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ABSTRACT

This paper discusses intellectual competence and ways in which to define, measure and use this concept in evaluating college effectiveness. Intellectual competence is divided into two categories: academic mastery and intellectual resourcefulness, with evaluation methods suggested for each. (CK)

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RESEARCH MEMORANDUM

INTELLECTUAL COMPETENCE: DEFINITION AND MEASUREMENT

Richard E. Peterson

Based on a talk given at the 12th American Meeting of the Institute of Management Sciences, Detroit, September 30, 1971.

Educational Testing Service
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INTELLECTUAL COMPETENCE: DEFINITION AND MEASUREMENT[1]

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Educational Testing Service

In the past year I have had occasion to do some systematic thinking about college and university goals. In connection with work on an Institutional Goals Inventory to be used by colleges in identifying goals and setting priorities among them, Barry Morstain and I developed a working conceptualization of the domain of higher education goals, which breaks down into 13 "output" goals and nine "process" goals.[2] The first two output "goal areas"--central aims for most colleges and universities, one may assume--have to do with student academic and intellectual development, and these are the matters I want to focus on in this paper. More exactly, I want to discuss a concept--name it, define it, discuss how to measure it, and comment on its use in evaluating the effectiveness of colleges.

Intellectual Competence: A Definition

The name I've given the concept is Intellectual Competence. How shall it be defined, such that the definition will both make sense given the nature of the times, and lend itself to credible measurement? To begin, I

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[1]Based on a talk given at the 12th American Meeting of the Institute of Management Sciences, Detroit, September 30, 1971.

[2]Output goals: Academic Development, Intellectual Orientation, Individual Personal Development, Humanism/Altruism, Cultural/Esthetic Awareness, Traditional Religiousness, Vocational Preparation, Advanced Training, Research, Meeting Local Needs, Public Service, Social Egalitarianism, Social Criticism/Activism.

Process goals: Freedom, Democratic Governance, Community, Intellectual/Esthetic Environment, Collegiate Environment, Innovation, Evaluation and Planning, Accountability/Efficiency, External Relations.

would suggest that we can usefully think of intellectual competence as comprised of two basic components, which roughly correspond to the first two goal areas in the conceptualization referred to above.

The first component may be called Academic Mastery. While the relative emphases may vary from college to college, academic mastery would generally embrace, first, in-depth understanding in one field; second, a more modest acquaintance with facts and principles of the western intellectual heritage; and, third, basic literacy--the ability to read, write effectively, and do simple mathematics. Nothing particularly surprising so far. But how many colleges, one wonders, in fact award degrees on the basis of some level of demonstrated mastery, let alone evaluate their effectiveness in terms of the amount of gain in knowledgeability.

The other component of general intellectual competence I would like to call Intellectual Resourcefulness. What it involves, fundamentally, is the capacity, in a social context, to solve problems. Its importance as an "outcome" of college, of course, owes to some of the likely social "givens" of the last half of the 20th century--social, technological, biological change; accelerated obsolescence of knowledge and vocational proficiencies; and so forth.

Among the specific skills of the "intellectually resourceful" individual might be the following:

(1) Skill in problem definition: ability to identify the forces that interact to define the problem, to systematically observe and empirically assess, to "transcend" the problem situation (minimize the intrusion of one's own values).

(2) Capacity/confidence to engage in new learning: ability to come to understand and be able to evaluate problem inputs from theretofore unfamiliar sources, skill in actively seeking out new kinds of information.

(3) Creativity in proposing problem solutions: ingenuity, ability to comprehend all relevant variables, capacity to forecast consequences of alternative solutions.

(4) Capacity for cooperative work: ability to function effectively as a member of an interdisciplinary task group: patience, tolerance, respect for divergent beliefs.

Again, much of this is not new to people who have thought about the problem of problem solving. But I doubt that many colleges have seriously considered some standard of ability to solve problems, however this may be defined, as an institutional goal, much less as a specific exit criterion.[3]

Both components--knowledgeability and ability to put the knowledge (and new knowledge) to work in solving problems on the job and in everyday life--seem essential as college goals. Assuredly, one cannot apply knowledge to the problems of life unless one has it to begin with. Just as assuredly, it is the person who has developed a resourcefulness in solving problems and continuing to learn who will be able to keep his sanity as the future comes crashing down on us.

So much for conceptualizing. What about measurement?

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[3]This leads, of course, to questions about the probable worth of more or less formal instruction in problem-solving techniques, per se, whether or not such skills can be learned separate from the content of particular disciplines, and so forth. My own belief is that an interdisciplinary "course" (or sequence, offered during the undergraduate years in which increasingly difficult problems are considered) addressed generally to the problems of living and working in a complex society is both feasible and valuable. An alternative would be separate courses that emphasize information (very broadly defined) from, say, the social sciences, the natural sciences, and the humanities and arts.

Measuring Intellectual Competency

With regard to "academic mastery," there are a host of available tests for assessing subject matter achievement or mastery, in depth and/or in breadth. And there are published tests that can be used to assess basic literacy.

Let me, however, suggest an alternative approach to the use of published tests in measuring specialized field proficiency, that is, for measuring knowledgeability in one's major field. It involves the use of what in the past were called "senior comps"--comprehensive exams given at the end of the senior year. The suggested procedure is for faculty, administrative and student representatives in a given discipline at the college, or from all the institutions in a multicampus system, to work together to jointly define the domain of knowledge, mastery of which would be requisite for the degree (e.g., a BS in chemistry, an AB in business administration).[4] The resulting general specifications for a degree examination would be turned over to some other agency--say, a statewide university examiner--which would construct the actual test. Professors and students would return to their respective departments to develop the most effective set of learning experiences they can conceive for instilling mastery of the subject domain as they have defined it. (The profs would never see the test itself.) This whole process of degree-definition might be repeated every five years or so.

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[4] The difficulties involved in a departmental faculty reaching consenses about the objectives of instruction in the department can hardly be over-emphasized. At many universities, the impasse regarding (departmental) curriculum design is such that faculty simply refuse to talk about it. (The prospect of using some published test, e.g., the GRE, could be a stick to prod departments to reach agreements about their learning objectives.)

As for measures of breadth of knowledgeability, there are available what are called "area" tests in the social sciences, natural sciences, and humanities. There are long, highly reliable area tests, and there are also short versions suitable for assessment of group performance. And while there are many available standardized tests of ability to read, write, and compute, the college's English and Math departments should be able to devise these instruments.

Technically, the task of preparing measures of different kinds of academic mastery is not all that difficult. The situation, however, is quite different with respect to the kinds of skills I outlined under the idea of "intellectual resourcefulness." In fact, the state of the measurement art is still such that there are no measures of adult "problem-solving ability" or "creativity" that I could recommend.[5] Here, it seems to me, is a challenge to the psychological measurement fraternity, ETS included. Given an appropriate marshalling of expertise and money, I'm reasonably confident the challenge could be met.

Basically, I would think these tests would be in the nature of what are called "situational" tests, or tasks, or games. For example, it should be possible to devise one or more problem sequences[6] in which a situation--data, prose summaries of political and economic forces, etc., for example--is presented, perhaps by means of slides for group administration, with the students asked to write out an answer to the question: "What would you do?"

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[5]Some of the advanced college achievement tests (e.g., some of the GREs) contain items that tap students' ability to apply facts and principles of the discipline to certain kinds of problems.

[6]Different problem solution exercises could be framed in terms of several broad disciplines such as the social sciences, natural sciences, physical sciences, business, education, social ethics, and so forth.

This sequence would be repeated perhaps twice, with successively new data introduced that would call for modified or new solutions. The entire sequence might take 30 minutes.

Another approach, developed at ETS and used quite widely in industrial settings, is known as the "In-Basket" test. Incoming "memoranda" present a problem; the subject records his decisions regarding the problem in outgoing "memos." One available in-basket test, for example, called the Consolidated Fund In-Basket, has the person assume the role of a paid community fund director.

The colleges that opt for the use of senior comps of the sort outlined here, it seems to me, have resolved that their degrees are, in fact, to mean something (other than an accumulation of credit-hours). Institutions in a multicampus system that use a reasonably standard set of senior comps have the further advantage of having their degrees mean roughly the same thing; e.g., the AB in business from Southwestern State College would mean roughly the same as the same degree from Southeastern State, which it seems to me is as it should be.[7] In another sense, senior comps are an embodiment and operational definition of some of the most central of the institution's goals.

So far we've been considering measurement for the purpose of providing exit criteria, for awarding degrees, for certifying. What about measurement for the purpose of judging institutional effectiveness?

Intellectual Competence and College Effectiveness

Let us understand "effectiveness," or "degree of effectiveness," as the extent of achievement of institutional goals. The process of determining

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[7]While there could be different content emphases, e.g., in business administration curricula, the general quality--in the sense of difficulty level--of the degree from one campus to another would be controlled.

the extent of goal achievement is generally known as "evaluation." Let us further assume that some concept of intellectual development is a central goal at most American colleges. Note I say intellectual development, not intellectual status, say, at graduation. Even though a university may uniformly graduate highly able people, it may be that it has recruited and admitted only the highly able to begin with; having induced relatively little growth in the meantime, it would be regarded as a relatively ineffective institution. The college that admits students of relatively modest ability, and manages to increase their competency by (an average of) 20 ability points, is rather more deserving of public support, one could argue, than the university which graduates the cream, having in the process made them only 5 (ability) points creamier.

To make these kinds of determinations, of course, requires repeated measurement--pre- and posttests before and after the "treatment" (in the language of the experimentalist--or clinician). In terms of the kinds of measures I've been talking about, a college would probably want to administer the area tests, the problem-solving exercises, and the literacy tests to freshmen at the time they arrive at the college. They would be given the specialized or departmental exams at the time they begin their major field work--typically at the beginning of their junior year. (These test administrations could have diagnostic and counseling uses, in helping students pinpoint strengths and weaknesses and then planning their programs accordingly.) All the measures would be repeated at the end of the senior year (the "senior comps"). Finally, and this may seem wildly unfeasible, all the measures should be administered to the people five years (or so) after graduation, on the assumption that there is little value in learning something if

it is forgotten soon after leaving college. (Differences between senior and "alumni" test performance could be interpreted in terms of how well the material had been learned originally, and also in terms of how strong a capacity and confidence for continued learning had been instilled during the four years on the campus.)

There could be problems in interpreting the gain (or loss) scores between the various administrations, and making judgments about institutional effectiveness, for many institutions in the beginning stages of the kind of evaluation program I've outlined. One problem is that there would be no available gain-score norms against which a college could interpret its gains.[8] Assuming a system-wide evaluation set-up, institutions in multicampus systems or consortia could compare their gains against system-wide gain norms (and/or against one another). Otherwise, colleges could compare the gain scores of successive graduating classes, and they could always make comparisons between graduates of different departments or other such academic divisions.

I'm sure that all this sounds prohibitive in view of the costs and student-hours involved. However, it may not be as bad as it seems. For a number of reasons, colleges, on the average, are going to get larger in the years ahead. With graduating classes of, say, 2,000, it should not be too difficult to assemble a sample of 500 alums-five-years-out at several test centers in the region, and then distribute (spiral) some ten or so tests among the 500--say, five per person. The same could be done with the freshman and senior testing--that is, sample students and test segments--providing one doesn't want

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[8] Between the senior and alumni assessments, there are likely to be losses rather than gains, at least for people not going on to graduate school.

test data on all freshmen for counseling purposes, or scores for every senior to determine degree eligibility.

As readers can maybe tell, I'm intrigued by this idea of colleges following-up a carefully selected sample of their graduates five years or so after graduation. In addition to taking the kinds of tests I've mentioned, alums could also fill out a questionnaire about career patterns, graduate degrees, other noteworthy accomplishments, and so forth.[9] Needless to say, the alums tested would be well paid for their time.

Further down the road, should state systems decide to move along the lines I've outlined, they would certainly be expected to allocate sufficient funds to implement the kind of evaluation that commands respect on the respective campuses. Even further on down the road, in the event the Federal Government decides to subsidize colleges in part on the basis of demonstrated effectiveness, it (Washington) would be expected to foot a sizeable part of the evaluation bill.[10]

Summary and Conclusions

The basics of what I've suggested regarding definition and measurement of intellectual competency are summarized in the matrix below.

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[9]Colleges often do mail surveys of alumni; their value is usually limited, however, because of low and biased return rates.

[10]Effectiveness, as I suggested earlier, should be conceived in terms of achievement of acknowledged (on- and off-campus) institutional goals. Nowhere in this paper have I meant to imply that (narrow) academic criteria need be the only standards for evaluating the performance of colleges and universities. Liberal arts colleges often assert the aim of developing the "whole" man/woman. Universities are generally committed to research, graduate education, and public service; junior colleges, to meeting a variety of local community needs; technical institutes, to narrow vocational training; and so forth. More broadly, a government that stands for social/cultural pluralism would, one would expect, also stand for educational pluralism.

INTELLECTUAL COMPETENCE

Defined	Measured
Academic Mastery	
1. Specialized knowledge	Specifications set by college departments, tests constructed by institution-based test specialists; or, published achievement tests.
2. General knowledge	Published "area" tests (of knowledge in the humanities, social and natural sciences, etc.)
3. Literacy	Published tests of reading, writing, and mathematical ability; or locally constructed tests.
Intellectual Resourcefulness	
4. Skill: problem definition 5. Capacity: new learning 6. Creativity: problem solutions 7. Capacity: cooperative work	Prototype instruments developed by measurement organizations (e.g., ETS); additional forms, variations, etc. prepared by institution-based specialists.

As an element in a systematic evaluation of institutional effectiveness, it was suggested that the various measures be taken at the beginning of the freshman year,[11] at the end of the senior year, and then five years (or thereabouts) after graduation. The fundamental criterion of effectiveness would be the amount of gain ("value added," in the economist's language) in intellectual competency during students' undergraduate years. Additional criteria would be (1) the extent to which knowledge and problem solving skills are retained (five years) after graduation, and (2) the quality of other post-BA educational, occupational, cultural, etc. accomplishments.

[11] The test of specialized knowledge would be first given at the time the student begins his major field work.

I have commented only on student academic and intellectual outcomes, which seem to me relatively noncontroversial and amenable to consensus on the campus and in the departments. I've said nothing at all about non-intellectual outcomes for students--values, commitments, self-insights--nor about noninstructional activities such as research and public service; all of these are goals that many people on many compuses would have their institutions embrace. While growth in the intellectual competency of undergraduates is undoubtedly a central goal at most colleges, it is only one in a larger set of priorities that institutions will need to come to grips with as American society, and with it, American higher education, evolves in the years just ahead.