriology)</td>
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</table>
The following questions do not require that you use a rating scale. Instead, you are asked to write your personal views based upon your rating of the science courses. Be as specific as you can in expressing your views.

1. Based upon your feelings about the science courses in high school, state the reasons why you felt this way.
2. Based upon your feelings about the science courses in the school of nursing, state the reasons why you felt this way.
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