SCIENCE

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EDUCATIONAL COSTS

I

IN the treatment of the educational institution as an industrial organization several points of view may be taken. That one which looks upon the student as the product of the factory or plant will be here dismissed without discussion as inherently false and as based upon very superficial analogies. In a second light the student may be regarded as the customer who buys the product instruction—possibly education—from the factory of which the workmen are the teachers. These theories, which the present writer has discussed at some length in another place,[1] will be passed over, in order that consideration may be given to a third viewpoint as follows.

The product of the college *considered as an industrial organization* is instruction; instruction in Greek, in chemistry, in mathematics, in history, or in any other subject which is there taught. The workmen of the educational factory fall into two classes: the instructors constitute the class of paid workmen; the students the class of unpaid workmen who may be looked upon, in a way, as apprentices. The product, instruction, can not be made except by the cooperation of the two classes of workmen. The finished product is education, or *an* education.

The analogy between the industrial plant and the educational institution is by no means as close as is asserted by those who advocate the application of the principles of business management to the college. It may be doubted if there be any instance of

[1] "The College as a Commercial Factory," *Educational Review*, December, 1913.

a factory which manufactures a product as intangible as the instruction of the educational plant, even though we neglect all the higher connotations of the word education and confine our attention to its lower and more utilitarian characteristics. Moreover, there probably exists no case of an industrial plant in which one class of labor pays a premium for the privilege of working for a limited period—three to six years—with the avowed intention of leaving the factory at the expiration of the term of service. There is no industrial plant which willingly and knowingly conducts its business at a loss; no business in which the product is never sold. Finally, it is impossible to conceive of an industrial plant in which, no matter how much of the product be disposed of, there still remains as much of the product in the factory as before.

II

For the sake of investigation, however, these discrepancies, these failures of analogy, may be overlooked, and we may proceed to the determination of costs on the hypothesis of a product, instruction; a class of paid workmen, the teachers; and a class of unpaid apprentices, the students, who pay a premium to the plant.

Adopting a usual classification of costs into (i) prime cost: workmen's wages and cost of raw material; (ii) works cost: prime cost *plus* the expense of shop production; (iii) total cost: works cost *plus* the expenses of administration and management; we may note that in the educational plant the second item is eliminated, and that there is practically no raw material.

Thus the items of cost fall into two classes: (1) Direct costs: salaries of the instructing staff. (2) Indirect costs: all costs except item 1.

But since the instructing staff is paid for both teaching and administration, item 1 must be subdivided into (*a*) Pay for instruction; the only direct cost. (*b*) Pay for administration; an indirect cost, and again subdivided into departmental and general administration costs.

Moreover, the various constituents of item 2 must be examined with care, in order that they may be properly allocated to different departments.

For purposes of illustration we shall assume a college of two departments, D_1 and D_2, with the following data. Department D_1 has 10 professors, salary \$3,000 each, serving 300 hours each per year; 10 associates, salary \$2,000 each, serving 400 hours each per year; 10 tutors, salary \$1,000 each, serving 500 hours each per year. Department D_2 has 5 professors, salary \$4,000 each, serving 250 hours each per year; 10 associates, salary \$2,000, serving 400 hours; 5 tutors, salary \$500, serving 500 hours each per year. The analysis of the data is given in the following table:[2]

TABLE I

Grade of Workman	Department	Number of Men	Hours of Instruction	Hours of General Administration	Hours of Departmental Administration	Cost of Instruction, Dollars	Cost of General Administration, Dollars	Cost of Departmental Administration, Dollars
Professor	D_1	10	1,000	1,000	1,000	10,000	10,000	10,000
	D_2	5	1,000	50	200	16,000	800	3,200
Associate	D_1	10	3,000	500	500	15,000	2,500	2,500
	D_2	10	3,000	500	500	15,000	2,500	2,500
Tutor.....	D_1	10	4,000	500	500	8,000	1,000	1,000
	D_2	5	2,400	0	100	2,400	0	100
Totals..	D_1		8,000	2,000	2,000	33,000	16,800	13,500
	D_2		6,400	550	800	33,400		5,800

The general administration costs—salaries of the president and other general administrative officers—amount to \$20,000 per year.

[2] This table of data is taken from the article in the *Educational Review* to which reference has already been made. The same article may be consulted for a tentative analysis of the several items of cost.

We shall assume that there are 200 students in department D_1 and 100 in department D_2. The two groups of students need not be mutually exclusive. A student may be doing work in both departments, or in one department only. The further assumption will be made that in department D_1 a student works 25 hours per week, in department D_2 20 hours per week, in classroom and laboratory. In addition, in department D_1 each student works 25 hours per week in preparation for class; in department D_2, 40 hours per week.[3] The year consists of 30 weeks, so that there are, in department

D_1, $50 \times 30 \times 200 = 300{,}000$ student hrs. per year.
D_2, $60 \times 30 \times 100 = 180{,}000$ student hrs. per year.

Finally, the tuition fee paid by each student will be assumed to be \$150 per year. With these data we may proceed to the determination of *costs per workman per hour.*

The writer does not know any equitable basis for the distribution of general administration charges. They are certainly not necessarily allocable in proportion to the number of students in a department, nor in proportion to the number of student working hours, nor in proportion to the number of hours of teaching. A small department may, from the nature of its work, require more administrative attention than a large one. On the whole it seems best, in the absence of exact information, to allocate the general administration costs equally to the several departments.

The general administration costs of our hypothetical college are, therefore (see Table I.), \$20,000 *plus* \$16,800, or \$36,800, of which \$18,400 are chargeable to each department. From this and from Table I. we compute Table II., which summarizes all the data.

[3] No account is taken of home or preparation work done by the instructing staff.

TABLE II

General administration costs ...	\$18,400	\$18,400
Departmental administration costs	\$13,500	\$5,800
Wages of instruction	\$33,000	\$33,400
Working hours, teachers	8,000	6,400
Working hours, students	300,000	180,000
Total working hours	308,000	186,400
Total costs	\$64,900	\$57,600
Tuition fees	\$30,000	\$15,000
Net costs	\$34,900	\$42,600
Net cost per working hour	\$.113	\$.229

III

Examination of the assumed data will disclose the fact that the D_1D_2 college is a rather costly institution. Department D_1 pays \$60,000 in salaries to 30 teachers, for 8,000 hours' instruction per year, for 200 students (there are 4,000 administration hours in addition) so that the average number of hours instruction per teacher per week is a little less than 9, and there are 6⅔ students to each instructor. In department D_2, 20 teachers receive \$42,500 for 6,400 hours to 100 students, or about 10 hours per instructor per week, with 5 students to each instructor.

That the cost per working hour is so low is due to the neglect of most of the items of overhead burden, such as rent, power, heat, etc. But as our object is to test what conclusions may be logically drawn from costs computed on a correct theory of accountancy, and as we have no intention of attempting to apply our present results in practise, the omissions are unimportant.

It will be noted that the cost per working hour is much greater in department D_2 than in department D_1. If, however, we do not analyze the salaries paid to the instructing staff into their components, and if, instead of dividing the administration costs equally between the two departments, we allot them in proportion to the number of working hours, the workman-hour costs of the two departments approach much

nearer to equality,[4] giving a net cost per working hour, department D_1, of 13.8 cents; department D_2, 18.8 cents; a difference of 5 cents as compared with 12 cents under the more careful analysis.

In other words, by neglecting the analysis of the elements of cost, and by failure to allocate the various items where they should be incident; that is, by dealing with "general averages" instead of with specific charges, the cost per working hour becomes more nearly uniform. Consequently, exact information as to actual departmental costs is lacking or disguised; a result in precise agreement with managerial experience in general. To be of practical value cost per workman per hour, in the educational factory, must be based upon exact and detailed analysis.

IV

Further consideration of one or two points in the above discussion is desirable. Objection may be made to the inclusion of time spent by the student-workman in study at home, outside of the factory. Unless we limit the product (instruction) to the actual imparting of information in the class-room, a view altogether too narrow even on a strictly utilitarian basis, it must be granted that this home work is as essential to the product as is the factory labor, the work in school. The fact of the work being done outside of the factory does not affect the actual overhead expense or wages of the plant. It is conceivable that the student-workman might spend his entire working time in the factory without change of results. That he spends 50 per cent. or more of his working time outside of the factory amounts simply to his paying an additional premium for his apprentice privileges in the saving to the factory of expense, heat, light, attendance, etc. Theoretically each department should be credited with the amount of this salvage; practically the saving is *nil* as the expense, with the exception, perhaps, of light and attendance, is continuous in any case. The weakness of the plan adopted consists not in the inclusion of the student-workman's outside time, but in the exclusion of the outside time of the teacher-workman. If this latter were included there would be a further diminution of the cost per working hour in every department.

A real weakness of the plan under discussion lies in the fact that the outside student work is unsupervised to some extent, and may not be up to standard. This weakness, however, is inherent in the whole work of the educational plant; but not more so, by and large, than in the industrial plant. If it could be assumed that the inside work were 100 per cent. efficient and that all examination papers were perfect, then the percentage obtained on an examination would measure the quality and amount of a student's outside work. If, still with perfect examination papers, it could be assumed that all outside work were 100 per cent. efficient, the examination percentage would measure the efficiency of the combined student and instructor factory work, but would not differentiate between the two. If it could be assumed that all outside and inside work were 100 per cent. efficient, then the examination percentage would measure the efficiency of the work of preparing the examination paper. This might be called an equilateral triangle of untenable hypotheses.

[4] Total working hours 494,400. Working hours, D_1, 308,000, or 62.3 per cent.; D_2, 186,400, or 37.7 per cent. Whence, general administration costs, D_1, 62.3 per cent. of \$20,000, or \$12,460; D_2, 37.7 per cent. of \$20,000, or \$7,540. Therefore, net costs, D_1, are \$12,460 + \$60,000 — \$30,000 = \$42,460; D_2, \$7,540 + \$42,500 — \$15,000 = \$35,040. Whence the net cost per working hour is, D_1, \$42,460 ÷ 308,000 = .138; D_2, \$35,040 ÷ 186,400 = .188.

However, this weakness is by no means an insuperable objection to the present point of view of educational costs. It is sufficient, at least until the whole subject of cost accountancy shall have been put on a more scientific basis, to do in the educational what is done in the industrial plant: to compute costs on the basis of the workman-hour, even if the efficiency of the workman can not be accurately determined nor all the labor be adequately supervised.

V

When the management of an industrial plant investigates the question of costs it is for the purpose of determining the exact cost of each article produced, in order that the selling price may be fixed and a profit assured.

The educational plant disclaims all intention of making a profit, and has no customer, nor any product which is sold. When the management of an educational plant investigates the question of costs what is its purpose?

It has been said that it is well "to compare the cost of instruction per student hour"—the cost per workman-hour—in one department with the cost in another, and that "high cost will call for explanation and justification." The former assertion may be accepted as true without accepting the latter as a necessary consequence. It is quite as logical to say that low cost will call for explanation and justification. The analogy[5] between the industrial plant and the educational institution would seem to be an *ignis fatuus* destined to lead the investigator wandering into the morass of logical inconsequence.

[5] "Analogy: a resemblance of relations; an agreement or likeness between things in some circumstances or effects, when the things are otherwise entirely different."

The { educational / industrial } plant makes { an intangible / a tangible } product { not to be sold / to be sold } at a profit. In the industrial plant, the lower the cost the greater the profit. Therefore, the { educational / industrial } plant should produce at the lowest cost possible. This would seem to be the argument. It may be allowed to stand on its own merits.

In the second place, there can be no valid comparison of the costs of widely dissimilar products. If an industrial plant makes tin cups at a cost of 25 cents and silver cups at a cost of 25 dollars per working hour, surely the high cost of the silver cup, *as compared with the tin cup,* does not call for explanation and justification. If in a factory, in a given number of hours, say one hundred, there are made 1,000 silver cups by 100 men at a cost of 25 dollars each, 100 silver flagons by 50 men at a cost of 100 dollars each, and a single silver ewer by one man at a cost of 500 dollars, the costs per workman hour are $2.50, $2 and $5 respectively. Now it may be perfectly true, as has been said, that "the principle of efficiency"—or the principle of economic common sense, for that matter—"demands that the expenditure be commensurate with the results produced." But whether the results be commensurate or not can not be determined by comparing expenditures only. Certainly it can not be said that expenditure and results are not commensurate in the case of the silver ewer *because* the cost per ewer working hour is double the cost per cup working hour. The results may be, for the cups a ten per cent. profit, or $2,500; for the ewer a 500 per cent. profit, or $2,500. Even if the profit on the ewer were only ten per cent., or $50, still the ewer might be a Cellinian masterpiece, which counts as "results" even in business. Mechanical engi-

neering may be costing 46 cents per working hour, English 18.2 cents. Either may be costing too much, or each too little. As for the results, the unfinished products, engineering instruction or English instruction, or the finished product, education, they still await measurement.

VI

Doubtless it would be well for the college to know exactly how it is spending, how it is losing, its money. What must be guarded against especially is the misuse of statements of costs, as well as inaccurate statements of costs derived from insufficient data and unscientific investigation. A determination of the cost per student hour, or per working hour, which does not separate salaries of the instructing staff into wages, general administration and departmental administration charges; which does not properly allocate to various departments costs of rent, power and other items; which makes no attempt "to apportion the overhead expense exactly, as would be done in a manufacturing business"—such a determination may, perhaps, be valuable and suggestive if applied to a hypothetical college, but is misleading and dangerous if applied to an actual institution for the purpose of deducing practical consequences and suggesting practical reforms.

There is no consensus of opinion as to what education is—except, perhaps, the widespread view that it is a failure—and no general agreement as to what it should be. It is, perhaps, unfortunate that so much attention is being given to the determination of the costs of this unknown quantity; unfortunate that, obsessed by the slight analogy between industrial and educational organizations, so many investigators and writers fail utterly to see the innumerable and insuperable differences between education and business. It is true that as yet but little harm has been done, but there are indications that if this tendency be not checked serious evil may follow.

The executive and administrative branches of the educational business are coming to be looked upon as its trunk and its roots. The college is coming to be looked upon as an establishment in which education is administered, not as a seat of learning, where knowledge is taught, scholarship fostered and wisdom diligently sought. The teacher is no longer looked upon as an essential part of education; he is no longer an individual, teaching in freedom and earnestness, but is simply one of a numerous class of underpaid workmen whose betterment is impossible and whose usefulness is doubtful. In investigating the costs of the educational institution it will be well to count these costs of education treated as a business, and to take heed lest academic liberty be sacrificed to executive demands; lest truth be sacrificed to expediency.

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FLOOD PREVENTION AND ITS RELATION TO THE NATION'S FOOD SUPPLY

The problem of preventing the enormous losses from floods is one of the greatest before the American people. It is second only to that of increasing the nation's food supply and thereby decreasing the cost of living. That the two problems are closely related will be seen from the following facts and figures taken from statements made by experts who have not been contradicted.

These few facts, which have been culled from a mass of overwhelming evidence should convince every reasonable person—

First: That the federal government's present policy of river regulation is wrong.

Second: That a better policy is possible and is now under consideration by Congress.

Third: The necessity for the immediate adoption of the new policy.

The present policy of building levees only is radically wrong because it ignores the necessity of preventing flood conditions, and is