MENTAL DISCIPLINE AND EDUCATIONAL VALUES

W. H. HECK

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W. H. HECK, M.A.
Professor of Education, University of Virginia

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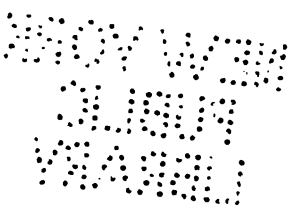

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TO MY MOTHER

MENTAL DISCIPLINE AND EDUCATIONAL VALUES

INTRODUCTION

It is time that recent modifications of the honored doctrine of formal discipline should have more effect on our practice. Though a great many teachers still believe in the old theory, whether or not they have carefully thought out their belief, the American students of educational psychology have been approaching a new point of view. They are reaching an agreement upon the inadequacy of "the doctrine of the applicability of mental power, however gained, to any department of human activity," or "the gymnastic theory of education that it does not matter upon what the mind is exercised, provided only the matter be vigorous and long-continued." (De Garmo.)[1] Most of the recent American and a few of the recent foreign books on educa-

[1] De Garmo, *Dictionary of Philanthropy and Psychology*, "Formal Culture."

tion suggest some modification of the doctrine of formal discipline, but the discussion of the subject is still in the polemical stage.

General destructive criticism is not sufficient. We must come to realize in what specific ways the doctrine of formal discipline is false and in what specific ways it affects unfavorably present aims, curricula, and methods. But even then our position would still be negative and therefore, at best, only a means to some positive conclusion. We must also establish a standard for the disciplinary value of studies and then apply that standard to the different elements in the curriculum. If we do not, we have accomplished little. Why and in what ways should a pupil get mental discipline from this or that study? To show why and in what way he does *not* get it is valuable only as a process of elimination in working toward a positive diagnosis. But even then, we have a third problem, the practical modification of courses and methods so as to gain from each and every part of each and every study its real, not to strive for its imagined, disciplinary value. These three large problems are discouraging when seen together in their significance. The practical changes involved are so far-reaching and the need for them so difficult to prove defin-

itely that both profession and laity are skeptical. In contrast to these difficulties, the doctrine of formal discipline has the momentum of tradition, it is emphasized by influential authorities, it has a powerful hold upon many teachers, it is easy to understand in its superficial meaning, it seems to explain many evident results of education, and it has long been the cause and the defence of dominant phases of curricula and methods. One should not be surprised, therefore, that the doctrine continues to make itself felt throughout our school system and that the opposition to it is disorganized, timid, and bookish.

Can educators afford to allow this opposition to remain unproductive? If the doctrine of formal discipline were of little influence in present practice, they might content themselves with theoretical objections, but the prominence of the doctrine necessitates definite, practical suggestions and attempts to modify it. If mental discipline *is* specific, not general, there is a pressing need to recognize the fact and to reorganize school courses and methods. Popular and professional misunderstanding will yield in time to a clear presentation of the value of a course based upon a theory of specific disciplines, of specialized habits, rather than a theory of general discipline,

of generalized habits.[1] The time is ripe for working out and testing the actual disciplinary value of the subjects and parts of subjects in the school course. The experiments so far made are suggestive, though not conclusive, in regard to the changes needed, and they point the way for further theory and practice.

Testing theory and practice in order to prove the comparative disciplinary value of the elements in the curriculum is very difficult, due to the number and subtlety of the factors involved; yet no one can gainsay the truth that studies ought to prove their worth before they are accredited with an undisputed place in the curriculum. If educators can work out no proof of the comparative disciplinary value of studies, they are doomed to wander in the dark, with no clear ideas to guide them in planning courses and methods intelligently.

This essay is but a tentative effort to modify the doctrine of formal discipline and, upon such a modification, to establish a standard of educational values. There has been no attempt to make

[1] As a good illustration of how the doctrine of specific disciplines has affected recent books on special methods, reference is made to Huey, *Psychology and Pedagogy of Reading*, pp. 363-5. The mental discipline emphasized by Huey, though far-reaching in its effects, is kept within the limits of reading, the special activity by which it is to be developed, or is applied to similar activities.

a full discussion of the subject but merely an outline for further study, a syllabus for individual or class use. The problems of mental discipline are too unsettled at present for any one to be dogmatic or to attempt more than brief suggestions. A secondary purpose of this essay has been to sum up and organize the recent discussions of the disciplinary value of studies, in hope that our readers will get a first-hand idea of how far students of education have advanced in their thought on this subject. It is also hoped that the numerous quotations will save them the time and trouble of searching through the widely scattered material from which our summary has been made. Most of these quotations are grouped together in four parts of this essay, where they can be omitted without great loss; but we trust that their value and interest will atone for our giving them so much space. In class discussions of the doctrine of formal discipline, we have felt the need of such a symposium of opinions to put in the hands of students as a source-book for parallel reading. The references at the bottom of the pages will furnish a fairly comprehensive bibliography for further study.

THE DOCTRINE OF FORMAL DISCIPLINE.

The doctrine of formal discipline was implied in the educational practices of the Greeks and the Romans, gymnastics, music, and oratory being used to furnish a general physical and mental discipline applicable to all the needs of individual and civic life. The doctrine was at the basis of the ascetic discipline of the mediæval monastics, who sought a complete development of the soul at the expense of bodily desires. It dominated the ideals and methods of scholastic education, with the drill upon the trivium and quadrivium culminating in the barren formalism and logical subtelties of University disputations, the ideal example in the Middle Ages of general reasoning power. But the doctrine was first clearly formulated as an educational theory in the seventeenth century, to serve as a defence of the classical studies, when their intrinsic value had been greatly reduced by the use of the national vernaculars in literature, government, and education,

and when the current emphasis upon them had been criticized by the growing spirit of realism in educational thought. Monroe gives an interesting account of this movement and of its influence in the next two centuries, especially upon the English secondary school and the German gymnasium.

"By the seventeenth century the linguistic and literary curriculum had become traditional, with the authority of the learning of two centuries behind it and with a scholastic procedure which in details of method and of curriculum, in the entire technique of the schoolroom, had never been equaled by any previous system of educational practice.....Since this narrow humanistic education no longer had any direct connection with the practical demands of the times and no longer offered the sole approach to a knowledge of human achievement and thought, a new theory must be found to justify its perpetuation. This new theory was, in a word, that the important thing in education was not the thing learned, but the process of learning. In respect to this principle, the new education was but a revival of the formalism of mediaeval scholasticism."

"The mind as a bundle of faculties was to be developed by exercising these various powers

upon appropriate tasks whose value consisted in the difficulties they offered. These faculties were considered to have no necessary connection with one another, hence these disciplines were separate and distinct things; though some faculties were higher than others. The highest was the reasoning power to be developed by appropriate discipline in mathematics, logical disputations, and the languages; but the faculty upon which all the others depended, and upon the successful development of which depended the success of the education, was the memory. Discipline of the memory then took precedence above all other exercises. The best training for the memory was afforded by the mastery of material which had no inherent interest for the child."[1]

The doctrine has not been essentially changed during the past two centuries, though it has been elaborated and applied in many ways. As it was based on the "faculty" psychology, its dominance was doomed when the latter was refuted; but the doctrine continued dominant long after its basis was destroyed, the close connection between the two was generally overlooked, and even now many people hold to the doctrine, who would re-

[1]Monroe, *Text Book in the History of Education*, pp. 505, 506, 567, 568.

sent an intimation that they were also holding to the "faculty" psychology.

During the third quarter of the nineteenth century the doctrine of formal discipline was vigorously used and its validity was impaired in the conflict between the classics and mathematics on one side and the natural and social sciences on the other. Spencer and Huxley were the great protagonists for the sciences in this conflict. In 1867 there was published in this country a collection of essays by prominent scientists on the "Claims of Scientific Education." These essays illustrate stages in the evolution of thought from the traditional doctrine of formal discipline to the present doctrine of specific disciplines. The main argument for the disciplinary value of the scienes is based on both the superior formal discipline and the superior specific disciplines and knowledge to be derived from them. The authors vary in their emphasis upon the former or upon the latter superiorities, but in general they emphasize a combination of both. This combination is well stated in the following extract from Youmans' introductory chapter on "Mental Discipline in Education":

"Let it be remembered that this culture does not deny the importance of mental discipline, but

only the wasteful policy of vicarious discipline. The question has three aspects. The ancients employed the useless fact A for disciplinary purposes, and ignored the useful fact B. The adherents of the current theory propose to learn first the useless fact A to get the discipline necessary to acquire the useful fact B; while a rational system ignores useless A and attacks B at once, making it serve both for knowledge and discipline. The ancient view was more reasonable than that which has grown out of it. It wanted one acquisition, and it made it; the prevailing method wants one, and makes two; and as it costs as much effort to learn a useless fact as a useful one, by this method half the power is wasted."[1]

A further advance is represented by the following quotations from Bain, written in 1878:

"Most definitions of training are obscured through the mode of describing mind by faculties. We have seen that to train 'Memory' is a very vague way of speaking. Equally vague is it to talk of training Reason, Conception, Imagination, and so forth. Moral training is much more intelligible; there is here a habit of suppressing certain active tendencies of the mind, and fostering others; and this is done by a special discipline

[1] Youmans et al., *The Culture Demanded by Modern Life*, p. 23.

—like training horses or making soldiers." "The element of Form, Method, Order, Organization, as contrasted with the subject-matter viewed without reference to form, has a value of its own; and any material that displays it to advantage, and enables it to be acquired, is justified by that circumstance alone. The targets used in learning to shoot, the wooden soldiers that are aimed at in the sabre drill, although unreal, are effectual." "It depends partly on the teacher and partly on the scholar whether the element of method shall stand forth and extend itself, or whether the subjects shall only yield their own quantum of matter or information."[1]

The present opinion on the subject is what concerns us here. To illustrate this opinion we quote both from adherents and from opponents to the doctrine of formal discipline. Such a group of quotations seems the most direct and useful way to represent the many-sided discussion of this problem. Out of the wealth of material illustrating the former position, we make two quotations from American books and two from English books, one book in each group being on educational psychology and one on school organization. The fifth quotation is from an American professor's

[1]Bain, *Education as a Science*, pp. 139-141.

plea for return to the method of the days when the doctrine of formal discipline reigned supreme.

"Every normal act of the mind leaves as a result an increased power to act in like manner, and a tendency to act again—*power and tendency being the results of all right mental action.* The power and tendency of the mind to observe is increased by observing; to imagine, by imagining; to judge, by judging; to reason, by reasoning, etc. An increase of the mind's power and tendency to put forth a given activity is what is meant by its development and training." The author objects to carrying his theory to its extreme conclusion. "The study of a branch of knowledge that trains several powers of the mind, may increase its capacity to master other branches that appeal to these powers. The critical study of language, for example, calls into exercise mental powers that are much used even in the mastery of botany, zoology, and other natural sciences. It is claimed that an increase of the mind's power to acquire one kind of knowledge increases its power to acquire all knowledge. This may be true, to some extent, but the exclusive activity of the mind in one direction may so increase its tendency thus to act as practically to incapacitate it to act in

other directions, the tendency becoming a habit." (White.)[1]

"Discipline is that condition of the mind which is characterized by power—power to perceive, to remember, to reflect, and to feel intensely, but to restrain feeling—and by *skill* to do these things quickly and well, and to express them adequately. Those who have claimed that there is no such thing as 'general discipline'—that there are memories, but not *memory,* judgments, but not *judgment,* and so on—are quite as wrong as those who, earlier, claimed that general discipline was the chief, if not the sole, end of education. The experience of every educated man and woman, and the increasing demand, in every kind of business, for the graduates of high schools and colleges, give conclusive evidence of the value of general discipline. Such evidence is far stronger than any amount of *a priori* theorizing, or the sporadic experimenting that has been done in psychological laboratories." (Roark.)[2] This quotation is probably a reply to Thorndike, who used an extract from a previous book by Roark to head a list of quotations illustrating the doctrine of formal discipline.

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[1] White, *Elements of Pedagogy,* pp. 119, 120.

[2] Roark, *Economy in Education,* p. 207.

"Suitable opportunities must be found for the exercise of desirable feelings, so that good habits of feeling may be formed. The feelings are principally egoistic, and consequently anti-social. The school discipline must therefore allow for their checking or regulation on the one hand, and for the cultivation of the social affections, as antidotes, on the other. Finally, as feeling ascends in the scale it involves the intellectual elements, and especially the faculties of memory and imagination. These faculties must therefore be properly cultivated and supplemented later on with the development of the child's reasoning powers, so that the final product may show itself in right conduct and good character." Here we have habits, faculties, powers generalized. One other illustration from these authors. "Arithmetic is a subject which if properly taught makes powerful appeals to the judgment. Some arithmetical exercises are admittedly and necessarily mechanical, but 'problems' are among the finest school exercises for training the judging faculty." (Dexter and Garlick.)[1]

"Objects of the study of languages in schools.

(1) To enable us to express our thoughts correctly.

[1] Dexter and Garlick, *Psychology in the Schoolroom*, pp. 211, 169.

(2) To train (a) the memory, (b) the judgment, (3) the aesthetic faculty, (d) the imagination.

(3) To open the door for all the other studies.

(4) To exercise the reasoning powers.

(5) To afford a mental discipline, by the consideration of the *words* apart from the *things* they symbolize.

(6) To develop habits of exactness and precision." (Collar and Crook.)[1]

"The practical aim of a general education is such training as shall enable a man to devote his faculties intently to matters which of themselves do not interest him. The power which enables a man to do so is obviously the power of voluntary, as distinguished from spontaneous, attention..... In other words, whatever interest people commands their spontaneous attention, and accordingly such power of concentration as is naturally theirs. But if a man is to make anything whatever out of a matter which does not interest him, he must concentrate his powers on it by a strenuous act of attention controlled by the full power of his will..... The elder education, to

[1]Collar and Crook, *School Management and Methods of Instruction*, pp. 129, 130.

be sure, cultivated voluntary attention, not because it specifically insisted that pupils should unintelligently devote tedious years to grammars and dictionaries of Latin and Greek, or to lifeless variants of the extinct vitality of Euclid; but, unknowingly, it cultivated the faculty well. Through daily hours, throughout all their youthful years, it compelled boys, in spite of every human reluctance, to fix their attention on matters which, of themselves, could never have held attention for five minutes together. No doubt, plenty of subjects other than classics or mathematics could have been made to serve this purpose and could be made to serve it now. You can hardly imagine a subject, essentially uninteresting, which would not reward plodding work with a similar result—with substantial ignorance of the matter studied, but with increasingly and lastingly muscular power of voluntary attention." (Wendell.)[1]

This general value of specific training in voluntary attention is also emphasized in the following discussion by Angell, though the author's point of view is somewhat different from that of Wendell. The article from which the extract is taken does not argue for the transfer of acquired abil-

[1] Wendell, *The Privileged Classes*, "Our National Superstition," 171-174.

ity beyond the common elements in the processes involved, but it does argue for the very general usableness and importance of many of the common elements in specific training.

"The persistent and voluntarily directed use of attention, especially when the subject attended to is lacking in interest, speedily becomes acutely distasteful. Voluntary attention involves some strain, and this strain, if long continued, is certain to become unpleasant. We first become bored, then restless, and finally find the thing intolerable and abandon it. Now no small part of the discipline which comes from the effortful use of attention in any direction or on any topic is to be found in the habituation which is afforded in neglecting or otherwise suppressing unpleasant or distracting sensations. We learn to 'stand it,' in short. This fact has been pointed out at times by writers on these topics, but it is rarely given the importance which it properly deserves. Anyone can attend to things which interest or please him as long as his physical strength holds out. But to attend in the face of difficulties which are not entertaining is distinctly an acquired taste, one to which children and primitive people always strenuously object. From this point of view

it may well be that such studies as the classics and certain forms of mathematics have a peculiar value in affording the maximum of unpleasantness diluted with a minimum of native interest, so that a student who learns to tolerate prolonged attending to their intricacies may find almost any undertaking by contrast easy and grateful. The actual mental mechanism by which this intellectual and moral acclimatization is secured, is extremely interesting, but we cannot pause to discuss it. Certain it is that something of the sort occurs and that it is an acquirement which may presumably be carried over from one type of occupation to another. If each form of effortful attention had a wholly unique type of discomfort attached to it, this inference might be challenged. But such does not seem to be the case."[1]

As early as 1878 Bain had expressed the same idea: "There is a form of mental efficiency that attaches more or less to every productive effort—the giving attention to all the rules and conditions necessary for the result intended.....This is a discipline that we learn from everything that we have to do; it is not a prerogative of any one

[1]Angell (J. R.), *Educational Review*, June, 1908, "The Doctrine of Formal Discipline in the Light of the Principles of General Psychology," pp. 9, 10.

study or occupation, and it does not necessarily extend itself beyond the special subject."[1]

Our second group is composed of quotations from those who oppose the doctrine of formal discipline, claiming that discipline is specific, not general, and therefore cannot be transferred from one function to another except in so far as the two functions have elements in common.

"The law appears to be this: in so far as the second exertion involves the same muscles and nerves as the first one, and, particularly, in so far as it calls for the same co-ordination of muscles and nerves, the power created by the first exertion will be available. In other words, the result is determined by the congruity or incongruity of the two efforts." "Through repetition, the energizing process becomes easier and more rapid. Repeated activity in the same direction tends to groove the mind, or, to change the figure, the stream of activity digs out for itself a permanent channel of discharge. Mental power is of two kinds, specific and generic. In other words, the power that is generated in any activity can be fully used again in the same kind of activity, but only partly used in other kinds—the measure of

[1]Bain, *Education as a Science*, pp. 141, 142.

the difference being the relative unlikeness of the two activities." (Hinsdale.)[1]

"The mind is by no means a collection of a few general faculties, observation, attention, memory, reasoning and the like, but is the sum total of countless particular capacities, each of which is to some extent independent of the others,—each of which must to some extent be educated by itself. The task of teaching is not to develop a reasoning faculty, but many special powers of thought about different kinds of facts. It is not to alter our general power of attention, but to build up many particular powers of attending to different kind of facts.....

"Training the mind means the development of thousands of particular independent capacities, the formation of countless particular habits, for the working of any mental capacity depends upon the concrete data with which it works. Improvement of any one mental function or activity will improve others only in so far as they possess elements common to it also. The amount of identical elements in different mental functions and the amount of general influence from special training are much less than common opinion supposes.

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[1] Hinsdale, *Studies in Education*, pp. 47, 73.

The most common and surest source of general improvement of a capacity is to train it in many particular connections." (Thorndike.)[1]

"It is agreed that wherever practice in one exercise leads to improvement in another certain specific elements in both are identical and call forth identical responses which promote success in both exercises. The identical elements that are thus distinguished may be divided into two groups, those of content and those of form. As examples of content elements we may mention sounds, colors, letters, nonsense syllables, words, objects, kinds of geometrical figures, standards of measurement, ideas, etc. As one grows familiar with such elements, the power to remember them and to attend to them when they appear in new situations and to do what they suggest increases. The elements of form may be said to consist of the characteristics that the various situations present as problems for the attacking mind. Thus we recognize one situation as a problem of memorizing where from the nature of the material a particular method of committing to memory may be especially useful. Again, we recognize the need of particular adjustments of perception, such as movements which we have already prac-

[1]Thorndike, *Principles of Teaching*, pp. 240, 248.

ticed. All situations demand adjustments of attention, some of which may invariably be necessary, while others may suit especially specific kinds of material.

"We observe that elements of form and elements of content are equally specific, equally capable of definition. Moreover, both are capable of generalization—that is, both are capable of appearing in a variety of settings. The problem of general training is then quite as much one of discipline in content, as it is of discipline in form. A better division of mental discipline for our purposes would be into two phases which we may denominate specific discipline and general discipline. Specific discipline consists in the analysis of the specific elements which are to be found to be critical in determining certain reactions, and in the practice by which the appropriate reaction is made the habitual response to each element thus discriminated. General discipline consists of training in the recognition of these critical elements in a variety of situations." (Henderson.)[1]

Representation should be given at this point to some Herbartian attacks on the doctrine of formal discipline. Herbart's psychology has had

[1]Henderson, *Education*, May, 1909, "Formal Discipline from the Standpoint of Analytic and Experimental Psychology," pp. 609, 610.

considerable influence in modifying the old point of view, on account of its refutation of the "faculty" psychology, its doctrine of apperception, and its emphasis upon interest. The theory that mental life is the result of ideas and their apperceiving masses has been used to deny the spread of training beyond the ideas by means of which the training was previously acquired. This is justifiable, if the theory is not carried so far as to make mental discipline little more than apperception of ideas.

The German Herbartian, Rein, thus disposes of the doctrine of formal discipline: "The fiction of 'formal education' must be given up. In general, there is no such education at all; there exist simply as many kinds of formal education as there are essentially different spheres of intellectual employment."[1] The English Herbartian, Adams, has a delightful chapter on "Formal Education," satirizing the emphasis upon form regardless of content by showing the superiority from this point of view of Fagin's school of crime in "Oliver Twist." "In short, the soul is not a mere knife that may be sharpened on any whetstone, and when sharpened may be applied to any purpose—to cut cheese or to excise a cancer. The

[1]Rein, *Outlines of Pedagogics*, p. 61.

knife takes character from the whetstone." "Since we cannot have the knowing ego by itself, and since each new fact is acted upon by the facts which then form part of the apperceiving soul, it follows that the more facts that have been organized into faculty, the more readily will the mind act, and the greater will be the range of facts upon which it will act easily. There are here two different qualities—readiness and range. The former is acquired by practice in apperceiving the same or closely allied facts; the latter by apperceiving a large number of facts of different character."[1] Here we have an over-emphasis upon apperception. This chapter is applied by Hayward to the problems of instruction in moral training. "Power and skill and the other qualities desired by the advocates of formal training depend on apperception masses, and are limited by them." "Habits do not seem, to any important extent, to become generalized; the generalizing factors in conduct—though our author does not expressly say this—are not habits, but ideas."[2]

The following quotation is from an early reply to the Herbartians by Hugh, who upholds the doctrine of formal discipline, though recognizing

[1] Adams, *Herbartian Psychology Applied to Education*, pp. 126, 131.
[2] Hayward, *Education and the Heredity Spectre*, p. 107.

"that the disciplinary value of studies should be sought, as far as possible, in those that have a value on account of their content."

"It seems, then, that formal education is to some extent a reality, according to the teachings of physiological psychology, both in the permanence of the acquisition derived from studies apart from their knowledge value, and also in the general application of this increased power for other forms of mental activity. Intellectual training stands on very much the same basis as physical training. A man's physical nature can be trained by doing useful work or the exercises of the gymnasium, which have no value whatever except their effect upon the physical system of the performer. So one's brain system can be trained in studies that have a knowledge value for the individual, but also in those that have none. In both cases, of course, it is best that the gymnastics should be secured in the performance of useful work, as in this case two ends are gained at the same time; but as, perhaps, all kinds of work only partially develop one's physical powers, so that it is necessary to have recourse to gymnastics to complete the physical training, in the same way it may be necessary to have special exercise to develop particular brain functions, though such

exercises have no knowledge value in themselves. In fact, it may be found that many physical exercises, that usually are not classed as mental training, have no less value for the training of the mind than the study of the classics or the sciences, that manual labor, foot-ball, and other forms of athletics are just as potent factors in intellectual development as many subjects of the curriculum; as they not only train the muscular system, but also the brain cells by which the muscles are controlled."[1]

Finally, we make a third group of quotations, those from authors who try to combine both adherence and opposition to the doctrine of formal discipline. These authors take about the same position as do those of the second group, but they lay greater emphasis upon the extended usableness of the common elements of subject-matter and especially of method in many functions. There is little reason for the third group to be considered as upholders of the doctrine of formal discipline and as opposed to the doctrine of specific disciplines. And there is also little reason for one group to criticise the other. They both really modify the old formalist doctrine for the same

[1]Hugh, *Pedagogical Seminary*, April, 1898, "Formal Education from the Standpoint of Physiological Psychology," p. 604.

reason, limiting the transfer of acquired ability to the common elements in the processes involved. However, the critics of the third group have done good service in cautioning against extremes and in suggesting many relations between functions, which were not thought of before.

"*Each of the numerous habits of the brain means tendencies to the excitement of localised tracts and paths under given physical conditions.* An excitement passing over one set of paths leads to one system of external movements, *e.g.* from eye centre to hand centre, when one sees and then grasps. If circumstances vary the paths, they vary the motor results.....Whatever has happened to the brain in the past has meant some definite and usually sharply localised interchange of induced activities among its elements. Every such interchange has altered the minutest structure of all the elements concerned, has established localised paths between them for future inductions to follow. They can never act again precisely as they would have done had they not acted once in just this way. And this is what is meant by saying that the brain *forms its habits*. One must now, in addition, note that this formation of habits may occur in the most subtle fashions. Parts that have often functioned together tend to function

more easily together again. This is true down to the minutest detail of localised functions. But what is still more significant for all our higher mental life is, that *general forms or types of activity, however subtle their nature, when once they have resulted from a given exchange of induced activities (due to sensory stimulations), may tend thereby to become henceforth more easily re-excited, so that habits of our brain may come to be fixed, not merely as to the mere routine which leads to this or to that special act, but as to the general ways in which acts are done.* A given 'set' of the brain as a whole, that is, a given sort of preparedness to be influenced in a certain way —yes, even a given tendency to change, under particular conditions, our more specific fashions of activity—may thus become a matter of relatively or of entirely fixed habits..... It is indeed true that, owing to the localised character of the phenomena which determine single habits, the training of one specialized cerebral function, in any particular case, *may not* result in the training of some other specialised function, even where we, viewing the matter from without, have supposed that these two functions were very intimately connected. The question as to *what* effect the training of

any one special function will have upon other functions, or upon the general tendencies of the brain, is therefore always a question to be answered by specific experience. This the teacher, in estimating the effects of new educational devices upon the pupils, must always remember." (Royce.)[1]

"It seems clear enough that the spreading or transference in the mind of the good effects of any course of training is much more narrowly circumscribed than has commonly been supposed, but it may still be doubted whether such spreading influence is altogether wanting or is limited to the transference of definite ideas. Moreover, it seems not improbable that the freedom with which the gains of culture circulate among our mental functions and contents may differ greatly in different individuals and may increase in the same individual as he matures in life and advances in his course of training. So the psychological determination of the possibility and the range of formal discipline is necessary to render the discussion of elective studies more precise and true to fact, and the scientific study of this question

[1] Royce, *Outlines of Psychology*, pp. 67-70.

may even yet yield vital and unexpected results." (Brown.)[1]

"Training in any exercise that requires skill undoubtedly increases more general habits of accurate perception and methods of eliminating useless movements that are transferable to other movements with other parts of the body. So, too, with memory, in the usual logical learning the factors involved are in large measure common to memories of related subjects. You cannot be sure that any fact is absolutely unrelated to any other, and so far as they are related, learning the one makes easier learning the other. In both rote and logical learning there are definite habits and capacities of attending to be acquired, and these may apparently be acquired in one field, and used in another. We have to do in memory, then, with a large number of fairly distinct physiological capacities, but their use has become so dependent upon habits common to the different capacities that they are functionally parts of a common whole. Training one part thus trains related parts, and the whole in some degree." (Pillsbury.)[2]

[1] Brown (E. E.), *Congress of Arts and Sciences*, St. Louis, 1904, Vol. VIII, "Present Problems in the Theory of Education," p. 77.

[2] Pillsbury, *Educational Review*, June, 1908, "The Effects of Training on Memory," pp. 26, 27.

OBSERVATIONS

The following observations are those which seem to us to militate most strongly against the doctrine of formal discipline:

1. The training of one part of the body results in a specialized development of that part, rather than of other parts or of the body as a whole, except in so far as a generally increased circulation and metabolism increase the vigor of the whole organism. The way to train a particular muscle or organ is through the proper exercise of that muscle or organ rather than of others. In so far as related muscles or organs are involved in the same training exercises, they will also be trained by these exercises. But muscles or organs cannot be trained unless they or the nerve centres controlling them have in whole or part undergone exercise and training. Each one of us is more capable in those parts of the body that have been better trained in the course of our lives. And even these parts act better for some special purposes than for others, because they have been trained to act in these specific ways.

2. The training of the mind in regard to one

subject results in a specialized ability to deal with this subject, rather than with other subjects. In so far as other subjects are similar in matter or in method to the first subject, the mental ability to deal with this first subject can be used with the other subjects. But ability to deal with any subject cannot be developed unless the mind has been exercised directly with it or indirectly on account of some of its elements being included in the other subjects with which the mind has been directly exercised. Furthermore, from the standpoint of psychophysics, mental exercise in connection with any part of the brain will tend to increase the circulation and metabolism in the brain as a whole, just as physical exercise in any part of the body will tend to increase the circulation and metabolism in the body as a whole; but this generally increased vitality is far different from the specialized ability acquired through specific training.

3. Most of us recognize that we are specialized in our mental abilities, showing more accuracy, concentration, reasoning, endurance, etc. in dealing with those matters with which we have had most to do. We know from experience that we cannot transfer these abilities to other matters without loss. We think better about some particular things than others, we feel more keenly

about some particular things than others, we do more easily some particular things than others. In many cases it is easy for us to trace out those past experiences that have produced these specialized abilities; and on the other hand we can justify our lack of ability in other lines by showing how little opportunity we have had to develop these other specialized abilities. We are more or less a bundle of specific abilities and of specific inabilities, doomed to our efficiencies and our inefficiencies by the activities which have made out of our native tendencies whatever we are to-day.

4. We also notice in those about us a similar particularization of ability to lines of activity which have become habitual. We notice this most strikingly in the narrow abilities of many specialists (doctor, merchant, housekeeper, etc.), who appear at an increasing disadvantage the further they digress into fields dissimilar to their own. Tact in social intercourse consists largely in allowing our acquaintances to reveal and revel in their native or acquired special abilities and to hide and forget their special inabilities. The friend who thus emphasizes the sources of strength and overlooks the sources of weakness in others is sure to be popular.

5. The business and professional world relies

more and more on the superiority of specialized ability resulting from special training. Men are thereby becoming more efficient specialized workers but less adaptable, less transferable, more dependent upon the specialized demand for their work. Thus is being produced an economic dependence which is almost fatalistic. The way to overcome this fatalism of specialization is not by claiming the transfer of acquired ability, a dogma that the employer and the public will not accept as a wise business principle. Either the ability of the specialist must be related in matter or in method to other abilities (and this is not often the case at present), or the specialist must be trained in the broader activities, if not in the details, of two or more specialties. This is one of the arguments for manual training courses as preparation for industrial work of any kind. It is no exaggeration to say that the necessities of economic competition have shown the fallacy of the doctrine of formal discipline.

6. The ability displayed by some people in two or more lines of activity may be due to their having been specially trained in these lines and not to a transfer of acquired ability from one activity to another. Or the activities may be so closely related that ability in one is in part ability in the

other. Or these several abilities may be due to the general native ability of the person, resulting from the innate structure and vitality of the brain. There is often a failure to distinguish in thought between native ability, which is either general or special, and acquired ability, which is special. The former is due to the superior nature of the brain, in whole or in part; the latter is due to the action of stimuli upon a specific part of the brain, according to the nature of the stimuli as well as of the brain. No one doubts that some people have unusual native capacity for receiving and holding impressions, for sustaining close attention, for making clear judgments, for exercising vigorous and precise muscular control, etc. A person may thus be talented in one or in several lines. His initial superiorities will render more efficient and rapid his development in one line of activity or in several; but, in the latter case, the development in a subsequent line of activity is not due to a previous development in a different line of activity, but to a similar native superiority of intra- or inter-cellular organization or metabolism in the different parts of the brain connected with the different lines of activity. The ability of school pupils in several studies is often used to support the belief in the transfer of acquired

ability from one subject to different subjects, whereas no such explanation seems needed or justifiable in these cases.

7. Furthermore, the ability of pupils in one study after they have acquired ability in another study may be due to general growth processes at that period of physical and mental development, regardless of particular studies and acquired abilities. The different stages in the growth of a child represent the birth of new tendencies, interests, and abilities, which greatly affect his school work. This is often seen in high-school pupils, whose general adolescent development of secondary sex characters and of the association centres of the brain will largely account for their increased ability in successive studies of different kinds. These factors of constitutional growth are generally overlooked, not only in the curricula and methods used at different stages of growth, but also in our explanations of the progress made in school work at these different stages.

8. The variations shown by the same pupils in their class standing in different studies are puzzling to the formal disciplinists. These variations may be due to differences in application, in native ability, or in acquired ability for this or that particular work. In so far as they are due

to acquired ability, the doctrine of transference does not seem to hold, for the abilities acquired in one study do not spread uniformly to other studies. The greater amount of uniformity often noticed in the class standing in related studies seems to show that in so far as studies are similar there tends to be a similar ranking of the pupils in these studies.

9. But what is more serious is the generally recognized fact that pupils who excel in school are often beaten in professional or business life by fellow-pupils who ranked below them in class standing. The school abilities acquired through school activities are not in these cases carried over to the environmental activities outside the school. This is due to the difference between the matter and the method of the two activities and to the consequent inability of the pupils to make success in the one issue into success in the other. If there were such a transfer of acquired ability as the doctrine of formal discipline implies, there would not be such a difference in the ranking of individuals in the two activities.

10. Closely related to a recognition of this fact is the popular demand for more "practical" courses in the schools. This demand is based upon a belief, not only that the kind of training

derived from these courses is different from that derived from others, but that this kind of training is the one needed for practical efficiency, because it is derived from materials and methods similar to those used in practical life. The doctrine of democracy in education and the doctrine of formal discipline cannot be well harmonized. When only the favored few "took" education, the doctrine could be cherished as a cultural ideal and the waste involved in its application could be overlooked or tolerated without economic hardship. But when the masses of limited means determined to educate their children, they questioned some of the school's circuitous methods of promoting mental development and exerted their power to eliminate indirect and wasteful ineffectiveness in preparing boys and girls as soon as possible for independent service. This is one of the reasons why the doctrine of formal discipline is retiring from the elementary schools and is showing signs of increasing discomfort in the secondary schools, as the latter become democratic in sympathy and usefulness as they have become democratic in support and control.

11. Finally, we notice that adherents of the doctrine of formal discipline shrink from carrying their doctrine to its logical conclusions, name-

ly, the exact equivalence of studies for mental discipline or, if a distinction is made between them, the concentration on a single superior study for the training of a given power or set of powers. In practice, if not in theory, these adherents acknowledge a variation in training of a given power or set of powers as related to a variation in content of study. A case in point is the inconsistency of the Committee of Ten on Secondary School Studies in stating what seems to be a belief in the equivalence of studies and then specifying elaborately varied curricula, representing different phases of the environment, different subject-matter and method. Baker dissents from the doctrine of equivalence in his minority report. Schurman seconds him in a magazine review, declaring that "the Committee of Ten, and some of the conferences as well, have fallen victim to that popular psychology which defines education merely as the training of the mental faculties."[1] Taylor, a member of the Committee, replies in an article of defence that the word "equivalence" was used "in relation to college requirements. The thought of the committee was surely equivalence of results, in this aspect, rather than equivalence of value, intrin-

[1] Schurman, *School Review*, February, 1894, p. 93.

sically considered."[1] This is not exactly the point at issue. Are studies equivalent for mental discipline, even though we recognize their difference "of value, intrinsically considered"? The practical influence of the Committee's report has been to strengthen the current belief in this disciplinary equivalence, though the Committee's real intention is better shown by its suggestive curricula.

[1] Taylor, *School Review*, April, 1894, p. 196.

EXPERIMENTS

Space will not allow descriptions of all the experiments so far made, which furnish evidence in regard to the doctrine of formal discipline. Rather than give a brief summary of each experiment, we deem it more profitable to describe typical and important ones, using as far as possible the words of those who conducted them. Care has been taken to describe experiments which seem to favor the doctrine of formal discipline, as well as those which seem to oppose it. The results of the other experiments are briefly stated in the summaries mentioned. We are not specially concerned with the large number of experiments on the effect of practice and the formtaion of habits in only one function. The reader is referred to the recent summaries of these by Ellison[1] and Bagley.[2] Our special concern is with experiments on the *transfer* of the effect of practice from one function to another. Summaries of most of these

[1]Ellison, *Pedagogical Seminary*, March, 1909, "The Acquisition of Technical Skill."

[2]Bagley, *Psychological Bulletin*, March, 1909, "The Psychology of School Practice." See also Thorndike, *American Journal of Psychology*, July, 1908, "The Effect of Practice in Case of a Purely Intellectual Function."

experiments are given by Henderson,[1] Thorndike,[2] Bennett,[3] and Coover and Angell.[4]

Although the experimenters variously interpret the bearing of their results on the doctrine of formal discipline, they differ mainly as to the extent to which the effect of practice in one function can be transferred to other functions having elements in common with it. This transfer results in either improvement of or interference with the other functions, according to whether the common elements are used in a similar or in a different way in the associations of these functions as compared with those of the first. As some elements are common to many functions, practice with them results in abilities of wide usableness. This widespread transfer has caused many students to overlook or even deny the specific character of the habits thus usable in many associations. Especially is this true in regard to elements of method, because they are usually common to more functions than are elements of subject-matter, the number of distinct methods

[1]Henderson, *Education*, May, 1909, "Formal Discipline from the Standpoint of Analytical and Experimental Psychology."

[2]Thorndike, *Educational Psychology*, Chap. VIII, "The Influence of Special Forms of Training Upon More General Abilities."

[3]Bennett, *Formal Discipline*, Columbia University. Has a bibliography of uneven value.

[4]Coover and Angell (F.), *American Journal of Psychology*, July, 1907, "General Practice Effect of Special Exercise."

being more limited and their range and applicability wider.

There have been several experiments on cross-education, or the improvement in an activity, involving one part of the body, as the result of improvement through practice in a similar activity, involving a bilaterally symmetrical part of the body. The results of most of these experiments have been summarized by Davis[1] and the writers previously mentioned. The improvement in the second activity in such experiments can be explained as due to two causes. In the first place, both activities are very similar and probably involve in part the same centres in the nervous system. Though bilaterally symmetrical parts of the body are controlled in part through cortical centres in different hemispheres, they are also probably controlled in part through lower centres which serve for both sides of the body. The improvement in the second activity is therefore probably due to the use in part of the same centres in both activities. In the second place, the improvement is due to the working out, in connection with the first activity, of a *method* of *how* to perform the act, and then to the use of this

[1]Davis, *Yale Physchological Studies*, 1898, "Researches Upon Cross-Education," pp. 6-50.

method in guiding the second activity. The use of this method in guiding the second activity is as different from the transfer of acquired ability as the knowledge of how to do is different from the ability to do. Such knowledge may lead to ability, but in itself it is not ability. (See our later discussion of both these points.) The first two experiments here described represent the methods and results of all those on cross-education.

1. The following experiments were conducted by Smith at Yale University, under the direction of Scripture:—

"The measure of accuracy was the ability to insert the needle into a single hole 0.1285 inches in diameter. The vertical metal plate containing the hole was placed directly in front of the observer; the right fore-arm was rested on the edge of the table; the stick was grasped like a pencil and by a steady movement of the hand and wrist the metal point was inserted in the hole. Any contact of the point against the side of the hole was counted an error. The per cent. of successful insertions was considered the measure of accuracy.....

"The first set consisted of twenty experiments with the left hand; the result was 50 per cent. of successful trials. Immediately thereafter twenty

experiments were made with the right hand, with a result of 60 per cent. of successful trials. On the following day and on each successive day two hundred experiments were taken with the right hand, the same conditions in regard to time, bodily condition and position in making the experiments being maintained as far as possible. The percentage of successful trials ran as follows: 61, 64, 65, 75, 74, 75, 82, 79, 78, 88.

"On the 10th day the left hand was tested with twenty experiments as before, with 76 per cent. of successful trials, thus showing an increase of twenty-six per cent. without practice in the time during which the right hand had gained as shown by the figures above.....

"From the results of these two thousand experiments the following conclusions seem justified:

(1.) Steadiness of movement can be increased by practice.

(2.) This increase of steadiness is not limited to the control of the muscles immediately trained but affects the control of the corresponding muscles on the opposite side of the body.

(3.) This training seems to be of a psychical

rather than of a physical order and to lie principally in steadiness of attention."[1]

2. The following experiments were conducted by Davis with six graduate students at Yale University:[2]

"At the initial test the subject's clothing was removed from the upper part of his body. His weight was then taken and his strength of forearm, or grip, measured by the usual spring dynamometer. The following measurements were then made: right and left upper arm both flexed and extended; right and left forearm with and without the hand clenched. These measurements were taken at the largest circumferences of the arm above and below the elbow. The weight (a 2½ kilo. dumbbell) was then given to the subject, who was instructed to lift it from a position where the arm hangs extended downward and the weight is supported from the shoulder, to one where the arm is flexed and the weight close to the shoulder. In this movement the elbow remains stationary. Hence, to accomplish this act, the biceps is employed almost wholly, though the muscles of the forearm are also used to a lesser

[1] Scripture, Smith, and Brown, *Yale Psychological Studies*, 1894, "On the Education of Muscular Control and Power, pp. 115-118.

[2] Davis, *Yale Psychological Studies*, 1898, pp. 18-29. See other experiments by Davis.

extent in gripping the dumbbell. This gripping was intensified toward the end of the test, when the subject became fatigued.....

"The subject then entered upon a practice extending from two to four weeks; this consisted in simple flexions of the *right arm* with the weight.....

"At the final test the same data were obtained in the same way and under the same conditions as at the initial test. Additional data were also obtained."

The following summary gives the results of several tests made of the right and the left arm, before and after practice of the right arm with the dumbbell. The six subjects averaged 26½ years of age, 14½ days of practice, and 310 flexions of the right arm in daily practice. The average girth gain in mm. of biceps, contracted, was —right 6⅓, left 2⅚; the average girth gain of forearm, contracted, was—right 4⅚, left 2⅙; the average gain in number of flexions made with the dumbbell was—right 757, left 178; the average gain in strength of grip as measured by the dynamometer, in kilos, was—right 5.56, left 5.41.

The author gives the following conclusions

from his own experiments and those made by others:

"a. The effects of exercise may be transferred to a greater or less degree from the parts practiced to other parts of the body. This transference is greatest to symmetrical and closely related parts.

"b. There is a close connection between different parts of the muscular system through nervous means. This connection is closer between parts related in function or in position.

"c. Will power and attention are educated by physical training. When developed by any special act they are developed for all other acts.

"With conclusions *b* and *c* established the explanation of the transference is probably reached. There is no doubt that the most important effects of muscular practice are central rather than peripheral. The central effects may be distinguished as: (1) those dependent on the development of motor centres, that is, their improvement through exercise; (2) those dependent on the development of psychical factors, notably attention and will power. Of these two effects we would emphasize the first as the most important."[1]

3. The following experiments were conducted

[1]Davis, *Yale Psychological Studies*, 1898, pp. 49, 50.

by Thorndike and Woodworth at Columbia University:

"Individuals practiced estimating the areas of rectangles from 10 to 100 sq. cm. in size until a very marked improvement was attained. The improvement in accuracy for areas of the same size but of different shape due to this training was only 44 per cent. as great as that for areas of the same shape and size. For areas of the same shape but from 140-300 sq. cm. in size the improvement was 30 per cent. as great. For areas of different shape and form 140-400 sq. cm. in size the improvement was 52 per cent. as great.

"Training in estimating weights of from 40-120 grams resulted in only 39 per cent. as much improvement in estimating weights from 120 to 1800 grams. Training in estimating lines from .5 to 1.5 inches long (resulting in a reduction of error to 25 per cent. of the initial amount) resulted in no improvement in the estimation of lines 6-12 inches long.

"Training in perceiving words containing e and s gave a certain amount of improvement in speed and accuracy in that special ability. In the ability to perceive words containing i and t, s and p, c and a, e and r, a and n, l and o, misspelled words and A's, there was an improvement of only 39 per

cent. as much as in the ability specially trained, and in accuracy of only 25 per cent. as much. Training in perceiving English verbs gave a reduction in time of nearly 21 per cent. and of omissions of 70 per cent. The ability to perceive other parts of speech showed a reduction in time of 3 per cent., but an *increase* in omissions of over 100 per cent."[1]

4. The following experiments were conducted by Squire and others at the Montana State Normal College:

"Careful experiments were undertaken to determine whether the habit of producing neat papers in arithmetic will function with reference to neat written work in other studies; the tests were confined to the intermediate grades. The results are almost startling in their failure to show the slightest improvement in language and spelling papers, although the improvement in the arithmetic papers was noticeable from the very first."[2]

5. The following experiment was conducted by Judd at Yale University:

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[1] Thorndike, *Educational Psychology*, p. 90. These experiments are described in detail in three articles in the *Psychological Review*, 1901. They have been criticised by Coover and Angell (F.), *American Journal of Psychology*, July, 1907, p. 330.

[2] Bagley, *Educative Process*, p. 208.

"A person who was to be tested was seated in such a position that his right hand and arm were entirely hidden from view by a large screen. Whatever he did with this right hand would, therefore, be unseen by him. On the left side of the screen and in full view, nine different lines were shown in succession, and he was required to place a pencil held in the unseen right hand in the direction indicated by the several lines seen before him. The errors made in placing the pencil were accurately measured and recorded. A standard of comparison was thus gained by which all later results could be valued. The next step in the experiment was to train the person being tested to more accurate localization of one special line, which for purposes of our description we may call No. 5. With this one line, No. 5, the reactor was given fuller visual experience and the error which he at first made with this line gradually disappeared. After this clear improvement with No. 5 the original conditions were restored, and the reactor was again tested as at first with all nine lines. Every line in the series was effected. This means that there had been a transfer of effects under the conditions of the training described.

"This, however, was not all. Some of the

lines had shown in the first series of tests an error in the same direction as line No. 5; others showed an error in the opposite direction. The transfer of practice differed in the two kinds of cases in that those lines which had a like error with No. 5 improved with No. 5, while the lines which had errors in the opposite direction to No. 5 grew worse as a result of practice with No. 5. The transfer of practice was no less real in the case of the lines which increased in error than in the case of the lines which improved. Both kinds of cases show that the functions involved are interdependent, and that transfer of practice is a complex process which must be studied from a variety of points of view if its different modes of operation are to be fully understood. Joint improvement is only one of the possible forms of transfer; reciprocal interference is just as significant a type of transfer as is joint improvement.

"The experiment was carried a step further. After practice with No. 5, a new practice series was instituted with another line, which we may designate as No. 2. It was found that the person being tested was now very much less affected by practice with No. 2 than he had been during the first practice series with No. 5. The amount of practice given with No. 2 was much greater in

quantity and more radical in type, but the reactor remained relatively unaffected. This means, of course, that when the reactor first came to the experiment he was open to all kinds of suggestions. He was in the habit-forming attitude; he easily took on the effects of practice. But after the training which he received with line No. 5, he was less capable of acquiring new adjustments; he was no longer in the habit-forming attitude.

"This is a third phase of transfer of practice. It is no less significant than joint improvement or reciprocal interference, for surely any influence which renders an observer immune to the effects of new practice is not to be overlooked in discussing the relations of various forms of experience to each other. The closing up of possibilities of future practice is much more important a consequence of any practice series than the direct transfer of effects to other functions."[1]

6. Of the few experiments on the transfer of the effects of memory practice, only one is described here in full. But mention should be made in passing of the experiments by James "to see whether a certain amount of daily training in

[1] Judd, *Educational Review*, June, 1908, "The Relation of Special Training to General Intelligence," pp. 28-30. See other experiments outlined in same article and the general conclusions drawn from them.

learning poetry by heart will shorten the time it takes to learn an entirely different kind of poetry." The results showed very little improvement in the second case; and the author concludes that "all improvement of memory consists in the improvement of one's habitual methods of recording facts."[1] Mention should also be made of the experiments by Ebert and Meumann on the transfer of acquired ability in memorizing syllables to ability in memorizing other syllables, stanzas, prose sentences, visual signs, etc. The amount of transfer noticed in these experiments was probably due to the similarity of the material used in the different tests and to the development of better methods of memorizing. The authors suggest, however, that there must have been some general ability developed by this specific training.[2]

The following experiments were conducted by Winch with London school girls:[3]

I. "The first series of experiments was made with girls of the average age of 13 years. The first step was to divide the children into two

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[1]James, *Principles of Psychology*, Vol. I, pp. 666, 667.

[2]Ebert and Meumann, *Archiv fur die Gesamte Psychologie*, IV Band, 1. u. 2. Heft, 1904, pp. 1-232.

[3]Winch, *British Journal of Psychology*, January, 1908, "The Transfer of Improvement in Memory in School-Children," pp. 284-293.

groups of equal ability as to memory. This was done, partly on an actual test and partly on the opinion of the class teacher. The test set was a passage from a historical reading-book, which was not in the ordinary way accessible to children of this class. Ten minutes were allowed for memorizing; the work was mainly visual, articulation, however, being permitted, provided that it was not audible. The girls were then required to reproduce in writing as much as they could remember, fifteen minutes being allowed for this. One mark was allowed for each word rightly remembered and correctly placed. There were ninety-eight words in the exercise.

"With the aid of the teacher, the girls were now placed in two equal groups. The members of the A group, during the next week or two, were practised in learning poetry, the B group meanwhile working sums. With this exception, the school work of the two sections was the same during the progress of the experiment. After four practice exercises had been worked by group A, the two groups were placed together and a final test given in history. The time allowed for each test and exercise and the method of marking were the same in all cases. The general result may be more clearly indicated by the following

summary, showing the pupils arranged in sections according to the marks they obtained in the preliminary test in history and giving the average marks of the different sections in both the preliminary and the final history tests.

	GROUP A			GROUP B		
Marks in preliminary test.	No. of children.	Pre-liminary test.	Final test.	No. of children.	Pre-liminary test.	Final test.
Full marks	3	98.0	133.0	2	98.0	131.0
95-98	5	96.4	130.6	7	96.0	121.1
90-95	4	91.5	123.2	3	91.0	111.6
80-90	2	82.0	113.5	2	85.0	92.0
Below 80	3	63.6	94.3	3	62.0	87.0

II. "A second series of experiments was made in another school, with girls of the average age of 13 years 3 months. The whole class, as in the previous school, was divided into two approximately equal groups, and one was practised in memory exercises, and the other not. The preliminary and final tests were, however, exercises in geography instead of history as in the former school; and the poetical extracts given were simpler in meaning. Group B was occupied in writing whilst Group A was memorizing. The time allowed for memorizing and the method of marking were as before.

Marks in preliminary test.	GROUP A No. of children.	Pre-liminary test.	Final test.	GROUP B No. of children.	Pre-liminary test.	Final test.
90 and over	3	90.3	98.6	3	90.3	95.0
85-90	6	88.0	92.0	6	88.2	93.1
75-85	5	80.0	94.6	5	80.4	85.2
Below 75	3	71.6	81.0	3	71.0	61.6

III. "A third series of experiments was carried out in a third school, with girls of the average age of 12 years 8 months. The general scheme of tests and exercises resembled that of the two previous experiments, history passages being used for the preliminary and the final tests.

Marks in preliminary test.	GROUP A No. of children.	Pre-liminary test.	Final test.	GROUP B No. of children.	Pre-liminary test.	Final test.
98-108	7	103.8	104.6	7	102.6	100.6
68-98	8	84.5	77.3	8	82.5	64.3
48-68	8	58.3	64.0	7	58.8	46.7
0-48	4	28.5	64.7	5	27.4	41.6

"The conclusion from these three series of experiments seems definite and clear. Improvement, gained by practice in memorizing one subject of instruction, is transferred to memory work in other subjects whose nature is certainly diverse

from that in which the improvement was gained.

"This, at least, is true as far as children of these ages and attainments are concerned. I expressly add this limitation as to age, for inferences from adult psychology to child psychology and to pedagogical practice are extremely unsafe, and I am anxious to avoid the opposite error."

7. The following experiment was conducted at the Speyer School, Teachers College, with sixteen children of about eleven years old. The purpose was to test the effect of acquired ability to discriminate between shades of blue upon the ability to discriminate between shades of red, of yellow and green, and black and orange. The great transfer of ability shown by the experiment was probably proportionate to the similarity between the test with blue and those with the other colors. The amount of error was calculated according to the grade of difference between the two shades used in each experiment, which the children failed to recognize. The results are given in averages, before and after the training with shades of blue.[1]

Tests with red and white.

Boys.	Before	4.5	4.5	3.0	3.2	2.3
	After	.6	.7	.9		

[1] Bennett, *Formal Discipline*, Columbia University, pp. 59-62*a*. See other experiments reported in this thesis.

Girls.	Before	3.5	6.0	4.2	3.4	2.4
	After	.48	.75	.65		

Tests with yellow and green.

Boys.	Before	6.7	5.3	4.0		
	After	2.0	2.0	1.3	3.0	
Girls.	Before	5.0	5.2	5.0	5.1	
	After	2.8	2.6	1.7	1.7	2.1

Tests with black and orange.

Boys.	Before	3.0	2.8	3.4		
	After	1.2	1.6	.8	.9	1.0
Girls.	Before	2.7	2.7	2.2		
	After	1.8	1.3	.9	.5	.5

8. The following experiment was conducted by Coover and Angell:—

"Four reagents were trained in discrimination of intensities of sound for 17 days during an interval of 57. Each reagent made 40 judgments in each day's training.

"Before and after training the reagents were tested in the discrimination of shades of gray, each test consisting of three series, each containing 35 judgments, delivered on 3 separate days.....

"All the test reagents with one exception show a gain in Right and loss in Undecided judgments after training.....The per cent. of gain for the

4 test reagents was 4, 4, 6, 6, 0, 0, and 27, 5, making an average of 9, 1.....

"Improvement seems to consist of divesting the essential process of the unessential factors, freeing judgments from illusions, to which the unnecessary and often fantastic imagery gives rise, and of obtaining a uniform state of attention which is less than a maximum.....

"Our conclusion from the experiment, therefore, is that efficiency of sensible discrimination acquired by training with sound stimuli has been transferred to the efficiency of discriminating brightness stimuli, and that the factors in this transfer are due in great part to habituation and to a more economic adaptation of attention, *i. e.*, are general rather than specific in character."[1]

9. The following experiments were conducted by the Dartmouth Pedagogical Department, under the direction of Lewis:—

"First, two test papers were prepared, one containing originals in geometry and the other questions in practical reasoning." The papers are given in the article from which these extracts are taken. Three questions were given in each paper.

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[1]Coover and Angell (F.), *American Journal of Psychology*, July, 1907, "General Practice Effect of Special Exercise." See also the description of their inconclusive experiment on card-sorting and typewriter reactions.

The second paper dealt with the value of high school education to the individual and to the community. "These tests were submitted to twenty-four different groups of high-school pupils. The students of each group belonged to the same class and were on an equality with respect to mathemaical preparation. Each group took both tests. The results of these tests were carefully corrected and the pupils of each group arranged in two series, the first according to their ranking in mathematical and the second according to their ranking in practical reasoning.

"If we take the first five mathematical reasoners from each of the twenty-four groups, we have in all one hundred and twenty pupils most excellent in mathematical reasoning. Of this number seventy-six, or 63 per cent., are at the foot of the practical reasoning series, conspicuous for their inefficiency in practical reasoning. Of the number of pupils at the foot of the mathematical reasoning series, fifty-seven, or 47 per cent., are conspicuous for their position at the head of the practical reasoning series.

"As a supplementary test, and one precisely the same in principle, one man examined the records of Dartmouth students who had taken mathematics and certain law courses which required a

good deal of reasoning. The records for ten different classes were examined, and tables were formed as in the previous test.

"The results of this test were found to be strikingly parallel to those of the earlier test. Fifty per cent. of the best students in law were conspicuous for their poor showing in mathematics; and 42 per cent. of those poorest in law stood at the head of the series in mathematics."[1]

10. Similar experiments were conducted by Collins at the State Normal School, Stevens Point, Wis., to disprove the extreme results of the Dartmouth experiments as to the disparity between ability in mathematics and ability in other subjects. His conclusions are thus summed up: "With the exception of about 20 to 25 per cent. of erratic people, those good in mathematics are good in other subjects, those of average ability in mathematics are of average ability in other subjects, and those poor in mathematics are poor in other subjects."[2] Collins explains his results by the "native endowment" of those examined and by the "quite general application" of the

[1] Lewis, *School Review*, April 1905, "A Study in Formal Discipline," pp. 289-291.

[2] Collins, *School Review, October*, 1906, p. 607. The conclusions of Lewis are also questioned by Kirkpatrick in the same number of the *School Review*, though Kirkpatrick states his belief in the specific character of mental discipline.

abilities gained from mathematical training. Therefore, he does not argue for the doctrine of formal discipline, though his choice of words is sometimes confusing as to his attitude. While offsetting the extremes of the Dartmouth results, he does not invalidate the general conclusions to be drawn from them.

11. The value of the Dartmouth conclusions have been more seriously challenged by Rietz and Shade, as the result of a recent statistical investigation made by them at the University of Illinois. The reader is referred to their pamphlet for explanation of their methods.[1] Coefficients of correlation were computed for the grades of several hundred students in mathematics, foreign languages, and elementary science (chemistry, botany, and geology). The conclusions of this investigation are stated in the following coefficients of correlation, with their probable errors: for mathematics and foreign languages, r=0.476—0.015 or +0.015; for mathematics and natural science, r=0.440—0.015 or +0.015. "Two characters are said to be correlated if to a selected series of sizes of the one, there correspond sizes of the other whose mean values

[1] Rietz and Shade, *Correlation of Efficiency in Mathematics and Efficiency in Other Subjects*, University of Illinois, pp. 20.

are functions of the selected values." "The probable error in any result may be defined as that deviation from the determined value, on either side, such that it is an even wager that the true value lies within this amount of the determined value." Although the coefficients of correlation are surprisingly small, the authors claim to be "justified in saying that efficiency in mathematics and efficiency in foreign languages go together in general to a high degree, and that to substantially the same extent do efficiency in mathematics and in natural sciences go together."

As this investigation is typical of others, it deserves further discussion. Even if the above coefficients of correlation were considerably greater than they are, we do not believe that they would give strength to the doctrine of formal discipline (as the authors would have us believe), because they do not prove that the ability derived from the study of mathematics is transferred to and thereby increases the abilities derived from the study of foreign languages or natural science, or *vice versa*. The way to prove the transfer of acquired ability from one subject to another is (1) to measure the ability in each subject at the beginning of the test, (2) to concentrate on increasing the ability in one of the subjects, and

then (3) to measure again the ability in the other subject to see if there has been any increase following the increase made in the subject concentrated upon. The investigations by Rietz and Shade do not meet any of these requirements. In the first place, there is no test, comparative or otherwise, of increase of ability in the given subjects. It must also be remembered that most, though not all, of the courses were taken simultaneously, not successively. In the second place, there is not the slightest proof that the marks in the different subjects had any relation of cause or effect to each other. A student might have received exactly the same marks in two subjects without there having been any relation of cause or effect between them. In the third place, the pamphlet states that there had been secondary school training in the different subjects or in allied subjects. This specific preparation in each of the subjects, based upon the native ability or lack of ability of the student, was sufficient to account for the correlation of the marks in the given subjects, without any transfer of ability from one to the other. But if there really were any transfer, it could easily be explained by the common elements in the given subjects. We conclude, therefore, that this investigation and others like it may in-

validate the extremes of the Dartmouth results but that they have little or no value as a support to the doctrine of formal discipline.

Similar investigations on the correlation of abilities furnish proof *against* the doctrine of formal discipline, by showing far greater differences between abilities than the doctrine would lead us to expect. Several of these investigations have been outlined by Thorndike.[1] We are inclined to believe that the investigation by Rietz and Shade should be classed along with these.

Although a small amount of correlation necessarily shows that there has been little transfer of ability, even a large amount of correlation does not necessarily show that there has been great transfer of ability. In the latter case, proof must be shown that the increased correlation is due to this transfer and not to native ability or to acquired ability in both subjects. The burden of proof rests upon those who have a positive correlation to explain, but a negative correlation is sufficient proof in itself of the absence of transferred ability. "Finding correlation between two functions need not mean that improve-

[1] Thorndike, *Educational Psychology*, Chap. IV, "The Relationship Between Mental Traits." See also the account of experiments by Peterson, *Psychological Review*, September, 1908, "Correlation of Certain Mental Traits in Normal School Students."

ment in one has brought about increased efficiency in the other. But the absence of correlation does mean the opposite." (Thorndike and Woodworth.)[1]

12. The following experiments with school children were conducted by Norsworthy to test the amount of correlation between selected functions:

"Tests were given in multiplication, in observing misspelled words, in marking words containing *e* and *r*, in observing the word *"boy"* wherever it occurred, and in marking semi-circles scattered amongst all sorts of geometrical forms. Differences of the same individual had been measured in arithmetic, spelling, and in ability to mark certain forms. One of them was taken as a standard and the other tests correlated with it.

"The conclusions reached from this study are in line with those already quoted, namely, that it seems probable that certain functions which are of importance in school work, such as quickness in arithmetic, accuracy in spelling, attention to forms, etc., are highly specialized and not secondary results of some general function.....Accuracy in spelling is independent of accuracy in

[1] Thorndike and Woodworth, *Psychological Review*, May, 1901, "The Influence of Improvement in One Mental Function Upon the Efficiency of Other Functions," p. 248.

multiplication, and quickness in arithmetic is not found with quickness in marking misspelled words; ability to pick out the word boy on a printed page is no guarantee that the child will be able to pick out a geometrical form with as great ease and accuracy."[1]

13. The last experiment to be mentioned here is that conducted by Stone to determine the arithmetical abilities of the sixth-grade pupils in twenty-six schools. The pupils were given under similar conditions the same problems in "fundamentals" (addition, subtraction, multiplication, division) and in "reasoning" (practical application of the fundamental operations). The results showed marked variation of pupils in (1) ability in fundamentals as compared with ability in reasoning and (2) ability in any one of the four fundamentals as compared with any of the other three. These variations are shown by the coefficients of correlation between these abilities. The author concludes that "the net result of the arithmetic work of the first six years is *several products* rather than *a product*. The study of arithmetic makes demands on a plurality of abilities. Hence it is inaccurate to speak of the arith-

[1] Norsworthy, *New York Teachers' Monographs*, December, 1902, "Formal Training," pp. 98, 99.

metical ability of pupils, and it is bad educational practice to treat the subject as though it were a unity instead of a plurality."[1] These results and conclusions are similar to those of a less extended study of arithmetical abilities by Fox and Thorndike.[2] As the author suggests, such a conclusion antagonizes the doctrine of formal discipline because it disproves the complete transfer of abilities from one phase of the same study to another. Even within the limits of the same study there are variations in abilities, according to the nature of the different activities involved in the study; even within the limits of the same study there is a decrease in the transfer of abilities, proportionate to the difference in the activities involved in the study.

[1] Stone, *Arithmetical Abilities*, Teachers College, p. 43.
[2] Thorndike, *Educational Psychology*, p. 39.

LOCALIZATION OF FUNCTION

The strongest theoretical objection to the doctrine of formal discipline is implied in the theory of psychophysical parallelism, which is defined by Stout and Baldwin as "the affirmation that conscious process varies concomitantly with synchronous process in the nervous system, whether the two processes have a direct casual relation or not".[1] It seems reasonable to draw from this theory the hypothesis that for every particular state of consciousness there is a concomitant stimulation of particular groups of cells in the cerebral cortex. Of course, it is recognized that cortical activity is not limited to these particular groups of cells in relation to a particular state of consciousness, for consciousness at any moment is related to an equilibrium of activity in the cortex as a whole; but it is held that cortical activity centers in these groups synchronously with the particular state of consciousness.[2]

If the afore-mentioned hypothesis is true, it

[1] Stout and Baldwin, *Dictionary of Philosophy and Psychology*, "Parallelism."

[2] See Angell (J. R.), *Psychology*, p. 44; Herrick, *Dictionary of Philosophy and Psychology*, "Localization."

follows that, as every stimulus modifies the particular groups of cells stimulated in such a way as to make the succeeding stimulations of those cells easier (the law of habit formation), a succession of similar states of conscious control of activity synchronizes with a succession of stimulations of particular groups of cells in the cerebral cortex and of connecting cells in other parts of the central nervous system. The stimulations so modify these groups of cells as to produce the physiological counterpart of a particular acquired ability. If, in the course of time, the acquired ability becomes so great as to require little or no conscious control and to approach the automatism of a habit, its particularity becomes even more decided, because the habit will be more and more difficult to modify in other directions. Acquired abilities and habits are particular or specific, on account of their relation to modifications of particular groups of cells. As was previously suggested in discussing the experiments upon cross-education, activities which are in part controlled through different centres in the cerebral cortex may also be in part controlled by the same centres in other parts of the nervous system. The only way to get the benefit of previous training is through a use of the modified cells, all or some, in former associa-

tions or in new associations. The extent of the benefit derived is proportionate to the number of the previously modified cells used and to the extent of the modifications in the cells used. However, if effort is made to use these modified cells in different ways in different associations, the tendency of the stimulation of these cells to issue into activity in the former way and association may interfere with the latter. This interference will be proportionate to the difference and the comparative strength of the two associations.[1]

The doctrine of formal discipline, on the other hand, seems to imply that the modifications produced by successive similar stimulations and activities are not localized in particular groups of cells but are distributed to many different groups and can be used in connection with entirely different activities. Or, the doctrine might imply that these modifications are localized in particular groups of cells but that the cells with these modifications can be used again with entirely different activities. Both of these implications seem untenable.

Mental discipline results from such a modification of particular groups of cells as will render

[1] See especially Bergström, *American Journal of Psychology*, June, 1894, "The Relation of the Interference to the Practice Effect of an Association."

future action along specific lines easier and more efficient. The aim of education is the control and direction of activity in the pursuit of certain ideal ends, and this aim is realized through discipline in the control and direction of activity toward these ends. In other words, the individual is educated through such responses to specific stimuli as will modify the particular groups of cells that he will use in adjustment to the important phases of his environment. These modified cells will represent the subject-matter of activity, the content in regard to which the activity has been controlled and directed, or the method of activity, the form in which the activity has been controlled and directed. Though these cells can be used again in new associations of subject matter or of method and the benefit of the previous modifications can thus be transfered to a partially new activity in so far as it makes use of these cells, there is a probability that such new associations and new uses of these modified cells will not be made unless the associations are worked out or suggested by or for the individual. The cells representing subject-matter may not be the same as those representing method in regard to this subject-matter, but the close association formed by practice between the two make it difficult to use the one with-

out the other. They tend to form a closed circuit. Therefore, it is necessary in education to break or enlarge this circuit by using in whole or in part the same subject-matter in association with different methods, and by using in whole or in part the same methods in association with different subject-matter. And even when several associations have thus been worked out or suggested, there is a tendency for the older or stronger associations to assert themselves and interfere with the newer or weaker associations, especially if the latter are radically different from the former. Consequently, effort should be made to develop as the strongest associations between specific subject-matter and specific method those that are of the most environmental value.

Experiments have shown that children break up old associations and form new ones more easily than do adults. Therefore they show more quickly and to a greater extent the transfer of the effects of practice from one association to another. The common elements in the two functions are more readily usable in both. This is due to the greater plasticity of the nervous system of children, to their limited experience, and consequently to the smaller degree of fixity and strength of the earlier associations. This fact is of great importance in

the education of the young, because childhood and youth are the golden periods for associating and using the elements, modified by special training, in the various functions in which the transfer of the effects of practice will be of great value.

Most modifications of the doctrine of formal discipline are based upon some theory of localization. But Thorndike is the only author who carries this theory to its extreme conclusion: "There seems to be no structural arrangement by which the changes wrought by practice in one set of nerve cells could infect other cells with a similar quality." "By identical elements [in two functions] are meant mental processes which have the same cell action in the brain as their physical correlate."[1] O'Shea gives in one sentence a similar but more cautious reason for modifying the formalist doctrine: "We should infer from current theory respecting the methods of neural action, that exercise of any special kind would furrow out channels for the discharge of energy in support of just this kind of activity, but not an activity of a different sort."[2] Wardlaw has expressed the same idea in a striking analogy: "If I have broken a path through the weeds, I can cross that field more

[1] Thorndike, *Educational Psychology*, pp. 30, 81.

[2] O'Shea, *Dynamic Factors in Education*, p. 75.

easily thereafter. This fact does not mean that the muscles of my legs are bigger than before, but simply that I am using the same path again—not that I have more strength to work with, but that there remains less work to do. And so, with the mind, there is a great difference between increasing a general power and increasing facility by using acquirements already made."[1] Most of the authors in physiology and psychology say very little about localization of function to particular groups of cells, probably because they consider it too speculative a hypothesis to be discussed either *pro* or *con*. The following quotation from Herrick regarding the sensory areas compares well with the later quotations regarding the motor area. "The minute delimitation of the areas for each segment of a sensory field is rendered impossible by the overlapping and intercommunication between them, but there is no reason to doubt the existence of such extensive representation on the cortex."[2]

The strongest support for our hypothesis comes from Schaefer, in spite of his denial of such a detailed localization as we have suggested. He

[1] Wardlaw, *Educational Review*, January, 1908, "Is Mental Training a Myth?" p. 28.

[2] Herrick, *Dictionary of Philosophy and Psychology*, "Localization." See also Thorndike, *Elements of Psychology*, p. 158.

divides the motor area of the monkey into five large divisions and then subdivides these into many more small divisions, representing various movements of the body. Though proving experimentally the localization of function to very small areas, he still denies localization to points on the cortex, basing his conclusion upon the experiments made by several investigators with monkeys or anthropoid apes.

"Within the limits of the several areas above enumerated, varieties of movement are obtained which indicate a still further differentiation, or in other words an intra-areal localization. It is obvious that these intra-areal localizations are likely to be most marked within the larger areas, and we should further expect the best differentiation in connection with those parts which are concerned with the more complex and precise movements directed by the will. These in the monkey are chiefly the movements of the upper limb, and especially the hand, and movements concerned with facial expression. Further, it is found that for many movements, if not for all, there is in each case a sort of focal point within the area, from which on the average of a large number of experiments the movement is more readily or more frequently obtained than elsewhere. It is possible

that its focal point does actually represent an absolutely localized centre of representation of each movement, but the fact that the movement is in many instances also got with extreme readiness in a circumjacent area of greater or less size, and that in many individuals it may be produced even more readily from other parts of such circumjacent area than the average focal point, seems to point to the conclusion, which is that usually accepted, that localization of particular movements is rather connected with small areas of cortex than with mere points on the cerebral surface; in a few cases only do these areas seem to be so extremely limited in size as to merit being spoken of as points. It is further rare to find that the movement which is provoked is simple and uncomplicated by other movements, although occasionally this is so." But the author makes some further statements which render this denial less damaging to our hypothesis; in fact, his statements might be considered as even suggesting it. "Undoubtedly the most striking character of many of the movements which are provoked by cerebral excitation is their co-ordinated and purposeful nature. In conformity with this, we find that they are rarely produced by contractions of a single muscle or group of muscles, but it is frequent for a suc-

cession of movements to occur, and these are very closely imitative of natural voluntary movements of the animal."[1] Barker says "it is significant that these observers [Horsley and Schaefer], like all observers who have experimented on the cortex, find that movements and not individual muscles are represented here."[2]

Is not the accepted conclusion, that "movements and not individual muscles" are localized on the cortex and that these movements "are rarely produced by contractions of a single muscle or group of muscles," the real reason why these movements are localized in small areas rather than in points? The different points in a given area, representing a given movement, probably consist of very small groups of cells controlling the different contractions of the different muscles. As the different muscles, through instinct or habit, act in concert, the first muscle electrically stimulated arouses the other muscles through its channels of association and produces thereby a unified movement or series of movements of all the muscles represented within the given area. The focal point is the best centre, on the average, for arousing the concerted action of all these muscles, but other points

[1] Schaefer et al., *Text-Book of Physiology*, Vol. II, pp. 737, 738.

[2] Barker, *Nervous System*, p. 997.

could also be effective starting-points in a greater or less degree, according to the individual animal experimented upon. It has been very difficult for the experimenters to stimulate single muscles and make them act alone, because the stimulus is transmitted to other muscles than the one directly stimulated and thus produces the concerted movement of them all. This is why the experimenters can localize movements, not muscles. But ought we to conclude that the single muscles are not represented on the cortex? On the other hand, there seems little reason why we should not conclude that the points in the given area represent the different muscles, the different elements, that are combined into the concerted movement represented by that area. Sherrington has found that not only a given muscle but even the different activities of the same muscle have specific representation on the cortex. "Under use of currents of moderate intensity we found that not from one and the same spot in the cortex can relaxation and contraction of a given muscle be evoked at different times, but that the two effects are provocable at different, sometimes widely separate, points of the cortex, and there found regularly."[1]

[1] Sherrington, *Integrative Action of the Nervous System*, p. 283. His discussion of the "principle of the common path" (Lecture

The hypothesis of localization to points, to very small groups of cells, is almost proved for the motor area of the monkey and is probably true for the entire cortex of that animal. Furthermore, the experimenters express little doubt that localization in the cortex of the monkey corresponds closely to that in man.

However, the suggestions made in this essay towards establishing a basis for the disciplinary value of studies need not rely upon our hypothesis of detailed localization. It is difficult to stop at any conclusion between this one and the accepted one of localization in large areas (visual, auditory, motor, association, etc.), of the division of the motor area into sub-areas (leg, hand, face, etc.), and of the division of these sub-areas into very small areas representing movements (opening of eyes, closing of eyes, opening of mouth, protrusion of tongue, etc.). But we do not care to overemphasize the extreme phases of our hypothesis, because the theories of localization now accepted are sufficient in themselves to disprove the doctrine of formal discipline.

IV.) offers some difficulty to our hypothesis, in emphasizing the fact that censory excitations from different parts of the organism may produce the same reflex reaction. However, this common path of response should be considered, for our purposes, a common element in the various stimuli evoking the response.

GENERAL CONCEPTS OF METHOD

If acquired abilities are specific, not general, does it follow that there are no general results from specific mental discipline? Is it not possible to be consistent with our emphasis upon the specific character of training and still grant that there is a general benefit to be gained from this training, not the general benefit claimed by the formal disciplinists but one of great value in mental development? If so, how can such a general benefit be gained? Bagley says through "a general ideal of work"; Bennett, through "knowledge or ideal consciously generalized"; Lewis, through "educating the will by inculcating some general principle or motive of conduct"; Horne, through "ideas and principles of action"[1]; Thorndike, through "identity of procedure"; Ruediger, through "identity of aim". As this phase of the subject is very important for practice, especially in secondary education, it is well to quote the best of these discussions before trying to work out some conclusion that will em-

[1] Horne, *Psychological Principles of Education*, chap. VI., "The Theory of Formal Discipline," p. 78.

body and modify their suggestions and will connect them with our previous discussion.

"The doctrine of formal discipline assumed that the mastery of a certain subject gave one an increased power to master other subjects. It is clear that there is a certain amount of truth in this statement, provided that we understand very clearly that this increased power must always take the form of an ideal that will function as judgment and not of an unconscious predisposition that with function as habit. In other words, *unless the ideal has been developed consciously, there can be no certainty that the power will be increased, no matter how intrinsically well the subject may have been mastered*.....An ideal is a type of condensed experience. It is the upshot of a multitude of reactions and adjustments, both individual and racial. Because it is a type of condensed experience, it is commonly formulated as a proposition or conceptual judgment. Or it may be attached to a single word.....The development of an ideal is both an emotional and an intellectual process, but the *emotional element is by far the more important.*" (Bagley.)[1]

"Identity of Procedure. The habit acquired in a laboratory course of looking to see how chem-

[1] Bagley, *Educative Process*, pp. 216, 222, 223.

icals do behave, instead of guessing at the matter or learning statements about it out of a book, may make a girl's methods of cooking or a boy's methods of manufacturing more scientific because the attitude of distrust of opinion and search for facts may so possess one as to be carried over from the narrower to the wider field. Difficulties in studies may prepare students for the difficulties of the world as a whole by cultivating the attitudes of neglect of discomfort, ideals of accomplishing what one sets out to do, and the feeling of dissatisfaction with failure." "In the case of the features of attitude and method, taking special pains that they are taught means in practice requiring their application to varied situations, for we can never be sure that a general idea or ideal or attitude is gained until we test it in application. Moreover in nine school children out of ten the only way that an ideal or attitude does become general is by being derived from and again applied to many different particular cases. To make ideals and attitudes operative in all fields the teacher must give them exercise in at least several fields." (Thorndike.)[1]

"According to physiological analysis, habits are

[1] Thorndike, *Principles of Teaching*, pp. 245, 246. There is some confusion here between general ideals and widely transferable habits in the use of specific methods.

specific—they cannot well be anything else—but according to common observation certain so-called habits appear unquestionably to be generalized. Such habits are industry, perseverance, self-reliance, and the like. The cause of the difficulty here is no doubt largely a verbal one. If instead of the word 'habits' we should use the word 'ideals' much of the difficulty would disappear. Where such a function as perseverance is generalized, it is done so partly at least through conscious control, which places it in the second category rather than the first." (Ruediger.)[1]

The last quotation is based upon the result of experiments carried out in the seventh grade of three schools to prove whether "the ideal of neatness, brought out in connection with, and applied in one subject, functions in other school subjects." The outline of the methods used in these experiments is too long to be quoted here. Neatness was emphasized in the written work, etc., of one subject, until the pupils showed decided improvement in that subject. The ideal of neatness was continually discussed by the teacher in connection with that one subject and with life generally, though no special allusion was made to the other

[1] Ruediger, *Educational Review*, November, 1908, "The Indirect Improvement of Mental Function through Ideals," p. 370.

school subjects. Then the written work in these other subjects, before and after the experiment, was compared to see whether the ideal of neatness had been carried over to them in such a way as to produce similar improvement in them. The results are summed up in the following paragraph:

"Evidently neatness made conscious as an ideal or aim in connection with only one school subject does function in other subjects. Directing our attention to groups [schools] I and III, the most marked improvement of the papers occurred respectively in geography and in arithmetic, the subjects in which neatness was emphasized, but there was unquestionable improvement on the average also in other subjects. In group I the average grades [in neatness] in geography show an improvement of 5 points, and those in arithmetic and grammar respectively 4 and 3.4 points; while in group III arithmetic improved 4.5 points, and geography and history respectively 2.9 and 2 points. The number of pupils showing improvement is about the same in all the subjects. In group II the improvement was in no case very marked, but it is significant that the averages show nowhere any decline." (Ruediger.)[1]

[1] Ruediger, *Educational Review*, November, 1908, p. 369.

While agreeing in the main with the points of view expressed by these authors, we prefer to state the matter thus: A general benefit can be derived from specific training in so far as the person trained has consciously wrought out, in connection with the specific training, a general concept of method, based upon the specific methods used in that training. The building of such a concept follows the same laws as does the building of other concepts. The common elements in a number of specific methods are abstracted and bound together in a general concept of method, a general rule or principle of how to do, how to act, in situations of a certain general type. These concepts may be held in the mind in one or more sentences, in a single phrase or a single word, in a metaphor or a line of poetry or some traditional maxim, in a formula of mathematics or chemistry or engineering. In all cases the symbol stands for a method of activity, be it in the realms of pure or applied natural science, of social science or practical civics, of business or professional life, of personal manner or social relations. The mind stores up by means of this symbol the rules and directions to guide its activity in adjustment to those phases of the environment to which such an activity seems applicable.

It is necessary at this point to emphasize three important distinctions. The first is the distinction between *what* to do and *how* to do it. The former is subject-matter, the latter is method. The ideals of the what and the ideals of the how ought not to be confused in thought, though they may be closely related. Dewey makes clear this distinction, using the terms "content and form". "Form represents, as it were, the technique, the adjustment of means involved in social action, just as content refers to the realized value or end of social action. What is needed is not a depreciation of form, but a correct placing of it, that is, seeing that since it is related as means to end, it must be kept in subordination to an end, and taught in relation to the end."[1]

The second important distinction to be emphasized is that between a widely transferable acquired ability in the use of some specific method and a generalized acquired ability in the use of several methods. The former is the result of activity in dealing with a concrete situation in a specific way and can be transferred to another situation only in so far as the method used is common to both. No matter in how many situations a given specific ability may thus be used, it

[1] Dewey, *Ethical Principles Underlying Education*, pp. 18, 19.

still remains specific; it never becomes generalized and usable in situations which do not have elements of method in common with it. As has been suggested before in this essay, there is frequent confusion at this point, especially because some specific methods have elements in common with a large number of other methods and therefore the abilities developed by the use of the former are widely transferable. But this transferability is far different from general mental discipline, from generalized abilities, powers, habits.

The third important distinction is that between a widely transferable acquired ability and a general concept of method. The one is power and efficiency to perform specific activities; the other is an intellectual proposition or judgment as to how activities of a certain general type should be performed. The one is ability to do; the other is knowledge of how to do. These are often spoken of as one and the same thing, but a little reflection will make evident the great difference between them. To know how to do, how to apply oneself, how to reason, how to control one's desires, is part of the victory, but it is only the initial part. It guides us in developing an ability, it eliminates much of the trial and error otherwise necessary, it focuses attention upon the required steps, it

short-circuits the process; but it does not bestow ability. Ability can be developed through the application of the general concept of method to a specific situation, but it is only by specific activity and neural modification that we can acquire an ability. We may know how to be good, reasonable, efficient, but we do not actually become good, reasonable, efficient until we have practiced, in specific situations, these virtues and incarnated them in specific deeds. It is the doing that makes us what we are. In fact, our knowledge of how to do, our concept of method, is really never complete until we have thus applied and tested it in specific deeds.

Can the formation of such a general concept of method from specific methods be explained on the afore-mentioned hypothesis of localization of function to particular groups of cells in the central nervous system? The conscious formulation of the concept into words or sentences synchronizes with stimulations and consequent modifications of particular groups of cells in a word or a concept centre of the cortex. Only in some such way does it seem possible for the concept to be registered in the brain. The modifications in these particular groups of cells cannot, of course, be generalized, but they can be made generally usable

through their associations with different groups of cells connected with different specific activities. These specific activities include those which, through their common elements, formed the original basis of the concept and also those which, through their common elements, will be subsequently guided by the concept. A general concept of method is, therefore, a centre, a clearing-house, connecting the previously used specific methods of a certain general type with the subsequently used specific methods of that type. This does not mean that the cells used and modified in a previous activity need be used again in a subsequent activity, unless it is necessary to vitalize the central concept guiding the second activity by reference to the concrete basis upon which the concept was built. As the general concept of method can be used for guidance in several activities, it can be considered a common, transferable element in them all; but this common element, this connecting link, is one of knowledge of how to do, not of ability to do. It can be a central guide even when the activities and the abilities derived from these activities are different and non-transferable.

We repeat that it is through general concepts of method, not through general discipline, that specific methods and training can be made generally

beneficial over and above their use in functions in which they form an essential part. The more numerous and varied the specific methods from which the common elements have been consciously abstracted, the more widely applicable is the general concept of method for the person who formed it. Of course, all these specific methods need not be worked out or observed at the time when the concept is formed. The specific methods used at the time may be limited in number and variety, but subsequent experience may add other methods and thus extend the applicability of the concept. Furthermore, all of these methods need not at one time or another be worked out or observed in the concrete; some of them can be imagined from a knowledge of other situations to which similar methods would apply. The essential thing in forming a general concept of method, with vital meaning and wide applicability, is to work out, or (in a less degree) to observe others work out, the specific methods from which the general concept can be formed. Then, after comprehending the value of the method in dealing with the specific situation or situations, the pupil should work out, or, if that is not possible at the time, he should think out, its application to other situations. Upon such a wide basis in reality he should

consciously build and hold his general concept of how to deal with these and other possible similar situations, applying and enlarging it as later experience gives him opportunity for so doing.

General concepts of method can be formed without as systematic or elaborate a process as is here suggested. Many are derived by pupils from their school work without any realization of the steps taken. However, some such process is necessary, and upon its care and thoroughness depend the validity and extension of the general concept. Furthermore, ability to use the specific methods from which the concept is derived is not a necessary basis for the formation of the concept; only an understanding of the specific methods, only a knowledge of how to act in the specific situations, is essential. This understanding of methods is often gained at school without ability to use them, and, on the other hand, ability is often gained in the use of methods without an understanding of them. But an understanding of specific methods is never complete without ability to use them, and ability to use them is never complete without an understanding of them. Therefore, it is well to urge a careful, systematic procedure both in specific training and in the formation of general concepts of method.

What are the steps by which a teacher can *lead* his pupils to develop a general concept of method. First, he can lead them to recall and explain the methods previously used, which are similar to those to be worked out. Second, he can lead them to work out and understand the specific methods used in connection with the subject-matter that is presented. Third, he can lead them to analyze and compare these specific methods in order to abstract their common elements. Fourth, he can lead them to bind together these common elements into a general concept of method. Fifth, he can lead them to apply, concretely or imaginatively, the concept thus formed to other subject-matter. Here we have the "five formal steps" used in developing a general concept of method, just as they should be used in developing other general concepts. Of course, these steps are only suggestive, not binding as some books would have us believe; but they do outline the successive stages in the mental process of forming concepts. With allowance for all the variations necessary under special circumstances, it must still be reiterated that these steps are a good guide for any teacher who strives to make his pupils derive general benefit from their specific activities and training.

Concepts of methods should be associated with sufficient emotional valuation and impulsion to make them effective in practice. But all voluntary acts need to be directly or indirectly motived by the emotions; the necessity is general and needs no special emphasis here. The stress put by Bagley upon "the emotional element as by far the more important" in his "ideals" shows that he is thinking especially of those concepts of method for the application of which great emotional motivation is needed, as, for example, the general concept of how to be courteous to those we dislike or of how to deny ourselves in social service. But there are a large number of concepts of method for the application of which little emotional motivation is needed, as, for example, the general concept of how to test the logical steps in an argument or of how to sift source material. Furthermore, emotions generally centre around the object in view, the subject-matter, rather than the method; it is *what* we should do, not *how* we should do it, that is usually the centre of our emotional struggles. But the general concepts to be derived from specific training are those of method, over and above subject-matter. Of course, the method can be made an end of action, not a means, and we may like it or dislike it; but it has then been mis-

placed and misvalued. Its real value is to guide in the doing of what we have decided to do, after such motivation and choice as the situation demands.

In this connection it is interesting to compare a few discussions of the elements of method, or form, in mental discipline. In addition, reference should be made to some of the discussions and experiments previously outlined, which emphasize either the transfer of ability acquired in the use of certain elements of method or the formation of general guiding principles of how to memorize, how to pay attention, how to pick out the essentials in a test, etc. Some of the authors fail to make one or more of the three distinctions which we have pointed out as necessary for clearness in discussing the elements of method.

Our first selections are from a valuable paper by Hoose, which antedates by four years Hinsdale's initiation of the American movement against the doctrine of formal discipline. "Form in mental activity means that peculiar activity which the mind exerts when it does any particular thing, or thinks any particular thought or word." "Form is given to mental activity by the form of the subject-matter that is cognized, seized, known, thought, or done; this proposition is true in the

most general sense. Each and every form of the thing to be done or thought requires its own (peculiar) form of mental activity to do it or to think it." "Exercise and repetition in the activities of one faculty lead to mastery in those particular forms only." "Mastery of one subject stands for itself alone in so far as the subject differs from others in form." "When the forms of different subjects are similar, the habit acquired upon one of the subjects will be conserved in greater or less part to aid one in learning the other subjects." "The teacher gives form in the school-room to all the subjects that are not natural —*i.e.*, to nearly all that the child studies. As the forms of the subject condition the forms of mental activity, the teacher (author) has great power and responsibility in the school-room."[1]

"For the empirical science of logic the term form, as applied to our intellectual processes, indicates a common element, or series of common elements, in those processes, which makes the theory of formal discipline at least intelligible and apparently tenable as a doctrine of intellectual training. In other words, formal training is discipline in certain discoverable forms of intel-

[1] Hoose, *Report of the National Educational Association*, 1890, "Mental Effects of Form in Subject-Matter," pp. 754, 755.

lectual activity." "Formal discipline is the practice of the mind in certain forms or methods of thinking which are 'common elements' in wide ranges of experience." "The one word which sums up the theory of formal discipline is method, or, rather, methods. It is the theory that the mind can be trained to do well certain kinds of work, to follow successfully certain methods of procedure." "For the carrying on of any pursuit, we need not only talent, native or acquired, but also information, interest, practice, before the work can be successfully done. Exercise in one function should not be expected, therefore, to give equal facility in the carrying on of another. Obviously it does not, and the degree of the difficulty of transfer is determined, not only by identity or difference in the formal elements, but also by differences and similarities in the contents as well. That such a position is in accordance with the results of investigation thus far will not, I think, be denied." (Meiklejohn.)[1]

"What are these formal elements? I am tempted to call them laws—the laws of nature, the laws of composition and succession of mental states, the laws of human intercourse and of

[1] Meiklejohn, *Educational Review*, February, 1909, "Is Mental Training a Myth?" pp. 132, 134, 136, 138.

human advantage." In any discussion of formal discipline, the forms of human activity, not the forms of the outside environment, are to be distinguished from content—the material with which or upon which the individual acts. Both the content and the forms of the environment furnish the subject-matter elements in mental discipline; the forms of dealing with this environment furnish the method elements in mental discipline. We must distinguish between forms of the environment, as we interpret them, and forms of human activity in relation to that environment. Later on, Delabarre makes this distinction and discusses those formal elements which we have preferred to call methods of activity. "There is still another class of what, I think, can with equal justice be called formal elements, to which I desire to direct your attention. These are the general forms, not of our apprehension of the world, but of our conduct toward its situations. We know them commonly as the fundamentally desirable moral qualities, the components of good character. We can easily see that included among them are sympathy, kindliness, fearlessness, truthfulness, justice, courage. These seem almost like the names of emotions. But they are more than that. They are desirable elementary forms of

our attitude toward the world, our reactions upon it. Any one of them is a form, whose possession gives us good judgment in dealing with a wide variety of situations, and perhaps slow but finally firm acquirement of any one of them is of enormously more importance to us than the learning of any number of specific facts." Here we have an emphasis, which we also noticed in Bagley's discussion, only upon those methods of activity which require great emotional motivation for their application. "The formula of common elements is true, but of no practical value. Practically all mental processes have elements, formal or structural, in common. Not only does good training in any subject improve methods of learning, of attention, of work, of comprehension; but it is also true that all knowledge possesses some elements in common, and the number of these may be very considerable even in case of subjects that appear at first sight little related. The structural, technical, content-elements are very important, but they can be left more safely to individual need and individual endeavor. The formal elements are universal, or at least of wide application, and hence are more helpful and more difficult to acquire. To them education should surely give its best attention. No one can be a mere specialist.

Everyone needs formal material for correctly judging a wide variety of experiences and relations that are essential to life." (Delabarre.)[1]

And, finally, a quotation is given which illustrates well a popular confusion on the subject, a confusion even implied in the quotations from Meiklejohn and Delabarre. Raymont makes a distinction for mental discipline between the matter and the method of instruction, but he gives general disciplinary value, general mental training, to the method, although denying it to the matter with which the method was used. He is really upholding the doctrine of formal discipline in regard to elements of method. "Mental discipline depends, not so much upon the subjects taught, as upon the method of teaching. Bad science-teaching will not improve the reasoning powers, but will leave the learner still under the thumb of authority and prescription; whilst good science-teaching will avoid this evil, and will also exercise the imagination, by opening out wonderlands as glorious as those of literature. On the other hand, bad literary and historical instruction will leave the imagination barren, whilst sound instruction in these branches will not only

[1] Delabarre, *Education*, May, 1909, "Formal Discipline and the Doctrine of Common Elements," pp. 591, 593, 599.

avoid this mistake, but will also furnish the means of abundant exercise in cautious judgment and valid inference." "Though the *method* of instruction should be carefully devised with a view to mental discipline, it is misleading to say that the choice of the *matter* of instruction depends upon considerations of discipline."[1]

[1] Raymont, *Principles of Education*, p. 100.

A STANDARD OF EDUCATIONAL VALUES

The doctrine of formal discipline implies that the mind is made up or possessed of certain general powers or faculties—memory, imagination, reasoning, etc. These powers are developed by exercise to a degree proportionate to the force and duration of the exercise taken, but the stimulus which calls forth this exercise of any power affects but little the kind of exercise and consequently the kind of development of that power resulting from such exercise. This development in strength, breadth, accuracy, etc. of the power involved can be used in response to any other stimulus than the one by which the power was previously exercised, with little change in nature or diminution in amount. The different powers are considered like different tanks or reservoirs with many pipes emptying into them and many draining out of them. No matter through what pipe water gets into the tank, it can go out by any other pipe and continue almost unchanged through the entire process. The practical problem of mental discipline in education then resolves itself into

(1) deciding what are the power tanks (memory, reasoning, etc.) to be filled by school education; (2) selecting the largest usable pipes to carry water into each tank; and (3) forcing water through these pipes into the tank until the supply is considered sufficient to meet any and all demands. When any given subject, say mathematics, is defended on this doctrine, the implication is that it is the largest usable pipe for carrying water into the tank of reasoning or accuracy or some other power, and therefore more of the desired power can be accumulated through this pipe than through any other. Or a given subject may be defended because it consists of a number of pipes carrying water to several power tanks, reasoning, accuracy, attention, etc.

The doctrine of specific disciplines, on the other hand, claims that there are no such general powers or faculties—memory, imagination, reasoning, etc., but that these names stand for vague classifications of mental responses to stimuli. The mind develops in a specific manner by practice in response to specific stimuli, and the benefit of this development can be fully used only in future similar responses to stimuli similar in whole or in part to those which called forth the previous responses. This benefit de-

creases just in proportion to the amount of dissimilarity between the future and the previous stimuli. To refer to the afore-mentioned analogy (which, of course, is in no way exact), the opposition holds that there can be no tanks or reservoirs of general power, with many pipes emptying into them and many draining out of them. Each pipe collects, holds, and discharges the water flowing into it. The practical problem is to choose pipes of the most specific value and then force water into them. Mathematics, for instance, would be defended on this doctrine because of its great specific value in developing ability to reason, to be accurate, etc. in regard to the mathematical elements in the environment.

As the following standard of educational values is based upon the doctrine of specific disciplines, its main emphasis is upon the specific or intrinsic value of each element of subject-matter or of method in the school curriculum. This value is determined by the environmental importance of the element and consequently by the environmental usefulness of the specific ability developed by the element. As a specific element of subject-matter or of method may appear in various combinations in the environment, the specific ability developed by it can be used with as many of these combina-

tions as are recognized as containing the given element. The value of these elements is therefore determined objectively and sociologically, but when brought into the school they should be so arranged and interpreted as to appeal to the pupil at successive stages of growth, and also to reveal to him their significance in the various combinations in which they appear in the environment.

Out of the specific elements of method can be formed general concepts of method, but these concepts should be derived from methods of the most specific value in the environment. Thus can be realized two educational aims—training in the use of valuable specific methods, and the formation and application of valuable general concepts of method. To seek these aims separately, giving one study for its specific value and one for its general method value, is clearly a waste of the most previous asset of the school, namely, the child's energy. It may be that in one study one value will be emphasized and in another study the other value will be emphasized, but with few exceptions the studies of the most specific value will be those of the most general method value. Therefore, it is certainly the wisest policy to base a criterion of studies upon the specific value of

their elements of subject-matter and of method.

The elements of studies that are common to the present or future environments of most of the pupils are the elements to be studied and tested in working out a school curriculum; the other elements are to be eliminated, no matter what traditional emphasis may have been given them. As even the important elements in the environment are far too many to be included in elementary and secondary curricula, also among them must there be a rigid and relentless selection. Every included element must have proved its supremacy over the competing elements that might have taken its place if such a test were not carefully enforced. "The question which we contend is of such transcendent moment, is, not whether such or such knowledge is of worth, but what is its *relative* worth?" (Spencer.)[1] *In how many and in how important ways (quantity and quality of usefulness) can the specific element be used by the pupil in adjustment to his environment? Here is our basis of comparison between elements, and there is no reason why each and every element of each and every study should not be subjected to such a comparison.* To select the most valuable elements and organize them

[1] Spencer, *Education*, 1861 Editon, p. 28.

into a graded curriculum ought to be the chief purpose of school administration. "As the educational aim is the unfolded and capable mind in the concrete social and natural situations of life, and as we are efficient in those situations in proportion as we have developed ourselves earlier in similar situations, it follows that those subjects have the greatest educational value which have the greatest number of identical elements with the situations of life.....A new problem is proposed to educational theorists at this point, viz., to go through our subjects of study with a view to determining what and how many elements they have in common with life." (Horne.)[1]

Of course, our standard is a utilitarian one. It would be wasteful and wrong to have any other. But this standard is by no means that of a narrow, materialistic utilitarianism; it simply stands for the test of usefulness to the whole person in relation to the whole environment, emphasizing especially those ethical, intellectual, and æsthetic ideals that minister to the best uses of the human spirit. A general development can be promoted by useful responses to important phases of the

[1] Horne, *Education*, May, 1909, "The Practical Influence of the New Views of Formal Discipline," p. 616. Has a short bibliography. See also Bolton, *School Review*, February, 1904, "Facts and Fictions Concerning Educational Values"; Tompkins, *Philosophy of Teaching*, p. 266.

environment far better than by the hypothetical all-roundness of an arbitrarily chosen group of cultural or of formal disciplinary studies. It is a sad commentary upon our educational abstractness that we often fail to realize the high and noble inclusiveness of the ideal of use in our preparation of boys and girls for efficiency and service in society. We sometimes run away from the real test of real things and cry out for culture, as if culture had any meaning apart from its use in adjustment.

It is especially important in teaching to lead pupils to recognize the various environmental relations and uses of the elements of subject-matter or of method which are brought into the school. If pupils are not thus guided they may fail to see these relations and uses and consequently may fail to apply the knowledge and abilities developed in school to those phases of the outside environment to which they should be applied. Of course, no relation is to be brought into the school which is not in the environment; to trump up artificial relations between elements for school purposes—to stimulate interest, etc.,—is misleading and almost dishonest. But as a given element of subject-matter or of method may be environmentally related in a number of different ways to a

number of different elements, the limited time and energy of the pupil necessitate a comparative test and a rigid selection of these relations, so as to bring into the school only those that have the greatest quantity and quality of environmental usefulness. The test will therefore be similar to that of the elements themselves; in fact, it is but part of the latter, because the values of the elements cannot be comparatively determined without a comparative test of the values of their relations. This is why many teachers do not know the subject-matter or method they teach; in knowing the elements apart from the environment which gives them value they really do not know what their value is. This is probably the weakest point in our teaching force,—the ignorance of teachers regarding the environmental relations and values of school studies. Their training should be more in practical sociology and less in hypothetical pedagogy, and a far greater emphasis upon the social relations of the curriculum is needed both in normal school and in university courses for teachers.

However suggestive may be the various schemes of concentration or correlation, they can never be widely accepted, because the centres of their circles are not the centres of the environ-

ment. The elements are not thus centripetalized in actuality. Therefore, in school they should be interpreted only in those inter-relations that represent, explain, and emphasize their comparative environmental nature and significance, the same elements, if necessary, being brought into the course again and again to reveal new relations and to help in apperceiving new elements.

It is not denied that elements and relations not directly useful in themselves must be included as a preparation for elements directly useful, but this indirect usefulness may be of more comparative value than the direct usefulness of some competing elements. It is also not denied that logical consistency and completeness sometimes require the introduction of elements and relations not directly useful in themselves, in order to bind together those elements of a subject that have been selected as of the most comparative value. The elements thus introduced would then have to stand the test of their usefulness in binding together directly useful elements. Furthermore, the logical consistency and completeness of a text or course must in themselves be tested. They should not exceed the logical consistency and completeness necessary for the proper use of the elements of that text or course in their environmental rela-

avoid this mistake, but will also furnish the means of abundant exercise in cautious judgment and valid inference." "Though the *method* of instruction should be carefully devised with a view to mental discipline, it is misleading to say that the choice of the *matter* of instruction depends upon considerations of discipline."[1]

[1] Raymont, *Principles of Education*, p. 100.

wealth of knowledge that makes up the course of study is that it may enable the educator *to determine the environment of the child,* and thus by indirection to direct." (Dewey.)[1] The outside environment must be made into the meaningful school environment of the pupil, and there is no need why, in this process, the elements of the outside environment should be misrelated or misvalued. On the other hand, it is only in so far as these two environments are similar that the child lives in school a life that has functional value outside. And this is the way to develop a true, educative interest, rather than an artificial interest, in school work, by arousing in the child a desire to express himself in response to those phases of his school environment which he recognizes as also important in his outside environment. With this limited outside environment as a starting-point and a constant source of reference, the school should continue to enlarge the child's experience through the knowledge and activities of a larger environment, the epitome of that outside environment for which he is being prepared. Thus will his school environment and his outside

[1] Dewey, *The Child and the Curriculum,* p. 39. See also Snedden, *Educational Review,* March, 1908, "The New Basis of Method"; Meriam, *Educational Review,* April, 1909, "Fundamentals in the Elementary School Curriculum."

environment together grow into that of the intelligent adult citizen, and thus will his specific abilities to meet the opportunities and responsibilities of his adult life be developed by meeting the opportunities and responsibilities of his constantly enlarging school life.

It may be objected that both the present and the future outside environment of each individual pupil are so different from those of any other pupil that it is impossible to select, by any comparative test of environmental usefulness, elements with which to organize a uniform course of study for the masses of children in the public schools. Such an objection really denies the possibility of making any suitable uniform course of study at all. If we cannot make one by selection according to environmental values, we certainly cannot make a better one by selection according to any other kind of values. The public school system is based upon the belief that at least the great majority of pupils have now and will have in the future a community of need, interest, and responsibility. This community is represented by the minimum requirements in the course of study, representing the essential elements in the common present or future environment of most pupils. Opposition to this common ground of school work is due to a failure

to realize that the like-mindedness of the citizens, as Giddings suggests, is a fundamental necessity in a democratic society, and that our public schools, through their common courses and interests, ought to lead in developing this like-mindedness. Above a minimum course there should be room for individual variations in advanced and parallel work and, even within this minimum, allowances should be made for individuality of response to the subject-matter and methods given. But if there is to be no common course for our public schools, in city, county, or State, our education will carry individualism to an extreme and will lose its great mission of being one of the principal cohesive forces in society.

This standard of educational values also applies to school management. The motives, routine, discipline, etc., of school life can be analyzed into elements of subject-matter and of method and can be tested for their environmental values. It is wasting a great opportunity to compel pupils into an artificial regime, when the very organization and processes of the school community ought to prefigure and prepare for the community outside. If this ideal is introduced into school management, it will become a great force for social efficiency and for ethical training by developing

through social relations those specialized habits and general concepts that will make for good in the individual and in the environment. What is needed is not necessarily a "school city" or a formal copy of some social organization, for these may or may not interpret the spirit of society and therefore may or may not be educative. The community life of the school must emphasize the standards, responsibilities, and methods of the community life outside, in so far as the school can use these for educational purposes. The doctrine of formal discipline cannot apply here any more than elsewhere. Specific subject-matter and method, specific training and abilities, general concepts of method—these are the materials, methods, and results of the ethical training that should come through school motives and discipline. If these materials and methods are those common to both the school and the outside environment, the results will be of untold value; but if the materials and methods of the school are artificial, the results will be of limited value. Through society are we educated for society.[1]

Before the standard developed in this essay is

[1] See especially Dewey, *School and Society;* Scott, *Social Education;* and Gilbert, *The School and Its Life.*

applied, for the purpose of illustration, to some phases of elementary and secondary school curricula, it will be profitable to compare a few standards of educational values, set by writers opposed to the doctrine of formal discipline. Three are by educationists and two by sociologists.

"The ability to deal with any situation depends upon one's having had experience with some similar situation. And the educationist will so plan it in view of this principle that the individual will in his educational course be made ready for those general and special duties which he will perform as a member of a community.....He will exclude everything which does not give very good proofs of its suitability to assist the learner in his relations with men and things, by presenting to him now situations which he will encounter, though it may be in a more complex form, in later life. In the matter of studies purporting to be of social value, for example, the educationist will proceed upon the doctrine that if the individual can be got to react in desirable ways to social situations actual or ideal during the developmental period, then he will acquire modes of reaction which will be serviceable to him in all times and places. The educationist will cast out everything which cannot return an affirmative answer to the

question, Will the individual in mastering you be making in the best way adaptations which he will be required to make as a member of a social organism?" (O'Shea.)[1]

"The educational values of different subjects, *i.e.*, their efficiency in promoting the realization of the aim of education as defined above [to prepare for complete living], consist (a) in the scope, kind, strength, and permanence of the incentives to activity; and (b) in the kind, degree, and permanence of the power to think and execute that those subjects may develop.....The kinds of incentives to activity, whether intellectual, æsthetic, moral, or constructive, derivable from the course of study, depend on content (the nature of the subject-matter). Since incentives are impulses to activity growing out of interest in the subject-matter, they will develop strength and permanence when interest in the subject-matter is strong, real, and permanent.....Power means ability to do something—to bring about results. The results achieved will always be in some one field of activity, however; and the kind of power developed through the pursuit of a given subject will consequently be usually restricted to power in dealing with data of a particular sort.....

[1] O'Shea, *Education as Adjustment*, pp. 288-291.

There is no such thing as power in general that can be cultivated through the pursuit of any one subject, and can then be drawn upon at any time for successful achievement in other subjects. .....The power developed will always be chiefly specific: but if, through correlation, the mutual ramification and interdependence of subjects are traced; and further, if the method of one subject is explicitly carried over to other subjects to which it can be legitimately applied, the power developed will also be to some extent general." (Hanus.)[1]

"With the abandonment of the dogma of faculty discipline, which assured us that all the powers of the mind could be acquired by formal exercises in dead languages, school mathematics, etc., there clearly remains but one alternative—to train the pupils for the specific goal it is desirable to reach. This alternative permits no compromise. The exercises which prepare for life are the duties, knowledge, and emotional attitudes of existing life itself, which the world's workers are currently using. The alternative recognizes that like produces only like, and, therefore, repudiates those exercises such as Latin or algebra, which in themselves are acknowledged to be unused, except

[1] Hanus, *Educational Aims and Educational Values*, pp. 7-10.

as mental trapezes of the schoolroom. It requires that the pupil's energy shall be centred upon the mastery of those things which existing world life requires of its active and productive journeymen; anything less is insufficient, and anything of a different character is irrelevant. How shall we obtain such a course of study, and who shall systematize it? Manifestly, the first step in the task is to catalogue the essential duties, items of knowledge, and emotional attitudes current in the world's usage. This material must then be set up and arranged in the schools as goals of instruction, and the business of the pedagogue will be to enable the pupil to acquire these world-used materials to an effective degree as readily as possible."[1]

"The prime problem of education, as the sociologist views it, is how to promote adaptation of the individual to the social conditions, natural and artificial, within which individuals live, and move, and have their being.....Sociology has no tolerance for the pedantry that persists in carpentering together educational courses out of subjects which are supposed to exercise, first, the

[1] Burk, *The World's Work*, July, 1909, "The Bankruptcy of 'Education,' II., pp. 11764, 11765. See Burk's interesting but exaggerated attack on the doctrine of formal discipline in the June number of the same magazine.

perceptive faculty, then the memory, then the language faculty, then the logical faculty, etc. On the contrary, every represented contact of a person with a portion of reality sooner or later calls into exercise every mental power of that person, probably in a more rational order and proportion than can be produced by an artificial process. Our business as teachers is primarily, therefore, not to train particular mental powers, but to select points of contact between learning minds and the reality that is to be learned. The mind's own autonomy will look out for the appropriate series of subjective mental process. In the second place, our business as teachers is to bring these perceptive contacts of pupils' minds with points of objective reality into true association with all the remainder of objective reality, *i.e.*, we should help pupils first to see things, and, second, to see things together as they actually exist in reality. In other words, the demand of sociology upon pedagogy is that it shall stop wet-nursing orphan mental faculties and find out how to bring persons into touch with that objectively is, as it is. The mind itself will do the rest." (Small.)[1]

"The only thing that can 'develop' or

[1] Small, *American Journal of Sociology*, May, 1897, "Some Demands of Sociology Upon Pedagogy," pp. 842, 843.

'strengthen' the faculties or the mind is knowledge, and all real knowledge is science. The effect of this on the mind is to furnish it with something. It constitutes its contents, and, as we have seen, the power, value, and real character of mind depend upon its contents. Without knowledge the mind, however capable, is impotent and worthless. But there is a great mass of knowledge in the world. It does no good unless it is possessed by the mind. It is a power as soon as it is possessed by the mind. It is as useful to one mind as to another. It is the only working power in society, and the working power of society increases in proportion to the number possessing it,—probably in a greater proportion. Only a few minds possess any considerable part of it. All are capable of possessing it all. The paramount duty of society, therefore, is to put that knowledge into the minds of all its members." (Ward.)[1]

[1] Ward, *Applied Sociology*, p. 312. The pansophic scheme of education, discussed in several of Ward's books, is very valuable but is strangely lacking in consideration of the child's capacities and interests. There is also a failure to distinguish clearly between knowledge and ability.

THE ELEMENTARY CURRICULUM

What are the elements of subject-matter and of method which are repeated over and over again in such important ways in the environment as to necessitate their being included in the school preparation of the great majority of people in that environment? Germany and France have answered this question with far more national unanimity and success than we can hope to attain in this country, because our local control and diversity of conditions render such uniformity undesirable and impossible. Is it not possible, however, for our States, individually if not collectively, to select a minimum of elements in language, arithmetic, geography, etc., which will be common and valuable to the present or future environments of the great majority of their elementary school pupils? These elements will be selected on account of the superior number and importance (quantity and quality) of their uses in the environment, in comparison with other elements competing for their places in the curriculum.

A glance at many text-books used in our schools reveals a collection of elements of all degrees of

value, from zero up to the highest. Especially is this true in arithmetic, geography, and history. And, far more significant, these elements are often not graded or emphasized so as to show their value as compared with each other; on the dead level of fact *versus* fact both teacher and pupil become bewildered in interpreting the usefulness of the elements presented. The amount of space and time devoted to this or that element is often disproportionate, above or below, their real value as judged by a true environmental standard. The emphasis put upon a given element in school should reflect the emphasis put upon it in the environment. The difficulty in mastering an element of subject-matter or of method might cause it to take up more time and attention in school than its comparative value would justify; but this would be unusual, if the element were properly placed in the curriculum and the proper preparation were made for it. However, if the time and attention required to master the element would still be far in excess of its real value, then there would be doubt as to its right to a place in the curriculum at all.

McMurry has well criticized the lack of proper emphasis in courses of study and has outlined a topical scheme based upon the comparative use-

fulness of the elements. He also shows how such a scheme would eliminate many elements of comparative uselessness, now emphasized on account of their supposed disciplinary value. "The idea that the discipline gained will make up for all losses is one of those long-lived myths which is at last rapidly disappearing before a more rational view of education. A large proportion of the time of children is now wasted by excellent teachers in gaining a formal excellence in studies which is beyond the present needs of the children, and has no defence except on the basis of the exploded doctrine of formal discipline."[1]

The present necessity is for an elimination of the less important elements and a graded scale of emphasis upon the more important. The overcrowded curriculum would then be reduced in amount, confusion, and strain. Room would be made for those new elements that by their comparative value deserve places in the curriculum; nature-study and manual training would be represented proportionately to their environmental usefulness; domestic, industrial, and commercial elements would be free to assert their value and rights in elementary education. Progressive changes in the environment would cause progres-

[1] McMurry, *Course of Study in the Eight Grades*, vol. I., pp. 47, 48.

sive changes in the curriculum, by the elimination of old elements, the introduction of new elements, or a redistribution of emphasis upon the elements. And, over and above the minimum requirements for any State system, or even for any local system, there would still be room for elements of special usefulness to individual pupils or groups of pupils according to their abilities, tastes, or future occupations.

There is no overwhelming difficulty in working out an agreement as to the elements of arithmetic, geography, history, etc., which will *identify* the school environment with the outside environment. What are the most important present uses of decimal fractions? These certainly can be determined. Then put these and only these uses in the curriculum. What are the elements of knowledge about the German Empire most often required of our citizens generally by our present relations to that country? These certainly can be determined. Then put these elements and only these in the curriculum. What are the facts about the Louisiana Purchase necessary for the mass of our citizens to know? These certainly can be determined. Then put these facts and only these in the curriculum. And so on through the elementary school studies.

We claim that these elements can be selected after careful appraisal by experts and that only in such a way can a curriculum be formed that will have the most functional power for the largest number of pupils. To claim that it is impossible for any group of people to realize an environmental standard of comparative values in making out a curriculum is to deny the possibility of intelligent guidance in education. We do not claim that the elements of most comparative value can be selected by this or that text-book author or publisher, however good he may be, for such a selection requires a broader, deeper knowledge of environmental values than one man can possess. Through expert committees, appointed by States or by professional associations, the best and most comprehensive knowledge available should be brought to bear upon the selection of elements for courses of study in the public schools. Rather than have these courses blindly conform to this or that text-book, which may or may not have any creditable or consistent selection and valuation of elements, the courses should represent and realize the best standard that the specialists can make. Then, to this standard textbooks should be made to conform. The choice of the mental food and exercise of hundreds of

thousands of children is far too important a problem to be left to a text-book author, to a publisher, to an official, or to a lay board of trustees. The lackadaisical way in which the selection of the curriculum is left to anybody or everybody is cause for a serious indictment of the educational profession. No wonder we are skeptical about ever knowing the value of this or that element, when we take so little care about the selection of it and rely upon a crude empiricism to test it.

The contest between content and form in the elementary school is often confused with the contest between the adherents and the opponents to the doctrine of formal discipline. "Until recently, the form studies, such as grammar, arithmetic and spelling, constituted the core and, in quantity, the bulk of the elementary curriculum. The training, or discipline, given by these subjects was held to be the element of chief importance in the early years of schooling."[1] These subjects, however, were emphasized more on account of their special disciplinary value than on account of their general disciplinary value. The pupil was trained in the ability to analyze sentences, the ability to manipulate numbers, and the ability to construct words out of letters. The general discipline supposed to

[1]Monroe, *Text-Book in the History of Education*, p. 529.

result from this training was considered of less importance than these great special aims.

An emphasis upon the form studies is not inconsistent with the doctrine of specific disciplines. The problem now is to control this emphasis according to the need of these specific forms in the outside environment, to give only such attention to them as will be required for their mastery and for their use in that environment. That a form is often over-emphasized, we agree, especially as it is sometimes taught apart from the content and relations with which it is environmentally used. But, as Dewey says, form is of as much value as content and should receive its due emphasis "in subordination to an end."

The building of general concepts of method from particular methods is not the work of the elementary school to a great degree. The pupil is not ready for such conceptualizing. The conscious abstracting of the common elements from particular methods and the generalizing of these into a general concept of method require a mental development that rarely comes before adolescence. Therefore, the mastery of particular methods, of special forms, is the methodological aim of the elementary school; and this means, of course, particular methods of the most compara-

tive value in relation to particular subject-matter of the most comparative value. In many subjects and especially in the realm of "morals and manners" there are opportunities for the teacher to suggest other particular applications of a method than those actually applied in particular situations in school or home or playground. These suggested applications extend the consciousness of the method's applicability, and tend to make widely transferable the specific ability developed through use of the method, even though general concepts are not formed. In the last two years of the elementary school some specific methods can be worked up into general concepts, but care must be taken not to force this process prematurely. The high-school furnishes the great opportunity in public education for forming general concepts of method, and it is to this aspect of the secondary curriculum that we will devote most attention.

THE SECONDARY CURRICULUM

The most generally valuable elements of the environment having been introduced into the elementary curriculum, there is not as much need for a large body of prescribed elements in the secondary curriculum. The basic representativeness of the elementary course, more than the age and nature of the adolescent pupils, allows election in the high-school. It must never be forgotten, however, that a general, all-round development of high-school pupils necessitates their mastering such similar elements of subject-matter and of method as will prepare them to meet the general and fundamental needs of the environment they will have in common with each other. Specialization in the high-school should be based upon a minimum of definitely and uniformly prescribed studies, such as English, geometry, United States history, and either biology or physics.

Over and above this limited prescription, studies with similar elements of subject-matter or of method can be grouped together and elected by pupils according to their individual capacities and careers. The group system can be defended on the principle that similar elements in group

studies, rather than exactly the same elements in prescribed studies, are sufficient to promote a similar general development in all pupils, while allowing some freedom of choice. The system can further be defended on the principle that, even thought the subject-matter in a group may be different, the similarity of the methods used with this different subject-matter is sufficient and far more important in promoting a similar general development in all pupils. This is especially true if the common elements in the specific methods used by the pupils are consciously abstracted and generalized by them into a general concept of method, applicable to the entire group. If studies have little similarity, either in subject-matter or in method, they should not be grouped together and pupils should not be allowed to substitute one for the other,except as a free elective.

And finally, over and above definite prescriptions and group electives, there ought to be some room in the secondary curriculum for free electives, to allow individuality free play without any consideration of uniformity or similarity as compared with the other pupils.

As to what proportion of the entire course should be given to each of the three divisions—definite prescriptions, group electives, and free

electives—few will agree. But, as Dutton and Snedden show, the practical agreement on this problem is really greater than might appear at first thought. "At present it may be said that throughout the secondary schools of the United States there are prescribed: a foreign language, algebra and geometry, English, a science, and one year in history. This makes about two-thirds of the course, leaving certain possible alternations, to be made according as the student aims to enter this or that college, or to go into active life."[1] Of the six prescribed studies, three (algebra, geometry, and English) are definite prescriptions, and three (foreign language, science, and history) are group electives. Of course, in many high-schools the foreign language or science or history is definitely prescribed, but we may consider it the present tendency to put these studies into groups. The authors also emphasize the influence upon this course of the doctrine of formal discipline. "Latin and methematics occupy prominent places in all secondary school curricula because of a general belief in their value as agents of mental training. This is illustrated by the fact that in almost all high schools mathematics is a prescribed study for girls as well as boys, although the former will very rarely follow the sub-

ject up and apply it to cultural or vocational stages. This theory has also affected the character of the teaching of other subjects not originally introduced for disciplinary purposes. Modern languages, science, and even history have been modified along lines supposed to be suited to mental training."[1]

It is helpful in this connection to quote how a leading opponent of the doctrine of formal discipline outlines definite prescriptions and group electives in the secondary curriculum: "The minimum of prescription is indicated by our study of relative educational values. No important field of knowledge must be overlooked; no essential type of mental training ignored Following the the order of our discussion of values, we see that the great types are the natural sciences, the humanities, and the economic studies. Of the first grand division mathematics, an exact science, and an evolutionary science are necessary to representative completeness of knowledge and mental training; of the second grand division, linguistics, literature, art, and history form the irreducible

[1]Dutton and Snedden, *Administration of Public Education in the United States*, pp. 366, 362. A similar discussion is to be found in Brown (J. F.), *American High School*, Chap. VII. Brown expresses a belief in the specific character of mental discipline but fails to make a consistent application of his belief in his program of studies.

minimum; of the third or economic grand division, some mastery of economic theory and some manual training or some skill in using the machinery of exchange are the essentials." (De Garmo.)[1]

Although the criticisms made against the haphazard selection of elements in the elementary curriculum apply with equal force to the secondary curriculum, we will not repeat our former discussion, but will confine our attention to the prescribed and the group elective system and to the general method aim of the high-school.

Does the present secondary course, as summarized by Dutton and Snedden, include for the majority of pupils the elements of the most comparative value in the environment? As to the specific value of subject-matter or of method, it does not. Algebra and geometry are of comparatively little specific value to most high-school boys and girls, except as a preparation for advanced work in similar subjects, which only a few will take. The need of algebra and geometry in physics has probably been over-elaborated, and the need of them in some vocations is a special (elective) not a general need. The subject-matter of English is, of course, of supreme value in

[1] De Garmo, *Principles of Secondary Education*, Vol. I, p. 177.

giving an acquaintance with the best uses of our language and the best ideals of our literature, though there is a doubt as to the environmental value of some of the linguistic and literary anatomy now required. The three group electives (foreign language, science, and history) vary in specific value according to the subject taken in each of the three groups. Some studies in a group may rank above others in that group in the community of their elements with more frequent and more important elements in the environment of most pupils. Therefore, a pupil may elect from a group a study of less value, and this loss in his general development may not be compensated for by advantages to his individual capacity or career, because in the same group a more valuable study for general development might also have had just as much value for him individually. As has been suggested, the group system is justified by its efforts to combine general representativeness with individual freedom, but many efforts of this kind fail by sacrificing the former to the latter without compensation. It might be wise to increase the number of definite prescriptions and still leave a surplus for group election. However, for both the definite prescriptions and for the group electives in the secondary curriculum, there

is great need for a more careful study of the specific values of subjects than has yet been attempted.

In the secondary school, far more than in the elementary school, studies have a general method value in addition to the value of their specific subject-matter and method. The rationalizing tendency of adolescent pupils can be guided to form from the specific methods used general concepts of method of great environmental value. But we repeat that concentrated effort on the part of both teacher and pupil is required to do this. The most wasteful weakness in high-school teaching is the failure to work out and apply general concepts of method—from mathematics, concepts of an exact and universally valid method; from natural sciences, concepts of the inductive and deductive phases of scientific method; from languages, concepts of how to interpret and master forms of expression; from history, concepts of how to understand and deal with social conditions.

What are the kinds of general method to be prescribed, definitely or by groups, in the curriculum of all high-school pupils? First, the method of pure mathematics; second, the method of the mathematico-physical sciences; third, the method of the biological sciences; fourth, the method of

the psychological sciences; fifth, the method of the sociological sciences. The first method is exact and universally valid—the ideal of all the sciences; the second approaches the first in so far as our knowledge of the data and their causes allows us to use exact quantitative forms; the third includes life variations, and, therefore, cannot use exact quantitative forms; the fourth includes the psychic in addition to the life variations; and the fifth includes the social in addition to the life and the psychic variations. There is a decrease in exactness and validity as we go from the first to the fifth. Every high-school pupil should know and use each of these five divisions of method, for one method cannot take the place of another and even within these large divisions there are subdivisions with important differences in method. In the secondary curriculum, geometry is a good example of the first method, physics of the second, botany of the third, psychology of the fourth, and history of the fifth. Physical geography uses mainly the second and the third methods; language, literature, ethics, and art the fourth and fifth. At present, the secondary curriculum is weakest in the fifth method,—the most important of the five. It should be specially represented

by history, civics, economics, and commercial geography. In addition to these five divisions of method, emphasis should be given to the methods of manual, domestic, and industrial training. If all high-school pupils are required to work out and apply each one of the methods here mentioned, they ought to be well educated, especially if the methods have been derived from studies of great specific value.

Our brief mention of elementary and secondary curricula serves only to illustrate the standard of values previously outlined. We have confined our discussion and our references almost entirely to the one problem of mental discipline, with a few of its applications. Though we have purposely omitted any discussion of college education, on account of our skepticism regarding it, we believe that the principles emphasized in this essay will apply to it also.

Mental discipline is the most important thing in education, but it is specific, not general. The ability developed by means of one subject can be transferred to another subject only in so far as the latter has elements in common with the former. Abilities should be developed in school only by means of those elements of subject-matter and of method that are common to the most val-

uable phases of the outside environment. In the high-school there should also be an effort to work out general concepts of method from the specific methods used. Through courses which develop valuable specific abilities and, in addition, valuable concepts of method, the school can become a vital, direct means of preparing boys and girls for environmental usefulness, especially if the school combines, simultaneously or successively, with the general course such vocational training as will make its graduates independent economic factors in society.