AN EDUCATIONAL STUDY OF STUDENT NURSES IN PHARMACY.*

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INTRODUCTION.

We are living in the era of statistical studies, success prediction and vocational aptitude in elementary and secondary school education. Educational measurements have also invaded the field of higher education and their applicability to the field of professional education will undoubtedly be forthcoming in a broader way than is extant at the present time.

In pharmaceutical education some work has been done as far as educational measurements are concerned. At the Des Moines meeting (1) of the American Association of Colleges of Pharmacy, one of the principal addresses was delivered by Dean Seashore on "Aptitude Examinations for College Students." However, these were not directly applicable to pharmacy. McGill (2) pointed out the importance of intelligence tests in pharmacy schools in interpreting the pharmaceutical success of the students.

In the Johns Hopkins Training School for Nurses, two of the present authors have conducted a course in pharmacy for a period of six or seven years. As these student nurses are all high school graduates, and in many instances hold bachelor's degrees from recognized colleges, it was thought that these student nurses would be excellent test subjects to study the relationship between college education and the prediction of success in pharmacy. Furthermore, the correlation between the intelligence quotient and success in pharmacy was thought to be of sufficient interest to warrant our study. With these purposes in mind, this investigation was begun.

THE NATURE OF THE COURSE.

The course in pharmacy includes ten lectures and five laboratory periods, given during the probation period of the student nurses' training. The subjects included in the curriculum are, in a general way, pharmacopœias, weights and measures, natural products, more generally used galenicals, endocrine products and the general methods of standardization. In the laboratory course, the students prepare ten very generally used galenical preparations.

PHARMACY AND GENERAL INTELLIGENCE.

In the group studied there were fifty-six student nurses who were each required to take an Otis Self-Administering Test and also a Kuhlmann-Anderson Intelligence Test. The average of the intelligence quotients obtained from these two tests is considered as a fair measure of the intelligence quotient of the student. The results obtained by these students showed that their intelligence quotient was on an average, a little above the normal, and when these data were correlated with the grades in pharmacy, a very high correlation was obtained. The following data indicate the correlation coefficient between the grades in pharmacy and the intelligence quotient calculated by the usual correlation coefficient formula. The general formula:

* Section on Education and Legislation, A. PH. A., Baltimore meeting, 1930.

$$r = \frac{S(xy)}{\sqrt{S(x^2) \cdot S(y^2)}}$$

was employed. X is equal to the deviation from the mean in intelligence and y is equal to the deviation from the mean in pharmacy. In this case the r was equal to 0.914, with a probable error calculated by the formula:

$$P.E. = \frac{(0.6745 \times 1 - r^2)}{\sqrt{N}} = 0.014$$

Interpreting this correlation coefficient in terms of prediction of success, a correlation coefficient of 0.91 is equivalent to a certainty of about 57 per cent; that is to say, if the intelligence quotient of a student is high, the accuracy of prediction of success in pharmacy is increased by about 57 per cent (4) over sheer guessing on chance.

RELIABILITY OF EXAMINATION.

The following examination was given in pharmacy as a means of evaluating the students' ability in this subject:

1. Name and define five classes of galenical preparations intended for internal administration.
2. What are the principal constituents of the following preparations: (*a*) tincture of iron, (*b*) paregoric, (*c*) Seidlitz powder, (*d*) laudanam, (*e*) infusion of digitalis?
3. How are ointments classified according to use? Name the two types of suppository bases.
4. In what forms is epinephrine available for use? What is the therapeutic principle involved in the use of epinephrine in insulin shock?
5. Define standardization and assay. Tell in detail how anyone of the following products are assayed: (1) digitalis, (2) ovarian hormone preparations, (3) insulin, (4) posterior lobe pituitary preparations.

The reliability of this examination as an accurate measure of the ability of the student in pharmacy was determined by calculating the correlation coefficient between the grades obtained on Questions 1, 3 and 5 and those obtained on Questions 2 and 4. The correlation coefficient between these data correlated by the foregoing formula was 0.76 with a probable error of 0.056. In the calculation of the reliability coefficient of an examination, the correlation coefficient is stepped up by the so-called "Spearman prophecy formula" which is

$$r_n = \frac{nr}{1 + (n - 1)r}$$

where n is the number of groups of data correlated and r is the correlation coefficient. The reliability of the examination by means of this formula is stepped up to 0.856. This reliability quotient is considered moderately high and indicates that the examination is a valid measurement of the students' ability in pharmacy.

CORRELATION BETWEEN PHARMACY AND CHEMISTRY.

It was thought desirable to determine whether or not there was a high correlation between success in pharmacy and success in chemistry among these same

student nurses. The course in chemistry is somewhat more intensive than the course in pharmacy, and includes twenty-five lecture hours, and ten laboratory periods. Yet the correlation coefficient between these data was not as close as one might *a priori* expect. By the above formula, the correlation coefficient between the pharmacy and chemistry grades was 0.676 with a probable error of 0.072.

INFLUENCE OF PREVIOUS EDUCATION.

The previous education of the student was ascertained, and the students were divided into three groups: those having only a high school education, those having one or two years of college work, and those having three or four years of college work. The following data are obtained from these groupings.

No. of Students.	Training.	Average in Pharmacy.	Average I. Q.	Ratio.
25	H. S.	73.8	102.6	0.720
12	1 or 2 yrs. Col.	72.0	103.0	0.700
19	3 or 4 yrs. Col.	82.0	113.0	0.725

An examination of this table indicates that those students who had the greatest amount of college training obtained the highest scores in the intelligence examinations, and also the highest scores in pharmacy; yet we find that one or two years in college seems to have no influence upon the grade in pharmacy. It is especially interesting to note that irrespective of the previous training, the ratio between the grade in pharmacy and the intelligence quotient is constant. This seems to indicate that the intelligence quotient is a better means of predicting success in pharmacy than the previous training the student has had.

CONCLUSIONS.

1. The correlation between the grades in pharmacy and chemistry is fair.
2. The correlation between intelligence quotients and the grades in pharmacy is high, and the intelligence quotient may be looked upon as a means of predicting success in pharmacy among student nurses.
3. Students with only high school training and a high intelligence quotient scored high in pharmacy. Students with college training and low intelligence quotients scored low in pharmacy.
4. The ratio between the grade in pharmacy and the intelligence quotient is constant irrespective of previous training.

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(1) Address. Dean Seashore. Des Moines meeting, American Association Colleges of Pharmacy, 1925.

(2) W. J. McGill, JOUR. A. PH. A., 12 (1923), 165.

(3) R. A. Fisher, "Statistical Methods for Research Workers," Oliver and Boyd, London, 1928, page 149.

(4) G. M. Ruch, "The Improvement of the Written Examination," Scott, Foresman and Co., Chicago, 1924, page 143.

ABSTRACT OF DISCUSSION.

Dean Jordan requested Dr. Krantz to explain why the college student had no higher I. Q. than the high school graduate.

The author replied that the college students referred to had only one or two years of college; those who had three or four years of college rated higher in the intelligence quotient.

A. B. Lemon stated that in the University of Buffalo endeavor is made to connect the results of placement tests with actual accomplishments, however, the ratio failed to be of great value in showing what a student would do in the courses; there is a predicative value in the relationship of the first year's work and that of the succeeding years. He stated that students coming from rural high schools were not as well prepared as those from city high schools. Factors of importance are to be derived from the work of students outside of the college in drug stores, the desire of students to go to college, home environment, etc. Studies are being made over a 5-year period, from which it is hoped to derive valuable data.

Dean Jordan referred to what had been termed orientation tests—if a student standing high in average and is deficient in one or more subjects the reason is sought; students rating low in all branches are advised to discontinue their studies, thereby saving time and money for them.

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THE LIMITED CONTENT OF THE PRESENT PHARMACEUTICAL CURRICULA.*

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My only apology for a line on this hackneyed subject is a profound concern for pharmacy of the future unless there is a radical change in the educational ideals of some of our schools of pharmacy.

I believed—and many others did too—that when the change from a two-year to a three-year course was made, the main purpose was to give opportunity for the liberalization of the curriculum. In many schools advantage was taken of this and the three-year course is with them as well balanced, as good a combination of culture, theory and practice of pharmacy and fundamental science as is possible in the time available. Some schools, however, have simply enlarged the two years to three in pharmacy, chemistry and materia medica. Not a semblance of liberalization! Personally, I deprecate such a state of affairs. When both medicine and dentistry have established standards which make certain cultural and scientific subjects obligatory upon those who would follow these professions, we are both surprised and distressed when we note the unwillingness of pharmacy to accept as natural and necessary a similar procedure.

With such a state of affairs in mind, I venture to suggest that the Section on Education and Legislation recommend to the resolutions committee of the parent organization the following:

> WHEREAS, high school and college education is now the accepted privilege of rapidly increasing numbers of our population, and
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> WHEREAS, this places upon those in any of the professions having contact with the public an added responsibility for the maintenance of the dignity and good name of members of these professions, and
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> WHEREAS, pharmacists contact the public more frequently than any other single professional group,
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> *Therefore, Be It Resolved:*
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> *First*, that it is the sense of the Section on Education and Legislation that pharmaceutical education should take cognizance of these facts.
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> *Second*, that as rapidly as possible the curricula of our schools of pharmacy be liberalized so that their graduates may not be handicapped in their contacts with this ever-increasing number of liberally educated men and women.

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