COMMUNICATIONS AND DISCUSSIONS

THE DOCTRINE OF FORMAL DISCIPLINE: TWO NEGLECTED INSTANCES OF TRANSFER OF TRAINING

Recent experimental results have offered cumulative evidence that the doctrine of formal discipline, all but repudiated in this day of educational vandalism, is still good pedagogical doctrine under certain limitations. Specific training does, under certain conditions and in varying measure, insure general training. Training of one function is susceptible of transfer to another analogous function: training of one organ allows of a cross induction of effect to another corresponding organ: the effects of exercise in one member are transferred, in varying degree, to another similar member.

It is not necessary to detail the experiments here. This has been done adequately by Horne, Angell, Judd, Pillsbury, Thorndike, Bagley, Colvin, O'Shea, Heck, and others. It is sufficient to refer briefly to the experimental facts. The fact of transference has been established in operations as diverse as the following:

In spatial discrimination, transfer is possible from the finger tips of the left hand to the right, or from the third phalanx to the first phalanx (Volkmann); the practiced discrimination ability for sound intensities has been transferred to intensities of brightness, and for sorting cards to typewriter reactions (Coover and Angell). The sensitivity for tactual, gustatory, olfactory and visual stimuli can be increased by practicing with sound stimuli (Urbantschisch, Epstein); and the same holds with respect to the estimation of magnitudes and weights, perceiving parts of speech, and the marking of words (Thorndike, Woodworth, Norsworthy). The effects of practice in rapidity of tapping, muscular steadiness, lunging at a target with a foil, and muscular power or voluntary effort are transferred to the unpracticed hand (Scripture, Smith, Brown, Davis). Series of experiments with and without knowledge of results

1 It should be stated, to avoid a wrong inference, that some of the results of these experiments are discrepant with the conclusion drawn from them in this paper.
have shown similar spreading of training in the judging of the length of lines, the perception of the Müller-Lyer illusion, and hitting a target under water, when the subjects were permitted to know the results of their practice (Judd). Similarly when the children's attention has been focalized upon neatness as an ideal of general application, neatness in geography has been found to transfer to arithmetic, grammar or history (Ruediger). Special training gives us a method of orientation or general power to meet entirely new situations more effectively (Bair), and by becoming habituated to distractions in one situation we can ignore them in others (Vogt). Finally a number of memory experiments leave us with the same conclusion. Children trained to commit poetry were able to learn selections from an historical reader with greater ease, the subject matter being quite different (Winch). Here we find transference of training at least in the field of verbal memorizing. By being trained to memorize meaningless syllables the power to immediately recall and retain numbers, letters, substantives of one syllable, Italian, prose and poetic words, visual signs, etc., has been increased from 55 to 70 per cent (Meumann, Ebert). Improvement of memory in a test series was found at times to be positively greater than in a training series where the order of four tones was memorized, as against the memorizing of the order of brightnesses, tones, and geometrical figures, the extent of arm movement, and verse (Fracker). As a further addition to this evidence I wish to direct attention to certain results in experiments with reversible perspective illusions which bear upon the question, and which seem to have escaped the notice of reviewers.

Several years ago a half hour daily during about sixty experimental days was spent by another subject and myself in an attempt to control the reversions in a number of reversible perspective outlines, such as a parallelopiped, book, table and pyramid. Most of the figures were plane drawings, but some were tridimensional or skeleton models. It had been ascertained in prior experiments that these figures possessed a preponderant perspective (except possibly the pyramid). The practice thus consisted in the attempt to uniformly envisage the infrequent or non-predominant perspective, in all cases monocularly.

It was found that perspectivity was subject to a high degree of practice control. Arranging the total of 9246 trials into three successive time groups, the percentage of successful control amounted, respectively,

\[\text{Wallin, Optical Illusions of Reversible Perspective, 1905, Chapter XIII The relation of Practice to Reversible Perspectives, pp. 264-266.}\]
to 40, 62 and 82 per cent. There was an average gain of 42 per cent between the first and the last 20 days of the series. Moreover, and this is especially to the point in the present connection, it was found that the practice results had been transferred to the unpracticed eye. Occasional tests were made with the unused eye during the latter third of the series, and corresponding successes were obtained. Practice with one eye afforded practice for the other unused eye. The education of the one retina to envisage a refractory perspective constituted a cross-education of the other retina to function in the same manner. There was established a general disposition or tendency to meet a given situation in a given way, which was of such strength that an organ not directly exercised at all shared in the tendency. This general tendency is explicable upon the assumption that the effects of practice are central: the training of the one eye established certain cortical tendencies and mental attitudes. The unused retina therefore tended to respond in harmony with the central predisposition. At the same time, certain peripheral elements could be involved conjointly. "Thus to take only the factor of fixation: since the two eyes function as a unity, the unused eye fixated sympathetically with the other. Or the establishing of fixation tendencies for the used eye gave rise to a sensation series which reflexly caused the same sort of adjustment to be made by the suppressed eye when it was (later) consciously fixated upon the drawing. Even without direct stimulation by the objective rays, the covered eye was being trained; it acquired by cross-induction a favorable fixation set." But even in the latter case, the gradually acquired mode of functioning of the used eye was so generalized as to inaugurate similar responses in the other. There would here seem to be then a tendency of training to spread or generalize, whatever the explanation.

Another observation in connection with reversible perspectives, though less significant, also contains a pertinent suggestion. In a given series of experiments in which the figures were reversed in the direct and indirect visual fields it appeared that the reversions occurred about two and a half times faster when the figures were directly regarded instead of being seen by the peripheral retina. But after practice with certain figures it sometimes happened that the figures (the cube, pyramid and book) reversed most readily when a point outside the figures was fixated. This furnishes an instance of the transference of fixation motives attaching to the fovea to the peripheral retina. Here an acquired foveal disposition spread to the adjacent retinal elements. In other words, the foveal tendency was transmuted into a "generalized retinal habit."
These two instances of "cross-education" or transference of training have a certain value when taken in connection with the more familiar experiments which bear upon the doctrine of formal discipline. They are offered simply as furnishing evidence in favor of the doctrine, with no attempt on my part at this time to further justify, limit and explain it.

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THE ORGANIZATION OF THE DEPARTMENT OF EDUCATION AT THE UNIVERSITY OF VERMONT

I am very glad to accept the invitation of the editor to make a statement concerning the organization of the Department of Education at the University of Vermont. Departments of education in universities are comparatively new, and in most places education courses are offered as electives on the same basis as any other subject and with the same degree of independence. A student takes a course in education just as he takes history or Latin, as if it had nothing to do with his other work. He may apply some of his educational theory to his other work. But the fact that such application is the primary reason for taking the education course does not appear in any definite form, and though he may be conscious of the benefit he derives from the course, the department would be strengthened if the organization were such as to show that education is intimately related to every other subject. Even when education courses are elected, not for the purpose of teaching but for the sake of general information, culture, and breadth of view, it must be remembered that the object is to get an insight into educational tendencies which are found in other subjects. It is very desirable that college graduates who are not teachers should have made some special and systematic study of education. They are the men who are to hold positions on public school boards and on boards of trustees in colleges. Method courses are not recommended for them but the courses they do take, the history of education, the philosophy of education and school administration, must never be thought of as isolated subjects.

Except in a few institutions which have large departments of education students are not preparing to teach education itself, but they are going into elementary and secondary schools and into colleges to teach some other subjects which they study in college. The chief function