REALS AND IDEALS OF ACCOUNTING EDUCATION: BUILDING EDUCATIONAL LEVERAGES ON FUNDAMENTALS

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Now, what I want is, Facts. Teach these boys and girls nothing but Facts. Facts alone are wanted in life. Plant nothing else, and root out everything else.

With these opening words from the mouth of Thomas Gradgrind, a doctrinaire schoolmaster, Charles Dickens set the stage for his harsh critique of pragmatic education in mid-nineteenth century Britain in his novel, *Hard Times for These Times*. The tension between liberal and pragmatic forces in education is not new. The more things change, the more they seem to remain the same.

FROM SPECIALIST TOWARD GENERALIST ORIENTATION

In April 1959, the AICPA Council adopted thirteen resolutions on accounting education (American Institute of CPAs 1959). One of these established the baccalaureate degree as a requirement for the CPA certificate. Another stated that postgraduate education for careers in public accounting is desirable, and that as soon as it is feasible, postgraduate study devoted principally to accountancy and business administration should become a requirement for the CPA certificate.

Nearly thirty years later in May 1987, the AICPA Council approved a professional standards plan which included a requirement that applicants for membership of the AICPA after the year 2000 have 150 semester hours of education, including a baccalaureate degree or its equivalent. (At the normal full-time study load of 30 semester hours/year, completion of 150 semester hours would take four years of undergraduate and one year of graduate education.) In January 1988, the membership voted to put the 150-semester-hour (or "five-year") requirement into the AICPA Bylaws (American Institute of CPAs 1990).

The accounting profession changed during the three decades that elapsed between these two actions of the AICPA Council. The Council responded to the change by altering the contents of the five-year educational requirement. The AICPA Council in 1959 called for five years of education because the knowledge needed to prepare an accountant as a specialist was thought to have become too voluminous to cover in four years; action of the Council in 1987, on the other hand, was motivated by a belief that the knowledge needed for an accountant as a generalist had become too voluminous. Both resolutions dealt with the so-called knowledge explosion; one was driven by the depth of knowledge, the other by its breadth.

The same trend toward generalists seems to be evident not only in public accountants but also in industrial, tax, and nonprofit and government accountants, and internal auditors.[1] Increasingly, they are called upon to engage in tasks that go far beyond the traditional scope of accounting.

Social as well as technological changes are responsible for this shift in the profession's knowledge base. In 1959, accountants kept books, audited and filed tax returns. By 1987, they also designed information systems, evaluated merger and acquisition targets, recruited executives and analyzed manufacturing or marketing strategies. Today's accountant may hardly be recognized as one by his/her compeers a generation ago. This broadening of the scope of activities of the profession is clear in the sources of revenue of larger public accounting firms (American Accounting Association 1989, p. 37).

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REALS AND IDEALS OF ACCOUNTING EDUCATION

Ideals of accounting education have shifted greatly over the past three decades, while reals of accounting education have remained the same. Educators must readjust their aim at this moving target by adapting the curriculum. And they must do so within the constraints of time and money that students can be expected to spend on their education. We believe that this gap can be bridged by building educational leverages on fundamentals of accounting, the issue we would like to elaborate on in this paper.

The American Accounting Association's Committee on the Future Structure, Content, and Scope of Accounting Education, (the "Bedford Committee"), reviewed the future educational needs of accountants (American Accounting Association 1986). The Committee recommended that accountants' education be broadened, with an emphasis on "learning to learn."

In February 1988, the AICPA Education Executive Committee published its report, *The Statement on Policy on "Educational Requirements for Entry into the Accounting Profession,* revising its October 1978 statement (American Institute of CPAs 1990). The Committee acknowledged the change in the profession's environment as follows: "Developments in computer and telecommunication technology brought about changes in auditing and information systems. These developments were paralleled by the increased complexities in financial practices and widespread internationalization of commerce. Collectively, these forces affected public practice, business and industry, and government and other not-for-profit organizations. With these developments came an expansion in the services provided by CPAs, arousing the interest and concern of congressional committees and private-sector groups regarding the role and performance of professional accountants. Civil liability suits and revelations of fraudulent financial reporting have prompted questions about the integrity of financial reporting systems (p. 7)."

Reflecting these changes in the environment of the accounting profession, the Committee recommended an illustrative 5-year program in which accounting education occupies only about 1 year (25-40 semester hours). It recommended that 60-80 semester hours of the total 150 semester hours be devoted to general education, and 35-50 semester hours to education in business administration.

A statement by the (then) Big Eight accounting firms published in April 1989 (Arthur Andersen et al., 1989) suggested that three basic skills (communication, intellectual, and interpersonal) and three types of knowledge (general knowledge, organizational and business, and accounting and auditing) are necessary for accountants in public practice. Concurrently, these firms pledged funding to support the development of new accounting curricula that are responsive to the needs of the profession. The Accounting Education Change Commission of the American Accounting Association was created to spearhead this effort. The thrust of the "Big Eight" recommendation is on the critical importance of general education: "For the good of the profession and society as a whole, education for accounting must include a sufficiently large, broad and deep general education component to yield a level of knowledge that is characteristic of a broadly educated person. . . Post-secondary education should provide a strong fundamental understanding of accounting and auditing. This includes the history of the accounting profession and accounting thought. . . Passing the CPA examination should not be the goal of accounting education. The focus should be on developing analytical and conceptual thinking -- versus memorizing rapidly expanding professional standards (pp. 7-8)."

THE KNOWLEDGE EXPLOSION AND MEANS TO COPE WITH IT

Knowledge explosion has affected virtually all disciplines, and has created understandable anxiety among many circles about the ability of our system of accounting education to meet its challenge. Knowledge includes skills necessary to put it to effective use, and "knowledge explosion" should also be interpreted broadly to

include the expansion in the variety of skills needed to make full use of the knowledge.

Specialization has been a major tactic to deal with the knowledge explosion. As the number of customers increases, businesses reduce the size of the territory or the number of products assigned to each salesperson. In academia, the courses, disciplines, and specialized diplomas are subdivided to cover the broadened or broadening knowledge base without allowing the content of any one division to expand beyond some specified level. Universities specialize by narrower courses, teachers, departments, disciplines and diplomas; students specialize by narrower professions or occupations.

We do not wish to argue against specialization. Few would want to forsake the gains in productivity of industrial societies created through specialization. However, for specialization to serve as an economizing strategy, we must know when to stop. Where do the gains from specialization, diminish, and turn into losses?

Structure of knowledge is interactive, not hierarchical--more like a collection of nerve cells than roots of a tree. When we subdivide knowledge into disciplines and educational programs, some of these interconnections are severed or ignored because each module must have a boundary. Specialization is desirable only as far as the gains from improved mastery of a smaller body of knowledge exceed the loss from the ignorance of linkages with the adjacent disciplines. Knowledge must be analyzed, comprehended, and mastered from an integrated, interdisciplinary, and problem-solving perspective. More knowledge has been found to be interdisciplinary as our perspectives grew and broadened. For example, what was previously considered to be strictly an issue in financial accounting standards was found to have serious economic and social consequences which can no longer be ignored.

Current efforts to reorient accounting education are shifting the emphasis from the specialist-orientation and toward the generalist-orientation. The specialist-orientation means that the accounting profession gives up a large portion of the so-called "common body of knowledge," replacing it with a collection of "specialized knowledge" which will be shared only by the specialists in the respective subfield of the discipline. The generalist-orientation, on the other hand, insists on the common body of knowledge and copes with its explosion by moving the focus away from peripherals and toward more and more fundamentals. We suggest that we resort to this second strategy--educational leveraging on fundamentals.[2] We discuss levels of knowledge in the next two sections before returning to this strategy in a later section.

MEASUREMENT OF THE DEPTH OF KNOWLEDGE

This shift in the focus of education toward fundamentals is certainly welcome, especially in professional education where immediate applicability of knowledge has been emphasized in the past. If we think about the structure of knowledge as a network of ideas and concepts, understanding interconnections among ideas and concepts becomes a key to education. Fundamental concepts have a great many interconnections that may take much study to comprehend; peripheral ones have fewer connections and are understood more easily. If we assume that the time it takes to understand a concept is related to the number of its interconnections, we could define levels of knowledge in terms of this time.

To create a framework of reference, let us classify knowledge by the time it might take for an average person to acquire it with concentrated and intensive effort. We call a piece of knowledge "Level 0 knowledge," if it is judged that it can be acquired by an average person with one hour's effort. The reason for "0" is that we measure the amount of time in logarithm with base 10. Since $1 = 10^0$, we equate 1 hour with the 0 exponent. Thus, Level 1 knowledge will require 10 hours of effort, Level 2, 100 hours, Level 3, 1,000 hours, and so on.

Level 0 knowledge, acquired within just one hour, is factual and specific. Brief information on news items and technical definitions of accounting terms are of this nature. Particular

treatment of accounting transactions under a given official pronouncement if the matter is relatively simple, and simple skills to operate a new software package in accounting can fall into this category. It is true that acquiring a collection of Level 0 knowledge will take more time. However, they are like records in a large database and can be learned independently of each other, as one piece of knowledge does not build on another. We treat such knowledge as Level 0 knowledge, even if it takes more than one hour to acquire a collection of such knowledge.

Level 1 knowledge is slightly more complicated since it requires 10 hours of concentrated and intensive efforts by an average person to acquire it. The need for this effort in acquisition of such knowledge may arise from its technical complexity, or the extent of time (historical) and space (global) over which an issue may have to be examined. Students can be expected to continue to acquire such knowledge through their accounting or managerial careers.

Level 2 knowledge could be thought of as a medium sized project that takes a hundred hours or two weeks (of fifty hours each) of concentrated and intensive efforts to acquire. This may involve mastering a special programming language, statistical techniques, or complex consolidation procedures.

Level 3 knowledge, requiring a thousand hours of concentrated and intensive work, is a major project. This amounts to 20 weeks of heavy full time work or 40 weeks of half time work. Acquisition of a foreign language, learning an advanced mathematical subject, elementary understanding of a foreign culture, proficiency in the mechanics of bookkeeping including advanced topics, are examples of projects that may fall in this category.

Level 4 knowledge is a major portion of a discipline or a professional common body of knowledge as it refers to knowledge that is acquired after 10,000 hours of concentrated and intensive effort, or 5 years at the rate of 2,000 hours per year. Such a fundamental knowledge may, perhaps, be chosen as a goal of a 5-year accounting education program in the sense that all efforts to acquire knowledge in individual disciplines culminate in knowledge acquisition at this level of depth and complexity.

Level 5 knowledge is work for a lifetime since it requires 100,000 hours of efforts or 50 years of work at the rate of 2,000 hours/year. This is obviously too large a goal for a 5-year program, although such a program should certainly contribute to acquisition of this knowledge. This may refer to some philosophical issues that may take one's lifetime effort to comprehend and master.

Knowledge at Level 6, and beyond, cannot be acquired by any single person, only shared among members of a group. This involves education of overlapping generations and social organization, and is beyond our scope.

KNOWLEDGE LEVELS OF EDUCATIONAL FOCUS

Setting Level 6 knowledge aside, let us work backwards from Level 5 to Level 0 knowledge.

Regarding level 5 knowledge, it is clear that undergraduate and graduate education should contribute to students' lifetime learning effort. Specifically, what kind of knowledge one should pursue in one's lifetime is a choice left to the individual. However, it is an important educational objective to teach students to continue their learning effort, in breadth as well as in depth, during their lifetime.

Unlike Level 5 knowledge, Level 4 is directly within the reach of our educational effort at universities, a comprehensive examination that may test knowledge at this level might take the following form. Select a contemporary accounting issue, such as "other post-employment benefits," and discuss the issue from, say, five disciplinary perspectives. The choice of the topic as well as the five disciplines may be specified, or left to the student. An important point of examination is that a student with the maturity of Level 4 knowledge should be able to professionally and insightfully analyze a real issue in accounting from not only technical accounting but also from, say, labor relations, legal, political, economic,

international, sociological, historical, or other managerial functional perspectives.

Taking one such perspective at a time, in isolation from others, may not be more than Level 3 knowledge in the sense that such a perspective may be obtainable after 1,000 hours of a concentrated and intensive study. What makes the knowledge exhibited in such an examination Level 4 rather than Level 3 is the synergic and symphonic effects that such perspectives can collectively produce. It is the maturity of the overall treatment of the issue that raises the level of knowledge from 3 to 4.

Once we develop a clear definition of the Level 4 knowledge we wish to impart at the university, we design the Level 3 and 2 modules needed to construct the accounting curriculum and design similar examinations to test the students' understanding of interconnections at the respective levels of depth. This approach may permit us to help design accounting curriculum based on a hierarchy of the depth of knowledge.

When it comes to Level 1 and Level 0 knowledge, we believe that for the most part detailed coverage of these lower levels of knowledge should be reserved for students' own study in school during their spare time or their work experience and training in the field upon graduation. There are several reasons for this.

1. Small Blocks of Time. The small blocks of time needed for acquisition of lower level knowledge can be found interspersed in busy work schedules; higher levels of knowledge require larger blocks of time, and it becomes increasing difficult for managers to find such time in work environments. (It should be noted here that Level 2 knowledge, for example, requires 100 hours of concentrated and intensive effort. If one has only one hour blocks of time, it might take many hundreds of such blocks of time to master Level 2 knowledge.)

2. No Instructors Needed. Factual knowledge is easier to acquire without much depth in thinking or analysis; students can acquire it by self-study and without help from an instructor.

3. Help from Electronic Media. Technological innovations have provided numerous tools to help us select, compile, and acquire, almost instantly, knowledge from vast databases. Many encyclopedias, as well as newspapers, economic, business and accounting data, are now available electronically with selective retrieval capabilities. Such technologies allow people to become instant experts in factual knowledge.

4. Large Savings by Not Covering. Factual levels knowledge tends to be more voluminous than fundamental levels knowledge, with corresponding demands on memory. This means that by not covering them in class, students and instructors are both relieved of the burden of having to spend a significant amount of time in discussing them and trying to memorize them. Not covering Level 0 and Level 1 knowledge in class might be the only way of coping with the knowledge explosion and still achieve the goal of educating a well-rounded generalist in accounting.

5. Transient Nature of Knowledge. Knowledge at the factual levels tend to be transient, changing from year to year, month to month, or even day to day. Such knowledge frequently becomes obsolete before students have a chance to use it at work.

6. Uncertainty of Selection. Finally, the vast amount of factual detail must be learned selectively according to the work needs of the individual; they are so task and job-specific that they cannot be anticipated at the time students earn their degrees. Therefore, it is best acquired closer to the point of its application.

These are the reasons why we think the educational focus should be placed on deeper level knowledge that is difficult to master in later years of the student's life.

This does not mean that Level 0 or Level 1 knowledge should be shunned in the accounting curriculum. Knowledge of factual details is essential for illustration, interest, and color in class. It is a valuable means of motivating and stimulating learning at deeper levels as we shall discuss later. In contrast, Dickens'

schoolmaster, Mr. Gradgrind, believes in teaching facts for their own sake.

BUILDING EDUCATIONAL LEVERAGES ON FUNDAMENTALS

Educational leverage is, following specialization, a second means of coping with the knowledge explosion. Instructors can provide the seeds which blossom into learning trees, so a few hours spent in the classroom lead to tens, even hundreds, of hours of additional learning and comprehension by the student. The Bedford Committee's emphasis on "learning to learn" should be the most fundamental objective of education.

Generally, leverages are means to achieve results effectively. One way of achieving this is to make sure that the students see the topics actually covered in the curriculum merely as a few of a large number of possible illustrations of a piece of knowledge that lies at the next higher level of generality. In this system, each topic actually covered in a course is shown to be related to topics at the co-ordinate level (most of which are not covered), and to topics at the next lower and higher levels of generality. Each topic covered serves a three-fold function. Of these functions, it is most important that we emphasize its relationship to other topics at higher as well as lower levels of generality.

For example, we advocate teaching inventory costing methods or depreciation methods as an illustration of cost allocation across periods. If we carefully delineate the general principle of inter-period cost allocation, it would be sufficient to illustrate it with a few examples, omitting the rest. There is no need to cover all accounts in the financial statements since they can be learned by students taking advantage of their own ability to generalize from principles and recognize exceptions. In this way, we can seek to achieve educational leverage.

Furthermore, financial accounting, managerial accounting, and other fields of accounting may also be viewed as illustrations of the more fundamental body of disciplinary knowledge called accounting. As long as they are illustrations, after two or three such examples, the rest can be left to the students' own learning. We illustrate the curriculum implications of our proposal by two examples in a later section.

We might even consider the discipline of accounting itself as only an illustration of knowledge at the more fundamental level. Such fundamental knowledge can be learned using accounting as an illustration or using some other discipline as an example. Since it is an illustration, it may not be necessary for every accountant to be an accounting major, although as we emphasize later, accounting illustrations are effective in educating accountants.

The axiom of educational leverage is that no topic needs to be covered for its own sake. If we judge a topic to be worth covering, we should be able to come up with its linkages to the higher level principles that it might illustrate, the coordinate level topics that it might do well to represent, and the lower level facts that may be used to illustrate it. We could examine the topics in the current accounting curriculum and carry out a thorough "means-ends" analysis. The final result of this analysis would be a hierarchy or network of topics linked in a logical fashion across levels of generality. This arrangement of topics would set the stage for choosing the specific topics to be covered in the courses at various levels of knowledge. (Even though the structure of knowledge is captured better by analogy of a network than a tree, organization of education into small modules forces us to arrange these modules in a hierarchical arrangement.)

If the knowledge "tree" has Level 4 knowledge at its trunk, and has ten branches at each level, it has ten Level 3 branches, a hundred Level 2 branches, a thousand Level 1 branches, and ten thousand Level 0 branches. If the objective of education is to let the student reach and comprehend the Level 4 knowledge, and if 2 branches are sufficient as illustrations of a deeper level knowledge, we need to "cover" only two Level 3 branches out of ten, only four Level 2 branches out of a hundred, only eight Level 1 branches out of a thousand, and only 16 Level 0 branches out of ten thousand. This yields a phenomenal educational leverage of 625 to 1.

Means-ends attitude in education (everything that is to be taught and learned is merely a means to achieve more fundamental ends) may be the only way to cope with the knowledge explosion. Teach knowledge for its own sake, and we become servants of knowledge; teach knowledge to grasp its fundamental principles, and we become its masters, unshaken by its explosion.

MATURITY AND THE DEPTH OF KNOWLEDGE

We have specified the levels of knowledge quantitatively in terms of the logarithm of the number of hours needed to acquire it. However, this quantitative classification is correlated with the qualitative idea of "maturity" in accounting education. Accounting students follow a maturing pattern, progressing from the Quantity Level to the Resource Level and to the People Level and to even higher levels (Ijiri 1984).

At the Quantity Level, students perceive accounting merely as a process of crunching numbers. Children learn natural languages by mimicking, and without an understanding of what the words represent. Students of accounting also learn to manipulate numbers without an understanding of what they represent. Textbook examples of journal entries do not require much knowledge of business activities as they are written to eliminate ambiguities; they can be mastered by a computer robot with a reasonable ability to decipher sentences in natural language. Consider a writedown of excess parts inventory. At the Quantity Level, a sentence, "Parts inventory was written down by $1,000," is enough to trigger a set of transactions by students who can correctly enter all its impact on current assets, net income, and owners' equity without an appreciation of the economic causes or consequences of the writedown.

At the Resource Level, students relate accounting words and numbers to resources of an entity in the real world. Resources are real, and words and numbers are their representations. These students may argue whether there was a good economic reason to write down the inventory. In addition to the knowledge of bookkeeping treatment of an event, these sophisticated students also know its economics. However, even these students do not see the people whose interests are affected by the journal entry.

The next level of maturity in comprehending accounting phenomena could be called People Level. These students view accounting not as a pure language, but as a language used in contracts that link the participants who have an interest in the entity. They realize that as a result of an inventory writedown, bonuses to management and dividends to shareholders may be affected and in some cases the company may go bankrupt, having violated a loan covenant on net working capital. They can participate in an argument on whether such "economic consequences" should be entertained in making journal entries. At this level, students' perspectives, moving from the company per se, can encompass such constituents as employees, managers, shareholders, creditors, auditors, customers, suppliers, government, and community.

Their comprehension of accounting may even reach deeper levels beyond the People Level that may include international and historical perspectives, and may even reach a level where they search for something generic to accounting that can withstand the test of varying space and time.

The design of the accounting curriculum should be such that students use their precious five years in the program to reach the level of accounting maturity as indicated by Level 4 knowledge. Deeper levels of understanding of accounting is gained not just in accounting courses but also in courses of general education and management. Fortunately, most accounting education is housed in business schools. Business faculty insist that the education of students who received accounting degrees not be restricted to accounting, introducing them to business organization, economics, personnel management, marketing, production, finance, systems, quantitative skills and statistics. In time, students begin to understand and apply this knowledge, and expand on its scope in the field. It is fair to say that this phenomena has been responsible, at least in part, for the remarkable expansion of the scope of activities

of accountants in the past three decades.

DEEPER-LEVEL KNOWLEDGE BUILT IN ACCOUNTING

We have earlier emphasized the importance of multi-disciplinary knowledge to gain maturity in accounting. We have also emphasized that all instruction should serve as a means of obtaining deeper-level knowledge. We now wish to consolidate these two issues to emphasize the importance of learning higher-level knowledge from the accounting perspective. Factual knowledge is a means to obtain deeper-level knowledge; the latter cannot be learned independently of the former. The two are closely tied together.

As accounting students gain maturity in understanding accounting phenomena, they are led to more fundamental disciplines that encompass a wider range of organizational and social issues, such as economics, sociology, and even philosophy. There is a definite advantage in learning these fundamental disciplines through accounting.

Just as accounting can be learned at various levels of maturity, there are similar levels of maturity in learning economics, sociology, or philosophy. At the most elementary level, students learn these disciplines no deeper than learning words and sentences. They can recite theories or quote others. Yet at this level of maturity, they do not have enough accumulation of experience that allows them to relate these theories or statements with real-world events. They may carry out discussions reasonably successfully just as a computer can feign meaningful conversation with humans by running a conversational program.

We often forget the fact that concrete observation precedes the formation of abstract concepts; to understand and comprehend the latter we must start with the former. Being more familiar with the concrete observations of the business management domain, students of accounting have an advantage in learning the more basic disciplines provided that we teach accounting by helping students learn easily to travel the road between the concrete and the abstract. Accounting offers a language at the most concrete level, resource flows at the most concrete level, and human conflicts at the most concrete level. Dealing with these issues repeatedly, they improve their ability to translate abstract concepts into concrete events and vice versa.

In fact, we may consider basic disciplines--economics, sociology or philosophy--from an accounting perspective. Basic disciplines encompass deeper level knowledge, and they are often taught in abstract, without the help from reality reflected in lower levels of knowledge. If an accountant acquires the knowledge of basic disciplines through means-end chains that extend all the way from lower level "facts" about reality to the abstract concepts, it gives him or her the best of both worlds--a more mature understanding of accounting as well as a better understanding of the basic disciplines.

Accounting is a highly applied discipline. This should be viewed as its strength rather than its weakness, as long as the applied knowledge is linked with more basic knowledge. It becomes a weakness only when the discipline remains solely applied and does not provide a pipeline to more fundamental disciplines.

The AICPA (in American Institute of CPAs 1990) and the (then) Big Eight firms (in Arthur Andersen, et al. 1989) placed significant emphasis on education of fundamentals including general education and general business education. Some fraction of their personnel in the profession could consist of graduates from such disciplines. Accounting education should have to prove itself by demonstrating that it is better able to serve the needs of the profession than other disciplines can. The justification for university education of accountants would be demonstrated if "accounting generalists" dominated "general generalists," and "mature accountants" dominated "mature persons," by their superior ability to go back and forth between the fundamentals and the applied issues in accounting.

Having emphasized the trend away from educating specialists, we must also sound a note of caution about the danger of excluding all specialist education. No profession can consist of dilettanti. The value of the specialist component of education derives from the experience it may provide in exploring a certain field in depth, and understanding its complex interaction with other fields.

In our familiar "T-accounts," we need both the breadth of the horizontal bar and depth of the vertical bar. Without experience, the depth of the vertical bar cannot be obtained. Experience in specialization in one field helps build confidence in one's ability to explore another field in depth when such a need arises. We believe that this is the value of specialization even in today's rapidly changing world where factual knowledge gained by specialization remains useful only for a few years.

EXAMPLES OF EMPHASIS ON FUNDAMENTALS

To illustrate what we mean by emphasizing fundamentals and knowledge at a deeper level, consider the examples of introductory courses in financial and management accounting.

In an introductory financial accounting course, the intricate articulation of balance sheet and income statement accounts under the framework of double-entry bookkeeping (i.e., the trial balance structure) is central, and difficult to comprehend and acquire. This knowledge belongs to Level 2 because the time needed to gain a mastery is of the order of one hundred hours. For the sake of illustration, we assume that having reckoned the benefits to students and the effort involved, we agree that this knowledge is fundamental, and must be covered in an introductory financial accounting course.

We then examine each of the remaining topics covered in an introductory financial accounting course from the point of view of the student who has mastered the trial balance structure. How much incremental effort would have to be expended by such an individual in acquiring a good understanding of each topic?

Again, for the sake of illustration, let us agree that students with a good comprehension of the trial balance structure can learn alternative depreciation methods and their implications for asset valuation and income determination in 10 hours. We would therefore classify the subject of depreciation as Level 1 knowledge. Suppose we also agree that the same is true with alternative inventory costing methods as well as all other subject matters covered in an introductory financial accounting course. We then conclude that such subject matters are Level 0 or Level 1 knowledge. We can cover one method of depreciation and one of inventory valuation in the course as examples, and then, having made the student aware of their existence in practice, leave the alternative methods of depreciation and inventory valuation for the students' own study after graduation.

We then re-evaluate such topics from the standpoint of how useful they may be as illustrations for teaching the trial balance structure. Suppose we conclude that although both depreciation methods and inventory costing methods are useful examples, there is no need to use both of them. We may then choose depreciation methods as an example of factors that affect journal entries under the trial balance structure, thereby impacting balance sheet as well as income statement values.

Since depreciation methods are used like "accounting cases," details of the methods are as peripheral as the location of a plant or the name of a manager in a management case. The details may be important in dealing with the case itself, but they do not constitute the knowledge sought to be imparted through analysis of the case. Since they are used only as illustrations, it would not be proper to ask questions on details of the methods in an examination. If we refrain from asking questions about the details used in an illustration, we would save our students the effort of memorizing the voluminous details at Level 0 and Level 1.

In a similar vein, perhaps the most difficult matter to master for students in management accounting is also the "trial balance structure" as it is reflected in operating and capital budgets. In fact, if we are to choose just one issue that has the capacity to integrate virtually all of the

topics in management accounting, it must be the trial balance structure that runs across divisions and subsidiaries (domestic as well as foreign) and runs across time periods in the future. The former covers divisional budgets and consolidation matters and the latter covers financial planning and capital budgeting issues.

This network of accounts across divisions and across time periods is the fundamental knowledge the student should acquire through various case subjects in management accounting. This is where accounting students doing financial planning and control differ from students in other fields doing financial planning and control. Accounting students' work tends to be comprehensive and complete, because the trial balance structure and its supporting double-entry framework force them to be so, while other students' work tends to be the opposite because they approach the problem without a comprehensive frame of reference.

Having the focus on the accounting network as the fundamental framework, we can then move a step toward lower level issues. In particular, we may take cost and revenue information for decision making as a central concept that must be mastered by students in management accounting. Suppose that the knowledge of this concept belongs to Level 2 and we choose to include it in the accounting curriculum. Again, let us focus on a student who has attained a good mastery of the trial balance structure as well as the structure of managerial decisions, and the information inputs needed for them. We could then examine all other topics in the management accounting curriculum from the standpoint of this student and evaluate the benefits of acquiring that knowledge at the university level against the additional cost and effort involved.

Suppose that the knowledge of product costing is judged to be at Level 1. We may familiarize students with, say, job order costing as an example of product costing, and leave process costing for their self-education or training as needed. Similarly, it may be unnecessary to cover product costing for manufacturing, merchandizing, and service operations; once the general principle has been taught, familiarity with an example should be enough for the university curriculum.

MULTI-DISCIPLINARY KNOWLEDGE AND PROBLEM SOLVING IN PRACTICE

College students often view accounting courses to be different from others. What are these differences? Let us explore this as a final issue in this paper.

Economics 101 starts with the statement of the basic economic issues about resource production, allocation, and conflict resolution that confront society. The instructor then proceeds to introduce to students various features of the economic systems that they may already be familiar with, and then point out how each of these features helps solve certain societal or organizational problems. In Physics 101 also the student is first introduced to the major features of the observable world he or she is already familiar with (e.g. , light, sound and magnetism), and given simple models of each phenomena. This approach to teaching (1) introduces the subject by broad-brush depiction of the problem, (2) uses and builds on the knowledge the student already has about the problem domain, (3) presents theories (or practices) of the discipline as answers or solutions to problems the student can personally identify with, and (4) aims to fascinate the young mind with the challenge of problem-solving in its domain with the hope to induce him to want further study.

A similar approach could be adopted to baccalaureate and graduate education in accounting. Many students in accounting have some prior experience of working with or at least observing activities of business or other organizations. They already have at least an intuitive appreciation of the problems of operating organizations. Accounting could be introduced to these students in steps which are similar to those used in other disciplines. The students will then see various aspects of accounting as clever, even ingenious, solutions to some difficult problems, and not as merely a mass of dry rules to be memorized.[3] Once a student becomes fascinated with finding solutions to this class of problems, we would have a good chance of attracting him/her to

want to study beyond the required course at the sophomore level.

In this way, we avoid the risk of presenting solutions before problems. No matter how ingenious the solutions may be, if they are presented before students gained sufficient understanding of the problem, they will not be able to appreciate the solutions. Presenting accounting methods as a matter of fact will thus hamper the students' curiosity as well as their chance to reach knowledge at a deeper level.

The problem-solving orientation is also important in bridging the gap between the academia and the profession. In accounting, as in other disciplines and professions, there is complex and continual interaction between practice and education, Education and curricula are developed to meet the needs of practice, and practice reflects the fruits of education. It is not fruitful to argue whether innovations in practice drive the education, or the other way round. Which comes first may well be a chicken-and-the-egg problem. Innovations arise in both.

Education and practice in all aspects of management have a symbiotic relationship. Innovations occur in the field when creative professionals bring their knowledge and vision to identify and solve new problems, or solve old problems in newer ways. In time, both problems as well as practices filter back to the classroom. Similarly, creative teachers and institutions look beyond the contemporary needs and introduce their students to new ideas and interconnections that have not yet become common place. Such evolution of lessons, courses and curricula occurs through a decentralized and continual process and is essential to a healthy system of education.

The problem-solving orientation and the interaction with practice also have important implications for education in that they both call for multi-disciplinary knowledge. We must realize that academic disciplines are devised as a means of conveniently dividing real-world phenomena. While such disciplines may have been suitable when disciplines were devised, the rigidity in academia can make disciplinary divisions obsolete in today's rapidly changing environment. More and more events in the real world occur crossing the artificial boundaries of disciplines; they have no respect for disciplines, they must be solved whether they are solvable within the confine of a discipline or not. The same is particularly true in the accounting profession that has expanded its coverage greatly in recent years as we observed at the beginning of this paper. Problems in accounting practice now call for integration of expertise in accounting, auditing, tax, law, regulations, systems, personnel, organizations, finance, marketing, production, transportation, international, cultural, and many other dimensions, because more and more problems must be solved within the context of a highly interactive environment.

This is why the accounting profession needs universities to educate more accountants with a broad understanding of interconnections rather than narrowly focused specialists, more multi-disciplinary knowledge rather than just a collection of specialized knowledge. Accounting education must recognize the need for this new dimension of knowledge and reorient its goals accordingly. We believe that the approach presented in this paper, focusing on the depth level of knowledge, might be an effective new way of rethinking the curriculum without being confined by existing disciplinary divisions.

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FOOTNOTES

[1] Other statements on accounting curriculum have been issued by American Assembly of Collegiate Schools of Business (1989), Federation of Schools of Accountancy (1982), National Association of Accountants (1986, 1988), Institute of Internal Auditors (IIA, 1987; and Barrett et al., 1985), and on behalf of tax accountants (Boley and Wilkie, 1986) and government accountants (Fox, 1981; and Hughes et al., 1987). Needles and Powers (1990) provide a comprehensive comparative review of these and other statements.

[2] See Simon (1981, Chap. 4, p. 108-109) on how professions cope with knowledge explosion through parsimonious compression of a large number of facts into a smaller number of simple rules or theories at a more fundamental level.

[3] Sunder (1989) is an initial attempt in this direction.