

SCIENCE

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THE NEW HARVARD ENTRANCE REQUIREMENTS¹

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In this address (a free abstract of which, written out later, is here given) it should be clearly borne in mind that the speaker is familiar only with eastern admission arrangements, and that what he says is wholly from the point of view of an eastern institution, with its own problems, in some respects different from those which meet the schools and universities of the west. Indeed, a knowledge of the real entrance requirements in any institution, as distinguished from the catalogue rules, can be gained only from an acquaintance with actual practise, for in the nature of the case the real requirements depend on the mode of administering the rules.

I

The earlier entrance requirements at Harvard, as at all contemporary institutions, were determined by the fact that the subjects studied in school were generally to be continued in college. It was accordingly necessary to know whether a boy who applied for admission had reached the point in Latin, Greek and mathematics where he would be able to go on with college work in those subjects. This was substantially the case until soon after the beginning of the administration of President Eliot in 1869. A process of radical modification in the Harvard entrance requirements then began, and at successive periods since, about ten years apart, there have been important and far-reaching changes.

¹ Address at the annual meeting of the Michigan Schoolmasters' Association, Ann Arbor, Mich., March 31, 1911.

The chief points in these changes appear to have been three: (1) a substitute for Greek has been provided; (2) with the development of the elective system the subjects studied by college students have in most cases become different from those which they have pursued in their school courses, and it is consequently necessary to learn not the degree of their attainment in Latin, Greek and mathematics, but whether they are competent to carry on studies in history, economics, modern languages and science; (3) it has been intended to aid the schools by setting in the several examinations a standard for school work to which the schools can hold up their boys. In pursuance of this last idea there has been a tendency to provide examinations in some subjects in which hardly any boys were likely to offer themselves, but which some schools wished to teach, and in which the college was told that such an examination standard would be found valuable.

In the successive changes made at Harvard, chiefly in 1871, 1878, 1886 and 1898, can be seen the working of these various motives, and especially can be traced a gradual process by which the substitute admitted for Greek, at first partial, has become complete, and has finally been made not much, if at all, more difficult than the Greek requirement.

The present plan of Harvard entrance requirements was adopted by the faculty in 1898, although the form of statement has since become somewhat changed. It includes a large number of optional subjects, many of them having a weight of not more than one "point" in the system. These options are in some (and the most important) cases real, in the sense of being practically available for schools, but in most cases they are illusory, because very few of the schools from which boys come

are equipped to fit boys in these less usual subjects. The chief technical peculiarity of the Harvard system is that the numerical values attached to the different subjects are not based wholly on the relative time supposed to have been expended on those subjects in the high-school course, but have been adjusted on the theory that work done in the last two years of the high-school course ought to be given a higher rating than the work of younger boys. Accordingly, in determining the "ratings" a coefficient was introduced corresponding to the stage in the school course at which the subject would commonly be studied.

II

Under this system of complete examinations for all high-school studies, which differs but little in theory from that of the other eastern institutions where examinations are required, some good results have been felt in the schools from the establishment in certain fields of study of definite standards tested by a college examination; and in general the system has provided a method, though an imperfect one, of selecting from the whole body of applicants those who were best fitted to undertake college work. About 75 per cent. of those applying have usually been admitted to the freshman class, as is shown in the table given below. At the same time certain bad results have been more and more clearly perceived, both from the point of view of the college and from the side of the schools. The latter, indeed, have not been slow to present complaints. And these bad results seem to be necessarily consequent upon the system itself. The gradual perfecting of an inherently defective type of machine has naturally brought out more and more clearly the working of its defects.

1. The system has resulted in loading a

large part of the freshman class, usually amounting to one half or more, with entrance conditions, and thereby making more difficult the task of the weaker members of every entering class. From the college point of view this difficulty has become intolerable, since it prevents the establishment of a proper pace of work for freshmen.

2. The Harvard system of examinations can ordinarily be prepared for without serious difficulty by any school which devotes itself mainly or largely to that end, and which boys attend for three or four years before entering college and with the purpose of fitting themselves for Harvard. It is not, however, adjusted to the courses of many excellent schools throughout the country—schools wholly occupied with substantial academic subjects and doing first-rate work in those subjects, and it is likely to exclude any boy who makes up his mind late in his school course that he wishes to go to Harvard. In other words, it is a system which was natural so long as resort to Harvard was wholly from private and endowed schools and a half dozen public high schools which made a business of fitting for Harvard and other eastern institutions. If Harvard is to offer the melting pot of a common academic life to boys from many parts of the country, it must adapt itself to the best systems of public education maintained in those widely distant regions. By dictating the whole school course as it does, the present Harvard entrance system unduly restricts the possibility of resort to Harvard College from other schools than that very small number which have for one of their primary objects to be Harvard fitting schools.

3. As a method of selecting the best from the whole body of applicants for admission to the freshman class, the present system is

imperfect. It admits to the class a certain number of boys who can do nothing well, but have been crammed to pass every one of the examinations with the lowest pass mark. These boys often get in clear of conditions, but usually come to grief in the first semester. A satisfactory system would exclude them from admission. On the other hand, some have to be rejected who would do well in college if they once got in.

Harvard College does not crave any considerable increase in numbers. What it does desire is the resort of about the same number of young men, but of better students from a wider range of territory. We should like, not a larger number of freshmen, but a larger number of applicants from whom we could make our selection of the best.

As the three evil results already mentioned are observed from the side of the college, so the two following have been urged, and it is believed with justice, by the schools.

4. A system of examinations which, like the present one, aims to test every subject studied in a four-year school course makes it necessary for every subject to be continued in the course in some form until the time for the examinations. Under the system of the German gymnasium the subjects are practically all carried down to the close of the last year, the stream of the minor subjects being kept slender yet sufficient to maintain the flow. The American school system is of a different character, and consequently it is necessary for the American school to review in the last year, or the last two years, those subjects upon which the boy is presently to be examined. This produces a spirit of "cram," deeply regretted by the school-masters, together with a serious overcrowding of the last year, or two years, of the school course.

An elaborate examination of school programs from good schools in different parts of the country recently made at Harvard has fully convinced us that the complaints of the schoolmasters in this matter are justified. If it be urged that the examinations can now be spread over three years, it is to be observed that the college examinations are necessarily adapted to the stage of maturity of boys nearly ready to enter college, and are, consequently, for the most part out of the range of a boy completing the second year of his high-school course.

5. Under the present system of entrance to Harvard College, not only is the course of study in the schools fixed from above, but also the methods of teaching have been dictated by the college. This has taken from the schools freedom to experiment with their own methods of education, a freedom which able and enterprising teachers crave, and ought to have. A certain relief, it must be said, has been found here in the examinations of the College Examination Board, but it appears to be only a partial one.

6. One further bad result upon the schools more directly under the influence of Harvard should be mentioned. The examination system has enfeebled their power to take responsibility for the quality of their own product. As Harvard has undertaken to test every subject studied in the school course, the school has been responsible for meeting these tests, not for maintaining its own ideal and type of education. Indeed, it was hardly open to it to form its own educational ideal or specific type at all.

III

These various incidental bad results of the present system have led the Harvard faculty to a complete reconsideration of

the principles which ought to govern a plan of entrance requirements, and to the adoption of a new system which, for the present, will be maintained side by side with the old system, the applicant having his choice whether he will come up for admission under one or the other plan.

In framing the new system the consideration chiefly in mind has been that entrance requirements must always test two things:

1. Whether the applicant has had an adequate school course. Inasmuch as a bachelor's degree represents the completion of the whole course of liberal education, it necessarily includes a guarantee that the earlier as well as the later part of the student's education has been adequate in range and intensity. The college is responsible not merely for college work, but also for knowing whether the school work has been devoted to such subjects as, in its opinion, may properly form a part of the education finally attested by the bachelor's degree.

2. What result has been accomplished by such a course of school study in developing effective ability in the individual boy or girl. This latter test has for its object to determine whether the applicant is likely to be able to do college work well.

Now these two ends for which college entrance requirements exist are entirely different in nature. The character of the applicant's course of study is a very different thing from the practical result in the boy as he stands. The former can be adequately ascertained by proper inquiry and by inspection of the school course he has actually pursued; the latter can only be determined by recitations, examinations, or some similar test, conducted either by the school or the college. The present examination system undertakes to reach both these ends by one instrument—a system of

examinations. The results have been outlined. It would seem better to adopt for each of these ends a method directly contrived to accomplish that particular purpose, and not to try to perform two distinct processes by a machine mainly adapted to one only.

Both in regard to the course of study and to the result of that study, the school and the college have each a distinct responsibility. The general type of school course which is to be accepted as a part of the whole education to be attested by the degree of A.B. or S.B., may, and indeed must, be determined by the college which gives the degree. But under that general type the details of curriculum and of methods of instruction are more likely to be effectively arranged by the school itself than by the authorities of the college. To deprive the school of its freedom and consequent responsibility is to weaken its power of maintaining and pursuing an educational ideal. On the other hand, the testing of the result of the school education belongs to the college, and an adequate test ought to give evidence of general intellectual power, not merely of the faithfulness with which a boy has studied individual subjects at school. The idea that an education consists in absolving individual courses, whether at school or college, is, at the present day, the root of much evil.

In New England, as elsewhere, one of the difficulties of which the schools have complained has been alleviated by the certificate system, which, through the co-operation of the colleges in the New England Certifying Board is now well organized with strict standards. Colleges which thus give to certain schools the privilege of certifying to the preparedness of their graduates for college thereby relax their control, not indeed over the subjects studied, but over the method of in-

struction in the individual subjects; and this has proved a considerable relief. But the certificate system, at least as organized in New England, violates both of the principles which have been laid down above. Under it the domination of the college over the topics which are to make up the school curriculum, over the relative weight which shall be given them, and over other details which properly belong to the judgment of the school, is quite as close and harassing as under the examination system. On the other hand, that portion of the task which is the rightful prerogative of the college, namely, the determination of how well the schools have done their work, is abandoned by the college and handed over to the headmasters of the schools, who certify, not merely that the boy has done such and such work in his school course, but that, in the opinion of the master, he is fit to enter college. In both these matters the certificate system has reversed the proper procedure, and puts the responsibility on the wrong side.

IV

Under the influence of considerations like these, the new plan already spoken of has been adopted at Harvard College. The following statement of it has been sent out widely.

NEW REQUIREMENTS FOR ADMISSION TO HARVARD COLLEGE

To be admitted to Harvard College, a candidate

- (1) Must present evidence of an approved school course satisfactorily completed; and
- (2) Must show in four examinations as explained below that his scholarship is of a satisfactory quality:

SCHOOL RECORD

A candidate must present to the committee on admission evidence of his secondary school work in the form of an official detailed statement showing

- (a) The subjects studied by him and the ground covered.
 - (b) The amount of time devoted to each.
 - (c) The quality of his work in each subject.
- To be approved, this statement must show
- (a) That the candidate's secondary school course has extended over four years.
 - (b) That his course has been concerned chiefly with languages, science, mathematics and history, no one of which has been omitted.
 - (c) That two of the studies of his school program have been pursued beyond their elementary stages, *i. e.*, to the stage required by the present advanced examinations of Harvard College or the equivalent examinations of the College Entrance Examination Board.

THE EXAMINATIONS

If the official detailed statement presented by the candidate shows that he has satisfactorily completed an approved secondary school course, he may present himself for examinations in four subjects as follows:

- (a) English.
 - (b) Latin, or, for candidates for the degree of S.B., French or German.
 - (c) Mathematics, or physics, or chemistry.
 - (d) Any subject (not already selected under (b) or (c)) from the following list:
- | | | |
|--------|-------------|-----------|
| Greek | History | Physics |
| French | Mathematics | Chemistry |
| German | | |

These four examinations must be taken at one time, either in June or in September.

In announcing this plan, the committee on admission wish to point out that it differs in essential principles from the old plan now in use, and that therefore comparisons between the new requirements and the old will be misleading if any attempt is made to express the new requirements in the terms of the old. Under this new plan the college does not intend to prescribe in detail the school course of the boy who wishes to enter, either directly by naming and defining subjects, or indirectly by an elaborate system of rating the studies of a school course in points or units. On the contrary, the college accepts the judgment of a school as to a candidate's program, subject only to the general limitations stated above. It is not necessary, therefore, for a school to fit a candidate's course to detailed definitions of subjects. A good student who has had a rationally planned course in a good school should have no difficulty in

proving his fitness for admission, even though his decision to come to Harvard be made late in his last school year. Under the new plan every school maintaining the kind of course indicated will be free to work out its own system of education in its own way. The college, on its part, undertakes only to test the intellectual efficiency of the boy at the time of his graduation from school. For this reason the examinations can not be divided.

A second important difference between the new requirements and the old is the emphasis put in the college examinations upon quality of work. The new plan contemplates examinations different from those now used with respect both to their character and the method in which they will be administered. It is hoped to secure a type of examination which shall be adapted to various methods of teaching, and which shall contain questions sufficient in number and character to permit each student to reveal the full amount and quality of his attainment. In administering examinations under this plan, the committee will always consider examinations in connection with school records, and will endeavor to see not whether a candidate has done a certain prescribed amount of work in a certain way, but whether the general quality of the candidate's scholarship is satisfactory. If a candidate is admitted, he will be admitted without conditions; if he is refused admission, no credit will be given for examinations in the separate subjects in which he may show proficiency, and the refusal will mean that his school record and his college tests do not show that he has the scholarship which makes his admission to Harvard College desirable.

The admission of a candidate under this plan, therefore, depends upon good scholarship as shown in two ways—in his school work and in his college tests. He can not secure admission by scoring points or by working up examinations one or two at a time. He must have done good work in his school according to the testimony of his teachers; and he must meet successfully college tests at the time when he is ready to enter.

In introducing this plan, which departs considerably from schemes of admission now in general use, the college is already aware of various grave difficulties. It will doubtless be difficult to prepare a type of examination paper sufficiently flexible to fit various methods of instruction in various parts of the country, and to enable all candidates to exhibit the full amount and quality of their attainments. To accomplish this end, the committee on admission are authorized to advise

with school teachers in regard to the preparation of papers and the methods and standards of marking; and they confidently hope for the cooperation of schools in working out a plan which they believe will serve the common interests of both schools and colleges.

The scheme, as above outlined, aims to determine by inquiry whether the boy's school work shall be counted as a sufficient preliminary education, and then to test by a sufficient number of examinations, not however, covering the whole school course, what has been the result of the education in the boy's power to do intellectual work. Each of these methods seems apt to the end desired, and careful provision has been made for keeping these two inquiries distinct.

The essence of the scheme is, in fact, that the admission of boys to college is now entrusted to a committee which is expected to use a large discretion under the limits laid down in the regulations. This committee will assemble a sufficient general knowledge of the schools from which boys come, such knowledge as can now be obtained by various trustworthy methods, even from distant parts of the country. It is further provided, through the certified record of the boy presented by the master of the school and through the results of the examinations, that adequate information on the two points emphasized above will be at the committee's disposal.

The restriction upon the type of school which will be allowed to send boys up to become candidates for the bachelor's degree is here made, not, as at present, through the list of examination subjects with their accurate ratings, but through the statement of the course actually pursued by each boy, with the grades attained. The college does not intend to alter at all its policy of requiring that the boy's education shall have consisted mainly of substantial academic subjects. No school

course will be accepted which includes any large dilution of manual and technical work.

The examinations are to be of a somewhat different type from those hitherto used, or, at any rate, the treatment of the examinations by the readers and by the committee is intended to be different from that which has been given to examinations in the past. The purpose of the examinations is not to test the work of the several courses of the school, but to sample the boy, as a cargo of cotton might be sampled from taking tests from different representative bales. Further, the object of the examination is not to see whether the boy can get a pass-mark in any one, or in all, of the subjects. It will rather be to bring out how much the boy knows. It is hoped that for his free (fourth) subject he will choose the field he can do best in, and so will be given a chance to exhibit himself at his best. Likewise, it is hoped that the schools will now be able to carry boys to more advanced work in those subjects (as, for example, classics or mathematics) in which they are best equipped—for they can do so with the confidence that the result of that special proficiency in certain subjects will be manifest in the examination, and recognized by the admission committee. The marking of the books under the new system will require that in every case a statement by the reader in words shall give his opinion of the actual quality of the boy as exhibited in that examination. There will be no mechanical adding of grades. It will be impossible to enter on a bare pass-mark in the several subjects. Indeed, it is difficult to say under the new system what would constitute "passing" any one examination. The only "passing" that is contemplated is the evidence, *drawn from the four examinations taken together*, that the boy has at-

tained a satisfactory quality of mind. He is expected to make a *creditable* exhibition of himself, and it is hoped that the system will exclude the boy who, under the old system, probably by the aid of a skilful tutor, can just scrape through every examination. It is hoped that in good schools the new system will make it easier for the school-master to prepare boys for Harvard; but it is not intended to make entrance to college in any way easier for the *boys*.

Inasmuch as the inquiry relates to the intellectual power of the boy at the moment when he stands ready for entrance, it is obvious that the examination can not be divided into preliminary and final. For the same reason, the evil of conditions will be wholly eliminated by the new system. A boy either is or is not fit to enter college. If he is not fit, then he must either abandon the idea or else go back to school and study until he becomes ready. There can be no conditions.

It is not the intention by the new system either to raise or to lower the "standard" of admission. That is to say, it is hoped that in a four years' course the amount of intellectual effort which a boy has to put out in order to prepare for Harvard will be as before. But a smaller proportion of it will be mere cram.

	1906	1907	1908	1909	1910
Admitted to freshman class	576	594	529	573	565
Rejected, or withdrew before completing the examination ..	166	164	147	197	221
Admitted provisionally as special students	66	40	12	0	0
Total number of applicants for admission to freshman class	808	798	688	770	786
Per cent. admitted to freshman class ...	71.3	74.4	76.9	74.4	71.9

The present policy of Harvard in admitting students can be seen from the above statistics, which are complete for the years covered.

Of those admitted in the past five years there are undoubtedly some who would have been rejected if they had been compelled to come up under the new system. Many of these have failed, or will fail, to complete their college course, at least with credit. Of those registered, some could probably have gained admission if the new system had been open to them; and of these a large proportion would very likely have shown distinction in their subsequent college course. What the effect will be upon the size of the classes admitted to Harvard College, when most of the applicants shall come up under the new system, is not easy to forecast. There has been some apprehension that the percentage of boys admitted will be considerably reduced, but it is hoped that the larger number of schools which will now find themselves able to prepare boys for Harvard will counterbalance this tendency, and prevent any large reduction in the numbers of the future entering classes.

V

In conclusion, a few words may be added as to the general results which it is hoped to secure from this new plan when it goes into full operation. These results are of widely varying kinds.

1. Harvard College hopes to secure a better body of freshmen, for they will have been selected from the whole number of applicants by more nicely adapted methods, and they will be free from conditions and therefore able to do better work.

2. A large number of excellent schools of the accepted type, now unable in their regular curriculum to fit boys to enter Harvard College, will, it is hoped, under

the new system find themselves able to do so without extra work. This applies to some public schools in New England and to a large number in other parts of the country. At present, there are only fourteen public high schools which have sent to Harvard College one boy a year for the past ten years, and all of these are in eastern Massachusetts.

These two results are primarily significant for the college. The other desired results, if they come about, are broader in their educational significance.

3. Schools of the approved type will, so far as Harvard College is concerned in the matter, gain the freedom which they require for doing their best work, since the new system will make it possible for them to concentrate their efforts by treating more thoroughly fewer subjects, or fewer topics of a subject. The great need of students in schools, as well as in colleges, is that they should acquire a habit of doing well what they undertake to do; the greatest evil in education at present is that students are satisfied with mediocrity.

4. The new system gives some help toward an adjustment of the problem of educating together in one school students preparing for college and students preparing for other callings. It does not wholly solve this problem, but it ought to tend somewhat to relieve it. The problem itself is insoluble. Preparation for a definite vocation must be determined by the character and needs of that particular vocation, and college is a vocation for a young man of seventeen to twenty-one just as much as service in a banking house or factory, and, like those vocations, it has its own conditions of fitness. Different needs can not all be provided for under one system of education. Nevertheless, some parts of a school course are an excellent preparation both for college and for an immediate

practical career, and the new system of examinations, under which requirements in specific subjects are kept as high as before but the subjects less closely defined, will, it is hoped, give as much freedom here as the nature of the case permits.

5. The new plan leads away from emphasis on single courses, and insists on the significance of the education taken as a whole. In accord with this underlying idea it is free from all attempts to determine the relative value of subjects as expressed in numerical ratings. In this respect it has a general educational importance, and ought to remove many causes of friction now existing between schools and colleges.

JAMES HARDY ROPES

HARVARD UNIVERSITY

THE BOLYAI PRIZE. II

INTEGRAL EQUATIONS

In these latter years, Hilbert has above all occupied himself with perfecting the theory of integral equations. We know that the foundations of this theory were laid some years ago by Fredholm; since then the fecundity of his method and the facility with which it may be applied to all the problems of mathematical physics approve themselves each day with more luster. This is certainly one of the most remarkable discoveries ever made in mathematics, and for itself alone it would merit the very highest recompense; if to-day, however, it is not to the first inventor, but to the author of important improvements, that we have decided to award the Bolyai prize, it is because we must take into consideration not only Hilbert's works on integral equations, but the totality of his achievement, which is of importance for the most diverse branches of mathematical science and of which the other parts of this report permit us to appreciate the interest.