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Scientific Geography for Schools

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only about 2 inches per year can be expected from the mountains, and practically nothing from the plains. In other words, with a mean annual rainfall of less than 10 inches, or from 10 to 15 inches, no living streams can be expected outside of the mountains, and, as shown by the map of the United States, rivers rising in regions of such aridity disappear upon reaching the lowlands, so that the arid region of the west is characterized by its lost streams.

Another set of results being obtained is in regard to the average discharge of the rivers of the country. It is recognized that with the great seasonal and climatic oscillations that take place the streams have great range, and may never flow for any considerable length of time at their average rate, but, nevertheless, even with these wide and irregular variations it is a matter of considerable moment to know what has been, for a period of ten years or more, the average discharge of the streams at certain points. This average discharge, when represented diagrammatically on a map, enables the student to see at a glance the relative importance of various rivers, as well as their length and position.

Having ascertained approximately the average quantity of water carried by rivers at various portions of their course, it becomes practicable, using this as a base, to study the variations from this mean, and to have a standard by which to express the relative quantity of floods or the relative deficiency of droughts. The intensity and duration of these are matters of great importance, both in their practical and scientific application, and can only be satisfactorily discussed when results have been obtained covering a considerable range of time. When such data have been assembled and arranged for convenience of reference, it will be possible for individuals, officials, engineers, or promoters to discuss the practicability of enterprises designed to add to the health, comfort, or wealth of the people.

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## SCIENTIFIC GEOGRAPHY FOR SCHOOLS.\*

By RICHARD E. DODGE, Professor of Geography, Teachers' College,  
New York.

I PROPOSE, in the time at my disposal, to offer one or two suggestions for improving the geography work in our common schools, which at present here in America, and particularly in the United States, is recognized as the poorest-taught subject in the curriculum. While other subjects have undergone tremendous changes in the last few years, geographical teaching has remained practically dormant until within the decade. Much is being done at the present time in the line of so-called improvement, but a great deal of the energy is, to my mind, misapplied, because it is unscientific and superficial. My excuse for bringing this subject before a meeting composed so completely of scientists is because the teachers of this country need scientific help if they are ever to improve the work in geography. Many scientists fail to realize that the reason why their scientific labours are so little appreciated is because they themselves have neglected to train the public spirit, which should follow them and be interested in them. We have in the United States a few scientific geographers who are aiding greatly school teachers and pupils, working arduously and earnestly with the hope of doing some good in this generation and more in the next. Those of us who are making this task our life-work, while we are at the same time attempting to do something in scientific geography, feel that

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\* Paper read in Section E (Geography) at the Toronto Meeting of the British Association, August, 1897.

we need the help and the interest of every geographer in this country and abroad, if we are to produce the results we so eagerly wish for in making geography hold the place in the minds of the people that by right belongs to it.

Until within a few years, the geography taught in the schools has been very largely what is termed "sailor geography." It trained the mechanical memory and gave a vast knowledge of details, often of little use to the learner, to be forgotten as soon as school was out. This old form is now giving way to what is commonly called "rational" geography, in which the child is taught to reason, and in which the subject is made to become a mental stimulus. There is still room, however, for great improvement. At present there is a great deal of argument among school superintendents and principals as to the psychological position of geography, as to its ability to produce mental training, and as to the stage of mental development at which it can best be introduced. Those of us who have the cause of geography so thoroughly at heart need not stop to discuss this subject. We are thoroughly convinced that geography is as capable of mental training as any other science. If we are in doubt, we can be reassured by reading the excellent papers of Mr. A. J. Herbertson \* and Mr. B. B. Dickinson,† which have appeared in the last year.

Leaving aside, then, the question as to the power of geography, let us see what the aims of geographical education are and what they should be. Hitherto the aim has been to give a knowledge of the world in its relation to man, and in some cases a knowledge of the world with very little thought of man. Now, we recognize that the teacher has not accomplished his task or fulfilled his duty thoroughly until he has trained his pupils in the ability to gain more education after they have left him than they have gained with him. They must leave school with the ability to study, to interpret, and to apply; with the power of gaining knowledge for themselves from maps, text-books, encyclopædias, books of travel, and all other sources of geographical information. If the end to be sought by geographical teaching is the power of knowing and applying one's self, then surely this power is more important than mere information. Incidentally, geography should train the pupils in an understanding of the features of the Earth, of their origin and structure, of their life-histories and their ends; it should develop in the pupils a love for nature and out-of-doors, a desire to study geography first hand and to come in contact with the Earth; it should leave them in a questioning spirit and with the power of thought.

All these points have been more or less dwelt upon by our teachers and geographers, but there is another point concerning which we hear less, and it is this: that the training in geography should be along scientific lines, and should lay the basis for scientific thought which the pupils may use in the later years. If the three steps which any scientist must follow, before he comes to a decision, are those of observation, inference, and proof, then our training is unscientific if we stop with mere observation and the study of relationships. We should early develop in our children the power of prophecy, and, what is further, the power of proving the prophecy. By prophecy I do not mean guessing, but I mean the power of foretelling the relationship of man to any part of the world from the study of a good

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\* 'On the Importance of Geography in Secondary Education, and the Training of Teachers therein.' By Andrew J. Herbertson. 'Rep. Sixth Inter. Geog. Cong.' (John Murray, London, 1896), pp. 83-87.

† 'Geography as a School Subject (an attempt to show that Geography can be taught as a training of the mind).' By B. Bentham Dickinson. Printed for the Geographical Association, 1896.

map or other representation of that region. From an experience of a few years in teaching, I know that this power of prophecy can be developed early in the child-life, and that it is vastly helpful in the future training of the children. The prophesying, however, must be founded on familiar conditions, and must start in a simple way. We all know that the German custom of making home geography the centre for future study of the world is becoming to be recognized as the true beginning for geographical work. If the home geography is so taught in the early years that the children get an understanding of the causal conditions, it becomes a basis for the study of prophetic geography later.

From the home geography we should go to a map representation of the facts, and from the home maps to maps of other regions drawn in a similar way. From these latter maps the pupils should be able to read the physical conditions, and to prophesy from these conditions certain great lines of geographical development. Climatic conditions, the lines of drainage, the character of the topography, the altitude, the occupations of the people, the places of residence, the manner of life, the lines of communication by water or rail—or the lack of them—the probable position of the great centres of population, and many other points, should at once be suggested to the child as the only results possible under such conditions.

In this development we have followed two of the steps of scientific reasoning: we have observed the home geography and the conditions abroad, and we have drawn our inferences from these conditions as to what their effects must be. The third step is the proof, the analysis, the decision as to whether the inferences have been true. That proof comes in the study of facts as they are given in the sources of information in the hands of the child or teacher. If these three steps be followed, the children are early led to appreciate the relationship between cause and effect, and to see that all is not chance in the world. Furthermore, they are given a mental stimulus and a training in right thinking that will be a help to them ever after.

During the last two years I have introduced this work into the school with which I am connected—the Teachers' College, New York City—and the results have been more pleasing than I had even expected. Children whose average age was eight years have, after a study of the home geography and a knowledge of the globe shape of the world, taken up a somewhat detailed study of the United States, and from a physical map prophesied simply, and yet accurately, all the conditions which I have suggested above, practically emphasizing the points of climate, drainage, topography, and occupations in the great central plain and mountain regions. In the succeeding grade, where the children average nine years of age, they prophesied from a physical map of Palestine all the primary geographical conditions of that region, and with such extreme accuracy that the teacher carrying on the work was as surprised as I was. This work has been done by teachers not particularly trained in geography, and who have only attempted the new geography within the last two or three years. Of course, much depends upon the ability of the teacher to keep the prophesying of a degree and quality in sympathy with the ability of the child. Naturally more work, and more detailed work, can be accomplished in the latter years than in these years, but these two illustrations show most clearly how it is possible to start scientific thought early in our school work. The teachers in our institution value this work, and recognize that it is going to be extremely important and a very great help in the later work in history, literature, science, etc.

The kind of generalization and the kind of prophecy that is possible in geographical work is different from that in any other line of science, and I feel that we should all make an effort to incorporate scientific geographical teaching in our grade schools. I believe that geographical teaching along the lines suggested is more

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scientific than that followed in many of our institutions, and if this line of thought be a valuable one, as I deem it to be, we should do all in our power to assist it. The common school-teacher not being trained as a scientist, it becomes the duty of those whose thought is scientific to help the non-scientific. A great many of the teachers of the United States recognize that the source of help to which they must go are the men scientifically trained as experts in the particular subjects in which they are interested. The geographers of the United States are having a tremendous demand upon them at all times for help and assistance, yet they are so few that their work, important as it is in certain localities, lacks geographical breadth and area.

We need the help of every geographer if we are to secure an immediate improvement in geographical teaching. First we need to persuade the superintendents and those in authority that geography is a science, and capable of giving scientific training. There is much writing and talking on "What is Geography?" but there is less on what it can do. We know what it can do, and we need to prove to others the strength of our position in reference to this subject.

At present there are but a few universities in this country where geography is taught scientifically, and the aid from the scientists must therefore be given to all stages of education, from the earlier to the more mature years. This assistance will, as I have said before, perhaps secure little return in this generation, but surely the next generation will profit thereby.

There are several lines in which scientists can help in geographical work. First and foremost is the necessity that geographers should publish their results in such a form and in such a place that teachers can make use of them. Much that is valuable is now not at the service of teachers, because buried in scientific bulletins and periodicals. Furthermore, many of our geographical results are given to the world in terms unintelligible to the lay reader, because phrased in roundabout statements or unusual words. We need to be more simple, more concise, and hence more clear. Teachers cannot afford the more costly scientific publications, and hence there is need that scientific geography be published in such a form that teachers may have access to it. The writer has endeavoured to do his little in this regard by publishing a journal of school geography,\* which, though youthful, has met with such a good success that I think it a sign of the times and of the opportunities of the times. Our pedagogical papers are full of geographical material, but most of it is rubbish, and geographical only in the mind of the writer thereof or by courtesy. Every geographer can assist in this good work, and help the papers of the country by giving them accurate facts.

Yet by this means of assistance alone teachers may become loaded with a mass of facts, dangerous because of their inability to apply it scientifically. Hence scientists can do much, though more local perhaps in its effect, by the giving of courses of definite lectures for the teachers of their neighbourhood. Much is being done, as you know, in this way abroad, and something in this country; but we should all of us be at the task, for in combination only is there a possibility of success.

Again, our schools need better and cheaper maps, more and better models and globes, lantern slides, etc.; and the selection of these should be managed by scientific men. Much credit is due to the work of Mr. B. B. Dickinson and the Geographical Association of Great Britain. Would we had several similar centres of geographical information—geographical information bureaus, if you will—in this country! Here is a chance for beneficial help that needs attention at once.

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\* The *Journal of School Geography*, a monthly journal devoted to the interests of the common school teacher of geography. Lancaster, Pa. One dollar a year.

As America is a country which is considered practical, we can help our cause by showing what applied geography is. If the geographers of this country and abroad would produce more publications showing the relation of the geographical conditions to history and progress, to literature and art, to human conditions of all kinds, the science would be helped, and the common people would soon learn to recognize the claims of geography and the need of improving the teaching of it. Prof. Charles R. Dryer, of Terre Haute, Indiana, has led the way in this work in this country by his recent publications of his *Studies in Indiana Geography*,\* and I hope many geographers will soon follow his example in other states.

I have spoken as a teacher and student of teaching, and have tried to show some of the helps we teachers need in our efforts to improve geographical teaching in this country. So far as I know, we have few schools where geography is taught in accordance with the plan I have outlined briefly. The number is increasing annually, however, and there is an ever-increasing demand for teachers of the so-called new geography.

Enthusiastically interested in the cause of geography as a geographer, and recognizing some of the difficulties that teachers have to deal with, I have ventured to summarize these conditions here, that they may receive some discussion, and I hope some recognition. I appeal to you all, therefore, whether you be from across the water or not, to give your active sympathy and cordial co-operation in the vast problem which awaits us—the improvement of geographical teaching along scientific lines.

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## THE HIGHLAND CONTROVERSY.

AFTER the formal meetings of the Sixth International Geographical Congress came to an end, a number of excursions, organized under its auspices, set out under duly authorized leadership. It may be supposed that each of these started with an equal amount of energy, for the distances traversed were inversely proportional to the members constituting them, the long-distance excursion to the remote highlands of North-Western Sutherlandshire being undertaken by one member of Congress alone—Prof. Penck, of Vienna. Under the guidance of Mr. John Horne, Prof. Penck explored many of the more important districts very thoroughly, favoured by exceptionally good weather; the results of his observations are to be found in a recently published paper, which must be regarded as a very striking contribution to what is already a very voluminous literature, one which seems not unlikely to add yet another to the many “heresy-hunts” which have from time to time beset this troubled region.†

Taking up the matter from the wide standpoint of mere earth-structure, Prof. Penck's attention is first concentrated on the conditions under which the Torridon sandstones were laid down upon the Archæan gneiss, and the first part of his paper consists of a careful examination of the appearances observed along the line of junction of these two formations. The structure of the Torridon breccias, as seen, for example, on the south side of Loch Torridon, on Loch Maree, and at the Gairloch, and the characteristic forms of the surface of the gneiss near Quinag, Loch

\* ‘*Studies in Indiana Geography.*’ By Charles R. Dryer. Inland Publishing Co., Terre Haute, Ind., 1897. Pp. 113.

† “*Geomorphologische Probleme aus Nord-west Schottland.*” Von Albrecht Penck. *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, Band xxxii. (1897), No. 3, pp. 146–191.