The Pedagogical Seminary

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/vzps20>

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Published online: 30 Aug 2012.

To cite this article: G. Stanley Hall (1902) What is Research in a University Sense, and How May it Best be Promoted ?, The Pedagogical Seminary, 9:1, 74-80, DOI: [10.1080/08919402.1902.10534169](https://doi.org/10.1080/08919402.1902.10534169)

To link to this article: <http://dx.doi.org/10.1080/08919402.1902.10534169>

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WHAT IS RESEARCH IN A UNIVERSITY SENSE, AND HOW MAY IT BEST BE PROMOTED?¹

By G. STANLEY HALL.

This topic is of very great importance. Its decision very largely determines the nature and quality of true university work. It is a theme to which the Carnegie Fund will give great prominence, and perhaps it might be called central for the higher education which seeks to carry on offensive and defensive warfare in new fields instead of holding old forts and curricularizing second-hand knowledge. To have fully realized all that is involved in this question gives a new educational consciousness, and for a young man to have really grappled with the problem and wrought out ever so tiny a result is an experience of epoch making importance. In the student it tends to a new type of mind that is more independent and resourceful, and perhaps we might add American. Without it education is incomplete, and with it the young man feels that he can stand erect; is an authority and not an echo on some subject; minute though it be; and therefore ought to be more docile and respectful to experts in other fields.

No individual is large enough to treat this subject adequately, and he can at best only suggest, in view of his experience in his own department. Even were he able to formulate what is best in one, his norms would have to be modified for other departments.

All university men will doubtless agree that there is great abuse of the words research and investigation now, which are dragged down the academic grades even into the high school, where comparing a few references and doing over again work that has been done a thousand times—the teacher holding the key, a method which is wasteful and unnecessarily retards the pupil's advancement.

A candidate for the doctor's degree must get certain results in a certain time, and, therefore, can only very rarely attempt great heroic work with large risks and possibilities of indefinite delay. His voyages of discovery must be coasting voyages, and he cannot set out to find new continents. On the other

¹ Abstract of a paper presented at the Association of American Universities, of Chicago, February 26, 1902.

hand, the practice, still too prevalent in some places in Germany, of making the student a mere apprentice doing some trivial and highly specialized work to fit into the work of his professor, is liable to great abuses and loss to the student. It may be almost as bad, although in a very different way, as the public research in the school above referred to. An American student lately sued a professor in a German university because he claimed that the latter had taken his work as his own without acknowledgment, and the laws of intellectual property in this field still await formulation, although German traditions in my judgment are hard on the student.

It is there, too, that we find the opposite extreme. I know a professor who assigned a crude student a subject; planned and caused to be made expensive apparatus; sat by him an hour or more almost daily; found and even brought him references; reconstructed his tables; and in the end took them and wrote the article in German, the student's name only appearing but with a foot note stating in what university laboratory it was done.

Half the problem is to select a good topic. This may be less important in most fields than it is in psychology where interest as an expression of personality furnishes a motive power of very great value. Most men who desire to devote themselves to philosophic study come to university work with a high head pressure of curiosity and zest in certain directions. Their previous training has either sown or developed roots that can be grafted on to or utilized with great economy. Indeed, choice of topic sometimes is decisive for careers, and in a few rare cases I have had students who worked for months on subjects, good in themselves, whom I have advised to change for work along some very different line, and that with great gain. In my twenty years of experience I have learned to keep a book of problems, which is always at hand, where I set down such thoughts and references that occur. Some of my colleagues do the same, and we often confer about topics that seem and do not seem promising. Bibliographies are collected and often books bought, and occasionally apparatus and other data are collected in advance. We then have personal talks with each new man; find the direction of his tastes, reading, and plans; and then seek, as perhaps the most responsible of all our functions, to fit the man and the subject, not infrequently, however, approving a topic a man himself brings to us.

When this is done, the first thing expected of a student investigator is that he shall read and otherwise post himself on all that immediately bears upon his subject. He must know what has been done, neglect no important author; try to stand on the shoulders of others and not do over again what they

have done. He must criticise, evaluate, relate, and perhaps first of all make a concise digest of all the important work that precedes, whether or not it be later printed. The specialization, while not too narrow, must be acute enough to permit more or less mastery of the resources concerning it. This itself is often an important service. Here in my subject, the French theses are usually better than the German or American. This brings the young man to the frontier. When he has seen what has been done, he can form an idea of what remains to be done. It is a new experience for him to see the frontier of human knowledge anywhere, and is of itself an indispensable element in the higher education.

But mere scholarship is essentially selfish. Many minds that are noetic amass great acquisitions, perhaps to their saturation point, and regard themselves as educated because they know. Thus it is almost proverbial with many directors of research that graduates from certain colleges; where the training is of the best and not without some exceptions the valedictorian type of mind, here reach a limit which it is very hard to pass. The faculties have been in a pupillary state so long that they cannot get into independent action. They must have authorities, while those who know less are less impeded in the freedom of their mental action. It is very difficult to bring a merely learned man to doubt standard authorities or to proceed to demonstrate their errors, but the essential thing in a university thesis is that it must add some tiny contribution. It may be a very small brick to the great temple of human knowledge, but it must be an advance. It must penetrate a little into the vague horizon that separates the known from the unknown. This means an appeal to conative, active powers. I should be very far from over estimating the value of these contributions, but they should not be under estimated. They aggregate into a great and precious body of new knowledge. Of course it will occasionally happen that the young explorer's net comes in empty and the results of his protocol figure up contradictory conclusions, but even in this case he has distinctly smoothed a way for the next worker.

Perhaps we might divide the stages of university investigation into three. First, the *method* must be either invented or adapted to the problem. There are conditions to be controlled; principles of selection must be determined; negative instances rejected; very often machinery must be devised and made; ways of constructing curves must be discussed; graphic methods of record as well as presentation wrought out. Method, as was said of old, is like the roof overhead in tunneling a sand bank, it keeps off the débris and permits the work to go on beneath. Just as the apparatus for research will probably not

be found in the cabinet to illustrate stated courses of lectures, so the mechanism of treating the data will not be laid down in any logic or perhaps not completely found in any of the standard methods dealing with and distributing statistics. The method must not be too precise and accurate. Pedants of method often need to be reminded of Aristotle's remark, that precision should not be more exact than the nature of the subject admits of. I have noticed that some investigators reach their acme of satisfaction when their formulæ are made; their machinery works well and this mechanical and preparatory stage is complete; and it is true that this is often all conditioning, but it is essentially preliminary.

Second, there must be *data collected*; experiments made and noted; facts gathered; protocol books filled; instances and experiments multiplied; and the basis of induction made broad and deep. This is no less essential to safeguard against theorizing on insufficient premises. In some lines of work this is relatively easy, so that many minds here fall into doldrums. They mount sections, multiply slides and tabulate results for weeks and months in a mechanical way, deferring the careful scrutiny that should be incessant, and often thus waste effort by the instinct of the ant that gathers, neglecting to add the functions not only of the spider but of the bee that mixes its own secretions with what it gathers. The counters, weighers, measurers and tabulators in my experience are especially common among novices in experimental and inductive work. They are over superstitious about their new methods, feeling that they will grind out results of themselves. Often as the spring begins and the necessity for having finished the thesis looms up, it requires drastic methods to overcome this stagnation and arouse to the next stage of work, which is most difficult and important. There seems to be a perpetual delusion here that disguises the difficulties and time ahead. Some, alas, are competent only here. The professor makes the methods and helps them over the initial difficulties. In this second stage of amassing, they seem competent because the work is of a more routine nature, but they never can be brought to cross the real Rubicon of interpreting their results. True, such men perhaps should not be put to research, but the professor must make up his mind in every case that he may have to finish any student's work, and that possibly he has so little conception of what research means that he will never realize that he has done nothing but mechanically repeat tests in an imitative way.

The third and main stage is to *think it all out*; to apply a rigorous, philosophic method; to reason logically on the objective facts; to find their unity; to determine what is central

and what is unimportant; to relate and determine the place and bearings of all; and find whether the accumulations are mere agglomerations or have a meaning and a value for science. It is really this that tests the metal of men,—their acuteness of thought, their originality, their power of imagination and the construction of hypotheses, the readiness to catch implications and suggestions of all related facts in their ken;—this requires a well organized brain, and as it were knits its different elements together into a higher unity. Most of us professors fail here. How often we have the experience of finding that some one else has extracted great truths from facts perfectly familiar to us, because he had the seeing eye and the divining mind. It was said of Helmholtz that almost his every serious thought in his maturity added to the world's sum of knowledge. This is perhaps the highest compliment that could be paid a man of science, and from this standpoint how incompetent most of us are to conduct research as it should be, and how new the standards of measuring men should be, and how different the faculties here required from those which successfully lead or drive platoons of collegians through textbooks.

My theme is treated, I know, in a way wretchedly inadequate, but a few rather incidental remarks I must add. Young men are not overburdened with gratitude. They have been aided all their lives, and often when a professor has done most of the work, the student alludes to him in his thesis only with formal and perhaps scant recognition. This condition, I believe, is a fact of nature which we must accept. Our place is to serve, and if there is the least jealousy or envy of our students; nay more, there must be no reluctance to give them all our best ideas *without any reserve* or without the credit which should go with them; that we must do not only with entire, but with rejoicing self-abnegation. Wherever there is doubt as to the authorship of ideas, the student should have every benefit of it, provided only that it is always stated where and with whom his work was done. I have in mind several cases of young men who have written books a year or more after they left their professor, most of the best ideas of which have stood for years in his lecture notes with no acknowledgment; but the least symptom, objective or even subjective, of reclamation here, I believe ungenerous and opposed to the interests of the young, which we all must serve, and to the best interests of university work.

Having published a successful piece of research, a young man is almost a new creature. He is a citizen of a higher academic community, and has to set himself a higher standard to live up to. He must consider himself and be considered an

expert, however narrow the field, and entitled to an opinion which, whether in the learned society, the conference of manufacturers about processes, committee rooms of legislators, in the councils of physicians, entitles him to a hearing. He is thus a member of the *university invisible*, not made with hands, and not a guest or servant or an alien in it. He has a better idea of what intellectual freedom means and he has had some experience with real conviction, which the masses know not of.

Thus he must print and at once. This is not only a test of the institution that it may be known to others what the degree really means, but the baptism of printer's ink gives enhanced self respect. He has nailed up his theses and must defend them. These must also be freely exchanged and circulated, so that they can be available to all who wish them. They must be concise and not suffer from inflation or over dilution. Most young men need discipline in learning to talk with the rifle rather than with the shot gun or water hose. If there are any historical or other topics that require length, there should be means to that end. It is pathetic to hear representatives of wealthy institutions, which charge large fees and claim to do university work, pleading poverty when it comes to printing theses, and either refusing investigators in other institutions, who wish to see manuscript copies deposited in their libraries, or making them wait for each other to do so.

Research from its very nature cannot be very much organized or mechanized. All committees and rules and uniformity are here impertinent, if not injurious and impossible. The freedom of investigation blows where it listeth. It often needs financial resources, but should never be controlled from without. Indeed, I am not clear that it is entirely compatible with administrative perfection and I fear that the over organization, from which so many things suffer in this country, is bad for it. When a professor becomes the director of a great building; must keep it in order and look after accounts; and direct various attendants, he is almost certain to be weakened as an investigator. Victor Meyer would have all chemical laboratories built so cheaply that they could be renewed every ten years, that they might be plastic to the exigencies of research to their very boards, brick and mortar. Great librarians have been eminent in history or literature, but it is in spite rather than because of their vast knowledge and responsibility for books.

Finally, among the most important of all instrumentalities in research in at least one department, I believe to be the frequent, perhaps weekly, pooling of results by a choice body of men for each other's benefit. Let one or two men in a company of perhaps twenty read once a week what they have done

that each may know what all the others are engaged upon and have the full advantage of following all their work and processes, and it will be found that the discussions and criticism which follow will be of great fruitfulness for each investigator as well as for others. Sometimes new references, names or other sources of information are brought to light, but more frequently the subject is seasoned and pruned by criticism and very often fructified by new ideas in this process. The teacher, who has successfully tried this plan for a term of years, can truthfully say that, while he has learned much from his masters, he has learned more from his own students. Here, too, by the ear and mouth method and by conversation that sharpens the minds of friends, he may perhaps have found one of his greatest pleasures in life and have been stimulated to render his own greatest aid.