Many social and intellectual forces focus introductory courses not on the process of inquiry but on its products.

Knowledge, Mind, and Facts

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In *The Great Conversation* Robert Maynard Hutchins (1952) argues that the purpose of education is to develop a good mind, which means improving our analytical, critical, and imaginative powers while cultivating the moral and intellectual virtues. The problem with most courses in general and with most introductory courses in particular is that they fail on both counts. They fail to develop good minds, because too often we simply forget that that is what they should do. Instead, we are usually satisfied if they are simply about history or about biology or about some other discipline. In each of these areas, we have the facts, and we are anxious to dispense them. In our enthusiasm to do just that, we tend to overlook the fragmented picture of education and knowledge that is implicitly presented in higher education. In contrast to that picture, which I will discuss at some length in this chapter, I suggest that education resides not in the collection and distribution of the products of our inquiries but rather in the process of inquiring.

Empiricism and Facts

The focus on intellectual products instead of their production coheres with a host of modern social (McCauley, 1982) and intellectual prejudices. Not the least of the latter is our empiricist predilection for atomistic accounts of cognitive phenomena. For nearly 300 years,

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empiricism has remained faithful to Locke's general vision of the genesis and structure of knowledge as increasingly complex combinations of simple ideas occasioned by elementary features of sense experience. On this account, most of our knowledge is the result of various mental operations on these epistemic building blocks. This position can quickly reduce the development of good minds to the distribution and collection of bits of information.

Mind as Container. A preoccupation with education as the acquisition of bits of knowledge not surprisingly impoverishes our view of the mind. On this account, the mind is like a box. We pour the products of our inquiries into it, and we periodically sample its contents in order to test its integrity as a container. This view is inadequate in at least two crucial respects. If our minds are containers, they are porous at best. What we forget in a lifetime dwarfs what we remember. If nonporousness is the true mark of a good mind, then almost no one has had a good mind. This failure has not seriously undermined our ability to get on in the world, because we have developed many tools, ranging from notes to computer memory, that do such work in our stead. However, we are not particularly distraught about this situation. Because we have developed such powerful mnemonic aids, the simple storing of knowledge has now become one of our more mundane intellectual accomplishments. The second reason why the view of the mind as container is impoverished is that it completely ignores the intellectual powers that we have not learned to duplicate mechanically—judgment, insight, imagination, and reason (Rorty, 1982). These capacities atrophy when education requires no more of a human being than the passive storage of facts.

This product orientation suggests a view of education that often seems plausible, because it touches the truth here and there. Good minds usually know a lot of things. Poor minds usually do not. But, to yield to the temptation of defining educated minds as boxes of stored information is to encourage both arrogance and laziness. On this view, we are content to instruct (from a Latin root meaning to pile upon) rather than to educate (from a Latin root meaning to lead or draw out), because it is both easier to do and easier to certify. In one sense, piling knowledge on students places the burden on them. It absolves us if they fail. Their minds leak. If, on this view, we fail, that is, if what we dispense proves to be less than the full truth, then the extent of our culpability is equally ridiculous. If education is primarily the dispensation of facts, then we had better be positive about what we are dispensing. In any event, this view of teaching and learning ignores a crucial feature of intellectual growth, namely, the direct interaction of human minds.

Passing out the facts is simply not enough. Learners must grapple with one another by grappling with one another's ideas. A picture of education that shows more experienced learners leading less experienced learners portrays an evenhanded activity in which every participant has some measure of responsibility for fruitful interchange.

Too often, we are happy to pile the things we know on our students, because our intellectual accumulations and the efforts that we expend to retain them impress us so. We lack both Socratic humility and initiative. We have confused the energy required for the mnemonic maintenance of an idea with the energy that it releases during intellectual fission. We are so busy collecting, storing, and measuring knowledge that we overlook the fact that these activities are only one aspect of cultivating a good mind. It is by no means sufficient.

An Alleged Scientific Connection. Empiricist epistemology has gained credence beyond its intrinsic merits from its association with the successes of empirical science. However, careful scrutiny of this allegedly privileged association over the past two decades in the philosophy of science finds it generally wanting. It is particularly ironic, then, that the scientific community has so often fallen prey, especially in introductory courses, to the product-oriented instructional model implicit in modern empiricism. Kuhn (1970) describes this phenomenon; Thomas (1981), Eiseley (1978), and others have deplored it. The explanatory and predictive successes of scientific pronouncement in conjunction with their frequent mathematical complexity lend them a gravity that is guaranteed to command obeisance from novices but also, as Eiseley (1978) puts it, to blunt their wonder. If students remain generally unacquainted with the tremendous controversies that lie behind most scientific facts, the towering accomplishments of science will simply overwhelm them. Overwhelmed minds are immobilized minds, unlikely to consider the possibility that things might not be as we have all been told. (The humanities provoke less intense epistemic allegiance. This is because their products are less determinant. Consequently, the inadequacies of instruction focused predominantly on the products of inquiry are even more obvious in humanities courses.)

Kuhn's (1970) account of the histories of the sciences construes them as series of extended periods of authoritarian calm (what Kuhn calls *normal science)* punctuated by periodic revolutionary upheavals. With surprising frequency, outsiders have provoked these revolutions. Examples include Dalton in chemistry, Crick in genetics, and Einstein in physics. In some of the most important episodes, it is clear that normal science, that is, standard education and research in a particular field, has not been the primary engine of discovery.

Scientific progress does not depend essentially on narrow specialization or mastery of all the facts. Popper (1972) offers principled arguments against the view that progress in science is ever a function of either the accumulation or the manipulation of facts. All facts are theory-laden, because it is only in the larger framework of theory that facts become intelligible. A simple illustration may help. At the turn of the seventeenth century, the dawning of each new day was an undisputed fact. The quarrel was not over that fact but rather over what was to be made of it. The controversial question was whether the diurnal pattern was a function of the earth's or the sun's motion. Sometimes, the role of theory is quite obvious in our interpretation of the facts—for example, in the case of the path that a particle takes through a bubble chamber, an apparatus whose function is inscrutable when divorced from our theories of subatomic physics. In our everyday dealings with the world, however, we are more likely to forget the implicit theoretical commitments underlying common sense. Modern common sense, for example, is thoroughly Copernican on a number of counts. It has not always been so. Sometimes, our implicit commonsense theories are demonstrably flawed. Science surpassed much of our persisting mechanical common sense in the late Middle Ages. Today, subjects can fail to solve many extremely simply mechanical problems because they either do not have the concept of inertia or they choose to ignore it (McCloskey, 1983).

The point is that the facts are always changing, even in science, that preeminent knowledge-seeking activity. They change because theoretical innovations offer new ways of construing the world and therefore new accounts of the phenomena in question. I do not deny that there may be a great deal of continuity between one successful theory and another, but I want to emphasize the importance of our imaginative accomplishments in science and the alterations they inspire in what we take to be the facts.

The Insufficiency of Facts

Mastery of Facts. If undergraduate education in general and introductory courses in particular primarily emphasize the mastery of facts, the products of our inquiries, then they fail to enhance many faculties essential both to the cultivation of good minds and to the progress of those inquiries. In addition, they incur the very practical risk of dispensing truths that are out of date. Interesting problems require insight, but insight almost never issues from the mere collection of knowledge. Instead, it guides our decisions about what knowledge to collect.

Thus, the talk about mastery of facts is misleading. If students do not appreciate the historical, polemical, and conceptual contexts from which facts emerge, it is likely that the facts will dominate the students. Facts dominate when we do not know how to use them. We can only master facts when we have made the systems of ideas that inform them our own. It is through novel ideas and novel connections of ideas that we discover new facts and new ways of using the old ones. Mastery of facts is a consequence of disciplined inquiry, not its goal. Such mastery is unattainable for its own sake.

Beyond Facts. It is precisely in the extent to which theories go beyond facts that they become empirically interesting. The facts are about how the world is (or is alleged to be). The growth of knowledge results from the success of theoretical conjectures, which not only reveal new facts but contradict some of the old ones. The facts are necessary, but as props on the stage, not as actors. The drama of inquiry (and inquiry *is* dramatic) is necessarily a result of human interchange and the confrontation of our schemes for dealing with the world. The roles demand talents that only human beings can supply. The dramas that we live require active human minds, not passive ones. It is no coincidence that Socratic inquiry takes the form of dialogue and conversation. These activities involve human beings in attacking problems by attempting to make something of the facts, not merely by reciting them.

We must step beyond facts to discover the truths that give them meaning. Discoveries are the result of a laborious ongoing process of assessing how our most carefully formulated conjectures withstand the critical onslaughts of others. The growth of knowledge, both corporately and individually, requires the systematic development of four interlocking powers: first, the imagination to formulate new conjectures; second, the analytical ability to discover their structure, their relation to the evidence, and the problem-solving strategies that motivate them; third, the judgment to recognize and devise telling criticisms; and fourth, the skill to communicate our ideas accurately to fellow inquirers.

Mixed Messages

The exercise of these capacities is crucial to the progress of our inquiries and to the development of good minds. Such exercise should be the central focus of undergraduate education in general and of introductory courses in particular. Unfortunately, both undergraduate education and introductory courses often have other priorities. We have convinced ourselves that we can efficiently dispense, systematically

present, technologically manipulate, safely store, exactly measure, and readily divide knowledge into discrete domains. Our declarations in support of liberal education notwithstanding, many dimensions of introductory courses disclose how much faith we put into this account of education as essentially the distribution and collection of facts.

The Setting. The notion that any long-term educational experience for introductory students can occur exclusively in a lecture hall indicates inadequate concern for the cultivation of good minds. The seating design directs students' attention to a single point in the room, from whence the truth shall issue. Such rooms have been designed for the pronouncements of experts, not for the conversations of learners. They discourage students from looking at one another, let alone learning from one another. In fact, they pressure professors to deliver lectures, because they clearly signal who is to do all the talking. This produces the all too familiar scenes of students so preoccupied with their notebooks (or so confident in their tape recorders) that they miss the power of the ideas that they preserve. Students have little or no opportunity to test their ideas by returning them to us. To compensate, schools sometimes schedule discussion sessions. However, the fact that these sessions are the responsibility of graduate assistants whenever possible clearly indicates how important the institutions hold them to be. Similarly, the fact that rigidly hierarchical departments often assign introductory courses to their most junior members indicates the esteem in which these courses are held.

The fact that so many introductory courses take place in such contexts has curricular implications as well. In philosophy, the expanding emphasis on symbolic logic in introductory logic classes is, at least in part, a function of the fact that the courses are increasingly taught in these large lecture settings. Arguments in natural language lack the rigor of formal systems. Hence, they do not submit to the tailoring that straightforward lecturing requires. Consequently, it is quite tempting to restrict or even eliminate this segment from the course. Of course, the problem is that arguments in natural language are the kind we all make.

Parallel phenomena in other fields have created an additional problem that concerns about enrollment only exacerbate. Approaching introductory courses as opportunities to recruit for particular disciplines inevitably misses the mark. Recent notions that most late adolescents either could or should know what field on which to focus or what occupation to pursue are preposterous. (This is not a necessary truth. It is an irony that excessive emphasis on career education defeats itself. If our system of education was in fact generally committed to the devel-

opment of good minds, students might be ready as new undergraduates to make such decisions in large numbers. However, encouraging students to make these choices prematurely tends only to perpetuate intellectual blight.)

Written Work. The format of written assignments in general and of examinations in particular also provides clues about our educational priorities. If written assignments focus overwhelmingly on the sort of work susceptible to machine grading, then we communicate quite effectively (albeit unconsciously) our expectations about the extent of their educational experiences. Even the most cleverly designed objective tests fail to examine the most crucial skill in the process of inquiry, namely, our ability to present and defend our positions in an economical, accurate, and clear verbal form. Such tests elicit only the products of our inquiries, not the processes by which we reach them. They look only at our conclusions. They ignore the reasons that we would cite to support them. People can arrive at the same conclusion for all sorts of reasons. It is important to know whether students come to their conclusions by sound reasoning, faulty reasoning, or random guessing.

The distinction between participating in this process and describing it (presumably after the fact) is arbitrary on a number of counts. The describing is the last and most important step in the process by which we reach the conclusions that we claim as our own. It is only when we must display our thinking to others for their critical inspection that we get our best view of how the products of that process stack up. Assignments that neglect this final step demonstrate our willingness to settle for half-baked ideas. They also communicate to students that it is only the products that matter, not also the logical rigor, strategic efficiency, and moral acceptability of their methods.

Turf. Reverent respect for disciplinary boundaries is another sure sign of where we put our faith. This suggests to students that we regard the knowledge we have accumulated in our own field as satisfactory and do not wish to explore others' issues. It also suggests that disciplinary boundaries are not convenient administrative fictions but almost unbridgeable gaps between piles of knowledge on whose pinnacles the experts sit. Their privileged vistas encourage tenacious oversight of curricular turf and necessitate distant treatment of the uninitiated. However, it is important to recognize that the organization of our knowledge is a by-product of inquiry, not the thing itself.

Crowds. Finally, even our enrollment practices communicate the wrong things to students. Introductory courses quite typically have double or triple the numbers that other undergraduate courses have. It follows that students receive less personal attention in introductory

classes. They also have fewer opportunities to try their ideas out publicly in the classroom and less experience in the give-and-take of critical exchange. The very numbers convey the message: Students are there to receive ideas silently and passively.

What Is to Be Done?

The points about introductory courses that I have raised in the preceding section belie our lofty remarks about good minds and liberal education. The structure of introductory courses results from practical compromises all along the line by trustees, administrators, and faculty. It is no doubt impossible to locate precisely where the bulk of the responsibility for these compromises ultimately lies. Consequently, there is no obvious reason to anticipate any substantial relief from the practical pressures. However, we have not explored other possible responses to these constraints. In the real world of limited resources, compromises are inevitable. The question is whether we have made the best ones. In the space that remains, I suggest some alternatives to the situation just outlined.

Small Crowds. Ideally, no course should have huge enrollments. If some courses must, then they should be in the upper division. If students have had the chance to mature intellectually through intimate and dramatic inquiry in their introductory and lower-division courses, they will have developed the powers necessary to proceed independently in the more crowded advanced classes. By that time we can hope they will have learned a good deal about how to learn on their own. This modification would eliminate the need for holding introductory classes in lecture halls, it would require such courses to receive a much larger share of faculty time, and it would require the students in them to receive a larger share of faculty attention. Although this alternative would probably limit a department's ability to offer upper-division courses, it would ensure that the upper-division courses had hearty enrollments.

Writing. If we restrict the enrollments in introductory courses to reasonable numbers, then grading essays will not consume half of the semester. Students must write. It is through that process that we (and they) learn whether they can simply regurgitate material or whether they have digested it, that is, whether it has become part of them, subject to their control. The only possible compromise when facing huge enrollments is to assign only one or two essays during the entire semester. Few steps can more thoroughly undermine undergraduates' confidence, unless their best grade is disproportionately weighted in the calculation of their final mark.

Unseating Experts. All faculty members should teach introductory courses. They would have to, if departments acted on my first recommendation. Doing so is an excellent way to reacquaint ourselves with our intellectual beginnings. From the construction of the syllabus to the way in which we conduct the class, the teaching of introductory courses demands constant reassessment of our most cherished intellectual and pedagogical prejudices. The mere exposure would decrease the distance between the most senior faculty and not only their students but their junior colleagues as well. Likewise, team-teaching arrangements, especially in introductory courses that cross disciplinary lines, force us, as representatives of our respective disciplines, to face the scrutiny of colleagues from other fields in the presence of students. Such interchanges enhance the learning experience for all concerned. In short, they keep us honest.

Conversation. If classes are not too large, genuine exchange is possible, even in lecture halls. In almost every class, there are at least a few students who are naturally inclined to speak up. It does not take extensive prompting to get people to talk in most situations. Why should classrooms be the exception? Participation should probably be an explicit factor in the evaluation of students' performance, since it almost always is an implicit factor. Eventually, the criticisms of fellow students deter thoughtless comments offered merely for the sake of appearances. Students prove much more willing to contribute if they understand from the beginning that their comments matter not only to the success of the class but to its direction as well. The general strategy enlists the insights and enthusiasm of the best students in encouraging others to try their hand. Learning is exciting, and excitement is contagious. It is so contagious that the conversations will extend beyond the class hour. The more *that* happens, the less distinct the boundary between education and the real world becomes. Learning becomes increasingly central to living.

Conclusion

Whether these simple ideas will promote greater emphasis on the process of inquiry in introductory courses or not, we must somehow revive that emphasis. We must focus strategies in introductory courses on how to compensate most effectively for the practical constraints that we all face, instead of on how to accommodate to them. Otherwise, our task will swiftly become one of merely doling out the facts.

All that is at stake is the development and maintenance of good minds, theirs and ours respectively. The facts age quickly in a rapidly changing world. By contrast, experience at inquiry perfects tools neces-

sary to contribute intellectually and to adjust personally. Even in the best of times, events are mostly beyond our control. The cultivation of exemplary minds is our only justifiable hope in the face of the resulting uncertainty.

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