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# UNIVERSITY OF ILLINOIS LIBRARY SCHOOL OCCASIONAL PAPERS

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## The University of Illinois Library School Placement Examination

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### Introduction

Contrary to many other fields in which an abundance of materials has been developed, librarians have not generally foreseen the uses of standardized tests. The American Bar Association states that admission to the Association is granted upon evidence of graduation from an accredited law school and the passing of an examination to determine fitness. Each state prepares and gives this examination(1). The National Teacher Examination was developed to obtain objective measurements of abilities and knowledge of prospective teachers. It is used a great deal by school systems as an aid in selecting teachers(2). The Graduate Record Examination was developed to meet the need for an objective measurement of students' abilities to do graduate work and is widely used by graduate schools throughout the United States(3). The American Association of Social Workers has been discussing the possibilities of developing a national examining unit. This unit would construct national examinations for use in state registration and licensing of social workers(4).

Most of the testing materials available in published form in the field of library science are on the college and high school level. A number of objective examinations at these levels have been developed, but data as to reliability are available on only the Peabody Library Information Test(5). The coefficient of correlation for the college form of this test is  $.88 \pm .02$  calculated by the Spearman-Brown formula. The Library Association in England regularly publishes in its Library Association Yearbook the examinations which it gives for all degrees(6). All of these examinations are of the essay type, however, and no statistical information is available on these either. Here in the United States there have been several examinations in the field of library science developed which so far have been unpublished(6a). Perhaps the best known of these is the Columbia University School of Library Service's comprehensive examination which has been given at the end of the first year of work in the library school(7). Until the school year 1948/49 at Columbia, it was possible to gain exemption from courses in the Bachelor of Science program by means of the comprehensive examination. This was open to those persons who had had substantial library experience or courses in a non-accredited library school. It was also possible to enter directly the sixth year Master's program by passing the comprehensive examination. In addition to the various library schools throughout the United States which have developed tests for use in course work, there are the national, state and city civil service examinations. Cities like Milwaukee and San Francisco have developed their own civil

service examinations for use in screening applicants for jobs in the city library. The Boston Public Library has developed a similar examination. The Indiana State Board of Certification has developed an examination which it has used in the certification of librarians for public libraries throughout the state. Virginia also has such an examination. All of these examinations are steps in the right direction, but they would be a great deal more valuable to the profession if the examinations and data on their use were available for study.

### Development of the Examination

In June of 1948 the University of Illinois Library School began offering the undergraduate courses in librarianship which make up part of the prerequisites for entrance into the fifth year Master's program. A short time before these courses were begun, work was started on what the School called its Placement Examination. This examination was to be an achievement examination made up of short-answer questions embracing the material covered in the eight core courses. These courses were The Library and the Social Order (L.S. 202), The Use of Books and Libraries (L.S. 201), Organization and Operation of Libraries I (L.S. 251--Administration and Book Selection), Organization and Operation of Libraries II (L.S. 252--Cataloging and Public Services), Literature of the Humanities and Social Sciences (L.S. 301), Literature of Science and Technology (L.S. 302), Library Materials for Children (L.S. 303), and Library Materials for Adolescents (L.S. 304).

One of the functions of the Examinations Committee of the faculty of the University of Illinois Library School has been the supervision of work on the Placement Examination of the School. In 1948, in conjunction with the office of the University Examiner, the Examinations Committee began an investigation of testing methods and procedures suitable to the material offered in the School's program. Through the University Examiner an appropriation for a Research Assistant to work with this testing program was secured. A Research Assistant was appointed and work was begun after a number of conferences on the purposes and objectives of the program had been held.

In May of 1948 the Research Assistant began work on the Placement Examination which was to cover the eight undergraduate courses and which formed the basis of the new program of the Illinois Library School. At the time when construction of the Placement Examination was begun, none of the courses which it was to cover had been taught, a condition which proved unfortunate but one which could not then be corrected. The Research Assistant assigned to the project began a study of the outlines of four of the basic courses which the faculty had prepared. These outlines were simply major topics for study and with the objectives for the courses stated in very broad and general terms. On the basis of the study which was made of the outline for each course, the Research Assistant drew up a tentative outline of materials to be included in the section of the Placement Examination which was to cover that particular course. Conferences were had with as many of the instructors who were to teach the courses as it was possible to do. In these conferences an effort was made to state as specifically as possible the objectives of the course in terms of what information the student should acquire and what skills or special knowledge he should develop.

A course objective is a personal statement of the aims of a course in terms of abilities, skills, attitudes, and understandings(8). According to another definition of an objective it is a statement of a desired change which is to take place in a student(9). This change may take the form of information which is to

be acquired in the form of facts, an increase in the reasoning power of the student in relation to material covered in the course, the location of relevant data on a particular problem posed by the instructor, the acquiring of skills characteristic of particular subjects, the determination of certain standards of technical excellence, the ability to write intelligible reports on an investigation, the consistency of application of certain points of view, or the change in the character of the student(10). Objectives should be stated in such clear and definite terms that they can serve as guides in the making of examination questions. In order to formulate the objectives for a course, the instructor may follow two methods. He may begin with broad statements of the purpose of the subject and analyze these into their various component parts and sub-functions or he may start with the content of the course and ask what the purpose of this topic is and what the students are expected to get from the topic in the terms of information, skills, etc.

With this material available, the Research Assistant then proceeded to construct short-answer questions for the Placement Examination. In order to be sure that the test emphasized approximately the same things which were to be emphasized in the course, a temporary outline of specifications indicating the relative emphasis which should be placed on each objective of the course was prepared. As each test item was written in its tentative form it was tallied in an appropriate classification and the test constructor was able to see where additional items needed to be constructed and could keep from overbalancing the test in those areas which readily lend themselves to the formation of questions. A rough draft of questions was thus prepared and discussed with the member of the Examinations Committee who was in charge of the testing program. In some cases it was possible to consult with the future instructors of the courses as to the desirability of including certain items and the exclusion of others. The instructor was asked to consider carefully the accuracy of the question both as to the correctness of the answer considered right and the technical accuracy of the information used. He was also to consider whether the meaning was clear and the wording technically correct. Wrong answers should be as plausible as the nature of the question permitted. The topic should be appropriate and sufficiently important to be part of the examination. And above all, the question must be valid in that "good" examinees would probably answer the item correctly and "bad" examinees would answer it incorrectly(11).

#### Administration of the Placement Examination

By the middle of August 1948, a total of 206 questions had been constructed and approved. These questions were constructed for only four of the basic courses and were not regarded as completely covering the material to be taught in these courses. The courses on which questions were constructed were The Library and the Social Order (L.S. 202), The Use of Books and Libraries (L.S. 201), Organization and Operation of Libraries I (L.S. 251), and Organization and Operation of Libraries II (L.S. 252). The 206 questions were divided into four sections according to the content of the course and were mimeographed for the examination. Eighteen per cent of the questions related to the course The Library and the Social Order, 26 per cent related to The Use of Books and Libraries, 17 per cent related to Organization and Operation of Libraries I, and 39 per cent to Organization and Operation of Libraries II. From these percentages it is evident that the two courses The Use of Books and Libraries and Organization and Operation of Libraries II were slightly overweighted in the Placement Examination. This may be partially explained by the fact that the material in these courses lent itself to the construction of test questions. Also, since this was the first time such an examination had been given, it was felt that it would be wiser to use all of the questions

which were available rather than trying to balance the examinations by cutting out some of these questions. Since scores were determined for each of the four sections separately, the seemingly heavy weight given these two courses was not in fact evident.

The questions on the Placement Examination were of five different types, namely, master-key, paragraph interpretation, true-false, multiple choice, and master-key and multiple choice combined. The majority of the questions on the Placement Examination were of two types: master-key and multiple choice. The explanation for this is that these were the easiest types of questions to construct. A distribution of the questions on the Placement Examination was made to show the emphasis on the type of behavior expected of the student. The questions were divided into those on terminology, factual information, and the understanding of the use of factual material or of basic principles. Of the 206 questions on the Placement Examination, 17 per cent called for definition of terms, 50 per cent required a recall of factual information, and 33 per cent required an understanding of the use of factual material or the application of basic principles.

By September 14, 1948, the Examination on the first four courses had been completed and was administered. This portion of the Placement Examination was given to those students just entering the School's new program, to those students who had had the core courses in the summer of 1948, and to students entering the sixth-year Master's or Doctor's programs. The latter two groups were asked to take the examination so as to give some basis for setting the passing scores. Using the results of the examination in an advisory capacity, those students who were just entering the new program were either allowed to begin work in the Master's program without the core courses or were advised that the completion of these courses would be necessary before they could be admitted to the advanced work. Forty-two students took the examination at this time. Twenty-three of these students had taken one or more of the courses which the examination covered during the summer of 1948 or had previously taken comparable courses elsewhere. Since this was the first time the examination had been given, students were allowed four hours to answer the questions. This proved very generous, as all of the students finished answering the examination at the end of three hours.

Since it was highly desirable for the scores on the Placement Examination to be available for counseling students as to courses for which they must register, it had been decided earlier in the summer to use International Business Machine (I.B.M.) standard answer sheets and to score the examination by means of I.B.M. test-scoring machines. The examination had been set up accordingly and all the answer sheets were scored this way in one day. A score was secured for the questions on each course which the examination covered. The critical or passing score was set at that point which would eliminate fewest of those students who had previously taken the courses and pass fewest of those students who had not taken the course. In addition, it was set so as to depart not too far from the mean. In all cases the critical score was about 70 per cent of the maximum score for the test. On the basis of the scores which examinees received on the Placement Examination, the students who had not taken the basic courses or their equivalent were either allowed to enter the Master's program without these courses or were told that they must make up the deficiencies during the school year.

#### Item Analysis Technique

As a result of the scores made on the Placement Examination, seven students were allowed to enter the Master's program without having actually taken all of the undergraduate courses. Some students were exempted from all of the undergraduate courses, others were exempted from only one of the courses. In order to check

the reliability of the examination in ascertaining knowledge which had been acquired, an analysis of grades received in graduate courses which depended upon knowledge acquired in the undergraduate courses was made for those students who were exempted from the undergraduate courses and for those students who took the undergraduate course. In all but one case the grades made in the advanced courses by the students who were exempted from the prerequisite undergraduate course were as good as or better than those made by students who had taken the undergraduate courses. Individual differences would probably account for this one case. The mean grade in advanced courses made by students who were exempted from the undergraduate courses was B+, while the mean grade made by those who had taken the undergraduate courses was also B+. With as few cases as are available at the present time, it is not possible to interpret these data as validating the examination. For example, it is possible that the advanced courses do not actually build upon and add to what was learned in the undergraduate work.

In order to know how well or how poorly each question on the Placement Examination had discriminated between those students who passed the examination and those students who failed the examination, an analysis of each question was made. This analysis of questions included the index of difficulty, the index of discrimination for each question, and the percentage of the total number of students taking the examination who chose each of the possible answers to the question. A sheet for recording this data for each question was worked out. A copy of this sheet is shown below.

FIG. 1

Item Analysis Record Sheet Used in the Analysis of the  
University of Illinois Placement Examination

(Content) \_\_\_\_\_ . (Behavior) \_\_\_\_\_ .

UNIVERSITY OF ILLINOIS LIBRARY SCHOOL TEST ITEM RECORD

- A: Statement of item (on other side; \*indicates correct answer).  
B: History of use and analysis of behavior of test item.

(1) Date of Test	(2) Course No.	(3) Item No.	(4) N Taking Test	(5) % Passing Test	(6) Index of Difficulty	(7) Index of Discrimination	(8) % of N Not Answering Question
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- C: Analysis of behavior of distractors.

A		B		C		D		E	
(9) % of N Choosing A	(10) % of 9 Passing Whole Test	(11) % of N Choosing B	(12) % of 11 Passing Whole Test	(13) % of N Choosing C	(14) % of 13 Passing Whole Test	(15) % of N Choosing D	(16) % of 15 Passing Whole Test	(17) % of N Choosing E	(18) % of 17 Passing Whole Test

The item analysis sheets will help in revising the examination for future use. The index of difficulty and the index of discrimination for each question, used in conjunction with each other, indicate the extent to which separation of those students who knew the answer from those who did not occurred. The analysis of the behavior of the distractors (i.e., wrong answers listed as possible choices) will help in determining how the question may be changed so as to increase the effectiveness of the question. An example of the item analysis technique, as it was used, is given later.

An examination is no better than the items which make up the examination. In analyzing the items or questions on an examination some measures of the difficulty and the discriminating power of the items are essential. The difficulty of the item may be obtained by dividing the number of students who mark the right answer by the total number taking the test, or by dividing the number of students who do not mark the right answer by the total number taking the test. In the first case a difficulty of 70 per cent means that 70 per cent of the students answered the item correctly. This would make the measure of difficulty of test items run from 100 to 0 where 100 indicates that everyone answered the item correctly and 0 that no one answered the item correctly. In the second case a difficulty of 70 per cent would mean that 70 per cent of the students did not answer the item correctly, and a difficulty of 100 would indicate no one answered the item correctly and 0 that all answered the item correctly. The second method was used in this work.

The difficulty of the test items should range from very easy to very difficult with the average difficulty about 50 per cent. If the test is to rank students from best to worst or highest to lowest, the difficulty may go as high as 100 per cent. The difficulty of a test is not known the first time it is given unless there has been some pre-testing done. Expert opinion is the only method of establishing the difficulty in this case. If one uses a revised edition of an examination, then the difficulty of the items has been tentatively established and the difficulty of the test may be calculated. It is generally agreed by test constructors that an examination should have a mean index of difficulty of about 50 per cent. Some questions should have an index of difficulty of lower than 50 per cent and others higher, with the majority having a value of close to 50 per cent. The questions on the Placement Examination should not have proved extremely difficult for students to answer correctly. The mean index of difficulty for all of the questions on the examination was 29 per cent. The indices of difficulty for these questions ranged from 0 per cent to 98 per cent.

In conjunction with the difficulty of the item, the discriminating power of the items or the index of discrimination must be used. The index of discrimination is a figure showing the relationship between the number of students who passed the test and answered the question correctly and the number of students who failed the test but answered the question correctly. The critical ratio, the bi-serial coefficient of correlation, the phi coefficient, and the product moment coefficient of correlation have been used as measures of the index of discrimination. Davis recommends as the most satisfactory measure of this relationship the use of the bi-serial coefficient of correlation between the total score and the score on the item. He makes use of a table worked out by Flanagan utilizing as a basis the percentages of examinees in the highest and the lowest 27 per cent of the group who answered the item correctly to determine the index of discrimination. The index of discrimination would range from -100 where all of the examinees who scored high on the examination did not answer the item correctly and all those who scored low on the examination did answer the item correctly to +100 where the high scoring examinees answered correctly and the low scoring examinees did not answer correctly. Other less refined methods of calculating the index of discrimination



in this same general pattern can be worked out by the test constructor, as was done here. The indices of discrimination for the questions on the Placement Examination ranged from  $-34$  to  $+73$ . The mean index of discrimination was  $+14$  and the median was  $+11$ .

In addition to the information which was recorded on the item analysis sheet, there was computed the coefficient of reliability for the whole examination, the coefficient of correlation between the Placement Examination scores for the four sections of the examination and grades for these courses taken prior to the examination, and the standard deviation for each section of the examination. The coefficient of reliability is one figure indicating the relationship between scores on two equivalent tests. The Kuder-Richardson formula, which approximates this figure when only one test score is available, was used in computing this coefficient for the Placement Examination. A high coefficient of reliability means that if the same or an equivalent test were given to the same students, the scores for each student would be the same as or very close to the first score obtained. The coefficient may range from  $-1.00$  to  $+1.00$ . The coefficient of reliability for the Placement Examination was  $+.847$ .

The standard deviation is a figure showing the range or variability of scores on a test. A low standard deviation in relation to the total possible score means that the range of scores is small, and, conversely, a high standard deviation means that the range is wide. Two-thirds of the scores will fall within one standard deviation of the mean, plus or minus. Standard deviations ranged from  $6.0$  to  $4.8$ . The mean standard deviation was  $5.5$ .

The coefficient of correlation is a figure which shows how closely two series of figures correlate or match. If there is perfect correlation, the coefficient of correlation is  $+1.00$ ; if there is absolutely no correlation, the coefficient of correlation is  $0$ ; and if one series is high when the other is low, there is negative correlation which approaches  $-1.00$ . The coefficient of correlation for the scores on the four sections of the Placement Examination with the grades secured by the same students who had taken those courses earlier were  $.03 \pm .15$ ,  $.14 \pm .15$ ,  $.49 \pm .12$ , and  $.82 \pm .05$ . There was some correlation in all cases, but only in the last two was this any better than zero. The standard error of the coefficient of correlation for the first two coefficients makes them possibly less than zero. Only in the last case is the coefficient sufficiently large to warrant accepting it as denoting a high relationship.

#### Revision of the Placement Examination

Using the results of the analysis of each item in the Placement Examination, the section of the Placement Examination which was given in September 1948 was revised. The data which were collected by the analysis of the examination as a whole and the individual items were used in three main ways. These were to improve the test for immediate re-use, to improve the items on the test and hence improve future tests, and to gain insight into the characteristics of good and poor items so as to be able to construct more efficient test items. Items with a low index of difficulty and/or a low index of discrimination were scrutinized to see if any change in the wording of the question or the possible answers would raise either one or both of these indices. If this were not feasible, the question was scrutinized to see if the entire question could be remade to focus on only one book, fact, or process. In studying the questions on the Placement Examination, some of them were discarded entirely. This was the general procedure when both indices used in the analysis were zero or not a great deal better than zero.

The following is a question taken from the first edition of the Placement Examination which has been analyzed to show the item analysis technique which was used in the revision of the Placement Examination:

Which one of the following titles constitutes a current supplement to the British publication, The Dictionary of National Biography:

- (A) Britannica Book of the Year
- (B) Dictionary of American Biography
- (C) Thomas's Universal Pronouncing Dictionary of Biography and Mythology
- (D) Who's Who
- (E) Who's Who in America

Answer keyed as correct: D

This question approaches the level of question which is desirable. The index of difficulty (28 per cent) is not high, but the index of discrimination is high (73 per cent). All of the students who passed this section of the examination answered this item correctly. Of the students who failed this section of the examination, only 27 per cent were able to answer the item correctly. In revising this question, answers C and E could be changed as they were of no value as distractors to those students who did not know the answer. Other choices might increase both the indices of difficulty and discrimination by proving more attractive to students who fail the examination but not to those students who know the answer. Answers C and E could be changed to Current Biography and Webster's Biographical Dictionary to achieve these aims. In the second administration of the Placement Examination where these changes were made the index of difficulty rose to 68 per cent. No data are available on the index of discrimination at this time. All distractors were operative in this revision of the item. The word "current" in the title Current Biography was a possible big distractor as 44 per cent of the students chose this answer as being correct.

After the revision of the questions on the first four courses of the Placement Examination had been completed, the Research Assistant began to study the content of the courses not previously covered by the Placement Examination and began to construct questions on these courses. Since the courses had been taught at least once by this time, a conference was had with the instructor in which the objectives and the factual content of the course were discussed. With this information, the Research Assistant studied the content of the course and drew up a list of possible areas in which questions might be constructed. He then proceeded to construct as many and as diverse questions as possible. The instructor then studied the first draft of these questions and discussed them with the Assistant. Changes were made in the questions until a satisfactory set of questions covering the content of the course was worked out. These questions were then checked by the member of the Examinations Committee in charge of the Placement Examination. The final draft of the questions was checked for form and was mimeographed. The procedure was followed with each of the four courses not covered by the first edition of the Placement Examination.

### The Future of the Placement Examination

The University of Illinois Library School realizes that the Placement Examination is not a perfect examination. For that reason plans have been tentatively worked out for future work on the examination. One of the most pressing of the things to be done is the statement of complete objectives for each of the eight courses which are covered by the Placement Examination. Without these statements of objectives it will be difficult to validate the examination and to improve it.

In addition to the statement of objectives which is needed for ascertaining the validity and reliability of the examination, more examinees are needed. Since Illinois alone cannot supply the number of examinees needed for this work, the cooperation of other library schools and the librarians of the nation will be needed. If a sufficient number of examinations from many different levels of achievement are available, norms for the examination can be set up. The Placement Examination needs to be enlarged and revised in the light of the continued teaching of the undergraduate courses in librarianship. A battery of test items should be built up so that any future examination to be given may be self-consciously constructed using the data given on the item analysis sheet as a guide to the indices of discrimination and difficulty and the behavior of the distractors. Thus any one examination could be made up of any number of pretested items to meet any standards desired, and the same questions would not necessarily be repeated in each subsequent examination. If the battery of test items were large enough, it would not then be necessary to keep the previous edition of the examination under lock and key. Any person who learned the answers to all of the questions on all of the examinations which had been released would in effect know the material covered and would, therefore, have achieved the same result as if he had taken the courses in some library school.

The Illinois Placement Examination seems to have definite possibilities for further development into a testing tool which would be valuable to library schools and to libraries. It would seem possible for the Placement Examination to develop into a national examination(12). In 1934 the American Library Association went on record as favoring certification for librarians. To date none of the states have done much more than certify a librarian upon the completion of a certain number of hours of library science in an accredited school. How much the librarian actually knows is left to the school to ascertain before "passing" or "failing" the individual in question. It would seem possible to allow a person with experience to take an examination of some kind and, if he passed it, become a certified librarian. This would enable the American Library Association to certify librarians in much the same way as the American Bar Association certifies lawyers. A central certification center would provide for setting certain standards of performance and nation-wide registration and licensing. The Placement Examination might also be used in granting admission to all of the library schools of the nation. It would seem that there are certain fundamental processes and facts which must be learned before advanced work in librarianship can be done. These processes and facts should be fundamentally the same in every section of the nation. If this is so, then advanced work must build on this knowledge. Therefore, it would seem desirable that admission to advanced work should be allowed only upon the successful passing of an examination which covered this knowledge. It is possible that libraries may see fit in the future to require a transcript of the score received on such an examination to be used in conjunction with reference and personal characteristics in choosing new employees.

It is admitted at the outset that such an ambitious plan as set forth here would require many years of work and the cooperation of the entire profession. Such a system as seen here would lead to a furthering of librarianship as a profession if for no other reason than that of setting national standards which must be met before any person may be cited as a certified librarian.

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## FOOTNOTES

(1) Rules for Admission to the Bar in the United States and Territories (St. Paul, West Publishing Company, 1949), p. 6.

(2) David G. Ryans, "The 1948 National Teacher Examination," Journal of Experimental Education, XVII (September 1948), p. 3.

(3) Graduate Record Examination, The Graduate Record Examination; A Descriptive Prospectus for College Students (November 1942), p. 6.

(4) Alice Padgett, "A National Examining Unit for Social Work," The Compass, XXVII (January 1946), p. 18-23.

(5) Louis Shores and Joseph Moore, Peabody Library Information Test: College Level, Form A, Directions and Keys (Minneapolis, Educational Test Bureau, 1940), p. 2.

(6) Library Association, Yearbook (London, The Library Association, 1893- ).

(6a) Alice I. Bryan, "The Testing Program in the Library School," Library Quarterly 9 (1939) 32-62.

(7) Columbia University School of Library Service . . . Announcement . . . 1947-48 (New York, Columbia University Press, 1947), p. 9-10.

(8) American Council on Education, The Use of Tests in College (Series 6, No. 9, Washington, the Council, 1947), p. 2.

(9) Ralph W. Tyler, Constructing Achievement Tests (Columbus, Ohio, Ohio State University, 1934), p. 14.

(10) Eugene R. Smith and Ralph W. Tyler, Appraising and Recording Student Progress (New York, Harper, 1942), p. 18.

(11) Dorothy C. Adkins, Construction and Analysis of Achievement Tests (Washington, U. S. Government Printing Office, 1947), p. 73.

(12) Charles C. Williamson, Training for Library Service (N.Y.: Carnegie Corp., 1923), p. 28-29.

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