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ABSTRACT

This study examined the specific words that college faculty in different disciplines use to convey goals for students using data from 1986-87 interviews with 62 faculty members teaching introductory colleges and a 1988-89 survey of 2105 faculty which established a listing of over 6000 goal statements. Goal statements were examined in order to understand the nuances of meaning behind phrases such as "effective thinking," "creative thinking" and "critical thinking" and to discover how disciplinary interpretations of such language differed. Study findings suggest that faculty do not consider effective thinking goals in isolation from other goals but express them in conjunction with other long-range goals such as basic skills acquisition, intellectual development, knowledge acquisition, future preparation, and personal development. Although effective thinking was usually broken into logical/deductive reasoning, critical/analytic thinking and problem-solving skills, these skills were so closely linked as to suggest that they were similar processes spoken of in different ways in different disciplines. Results suggest that, with faculty understanding of diverse perceptions of and approaches to thinking skills, a more successful general education program may be achieved. (Contains 39 references.) (PRW)

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Listening for Disciplinary Differences in Faculty Goals

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This paper was presented at the annual meeting of the Association for the Study of Higher Education held in Memphis, Tennessee, October 31 - November 3, 1996. This paper was reviewed by ASHE and was judged to be of high quality and of interest to others concerned with higher education. It has therefore been selected to be included in the ERIC collection of ASHE conference papers.

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Purpose of the Study

The recent wave of learning movements in the past fifteen years depict the academy's efforts to find the best ways to get students to learn better and think more deeply, broadly, and effectively. Attempts to increase and improve learning have occurred both within as well as across specific disciplines. Professional journals such as *Teaching Sociology, The Physics Teacher, and Teaching Philosophy* address teaching methods within specific disciplines while periodicals and newsletters such as *The Teaching Professor, The National Teaching and Learning Forum*, and *New Directions in Teaching and Learning* focus on teaching methods aimed at being adaptable across the disciplines. Curricular instruction methods such as "writing across the disciplines," case study methods, collaborative and experiential learning, as well as the most recent teaching method, interactive learning through the use of media-based technology, are proof of educators' attempts to find tools to foster better learning.

These attempts respond to societal and governmental pressure to create more effective learners and skills standards by which student outcomes can be measured. Such standards are being discussed and disputed at federal and state levels in the United States. In 1990, the National Education Goals Panel (NEGP) established long term objectives for all Americans including basic and technical skills, citizenship skills, critical thinking, and problem solving (Greenwood, 1993). The National Institute of Education's report *Involvement in Learning* (1984) focused attention on the importance of making faculty course goals and expectations public. According to the NIE study Group which produced the report, such public declarations of goals "...act as spurs to greater achievement, largely because students come to share those standards..." (p. 20). Yet, these efforts at creating better learners and thinkers may be wrought with frustration due to the diverse backgrounds of those engaged in helping students learn. While institutions try to respond to the current societal demands of creating better learners by supporting innovative learning possibilities, individual faculty members also bring specific disciplinary goals to the classroom. These goals influence the decisions they make about course objectives and instructional processes that together will ultimately have an effect on how well students learn.

In their attempts to establish, make public, and assess the achievement of clearer educational goals for students, colleges have found that faculty do not always share the same

goals. Disciplinary differences have especially hampered productive discourse about developing general education programs, often leading to the distribution method as a compromise to ensure that students are exposed to varied goals and perspectives. As Gerald Graff (1992) has pointed out, faculty members tend to camouflage differences in their perspectives rather than discuss them openly with students and each other.

A partial solution to this problem lies in faculty's understanding of what fellow educators are hoping to achieve in their classrooms and how they work within their discipline to attain those goals and measure students' skill performance. Just as important is determining how or whether individual faculty work at cross-purposes or in tandem with one another when trying to attain their separate goals.

Understanding faculty goals requires communication among faculty and between faculty and students. Only effective goal explications will help to ensure that the diverse efforts at creating better learners will achieve their desired effect. In order to make clear the meanings of faculty goals, it is necessary to listen more closely to faculty speaking in the contexts within which these goals are stated. It is not enough to casually accept commonly heard terms at face value, assuming that their meanings are self-evident. Instead, faculty must endeavor to ask themselves what they mean when they use terms such as "critical thinking" and "problem-solving" to describe their goals for their students. If faculty fail to acknowledge their differences in expressing student goals and make no attempt to bridge these differences, curriculum change and institutional improvement may also have difficulty taking root.

The purpose of this study was to identify and explore the specific words that faculty in different disciplines used to convey goals for students. We examined numerous goal statements from diverse faculty in order to more thoroughly understand the nuances of meaning behind the popular catch-phrases such as "creative thinking" or "critical thinking." By doing so we hoped to make clear that although the language being spoken is the same, the disciplinary interpretations are different.

Literature Review

Several recent studies have identified faculty course goals and examined course planning

activities, noticing disciplinary differences in the process. Thomas A. Angelo and K. Patricia Cross (1993) developed the Teaching Goals Inventory by asking faculty to select goals they endorse. Their goal categories included higher order thinking skills, basic academic success skills, discipline-specific knowledge and skills, liberal arts and academic values, work and career preparation, and personal development. At private four-year colleges acquiring higher order thinking skills was the most commonly mentioned goal for all disciplines.

Disciplines exhibited different perspectives on knowledge acquisition goals as well as teaching and grading methods according to Jennifer Franklin and Michael Theall. Their study at a single institution examined discipline-based relationships between course grading of facts, problem-solving and creativity. Franklin and Theall (1992) found mathematics and sciences instructors placed stronger emphasis on fact, principles, and problem-solving than humanities instructors. Humanities faculty placed more emphasis on creativity and self-knowledge goals as well as writing and oral communication skills.

Knowledge acquisition and course content were the object of Janet Donald's explorations of disciplinary differences in approaches to knowledge. Donald (1993) focused on the nature of concepts, logical structures, truth criteria and methods used by various disciplines. Donald found logic structures and truth criteria to be tighter in the sciences. Social science instructors favored abstractness of concepts and humanities faculty concerned themselves with authenticating knowledge of a diverse nature. Such differences may foreshadow differences in what skills faculty in various fields view as higher learning.

Joan Stark, Malcolm Lowther, and their co-workers investigated the factors that influence faculty course planning and the ways in which academic disciplines shape those influences. They found substantial differences in educational beliefs among the disciplines that help direct not only the course goals faculty chose but the extent to which faculty allowed contextual factors to modify them (Stark, Lowther et al, 1988, 1990). These researchers grouped goal statements made by faculty into broad categories and noted that the language used by faculty members to express goals in each category might differ substantially by discipline.

The above-mentioned research, when exploring or noting disciplinary differences in faculty goals and approaches to knowledge tended to use quantitative approaches, such as determining which factors predicted or had greater influence on course planning and grading. And although, as

Angelo and Cross noted, higher order thinking skills dominated faculty goals, the agreement between faculty to use the same terms such as critical thinking, logical reasoning and problem solving does not indicate that they are interpreting those concepts in the same manner. A qualitative approach to faculty goal definitions seemed therefore warranted.

Lisa Lattuca and Joan Stark (1994, 1995) and Stark and Lattuca (1993) performed qualitative analyses on task force responses to an American Association of Colleges (AAC) challenge (See *The Challenge of Connecting Learning* and *Reports from the Fields*). Through content analysis they determined how social sciences, natural sciences, and humanities faculty felt themselves capable of connecting learning, providing coherence and critical perspectives, and being inclusive of underrepresented groups in the curriculum. While these analyses shed light on how the disciplines react to goals imposed upon them from external forces, they do not provide us with the richness that open responses to general questions about faculty goals would elicit. For this reason we found it necessary to use methods similar to those employed by Stark and Lattuca, but focusing instead on answers volunteered by faculty from introductory courses.

Perspectives on Effective Thinking

Although most educators agree that teaching students to think is a major goal, and these educators often use the same terms to talk about aspects of thinking, our literature review revealed that thinking skills remain poorly defined. Even educational researchers specializing in studying thinking have not reached a consensus on which thinking skills are the broader skills and which skills are a subset of the broader thinking skills.

In the educational research "critical thinking" was often the encompassing term for higher order thinking skills. Joanne Kurfiss (1988) defined critical thinking as "...an investigation whose purpose is to explore a situation, phenomenon, question, or problem to arrive at a hypothesis or conclusion about it that integrates all available information and that can therefore be convincingly justified." (p. 2). Robert Ennis (1962) defined critical thinking as "reasonable, reflective thinking that is focused on deciding what to believe or do" (Marzano et al., 1988, p. 19) and identified twelve aspects of critical thinking based on a three-dimensional scheme of logical, criterial, and pragmatic elements. We chose "effective thinking" as the umbrella term for higher order thinking skills including critical thinking, problem solving, deductive and inductive logic, and creative

thinking. We felt that the term "effective thinking" would be synonymous with the broadest definitions of critical thinking found in the literature but would be a more neutral term, thereby avoiding other narrower definitions of "critical" which are used in some fields.

Frequently we found in the literature that the conceptual differences of effective (critical) thinking were embedded in the question of transferability of these skills and the ability or inability to teach them independently of the disciplines. Peter Facione's (1984) invitation to a discussion on critical thinking suggested a theoretical definition that would be generally applicable as well as a more domain-specific definition. Stephen Brookfield (1988) found critical thinking to be "context"-specific and intertwined with personal development. Teachers determined to teach critical thinking "focus on contextual skill development, so that cognitive skills are acquired in the exploration of genuine student experiences" (p. 80). Yet, contextual skill development and domain-specific skills development are not necessarily synonymous to Brookfield. In outlining his theory of developing critically thinking adults he focuses on individual rather than on disciplinary differences.

Moshe Rubinstein and Iris Firstenberg (1987) proposed the development of a "frame of action procedures [for problem-solving] that can be applied to an ever-changing data base" (p. 24). They assumed that knowledge bases for problem solving are domain dependent, but that thinking skills are indeed generalizable throughout the disciplines. Metacognitive skills are necessary, however, to determine which heuristic tools will be useful in other domains.

Proponents of domain-specific higher order thinking skills seemed to be abundant, however. In his analysis of how to teach thinking skills well, Donald Woods (1987) suggested that "...problem-solving should be embedded in a subject discipline not taught as a separate course, and it should include applications to real-world problems" (p. 58). Woods focused almost exclusively on problem solving examples in the sciences and engineering. Similarly, in her analysis of teaching critical thinking in secondary schools, Grace Grant (1988) proposed that effective thinking strategies vary by subject matter as well as by the individual's and teacher's conception of that subject matter. John McPeck (1981) argued that critical thinking is done only in connection with some activity or subject area and stated that "critical thinking [skills] are parasitic upon detailed knowledge of and experience in parent fields and problem areas" (p. 10). In Kurfiss' (1988) examination of disciplinary differences in expert and novice problem-solving, she concluded that "introductory courses on thinking cannot substitute for discipline-based instruction

in reasoning" (p. 24). She even mentioned evidence supporting metacognition's domain-specificity. James Ratcliff (1992) used the coursework cluster analysis model to examine higher order thinking skills and their relationship to course sequences. He found that, not only science and math courses but also humanities and social sciences increased effective thinking. He also acknowledged that general education faculty, who hold primary responsibility for teaching higher order thinking skills, seldom discuss how their course goals together or separately achieve general education goals.

These researchers and discussants have explored the relation between thinking and content in various ways. Only a few have attempted to capture faculty thinking in the actual phrasing of discipline-related goals for students. In their content analysis of the Association of American College's task force responses to connecting learning, Joan Stark and Lisa Lattuca (1993) noted that faculty place different emphasis on goals for students. Mathematics and sciences emphasized students' need to learn concepts and principles. The social sciences task forces linked concepts and principles with the development of effective thinking and the humanities task force was more concerned with development of a student's "critical perspective." The responses in *Reports from the Fields* relied upon the language presented to them in the charges given in *The Challenge of Connecting Learning*. Had these task forces not been provided with a structured framework, their responses may have been very different. Thus, we chose to use qualitative methods which provided us with a less rigid structure in which to listen for faculty goal expressions.

Data Sources and Methods

Data used to examine faculty goals in this study came from the Stark and Lowther data which were collected during studies of introductory college courses in the mid and late 1980s. The first data set (I) was based on 1986-87 interviews with 62 faculty members teaching introductory courses at eight colleges. The second data set (II) was a base of over 6000 goals stated by 2105 faculty in response to an open-ended question on a 1988-89 nationally representative survey on course planning. This group of faculty taught a slightly broader range of introductory courses at 267 colleges. For the purposes of this analysis we examined the goals of faculty teaching English composition (Data sets I and II), literature (I, II), sociology (I, II), history (I, II), psychology (II),

biology (I, II), mathematics (I, II) fine arts (II), and romance languages (II) (See Table 1). These data sets had been previously examined in connection to a variety of factors having an influence on course planning (Stark et al., 1988). We chose these courses from a larger range of introductory courses surveyed by Stark and her colleagues in order to focus on common general education courses.

Table 1: Faculty Distribution in Data Bases I and II

Data transcripts for the above-mentioned fields were re-analyzed in 1995-96 by three researchers not involved in the original study. For the purposes of this study we asked the following questions:

° How are faculty goals for students expressed in various disciplines?
° Which goals are most often mentioned in the individual disciplines?
° Do faculty in different disciplines use different vocabulary to describe goals that are actually very alike?
° Conversely, do faculty in different disciplines use the same vocabulary to describe goals that are actually very different?

As we shall later show, in our analysis of faculty goals we classified statements into seven major categories. Considering the importance placed on the major goal category Effective Thinking skills by many of the disciplines, we narrowed the focus of this paper to close analysis of Effective Thinking goals. A forthcoming paper will examine other important goals such as Intellectual Development and Personal Development.

Abstracting Goals Statements

We abstracted goal statements (451) volunteered by interviewed faculty from any part of the 90- minute interview sessions and not simply from faculty responses to the direct question: "What are the primary goals you have for students in your course?" We reached this methodological decision because in unstructured interviews faculty often made goal statements

before the question about goals had been posed.

The survey goal statements were taken only from responses to the open-ended question: "Please state briefly two goals for your introductory course that you believe are important to communicate to students." Since the transcribed responses from the 1988 study often reflected more than two goals, a limit of four goal statements per response was imposed. If more than four goals were present, goals were chosen in order of their mention in a statement. For example, if a faculty member wrote "the development of reading, writing, and critical thinking skills" as a single goal statement and then "cultural tolerance and awareness of differing opinions" as the second goal statement, the first two goals "development of reading skills" and "development of writing skills" from the first statement and the last two goals "cultural tolerance" and "awareness of differing opinions" of the second goal statement would be selected as goals. The decision to limit goals was based on the concern that further dissection of the goal statements would render contextual analysis less meaningful.

Analysis

Through content analysis, we reaffirmed or modified previously identified literature-based major goals and their subcategories (Stark, et. al, 1988) to adjust for differences in the two slightly different data sets. We coded the Data I set (interviews) knowing the interviewee's disciplinary background. We coded the Data II set (surveys) without previous knowledge of the respondents' discipline. Specific goal definitions were developed for each major goal as well as for the goals within each major category (see Table 2 for an outline of the major goal categories).

Table 2: Major Goal Categories

During a preliminary analysis of the survey goal statements, we noticed that the category Knowledge Acquisition predominated among faculty goal statements. Other major goal categories which suggested closer analysis included Effective Thinking, Intellectual Development, and Personal Development goals. We felt that an in-depth analysis of the Knowledge Acquisition category would elicit many disciplinary differences, but those differences would be based more on

various content matter. In our opinion, comparing content matter of different subject domains would not allow us to see the similarities between disciplines or the instances in which faculty of different disciplines are speaking the same language but thinking different things. We felt that such differences would resonate more loudly from the Effective Thinking category, and considering the academy's extensive discussion of effective thinking during the past decades, this goal category seemed the most logical choice for this particular paper.

After sorting the goals by goal sub-category, goal codings in the Effective Thinking category were reviewed by each coder in order to assure reliability of goal codes. Joan Stark acted as arbiter in the case of disagreement amongst the three coders. Several faculty used variations of terms meaning effective thinking, but failed to elaborate further. We classified all such statements into a general Effective Thinking category. We did not assign to a subcategory any statements that were unclassifiable or if those statements came from faculty whose discipline or teaching department was unclear.

Table 3: Effective Thinking Goals (defined)

In order to create an overview of disciplinary differences and similarities in goal descriptions, a matrix was created to cross-tabulate sub-goal categorization with the various disciplines. Terms frequently encountered in the goal statements were entered in the corresponding cells of the matrix.

Distributions of Effective Thinking goal statements were found by determining the percentage of mentions of a particular subcategory in relation to all Effective Thinking goal statements given by a discipline. In order to avoid overquantification of this qualitative study, we devised a scheme that would not overrepresent the data's meaning. We devised a scale of low- to very high mentions which reflects the skew of the responses, rather than a normal distribution. We chose the terms low, moderate, high and very high in discussing the percentages of mentions of a particular subcategory by discipline.

Finally, our analysis involved revisiting all Effective Thinking goal statements to determine whether particular goals in the Effective Thinking category were mentioned in the context of or in tandem with other goals, including goals within the Effective Thinking category and other major

educational goals. We sought trends to determine if different disciplines had particular combinations of goals that were prevalent.

Results and Interpretations

Salient Differences Among the Disciplines

Higher order thinking skills appeared often in all of the disciplines' goal statements with the exception of the romance languages. We speculate that the almost virtual absence of romance language goals from the Effective Thinking categories is due to that discipline's focus on basic skills (reading, writing, speaking, listening) in introductory language courses. Of the eight subcategories comprising Effective Thinking goals, 79% of the goal statements were in the Problem Solving, Deductive Reasoning and Critical/Analytical Thinking categories. The terms referring to Critical and Analytical Thinking goals were the most frequently mentioned category of Effective Thinking goals in every discipline with the exception of mathematics, where statements using the words "problem solving" were most prevalent (see Table 4).

Table 4: Frequency of mentions of effective thinking subcategories

We found that the development of synthetic thinking, the melding of one's own ideas or those of others into a coherent whole, and creative thinking, the ability to think in new and creative ways, were, at best, moderately professed goals for faculty teaching introductory level courses. The goal subcategories Classification Ability, Analogic Thinking, and Inductive Reasoning all had low numbers of mentions in all disciplines.

Contextual Language Differences

Although some faculty responses consisted only of the key words we used to describe the Effective Thinking goals, many responses provided us with enough context to determine different meanings attributed to those key words. These differences were, we believe, a reflection of faculty members' disciplinary background. A detailed breakdown of the language differences identified within the context of goal statements follows. We examined each subcategory separately and have

illuminated examples from the separate disciplines in order to emphasize the various interpretations of the frequently mentioned terms. The subcategories are presented in order of their overall prevalence within the range of Effective Thinking goals.

1) Critical thinking/analytical thinking.

The extensive use of the terms "critical and analytical thinking" was immediately evident in responses from all disciplines — often these were the only words in the goal statement, perhaps implying that everyone interprets these words alike. To the contrary, more embellished statements revealed differences in meaning that were seen across the disciplines.

Critical Thinking as Finding Deeper Meanings: The ability to discern deeper meanings of a medium (most often in a printed text) was a popular Critical Thinking goal of literature and composition faculty. According to statements made by these faculty members, the ability to think critically involves interpretation and the ability to discern simultaneous meanings ranging from obvious to subtle:

> I see it as a vehicle for which they can acquire more knowledge or to sift through their knowledge, to understand what it is that they mean. I don't want them to be sponges. I want them to be filters. (Composition)

> I want them to develop skills in understanding what they read, both on the literal level of what is said and on the symbolic level, what it means. (Literature)

Critical Thinking as an Evaluative Function: Along with discovering deeper meanings, both composition and literature faculty statements linked analytical thinking to the ability to critically judge a work, noting strengths and weaknesses as well as general quality: "(t)o learn to discern between literature which is excellent and that which is mediocre" (Literature). Students are expected to "critique" the literature they read or "evaluate written material." This critique is not only directed at the work of others, but also at students' own work:

> One of the things I have worked very hard on in that class is teaching students how to talk about writing. How to evaluate and articulate what they see in writing. If they're able to do that with other students' work, it enables them to do it with their own. (Composition)

Evaluative capabilities are often associated with the hope of instilling interest in the subject: "(t)o develop taste, discrimination and enthusiasm in the field of reading" (Composition). Through critical thinking one might develop a greater sense of appreciation as well: "(t)o help the student

develop analytical habits of mind in the reading of texts so that he/she will appreciate that text both as meaning and as art" (Literature).

Fine arts analytical goal statements also reflected the link between critical thinking abilities and the ability to judge pieces of work. Sometimes this judgment is described as discerning quality: "choose the best" or "determining the excellence of a work." More often, however, fine arts faculty seem to imply that critical judgment has more to do with determining the effectiveness of artistic elements in a work:

> Student will be able to evaluate how effectively elements of art and principles of design are used in a work of art. (Fine Arts)
>
> Students should be able to make informed judgments regarding aesthetic potential of particular pieces of art music. (Fine Arts)

Although the social science faculty also utilized the word "evaluate" when describing Critical Thinking goals, the word's connotation appeared significantly different from those of humanities faculty. While the humanities goal statements were concerned with evaluation of a work's effectiveness as a reflection of its quality, the social sciences and mathematics goal statements stressed critical evaluation of data and information in order to ensure objectivity or differentiate fact from fallacy:

> Students should learn how to critically interpret information by using methodology to be objective. (Psychology)
>
> As consumers and promoters of goods, we should (and must) question and test the truth of statements "supported" by data. We must be responsible consumers. (Mathematics)

History goal statements provided an anomaly in their use of the word "critical" to mean serious instead of analytical. Frequently faculty mentioned the importance of dealing with "critical issues" or problems confronting society. The ability to discuss and consider such problems would demonstrate analytical thinking, according to these disciplines.

2) Logical/deductive reasoning.

Logical reasoning of a deductive type involves drawing conclusions or generalizations that one can support with evidence. This thinking skill is emphasized early in precollegiate studies and

faculty teaching courses in several disciplines, including composition, history, and the social sciences, stressed this emphasis in introductory courses.

The emphasis on deductive reasoning was strongest among composition instructors who believed that "writing is a tool (or an aid) for thinking." Instructors consistently said that, "writing helps to fine tune thinking" and sort one's thoughts." Several expressed the view that "writing is equivalent to thinking itself." This perceived equivalence between writing and thinking was captured best by this statement:

> [My goal is] "to foster more effective writing and it's to foster more effective thinking. As you know, I don't believe you can separate the two.. One of the things I try to indicate to my students from the very first is that effective writing is effective thinking on paper."

Others said, "To write well is to think well." "Errors in writing usually reflect errors in thinking or understanding." "If one can think, one can write." "Clear writing arises from clear thinking." Some composition instructors attributed deductive thinking skills solely to writing. "I want the students to recognize that certain kinds of thinking can **only** be realized through writing and re-writing." Writing, then, appears to be an excellent vehicle for demonstrating as well as using deductive skills.

Another characterization of deductive thinking goals by composition instructors is the ability "to write clear prose that supports a position with sufficient evidence," thus marshaling the evidence appropriate to the task. Frequently, these instructors mentioned what they did **not** want students to do—give a personal opinion or a "gut reaction" that is not based on evidence. Additionally, they wanted students to be able to organize and articulate their thoughts in a logical way to present them clearly in their writing. A few literature instructors also said they encouraged students to look for evidence to support a generalization and to use it in organized essay form. The search for evidence they mentioned more often concerned a literary text or several texts rather than allowing students free rein to search for evidence in their own personal thoughts and experiences. Psychology instructors took a similar position but mentioned the ability to take a position on controversies within the field and to argue or defend a particular approach by citing empirical research that supports it.

Although they mentioned deductive reasoning far less frequently than composition

teachers, history and sociology instructors also described this goal by stressing the collection of evidence to support or defend a thesis. In describing the introductory course, one history instructor said "All of the assignments stress the need for finding evidence and developing a thesis." Another said, "I try very hard to encourage them to look for general statements, that are supported with evidence. And to look at specific evidence that they have and go back and look for what the generalization is that ties it together." An important difference between these instructors and those who teach composition was that history and sociology instructors more often connected the deductive thinking act with acquiring "a substantial body of knowledge" in the subject rather than with the creation of knowledge from one's own experience.

The modest number of fine arts instructors mentioning logical reasoning as a goal made interpretations similar to those made by other humanities faculty. They wanted students to be able particularly to defend judgments about the works of art, to draw conclusions in a historical context and to learn about artistic materials by writing about them.

Biology instructors who mentioned deductive thinking typically did not define or interpret this skill further except to equate it with the scientific method and especially with the final scientific step of interpreting the evidence. Similarly, although mentioning aspects of logical thinking infrequently, mathematics instructors used few words to define this goal beyond phrases such as "to think logically" or "to reason validly." They saw mathematics as a key vehicle to help students acquire the ability to think in a disciplined manner in order to solve problems through use of a clear and direct sequence of steps or algorithms. Several appeared to define logical thinking in terms of what they felt it did **not** involve, namely memorization of formulas or facts.

Thus, three uses of deductive thinking were stressed in the faculty goal statements we analyzed. Deductive thinking is used when: 1) organizing ones' thoughts to create a text (composition) or when solving a problem, 2) examining or interpreting texts or knowledge created by others (literature and history), and 3) collecting, choosing, or interpreting evidence to support a generalization (all fields). In humanities and social science fields, the ability to present one's logically developed thoughts in writing was closely linked with the thinking process.

3) Problem solving.

Problem solving is the process employed to identify or to work out the correct solution to a

challenging situation. Kurfiss (1988) considered critical thinking to be "a form of problem solving" (p. 28), but noted that the defining difference is that problem solving typically assumes that a correct solution exists, while critical thinking is more often associated with ill-structured problems. Although problem-solving goals were reported by faculty in each of the disciplines, mathematics instructors most often used this term to express effective thinking. Faculty in other fields most often expressed their goal directly, specifically using the term "problem solving" in their goals, and rarely referring to a particular application or setting. As if problem-solving were a universally understood goal, most of the statements do not include examples or explanations of the context or perspective to be employed in finding solutions. While some of the respondents indicated a desire for students to apply problem-solving skills in their personal lives, others encouraged application to current or historical societal problems. Most seemed to presume that problem-solving skills will be helpful in addressing academic or intellectual problems.

The most common language for expressing this goal was simply "problem solving." Most other problem-solving goal statements appeared to fit into three groups: applying acquired knowledge to problems, problem-solving approaches or techniques, and the importance of problem solving as a tool.

Problem solving as the application of acquired knowledge: For mathematics faculty, many goals conveyed the importance of identifying the appropriate mathematical tools for solving a particular problem, and learning to perform the required calculations. Specifically, faculty identified word problems, calculus problems, mathematical proofs, derivative operations, and probability problems.

Problem solving approaches and techniques: Many of the mathematics goal statements conveyed the importance of particular strategies, techniques, or approaches to problem-solving, especially "systematic" approaches, described as "organized," "logical," and "algorithmic" strategies. "The idea of breaking big problems down into little problems" and "trial and error" were among the approaches encouraged by mathematics faculty. Others stressed the need for learning multiple techniques "[because] there is always more than one way to successfully complete a problem."

Fine arts faculty contributed a single goal statement regarding problem solving, and it addresses receptivity to multiple approaches and solutions. From a discipline where an array of

media are employed to communicate a plethora of themes, a single respondent encouraged openness "about the validity of a number of approaches to problem solving" among those who create and appreciate the arts. Although we tend to see the differences between mathematics and fine arts, these goal statements shed light on a similarity, namely, appreciation of the range of appropriate problem-solving strategies.

Occasionally a mathematics instructor stressed process over product: "The manner in which a problem or situation is approached through step-by-step processes or procedures is more important than the answer itself." Although only two English composition instructors expressed problem-solving goals for their students, they also focused on process. Said one, "I can never solve a problem without...messing with it in writing." Both equated writing with problem solving, saying, "[writing] is problem solving. It's looking at a piece of work and saying how do we get these characters to move[?] How do we get them to sound alive? Or what are some other ways to approach a poem?"

Problem solving as a tool:: These goal statements convey faculty perceptions that problem-solving strategies are essential in and beyond their application in the discipline. Some of the respondents emphasized mathematics as a context in which to practice problem-solving strategies that may be more broadly applied. Their emphasis is on mathematics as a means rather than as an end. For example, one instructor wanted his students "to learn to use mathematics to help think and solve problems."

Mathematics faculty urged students to identify the problem, and to "develop the ability to select the correct procedure to solve a problem." Another mathematics instructor explained that "the tools learned are of limited use until one learns to choose the correct tools to solve problems at hand."

Although only a few biology faculty reported problem-solving goals, most commonly using the simple phrase "problem solving." However, one implied that faculty are more concerned with knowledge acquisition than application in the introductory courses. This instructor intended to "introduce students to the basic concepts of biological science in such a way they are able to use them in problem solving, [and in] investigations of library/laboratory research." Although the language is different, the essence of this goal is much the same as that of the mathematics instructor above, who described the basic concepts of mathematics as tools.

Occasionally, problem-solving goals conveyed the instructor's enthusiasm. A mathematics instructor said, "Solving difficult problems is exciting. The love of mathematics comes from the challenge of elusive problems and the satisfaction of solving them."

4) Creative thinking.

Sternberg and Lubart (1996) hold in their consideration of psychology's underinvestment in the study of creativity that our understanding of the notion of creativity must acknowledge that disciplines differently define creativity and any single perspective must be replaced by a multidisciplinary approach. While we found that the development of creative thinking is only occasionally expressed as a goal by the faculty teaching introductory level classes, our data clearly illustrate the diversity of disciplinary definitions of creativity.

Creativity as a generative process: Sometimes faculty members regarded creativity as a process by which ideas are released (Composition). A student in the act of generating ideas would be considered to be demonstrating such creativity. A faculty member from composition noted "that anything a student writes would be active creativity....And so their writing anything would be creating something and that would be a major goal." The act of writing, then, might be considered as creating, an end unto itself.

Creativity as a process of interpretation: Whereas some composition faculty considered the mere act of creating as attainment of creative thinking skills, other composition faculty and instructors in other disciplines described creativity as a process which allows a student to make sense of information for herself; it "enables one to adapt to a changing world," "interpret data," and "make sense of the past" (History). And, as in Sternberg's work on intelligence and creativity (as cited in Sternberg and Lubart, 1996), we found that fine arts faculty emphasized the place of imagination in the interpretive process. These faculty believed students need help in exploring "ways of using their imagination," in getting "in tune with the imaginative parts of his/her being," and in "rekindling their imaginations." Literature faculty also related creativity to the use of one's imagination.

To summarize, we found that faculty conceptualized creativity in a variety of ways— as interpretation, adaptation, imagination and/or idea generation.

5) Synthetic thinking.

Synthesis as forming a coherent whole: Although few statements related to synthetic thinking, the disciplines all shared the common perception of synthesis as the pulling together of information, knowledge and ideas. The most distinctive language describing this process emerged from history faculty and a biology instructor who portrayed synthesis as the creation of a pattern, a picture, or interpretation. As one history faculty member noted, "I am still more concerned about them being able to create a pattern than I am with learning particular events. But those things are in a way inseparable for history." Similarly, a biology instructor wanted students to be able to "tie all major facets of the subject into an understandable overall picture." Goal statements from other disciplines were characterized by straightforward mention of the terms "synthesis," "synthesize," or "synthetic thinking" with little or no attempts to convey a definition.

Synthesis as a means or an end: Faculty differed in whether they talked about the synthesis as an end unto itself or as a means to another teaching goal. For example, a biology instructor spoke of synthesis as a means of integrating or tying knowledge "so that they [students] can come up with some effective conclusions." For composition faculty synthesis was a means "to gain a broader perspective of life," "to support your argument," "propose new ideas" and "to form their own opinions." In contrast, sociology instructors mentioned integration of the discipline and its principles without specifying any outcome arising from this process. Synthesis served varying purposes for the disciplines, ranging from the bringing together of ideas, broadening one's perspective of life, and pattern building to facilitating creativity and enhancing one's argument.

6)Logical/inductive reasoning.

Inductive reasoning is the reverse of deductive reasoning. In this thinking process, an individual examines broad information and generalizations, and infers what the details might be that support these broader views.

Apparently, few instructors teaching introductory courses are concerned with inductive reasoning. The faculty members in our interview and surveys were more likely to be concerned with helping their students deduce generalizations from evidence, than to infer evidence from generalizations. Those who used the words "infer" or "inductive" in stating thinking goals for students, often did not clarify these terms, or used them in conflicting ways.

A composition instructor suggested that students "should be able to understand nuances and inferences when they read." A history professor related inductive and deductive reasoning by saying, "I try very hard to encourage them to look for general statements, that are supported with evidence. And to look at specific evidence they have and go back and look for what the generalization is that ties it together." Similarly, a mathematics instructor related inductive reasoning to commutativity, using the common example of putting on one's shoes and socks as an ordered process. "You don't teach an abstract concept. That's something that happens in the middle. You see all these instances and you make an inductive link. And that's when you're doing mathematics.

7) Classification ability and analogic thinking.

We defined classification as the ability to place things in categories based on obvious relationships or commonalities and analogic thinking as a similar but more advanced ability to identify such relationships based on similarities which are not obvious or must be inferred. Both of these thinking skills were mentioned as goals by very few faculty members.

Classification, as a goal mentioned for introductory courses, overlapped substantially with deductive reasoning which also requires the process of organizing and grouping thoughts, ideas, arguments and processes. It was similarly related to synthesis, the process of bringing disparate ideas together so as to integrate the course material, bringing arguments together to support a position, or identifying patterns in mathematics.

Arguably the most complex of the effective thinking skills, analogic thinking was mentioned only twice by faculty but the statements they made help to interpret the skill involved. One reference was from a literature instructor, who identified "the need to relate disparate phenomena, to see political implications of literary and other texts." Another, from an instructor of history, asked that "the student will speculate as to the different historical outcomes possible given the absence of pivotal people and events."

We believe that analogic thinking was not a goal mentioned often by faculty members because the depth of understanding of concepts and theories of a discipline required by this thinking skill would not typically be achieved in an introductory course.

Links and Connections with Other Major Goals and Subcategories

Faculty do not consider effective thinking in isolation from other goals. Indeed, they expressed many of the effective thinking goals in conjunction with other goals both within and outside the Effective Thinking category. Effective thinking skills were sometimes mentioned as precursors to other long range goals and sometimes as skills to be developed simultaneously with other skills.

Links with Basic Skills.

Perhaps because introductory courses occur at the beginning of a student's undergraduate career, many goal statements linked the development of thinking skills with the improvement of basic skills. Composition, literature and history faculty especially linked critical thinking with the development of reading and writing skills, for example. Composition faculty emphasized "critical essays," as evidence of a student's ability to think critically. Literature instructors frequently linked "close readings" of literature and "critical writing" to analytical thinking, while history instructors coupled writing skills with analytic thinking. Mathematics faculty occasionally linked problem solving to mathematical (computational) skills, but more often assumed that students would learn the required computations through repetitive practice at solving problems. The connection of basic skills with analytical/critical thinking was less frequently mentioned by faculty in the sciences and fine arts.

We noted an implied link between deductive reasoning and basic skills in both composition and mathematics. If students don't possess basic skills, they will be unable to search for evidence in written materials, to demonstrate the use of deductive reasoning through a written argument, or to solve problems that require computational skills.

Links with other Effective Thinking goal categories.

Despite our efforts to separate the subcategories of Effective Thinking from one another in our analysis, we found that they inevitably became linked again. Often the links of these Effective Thinking goal categories were discipline-dependent. In other instances, faculty intermingled the terms to describe similar processes.

For example, we separated Critical/Analytical and Deductive Thinking for the purpose of analysis and achieved good inter-rater reliability in classifying them. Faculty, however, often described deductive thinking and critical/analytical thinking in similar ways. The ability to write and/or think analytically about what one has read and the ability to think deductively by supporting one's general proposition with evidence are closely related.

The act of deductive thinking that composition instructors call writing seems closely related to the act that mathematics instructors call problem solving and biology instructors view as the scientific way of thinking. In fact, a composition professor used the terms together, "I can never solve a problem without messing with it in writing..." Another said, "Writing is solving problems; writing is making decisions; Writing is deciding how much to include, what to leave out, what order..." and a biology professor said, "...students will look at science as a way to solve problems not just a collection of facts."

In different ways for different fields, deductive thinking was linked with creativity. In composition, this link was found in the capacity to express oneself, in the sciences in one's ability to interpret data in new ways rather than memorize facts, and in some other fields, such as history and psychology, with the ability to take sides in active controversies within the field. As one history instructor remarked, "creativity is a major goal...I think thoughtfulness is the term I use rather than creativity...understanding or interpreting a lot of data." Combining critical and creative thinking seems to allow historians to make better sense of their world and "adapt to a changing world," a goal which might equally well be viewed as an element of Personal Development.

Synthesis was frequently mentioned together with one or two of the other Effective Thinking categories. For history, composition, and literature faculty, synthesis was linked with either Critical/Analytical Thinking and/or evaluation. As composition faculty discussed their course goals, mention of a primary goal of Critical Thinking often was followed directly by emphasis on the synthesis of course materials. For mathematics instructors, synthesis was linked with problem solving; for psychology instructors with critical thinking; and for literature instructors with creative analysis. Biology and sociology faculty each spoke of synthesis as an integration of knowledge, but faculty in these disciplines did not give statements that mentioned synthetic thinking together with another form of effective thinking.

Logical thinking was closely allied with synthetic thinking because, especially in literature,

history, psychology, and sociology, instructors made it clear that one must not only gather but synthesize material in order to support a generalization or thesis. And, or course, one must evaluate the material in order to decide whether to include it in the synthesis. In all fields, logical thinking extends to knowing how to organize one's material, thus it is related to the ability to classify as well.

Links with Intellectual Development.

The instructor goal statements we classified as Intellectual Development deal with the increased understanding of various relations and connections, including seeing relationships between various fields of study and between an academic field and the student's personal life. Intellectual development also includes developing a student's ability to become open to new ideas and tolerant of their ambiguity. A major aspect of intellectual development is a student's ability to think independently and pose her own questions, thereby developing intellectual curiosity. Thus, Intellectual Development as we defined it, is broader and more encompassing than effective thinking.

Because effective thinking skills involve determining relationships and connections, it seems logical that mentions of Effective Thinking goals paralleled mentions of Intellectual Development goals. For example, both classification and analogic thinking deal with the student's ability to identify obvious and non-obvious relationships. Synthetic thinking consists of creating new relationships between the student's and others' ideas, to form a coherent whole. Critical Thinking goals in particular were linked to the Intellectual Development subcategory.

Critical thinking as a precursor to or an element of independent thinking was an aspect of intellectual development mentioned in sociology and history faculty goal statements. According to some faculty statements, critical evaluation of facts and data is not enough, rather, one should begin to question one's own assumptions as well as "traditional truths" generally accepted by society or in the classroom:

> The need to think critically about "new" information - to be able to do this independent of instructor's guidance. (Sociology)

> I think that students should question traditional assumptions and beliefs...We examine and question old assumptions, beliefs, things that you know they've sort of grown up with in terms of their understanding of our past and not all of it is real accurate. (History)

That they need to approach their public world with skepticism, healthy doubt, and critical scrutiny: our national leaders do lie. (History)

Independent thinking was addressed in a different manner in composition goal statements. Here, a critically thinking student is an active thinker as opposed to an empty vessel:

To read various academic and non-academic materials (ie. essays, works of literature, newspapers and magazine articles) analytically, i.e. actively, not simply as passive absorbers of print. (Composition)

We classified being aware and tolerant of other points of view as one component of the broad goal category of Intellectual Development. We noted a tenuous link between deductive Reasoning and the growth of tolerance. In mentioning logical reasoning, some faculty said, "I want my students to learn to think beyond themselves to other points of view."

Critical thinking also involves being aware of differing points of view and being able to understand those points of view, as well as determining one's own perspective. This interpretation of critical thinking was prevalent in humanities goals statements.

To learn to think clearly and critically - to evaluate ideas and arguments from varying points of view in an effort to develop an individual perspective. (Composition)

Importance of studying conflicting interpretations and the development of tolerance and critical thinking. (History)

To be able to recognize and evaluate literary context (including idealogical biases on both author's and reader's parts). (Literature)

This last quote also reflects another aspect of critical thinking prevalent in faculty goal statements for history, fine arts and literature. Instructors in these three disciplines suggest analysis requires an awareness of a larger context in which historical events or cultural attributes play an important role. We categorized this ability to see cultural and historical context as a component of Intellectual Development.

Ability to interpret literature i.e. explicate stories, poems, plays, novels in terms relevant to author's period/era and to "modern" or "contemporary" world which reviews it. (Literature)

Critical analysis of theatre performance requires understanding its process of creation as well as its purpose to a culture. (Fine Arts)

I place a great importance on students being able to learn how to connect events

and develop interpretations which will embrace a large number of events. (History)

This emphasis on the historical context might also be reflected in the chronological sequencing of introductory courses in these disciplines. Although social science faculty do not necessarily arrange their courses chronologically, our social science respondents often included a particular context in their emphasis on problem solving: "with a sociological perspective." Whereas a psychology instructor wanted "to give the student some idea of how to attack and resolve problems of interest to psychology," a history instructor emphasized application beyond disciplinary bounds, stressing that "students must learn to apply that knowledge to society."

In summary, we found that the most frequently mentioned subcategories of Effective Thinking, namely Problem Solving, Deductive Reasoning, and Critical/Analytical Thinking were closely connected to broader Intellectual Development goals.

Links with Knowledge Acquisition.

We classified the greatest number of faculty-contributed goals in the goal category we called Knowledge Acquisition. This category included goals that relate to learning various levels of domain-specific content such as vocabulary, facts, principles, concepts and their applications, and methods of inquiry. The frequency of such goals in our data base accords with the common notion that many faculty concentrate on teaching "content" rather than thinking skills.

However, both sociology and psychology faculty linked critical thinking to the methodologies used to discover knowledge in the field. As was the case with humanities faculty, social science instructors used the word "interpret" when speaking of Critical Thinking goals, but "interpretations" were more confined to defined inquiry methods. Whereas critical evaluation in the humanities goal statements should result in the student's appreciation of a particular or differing perspectives, critical evaluation in sociology and psychology means becoming totally objective by removing one's personal perspective.

To guide the student to interpret facts through critical thinking and the use of the inquiry method. (Sociology)

Students should learn how to critically interpret information by using methodology to be objective. (Psychology)

Critical/analytical thinking therefore, goes hand in hand with critical observation as an important

inquiry method, according to social science faculty statements.

Goal statements made by biology faculty also stressed the importance of critical observation: "(l)earn how to question, analyze, observe accurately." History goal statements linked critical thinking with the historian's method of inquiry. The historian's analytical approach seems to involve critically viewing a whole range of interpretations: "(a)n understanding of historiography and the ability to recognize and evaluate differing interpretations" rather than an emphasis on "pure objectivity."

More than one fine arts faculty member articulated the idea of artistic impression and creative process as a method of inquiry. "Creativity involves important methods of gathering information, manipulating it and revising the original idea." Mathematics faculty viewed creativity as a means of applying principles in their field, a process by which to approach problems and "gain...success in the more advanced courses in math and physics." Mathematics faculty occasionally linked problem solving to the application of concepts, followed by learning the fundamental principles/concepts and facts of the discipline. It appears that faculty in mathematics emphasized the acquisition of concepts in order that they may be effectively applied in problem solving. Although few problem-solving goals were reported by faculty in biology, history, and English composition, a high proportion of those goals also were linked with applying concepts.

The mathematical approach to knowledge was also common in mathematics faculty's Critical Thinking goal statements. Here critical thinking was described as necessary to determine which solution method will work most adequately in a given situation: "(t)o develop skill in analyzing a problem and developing several possible solution techniques." Analytical skills, then, were emphasized as a crucial and inherent part of problem solving.

In summary, faculty frequently linked logical reasoning skills with knowledge acquisition, which was a key goal in their teaching. Reasoning seems not to be left out as some observers have claimed. In fact it was clear that in many disciplines, for example, history, sociology, psychology, fine arts and psychology, content knowledge is often the frame within which the reasoning is defined and used.

Links with Future Preparation.

Our goal category Future Preparation addressed the application of knowledge and skills to

other academic and nonacademic domains in a student's lifetime. Some of the subcategories of this goal included preparation for the next course, preparation for college, preparation for career, and preparation for citizenship. Some critics have recently opined that college instruction contains too much emphasis on future vocational preparation while sacrificing effective thinking. Other critics feel that connecting thinking skills with future preparation fosters potential engagement of students, and thus educational coherence is achieved.

Some mathematics statements emphasized the importance of being able to use critical thinking skills outside the classroom:

> The ability to think analytically is crucial to being able to solve problems in life, both mathematical and non-mathematical in nature. (Mathematics)

Others emphasized the usefulness of problem solving for subsequent courses in mathematics, but others conveyed their hope that students would successfully apply these skills in other arenas, such as the "major field," "other fields," or "any field;" in "other situations;" in "life;" and in "the real world."

Sociology and composition instructors, too, seemed to place some importance on the transferability of critical thinking skills outside the classroom to non-academic related instances:

> That students are in charge of their learning and the skills taught in class can spill over into other areas of their lives - i.e. critical thinking, communication, etc. (Sociology)

> Developing critical thinking skills that transcend the boundaries of the English classroom. (Composition)

Although statements about critical thinking across the disciplines might be construed as indirectly implying the transferability of such skills outside the classroom, these disciplines seemed more apt to address it directly.

We also observed links among Creative Thinking and Future Preparation and Personal Development. Composition faculty frequently linked thinking creatively and critically with the development of self-confidence, creative thinking, and thus with preparation for future life. As one faculty member noted, "Critical thinking and creativity are necessary for one who is educated to live well, and not just trained for a job." Faculty expressing deductive thinking goals also felt students should enjoy a quality life by developing an enhanced ability to reason and to express themselves. We included self-expression in our category of Personal Development, rather than in

Effective Thinking.

Thus, we found that faculty linked Critical/Analytical Thinking and Problem-Solving goals to applications in later life. They also connected Creative Thinking and Future Preparation goals to the students' Personal Development.

Links with Personal Development.

Our Personal Development category encompassed several subcategories ranging from increasing student motivation and self-confidence to clarifying values and developing leadership skills. Since it was mentioned just a few times, development of student self-confidence in solving problems provided a weak link with the goals for Personal Development. In perhaps the most explicit illustrative statement, a mathematics instructor expressed concern that students "develop confidence in their ability to consider, understand, and solve problems involving quantitative reasoning." Persistence in solving problems also was seen as an aspect of Personal Development, especially when development of motivation and responsibility was defined to include development of perseverance.

Creativity was also thought of as a means of affording students the opportunity to enhance their "tolerance and understanding of various styles and approaches" and their understanding of themselves. In general, faculty views of instructional goals were not strongly associated with goals concerning students' Personal Development.

Study Limitations and Suggestions for Further Research

Our analysis has shed some light on disciplinary differences in faculty goals for introductory courses and the nature of these differences. This first analysis focused on Effective Thinking goals, including several subcategories or terms that convey different aspects of Effective Thinking. We have not yet analyzed in depth other types of goals faculty mentioned for their courses, such as Personal Development and Intellectual Development. We will understand the language faculty use more fully when we complete these additional analyses.

Our analysis is limited to goals faculty expressed for introductory courses and is somewhat constrained by the specific sample of goal statements we examined. Because the sample was

representative of introductory courses, it included statements from large numbers of instructors teaching composition (often part-time instructors), literature, and mathematics. Oversampling of introductory courses in other disciplines would have allowed us to draw firmer conclusions and detect nuances more clearly regarding goals for fields such as history. Further, the only fine arts faculty included in the data base were those whose primary focus was history or appreciation of the arts. Studio or performance-based faculty might have suggested more often that creativity was a major goal.

The interview format (Data Base I) allowed faculty to freely express their goals in the course of a 90-minute interview and created a contextual frame for goal statements. In contrast, the survey format (Data Base II) allowed only a few lines for faculty to state primary goals, and we could only select the first few ideas mentioned. This left little room for interpretation of the thoughts behind words such as "problem solving" or "critical thinking." Thus, the interview format, while including fewer faculty, was more effective in assessing language differences among the disciplines. Unfortunately, Data Base I did not include interviews with romance language, psychology, or fine arts faculty.

We must also note that the period in which the data were gathered may have influenced the faculty voices we heard. In the flurry of critical reports on higher education released during the 1980s, certain ideas such as "critical thinking" became "the thing to emphasize" when discussing teaching or student learning. Because of this context, faculty who teach the general education courses that were the object of our study may have been inclined to give socially desirable responses when asked about their course goals.

We noted that some types of effective thinking were mentioned infrequently and we assumed they may be goals faculty more likely express for specialized or advanced courses. In a follow-up study, Joan Stark and Kathleen Shaw (1989) did ask a random sample of respondents from Data Base I to contribute goals for an advanced course they taught. A qualitative analysis of those faculty goals may help to complete the picture but more research will be necessary to determine to what extent faculty from different disciplines expand and extend their use of higher order thinking goals in advanced courses.

Similarly, faculty goals for the many students enrolled in undergraduate professional programs were not included in this study of general education courses although responses from

instructors in a few scattered types of professional courses originally had been gathered in Data Base I. We believe a systematic study of both intruductory and advanced courses in professional fields will reveal uses of the Effective Thinking terms different from those we heard in the arts and sciences. Surely, they may suggest many more connections between Effective Thinking and Future Preparation.

Conclusions and Speculations

We tried to dissect the various phrases and meaning used by faculty in these several disciplines to determine what is meant by the broad term "effective thinking" and various other terms that are used to convey the same or similar goals. Although we were readily able to classify the goal statements into separate subcategories of effective thinking skills, when we began to interpret meaning we found that these skills did not stand in isolation from one another. Some, especially logical /deductive reasoning, critical/analytic thinking, and problem-solving skills, were closely linked. They may, in fact, be similar processes spoken of in different ways in different disciplines. To illustrate, mathematics professors' ideas of problem solving seemed to parallel the way social science faculty viewed the application of concepts, and the way humanities faculty used terms like critical analysis and deductive reasoning.

Critical Thinking was the most frequently mentioned of all the Effective Thinking goals. This was true in every field except mathematics. Yet, disciplinary perceptions of critical thinking varied from interpreting it as the ability to evaluate and judge to the ability to question or interpret. Similarly, deductive reasoning as described in some fields required synthetic thinking; as described in other fields it required creative thinking The importance of teaching critical thinking skills was often accompanied by mentions of other key goals, including acquiring basic skills, fostering intellectual development, and ensuring knowledge acquisition, especially learning methods of inquiry in the subject field. Despite its popularity as a term faculty use to express goals, faculty in the various disciplines differed in their perceptions of how to develop critical thinking skills and which other skills enhance their development.

We expected to find the term "problem-solving" used in several disciplines, but it was sparsely used outside mathematics. In the social sciences, faculty often emphasized the application

of concepts but did not call this process problem solving. When placed in context, it appears that the goal being expressed is quite similar although the language used by faculty members makes it sound different. Perhaps the infrequent mention of problem solving in fields other than mathematics is a function of the introductory nature of the courses. In the sciences for example, faculty seemed to feel that acquisition and understanding of fundamental knowledge concepts must precede their use in problem solving. This explanation is consistent with Kurfiss' (1988) conclusion that "students' success as problem solvers is often hampered by limited or incorrect understanding of concepts needed to construct an adequate model of the problem" (p. 34).

Goals incorporating creative thinking and synthetic thinking were also mentioned only occasionally by faculty in this study. As we continue to explore the other major goal categories such as Intellectual and Personal Development, we may gain better insight into why this was true. As with problem solving, we suspect this may be explained by our focus on introductory level courses. The heavy emphasis on the development of critical and logical thinking skills, sometimes called deductive reasoning, may lay the foundation from which the ability to think in new and different ways and the melding of ideas into a coherent whole is subsequently cultivated. Students may need to be skilled in examining alternatives, analyzing iformation, and making choices, before being encouraged toward integration of ideas or the creation of new ones.

Negotiating the web

We likened our analysis of the Effective Thinking skills categories to navigating through cyberspace. Links among different skills were not simple paths, rather we found multiple connections depending upon which faculty were discussing those skills. Each time we moved down a layer of meaning into our subcategories of Effective Thinking, we discovered another array of meanings from among which faculty in the disciplines make different choices. For example, close interpretations of the text surrounding words faculty use rather casually to convey educational goals showed that instructors in different disciplines have different conceptual orientations toward the terms creativity, synthesis, problem-solving, logical reasoning and critical/analytical thinking. Thus, although faculty from different disciplines often used the same words to describe the goals of their introductory classes, our analysis indicates that the language of effective thinking is embedded in the disciplines.

Similarly, as when negotiating the World Wide Web, we found many links among the various goals and many routes to student learing. The strong link of Effective Thinking with content matter (or Knowledge Acquisition, as we called it in our goal framework), supports the idea that content knowledge is indeed an integral part of the development of thinking skills, as suggested by McPeck (1981), Grant (1988), and Kurfiss (1988). In light of this rather obvious fact, one wonders why the debate about whether effective thinking is domain-specific still rages. Arguably, all fields except composition deal with a specific content base in which problems are solved, theories are critiqued, and theses are defended. In composition, any topic will do, but you must know it well enough to organize and defend it adequately. For most fields, the link between general or basic skills (reading, writing, computing, and research/library skills) and effective thinking skills may be mediated through knowledge acquisition goals. Composition instructors are also emphatically teaching thinking skills but perhaps they can be said to do so using "borrowed content."

Negotiating the web of general education

What does our analysis suggest for general education? First, considering the results of our analysis, we feel the umbrella term "effective thinking" is a good choice for a broad term to express the goal of higher order thinking skills. It is superior to "critical thinking," which is more frequently used in the literature, because critical thinking goals may be synonymous with other thinking goals such as deductive reasoning and problem solving rather than subsume them. Critical thinking is only one way to interpret the meaning of effective thinking. Using the broader term and recognizing the linkages we discovered could foster better communication among faculty teaching the introductory courses in general education programs.

Second, because the disciplines emphasize different aspects of effective thinking skills in their approaches to subject matter (deductive, analytical, creative, synthetic), in our view it does seem worthwhile to include a broad range of general education epxeriences in an undergraduate program either as essential courses distributed among the disciplines or as integrative seminars which conscientiously include the various types of effective thinking skills. As Gerald Graff (1992) suggests becoming comfortable with the diverse components of effective thinking as demonstrated in different disciplines will result in a more complete education for the student.

Indeed, these varied approaches to thinking may be remembered longer than the actual content in which the thinking is embedded.

A corollary is that improved communication among faculty about the various forms of effective thinking will help students in setting their own educational goals. Students should be better informed than they often are about an instructor's goals for a course. A written description of goals in the syllabus might be enhanced by discussing a model that demonstrates the attainment of a course goal. For example, the professor might take time to examine an exemplary paper with a class, discussing how the writer displayed the effective thinking skills desired as a course outcome. To extend such communication with students across disciplines, special efforts could be made to encourage students to analyze the process of problem solving as faculty from several disciplines engage in it.

Third, based on this still fragmentary analysis, faculty teaching general education courses may need to make more effort to strengthen the links between effective thinking skills and at least two other broader goals expressed in our study, intellectual development and future preparation. Intellectual development encompasses the students' abilities to look at broad relationships; future preparation signifies the connection of learning to the students' current and future lives and careers. Linking effective thinking skills to these other two broad develomental arenas is one way of designing "coherence" in the college curriculum. Faculty consciousness of, and emphasis on, the importance of connecting effective thinking to these two broader goals wasnot very obvious in the data we examined.

Fourth, our findings have implications for faculty groups attempting to measure or assess student outcomes in general education courses and programs. Given the difersity of goals and interpretation we discovered, a good assessment program requires that faculty members recognize that more than one type of measurement may be necessary to determine whether students have acquired effective thinking skills. Furthermore, the complex web of goals suggests that to successfully capture the whole educational expeience, assessment may need to identify and focus on the links between effective thinking and broader goals such as intellectual and personal development.

Our results have shown that the layers of meaning behind commonaly used terms for faculty goals do indeed become complex. The numerous interpretations by faculty within the

different disciplines and the ways in which different effective thinking goals are interwoven with other major goals make the task of creating a coherent general education program a considerable challenge. An encompassing program that includes diverse approaches to effective thinking and communicates them to students will not happen without effort. To achieve such a program, faculty may need to discuss and even role play with colleagues to illustrate how they try to foster higher order thinking skills with students in their field. Stark (1989) presents scenarios that might occur in a faculty development seminar where colleagues have just begun to experience the friction resulting from recognizing disciplinary differences in definition, purpose and pedagogical technique. In discussing specific strategies to overcome such friction, Michalak (1986) mentions that one of the most valuable results reported by the participants of an interdisciplinary workshop on critical thinking was finding out how other faculty members integrate thinking in their courses. In such workshops, faculty are given the opportunity to evaluate and strengthen their contribution to the student's entire educational program.

With faculty acceptance of and understanding of disciplinary diversity in approaches to instilling effecting thinking, it may be possible to achieve a more successful general education program and to assess its results. Coherence may be achieved when these different faculty perceptions are recognized and accommodated.

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Table 1:
Faculty Distribution by Discipline
in Databases I and II

Discipline	Database I	Database II
Biology	13	215
Composition	14	415
Fine Arts Appreciation	-	205
Foreign Language	-	172
History	8	263
Literature	12	210
Mathematics	12	304
Psychology	-	180
Sociology	10	141
Total	**69**	**2105**

Table 2:

Major Goal Categories (Defined)

Major Goal Category	Definition
Knowledge Acquisition	Gaining content knowledge of the field
Intellectual Development	Seeing relationships and connections
Effective Thinking	Thinking and reasoning in multiple ways
General Skill Development	Using basic skills such as reading, writing, speaking, calculating
Personal Development	Improving personal characteristics or quality of life
Future Preparation	Preparing oneself for future academic work, career, life
Instructional Process Goals	Describing faculty ideas on teaching methods

*Note: We also included a residuals category

Table 3:
Effective Thinking Goal Subcategories (Defined)

Effective Thinking Goal	Definition
Problem Solving	To learn problem solving techniques relevant to the field.
Critical/Analytical Thinking	To examine alternatives, analyze information and make choices based on evidence.
Logical/Deductive Reasoning	To make logical conclusions and support them with evidence (e.g. writing as thinking).
Logical/Inductive Reasoning	To examine broad information and generalizations and infer what details might be.
Classification	To develop ability to classify based on obvious relationships or commonalities.
Analogic Thinking	To be able to identify relationships and classify information based on relationships which are not obvious or must be inferred.
Synthetic Thinking	To meld one's own ideas or those of others into a coherent whole.
Creative Thinking	To be able to think in new and different ways.

Table 4:

Frequency of Mentions of Goals and Subcategories of Effective Thinking by Discipline

	Introductory Course Instructors									
Effective Thinking Goals	Biology N=228	Composition N=429	Fine Arts N=205	Foreign Languages N=172	History N=271	Literature N=222	Mathematics N=316	Psychology N=180	Sociology N=151	**Total** N=2174
General Effective Thinking	moderate	low	low	moderate	low	low	low	low	low	low
Problem Solving	moderate	low	low	low	low	low	very high	low	low	very high
Logical/Deductive Reasoning	moderate	high	moderate	moderate	low	low	low	moderate	low	high
Critical/Analytic Thinking	moderate	high	very high	low	very high	very high	low	high	very high	very high
Classification Ability	low	low	low	low	low	low	low	low	low	low
Analogic Thinking	low	low	low	low	low	low	low	low	low	low
Creative Thinking	low	low	moderate	very high	low	low	low	low	low	low
Logical/Inductive Reasoning	low	low	low	low	low	low	low	low	low	low
Synthetic Thinking	low	low	low	low	low	low	low	low	low	low
Total number of goal statements	42	236	52	5	126	100	172	31	56	820

N= Number of faculty responding
low 0-15% of discipline's goal statements in this category
moderate 16-30% of discipline's goal statements in this category
high 31-45% of discipline's goal statements in this category
very high 46+% of discipline's goal statements in this category*

*the highest percentage of mentions was 68%

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