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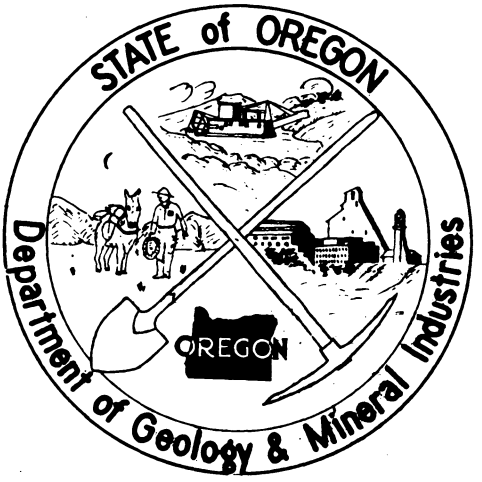

STATE DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
Head Office: 702 Woodlark Bldg., Portland 5, Oregon



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# IT IS JUST NOT SO

by

George W. Gleeson
Acting Dean of Engineering, Oregon State College

Criticism has been aimed at the curricula of our engineering schools for failure to include more "cultural" subjects, and engineers will be interested in facts presented by Dean Gleeson to show that engineers are not, as has been often alleged, deficient in understanding of subjects outside their own profession.

Engineers as a group lack culture, lack appreciation for the "finer" things of life, lack understanding of contemporary political, economic, and social institutions, and, in general, exist at an inferior educational level. DON'T YOU BELIEVE IT.

In the last two or three years, a distinct national pattern has developed in technical education wherein emphasis has been directed toward broader understanding of the social science fields. As a corollary to this development, the "appreciation fields" of art and literature have received due consideration. Perhaps the most significant outcome of the various deliberations is the recommendation recently adopted by the Society for the Promotion of Engineering Education in which it is suggested that technical curricula specify approximately 20 percent humanistic subject matter as a degree requirement. This recommendation has been the subject of extensive debate, but it is quite evident that the principle of a broader base for technical education is, in general, favored by the technological professions and curricula patterns are developing in this direction.

It should be emphasized that the above described trend reflects the deliberations of the technical fraternity, and that it is not in response to the pressure of various unaffiliated groups. Furthermore, the recommendations in no manner infer indorsement of any particular humanistic field or, what is more important, of current teaching practices or subject matter selection in these fields. Briefly, the technologists have concluded that it is evidently necessary for them to expand their activities outside the technical sphere if they are to accomplish their objectives.

It is not surprising, but it is unfortunate, that many groups have taken advantage of the circumstance of the broadening of the pattern, particularly of engineering education, to "grind their axes." The engineer has once again become the subject of discussion among the "cultured," and his "shortcomings" have been the theme of such effective propagandism that even many in the engineering profession have engaged in self condemnation. Suppose we adhere to our proved procedure and <u>look at the facts</u>.

The statement of Dr. W.S. Learned before the seventh session of the Conference on Examinations, Dinard, France, in 1938 gives a clue. Said Dr. Learned in part " . . . students of engineering absorbed far more general academic knowledge than students either of education or of business even when their average intelligence test records showed them to be of approximately the same ability." Surely, such a statement provokes further reading and reference to "The Student and His Knowledge", Bulletin 29, Carnegie Foundation for the Advancement of Teaching, provides somewhat startling information. The report is lengthy, and the following resume does not do justice to the study. To those who claim the engineer to be uncultured, the report gives an answer. IT IS JUST NOT SO.

Some ten years were devoted to the preparation and administration of a test battery which should indicate general cultural attainment. That the test was sound and adequate is indicated by the expressed opinions of the best authorities in the field. In brief, the battery consisted of 251 questions in fine arts, 346 questions in history and social studies, 333 questions on translated literature from languages other than English, and 292 questions in natural science, or a total of 1,222 questions assembled under the heading of GENERAL CULTURE. The scope of the battery can best be evaluated by reference to the report which gives a complete subject outline. For the purpose of this writing, it is sufficient to quote, "The engineers, for whom a general test in liberal arts and sciences would appear as little appropriate as for any group, from a curricular point of view, score a trifle better than the A.B. group for which the test might be thought to have been designed. Whatever superiority they display . . . would surely not be due to any advantage in their curriculum, which is more highly technical and therefore lies farther from the average demands of the test than any other."

The "trifle better" is reflected in Table I.

TABLE I

General Culture Scores of Curriculum Groups

| | Test Scores | | | Number of |
|---|---|---|---|---|
| | Minimum | Median | Maximum | Participants |
| Engineering | 65 | 280 | 755 | 543 |
| Bachelor of Arts | 55 | 275 | 725 | 1774 |
| Bachelor of Science | 65 | 259 | 645 | 1358 |
| Business Administration | 25 | 217 | 595 | 589 |
| Education | | | | |
| Arts College | 25 | 235 | 565 | 608 |
| Teachers College | 45 | 211 | 555 | 796 |
| Certificate | 25 | 155 | 425 | 558 |

The results of Table I are not for a "selected" group. Some 49 institutions of high caliber participated, and the 6,226 individuals were scattered among 7 Engineering Schools, 35 B.A. Schools, 27 Schools of Science, 9 Schools of Business Administration, 9 Schools of A.B. or B.S. in Education, 12 Teachers Colleges, and 3 schools offering teaching (2-year) certificates. The "trifle better" amounts to this; by means of a test battery specifically designed to test general culture and taken over a wide enough range to eliminate any selected groups, the engineers showed evidence of higher cultural attainment than any other educational group.

There are further test results which are significant. The testing procedure was repeated over a time interval of two years (1930-1932) to test the progress in general cultural attainment. The report states, "The students in women's colleges made a mean gain of 0.65 sigma as compared to the general mean of 0.50 sigma. This fact possibly indicates that the opportunity for gain favored the literary, linguistic, and social studies of the usual women's curriculum. But there was a large group consisting solely

of engineers engaged in professional, non-literary studies which nevertheless gained 0.32 sigma, while a collegiate division in professional education, where social and literary tendencies would presumably dominate, remained almost unchanged." Did someone remark that culture was attained through courses of study?

Table II presents the results (broken down by proposed occupations) of the general cultural test for 2630 individuals. Note the top position of the technologist and note also that on a cultural test there is compatibility between the gain or progress overall and in the subject of greatest gain which would obviously be in the general science portion of the test.

TABLE II

Average Gains Of Prospective Occupation Groups, 1930-32

| Proposed Occupations | Number | Av. sigma position total score 1930 | Av. gain '30-'32 sigma of 1930 | Greatest gain in | Sigma (1930) value of greatest gain |
|---|---|---|---|---|---|
| Engineers, chemists, technicians | 292 | 56.7 | .42 | Gen. Sci. | .45 |
| Journalists and writers | 45 | 54.9 | .55 | For. Lit. | .70 |
| Artists, musicians, dramatists | 25 | 53.2 | .73 | Fine Arts | 1.10 |
| Physicians | 187 | 53.1 | .50 | Gen. Sci. | .54 |
| Librarians | 32 | 52.2 | .57 | Fine Arts | 1.05 |
| Lawyers | 177 | 51.6 | .51 | Soc. Studies | .84 |
| Ministers | 99 | 51.3 | .60 | For. Lit. | .85 |
| Teachers (Arts Colleges) | 1,036 | 50.0 | .56 | For. Lit. | .72 |
| Business | 290 | 49.4 | .37 | Soc. Studies | .47 |
| Teachers (Teachers Coll.) | 273 | 47.1 | .56 | For. Lit. | .66 |
| Secretaries | 72 | 47.1 | .43 | Soc. Studies | .50 |
| Teachers (Health and Physical Education) | 101 | 40.9 | .29 | Gen. Sci. | .35 |

It is of interest to compare results for a single institution. In this case, University of Pennsylvania with six major schools involved gave tests to 919 seniors. This test was somewhat broader than the general culture test battery, and the Moore School of Electrical Engineering represented the Engineering profession. Table III shows the placement of the engineering students.

TABLE III

Placement of Moore School of Electrical Engineering

| First place | Number of questions | Third place | Number of questions |
|---|---|---|---|
| Mathematics | 117 | Languages | 150 |
| Physics | 102 | English Literature | 183 |
| Astronomy | 40 | Geography | 29 |
| Scientific Method | 59 | Biology | 65 |
| Politics | 134 | Modern Literature | 65 |
| Intellect. History | 149 | Oriental Civilization | 36 |
| Modern Science | 61 | Roman Civilization | 125 |
| Social Stud. Meth. | 84 | Social Theory | 90 |
| | | German Literature | 77 |

| Second place | Number of questions | Fourth place | Number of questions |
|---|---|---|---|
| Economics | 111 | Natural Science | 168 |
| Legal Inst. | 57 | Econ. Pol. Hist. | 298 |
| Chemistry | 115 | Soc. Sci. Anthrop. | 104 |
| Bible | 28 | Greek Civilization | 222 |
| Fine Arts | 161 | Other Literature | 79 |
| Geology | 37 | | |
| Education | 49 | Fifth place | |
| Modern Art | 75 | | |
| French Literature | 127 | Social Conventions | 52 |
| Religion | 94 | Near East | 89 |
| | | Prim. Society | 50 |

Moore School was in Sixth Place in no subject.

In overall results, the Moore School of Electrical Engineering placed first in the 3482 questions with an average percentage of 24, the School of Education second with 22, the College of Arts and Science third with 20, the Wharton School of Finance fourth with 17, Towne Scientific School fifth with 16, and the School of Fine Arts last with 15.

It would be possible to digress at this point and effect an essay upon education in general and particularly upon the most recent propaganda entitled "fragmentation". Suffice to mention some very interesting data in Bulletin 29 which leads to the obvious conclusion that the sequential material of science and engineering creates permanent knowledge. This is less true with language, literature, and fine arts, and almost non-existent in the social sciences. To quote briefly " . . . as the students accumulate credits without knowledge in social studies, their knowledge in other fields does not increase; it actually recedes."

As a last reflection, but already rather widely recognized as "natural" selection, Table IV presents the intelligence test results of the individuals taking the cultural test battery.

TABLE IV

Intelligence-test Scores of Curriculum Groups

| | Test Scores | | |
|---|---|---|---|
| | Minimum | Median | Maximum |
| Engineering | 27 | 61.4 | 75 |
| Bachelor of Arts | 21 | 57.3 | 75 |
| Bachelor of Science | 21 | 56.0 | 75 |
| Business Administration | 29 | 55.4 | 75 |
| Education | | | |
| Arts College | 22 | 52.7 | 74 |
| Teachers College | 23 | 51.9 | 75 |
| Certificate | 18 | 48.7 | 74 |

Note that the order of curriculum groups in Table IV is the same as in Table I. This would infer that the higher intelligence of the engineering group was responsible for their higher cultural attainments. This is an easy matter to examine, since it is possible to break each group down into sub-groups of equal intelligence and then compare the cultural scores of the equal intelligence groups. This breakdown was into six intelligence groups with 1 designating the lowest and 6 the highest intelligence score. The progress of each equal intelligence group over a two-year period can likewise be compared, since the data were so obtained. The results are given in Table V.

TABLE V

Achievement of Equal-ability Groups

| | Test scores for intelligence groups | | | | | |
|---|---|---|---|---|---|---|
| | Low 1 | 2 | 3 | 4 | 5 | 6 High |
| **First Test (1930)** | | | | | | |
| Engineering | 571 | 604 | 612 | 655 | 736 | 828 |
| Liberal Arts | 463 | 530 | 580 | 622 | 682 | 800 |
| Education | 413 | 498 | 527 | 535 | 603 | 651 |
| Business Administration | 405 | 466 | 505 | 549 | 616 | 676 |
| **Repeat Test (1932)** | | | | | | |
| Engineering | 639 | 675 | 685 | 701 | 793 | 894 |
| Liberal Arts | 545 | 612 | 681 | 709 | 782 | 904 |
| Education | 459 | 523 | 563 | 611 | 680 | 704 |
| Business Administration | 445 | 501 | 550 | 607 | 663 | 747 |
| **Gain** | | | | | | |
| Engineering | 68 | 71 | 73 | 46 | 67 | 66 |
| Liberal Arts | 82 | 82 | 101 | 87 | 100 | 104 |
| Education | 46 | 25 | 36 | 76 | 77 | 53 |
| Business Administration | 40 | 35 | 45 | 58 | 47 | 71 |

It appears odd that in no intelligence group under the Schools of Education and Business Administration did the students after a two-year interval match the score of the engineers in the first test. The conclusion might be drawn that even after two years of study, the students in Education and Business Administration were not as cultured as the freshman engineer. There is no factual indication that they would ever be.

From the foregoing brief resume of an extensive study, a number of far-reaching conclusions might be drawn; however, they are sufficiently obvious. It would be more pertinent to formulate a specific recommendation, namely, that the engineering profession should think better of the inherent qualities of a technical education, and should refuse to accept unsupported condemnation. That the engineer is uncultured is just not so. By the same token may we refrain from the condemnation of others, but one cannot help but wonder what the test scores would look like had the examination included technical subject matter compatible with the importance of technology in the culture of our present-day civilization.

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## OREGON ALUMINA RESERVES EXTENSIVE

Extensive new areas containing low grade bauxitic iron ore deposits have been found in Washington and Columbia Counties from 35 to 60 miles northwest of Portland, according to the Oregon Department of Geology and Mineral Industries. Some of these deposits have been mapped and sampled by the Department, and records of the exploration including analyses of samples, have been placed in open file at the Department office at 702 Woodlark Building, Portland, where they may be examined by interested persons. Later a report containing all the records will be published.

The Department began the study of these deposits more than a year ago, and a preliminary report describing deposits in Washington County was published in August 1944. Since then, investigations have been continued and the area containing the same type of deposits has been found to extend over a large part of Columbia County in addition to northern Washington County. In the aggregate, the deposits will contain many millions of tons of ore which could be cheaply mined.

According to the Department, these deposits are unique in mineral composition for occurrences of large extent. They are made up of an intimate mixture of aluminum and iron oxides in approximately equal amounts with minor amounts of titanium oxide.

High grade bauxite is the ore from which aluminum is now being produced. The ore is first treated to obtain pure aluminum oxide, or alumina as it is called, and the alumina is then reduced electrolytically in aluminum reduction plants to produce aluminum metal. All alumina for Northwest aluminum plants is now being produced in the east and hauled across the country to Oregon and Washington. The process now being employed to produce alumina from high grade bauxite would not be applicable to the Oregon ore.

Alcoa Mining Company has recently announced plans for investigating the Oregon deposits. According to the announcement, the investigation will include drilling and sampling to determine size and quality of deposits as well as metallurgical testing to attempt to work out an economic method of ore treatment.

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## QUICKSILVER REPORT

The monthly mercury report for February 1945 issued by the U.S. Bureau of Mines April 10, 1945, gives a tabulation of statistics as given below. According to this release it is currently reported that mercury from Spain would soon be available in the domestic market. The average quoted market price in February was nearly $166 a flask.

Salient statistics on mercury in the United States in 1939-44 and in January and February 1945, in flasks of 76 pounds each

| Period | Production | Consumption | Stocks at end of period 1/ | | Price per flask at New York |
|---|---|---|---|---|---|
| | | | Consumers and dealers 2/ | Producers 3/ | |
| | Average monthly | | | | |
| 1939 | 1,553 | 4/ 1,742 | 12,600 | 376 | $ 103.94 |
| 1940 | 3,148 | 2,233 | 14,100 | 607 | 176.87 |
| 1941 | 3,743 | 3,733 | 12,400 | 439 | 185.02 |
| 1942 | 4,237 | 4,142 | 10,700 | 1,377 | 196.35 |
| 1943 | 4,327 | 4,542 | 13,200 | 3,457 | 195.21 |
| 1944: | Monthly | | | | |
| January | 4,400 | 3,400 | 11,300 | 5,459 | 151.60 |
| February | 3,800 | 3,700 | 9,400 | 5,450 | 130.00 |
| March | 3,800 | 3,600 | 9,900 | 5,011 | 130.00 |
| April | 3,700 | 3,200 | 9,700 | 5,604 | 128.20 |
| May | 3,400 | 3,100 | 8,900 | 6,171 | 115.54 |
| June | 3,000 | 3,400 | 9,000 | 5,757 | 101.69 |
| July | 2,700 | 3,000 | 9,300 | 4,025 | 100.56 |
| August | 2,500 | 3,900 | 9,100 | 2,252 | 104.04 |
| September | 2,500 | 3,900 | 8,400 | 1,936 | 104.28 |
| October | 2,700 | 3,900 | 7,400 | 2,550 | 109.20 |
| November | 2,300 | 3,900 | 7,800 | 2,094 | 116.30 |
| December | 2,500 | 3,900 | 10,400 | 2,714 | 128.88 |
| Total | 37,300 | 42,900 | - - - | - - - | $ 118.36 5/ |
| 1945: | | | | | |
| January | 2,500 | 5,200 | 9,000 | 1,852 | $ 156.85 |
| February | 2,700 | 5,100 | 12,000 | 1,189 | 165.55 |

1/ Based on location rather than ownership. 2/ Largely excludes redistilled metal.
3/ Held by reporting companies. 4/ Apparent consumption. 5/ Average.

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