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ABSTRACT

This study surveyed faculty at an elite private research (Ivy League) university on their attitudes toward teaching and their teaching practices. A total of 115 faculty from several schools within the university completed a 68-item questionnaire on how they learned to teach, what motivated them to invest time and effort in their teaching, what were their conceptions of the goals of undergraduate instruction in their respective departments, what teaching methods they used, and what were their perceptions of the material they taught. The large majority of faculty reported that they did not receive any orderly, systematic preparation for university teaching, with the primary source of their pedagogical knowledge being their own classroom experiences as teachers. Internal satisfaction and positive student feedback were the prime motivators for investment in teaching, and most respondents used the lecture method of instruction. Providing students with current domain-related knowledge was not highly rated as a goal. Faculty in mathematics, the sciences, and engineering reported more departmental emphasis on teaching than faculty from education, the humanities, and social sciences, and also reported more use of problem-solving and writing on overhead projectors or blackboards in the classroom. (Contains 36 references.) (MDM)

Teaching in a Research University: Professors' Conceptions, Practices, and Disciplinary Differences

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Abstract

This study reports results of a survey on teaching issues that was administered to faculty a private research (Ivy League) university. The survey examined faculty perceptions regarding five questions: How do university professors learn to teach? What motivates them to invest time and effort in their teaching? What are their conceptions of the goals of undergraduate instruction in their respective departments? What teaching methods and practices do they most frequently use? And finally, what are their perceptions of the material they teach? Responses are presented for the whole population and are also broken down on gender, academic rank, teaching experience, and disciplinary differences. Results tap important issues such as effects of reflection and of institutionalized support for teaching on instruction, and teacher isolation. Several of the findings stand in contrast with accepted notions and expectations.

Research and teaching are the most important tasks of the research-university professor. However, in contrast with highly visible research activities such as grant proposals, publications, talks in conferences and colloquia, peer discussion, or collaboration of several researchers, instruction is quite a non-cooperative and invisible venture. Therefore, teaching sources have not produced much explicit knowledge about university instruction. Though, research sources have not generated such knowledge either. Research on teaching has traditionally concentrated on the pre-college level and those studies that were done at the college level primarily concentrated on analyses of student ratings of instructors. Students' ratings however, cannot produce knowledge about important issues such as teacher thinking and beliefs which currently are a major research interest at the pre-college level.

Research on teaching at the pre-college level has shifted its focus in the last 15 years "from trying to study the world of teaching as a public, social phenomenon to trying to understand how teachers define their own work situations." (Feiman-Nemser & Floden, 1986, p. 505). The attempt here is to understand how teachers make sense of their work and what are their perceptions and beliefs regarding instruction. Results indicate that teachers develop and hold implicit theories about their students, about the subject matter that they teach, about their roles and responsibilities, and about how they should act (Clark, 1988). These theories influence teachers' actions in the classroom and thus play an important role in teaching (Clark & Peterson, 1986; Nespor, 1987; Shavelson & Stern, 1981; Thompson, 1992) and consequently on what is learned by students (Clark & Peterson, 1986). Thompson (1992) explains that teachers' beliefs "act as filters through which teachers interpret and ascribe meaning to their experiences as they interact with children and the subject matter." (pp. 138-139). Therefore, "to understand teaching from teachers' perspectives we have to understand the beliefs with which they define their work" (Nespor, 1987, p. 323).

In comparison with the pre-college level, research efforts at the college level regarding teachers' thought-processes, theories and beliefs, have been meager. A comprehensive summary of research on these topics (Clark & Peterson, 1986) has not identified previous studies at the college level whereas a similar summary of research on teaching in higher education (Dunkin, 1986) has not identified previous studies on these topics. Since 1986, studies on teacher thinking at the college level that relate to the present study have involved teachers' reflection on their work, that is, on their engagement in self-evaluation or self-assessment (Amundsen, Gryspeerdt, & Moxness, 1993). Teacher reflection is perceived as a strategy for improving instruction as it provides informative feedback to instructors (Amundsen et al., 1993; Paulsen & Feldman, 1995). Reflection promotes instructors' active learning from classroom experience, rather than merely receiving experience passively or responding to it automatically (McAlpine & Weston, 1996; Rando & Menges, 1991). A different kind of study of teacher thinking (Hativa, 1996) illustrates how a university teacher's thinking and beliefs regarding his instruction and his students affected his classroom behavior and students' learning.The study presented here aims to increase our knowledge about university professors' thinking and beliefs regarding teaching and students, and also about disciplinary differences regarding these issues. Disciplinary differences in teaching and learning have attracted a growing research interest in recent years (e.g., Hativa & Marincovich, 1995). This study concentrates on a research university because of the substantial conflict between research and teaching with teaching carrying much lesser rewards. Smart and Ethington (1995) show that faculty in different Carnegie-based types of higher-education institutions (research, comprehensive, liberal arts, and two-year) attach different levels of importance to different goals for undergraduate education. This findings suggests that faculty thinking and beliefs should be examined separately for the different types of institutions.To keep the survey form reasonably short, only five questions out of all those related to teacher thinking and beliefs that may affect professors' classroom instruction are examined here. The basis for selection was the interest preferences of the researcher and of the university administrators who supported the study. These questions are next described.

(a) How do university professors acquire their pedagogical knowledge? Pre-college teachers acquire their pedagogical knowledge through a long process of teacher education which includes theoretical learning and practical training by means of apprenticeship-based classroom experience. In contrast, the majority of college and university faculty do not receive any systematic preparation for teaching, neither theoretical nor practical. The question is--how do these instructors gain their pedagogical knowledge? Several issues are raised through the 15 items of this question, as follows.

Learning from own experiences as students: Teacher observations and TA-ship. The lack of systematic teacher preparation procedures for university faculty results from an implicit assumption that these faculty learn to teach in their prospective discipline from observing their instructors during their years as students, and that they acquire their practical teacher training through their work as teaching assistants (TAs). Indeed, there is some indication at the pre-college level (Grossman, 1989; Nespor, 1987) that teachers learn about instruction through their experiences as students. This assumption is examined here for the college level.

Learning from classroom experience. Classroom experience is a major source for pedagogical knowledge at the pre-college level (Grossman, 1989). A few items examine here to what extent this is also true for the university instructor and which factors in teaching experience contribute to this knowledge.

Institutionalized support for teaching. College teachers were found to rely on untested assumptions when diagnosing and acting in problematic classroom situations (Hughes, 1990). When teachers have no way to test their interpretations of classroom experiences, they may develop misleading interpretations about teaching and students. Organizational or professional support is important for preventing mislearning from classroom experience (Grossman, 1989). A few items examine this support which may be provided through workshops, individualized consultation, class visits by peers and administrators with constructive feedback to the instructor, and through apprenticeship by senior faculty who are excelling instructors.

Teacher isolation. This is a frequently observed phenomenon at the pre-college level where teaching takes place behind close doors and teachers have or make only few opportunities to observe each other or to discuss their work. Teachers tend to cope with their problems on their own, seldom turning to one another for help and support, which may lead to undesired attitudes and results (Feiman-Nemser & Folder, 1986). The character and extent of teacher isolation is also examined here for the college level.

(b) What Motivates University Professors to Invest Time and Effort in Their Teaching?

Hativa (1993) and Smeby (1996) show that faculty in research universities invest a very large amount of time in preparing their lessons, particularly when teaching new courses, and even more so in courses which do not follow a textbook. The question is-- what motivates professors to make this large investment in teaching when they are mostly rewarded for their research performance? That is, what types of reward influence university instructors?

In a summary of research on 'teaching cultures' at the pre-college level, Feiman-Nemser and Floden (1986) classify the factors that affect teachers' satisfaction from instruction into extrinsic and intrinsic rewards. Extrinsic rewards refer to public benefits such as high salary or status whereas intrinsic rewards concern aspects of work that are valued by and visible to insiders only, such as knowing that students are learning, enjoyment of teaching activities themselves, and enjoyment of learning from teaching. Teachers vary in the importance they attach to these types of rewards. A few survey items examine faculty perceptions regarding the effects of extrinsic and intrinsic rewards on their motivation to invest their resources in lesson preparation.

(c) What do University Professors Think of the Goals of the Undergraduate Courses They Teach?

Professors' goals in teaching affect their instructional practices. "If we are interested in why teachers organize and run classrooms as they do, we must pay much more attention to the goals they pursue" (Nespor, 1987, p. 325). Several studies of

higher-education teachers' thinking and beliefs concentrated on goals in teaching. Cross (1991) asked 2,700 teachers from 33 colleges (excluding research universities) which one of six teaching roles she listed they considered as primary. The two main roles selected were: "developing students' higher-order thinking skills", and "teaching facts and principles". The most significant differences in choice of teaching roles emerged across disciplines. The role of "promoting higher-order thinking skills" was chosen by social science (SS) instructors more than by others whereas "presenting facts and principles" was selected most frequently by science and math teachers. Humanities and SS appreciate the role of "student development". When asked to select their top priority teaching goals, humanities and SS teachers shared: "promote thinking for self" and "value of subject". Science instructors' highest priorities were "applying principles" and "teaching terms and facts, concepts, and theories", whereas for math instructors these were "promoting math and analytic skills", and
"problem solving".

Franklin and Theall (1992) surveyed 466 instructors in a large private urban university. Regarding goals, engineering, math, and science instructors placed significantly more emphasis on facts, principles, concepts, and problem solving than their colleagues in other departments. Humanities instructors, in contrast, emphasized creativity, attitude toward subject matter, writing, groupwork, oral communication skills, social skills, and self-knowledge.

A third study (Hativa, 1993) surveyed 60 faculty in the math, physics and chemistry departments at a research university. The instructors were asked to rate the importance they placed on ten teaching goals that concentrated on promoting students' aptitudes and skills in the domain.The four goals rated highest were: developing students' abilities to learn independently; to think, to solve problems; and stimulating their interest in the subject matter and desire to pursue studies in this academic area. A fifth goal, rated somewhat lower, was presenting the beauty, achievement, and contribution to humanity of the discipline.

Smart and Ethington (1995) used the 1989 Carnegie Foundation faculty survey to examine institutional and disciplinary differences in faculty members' opinions concerning desired outcomes of undergraduate education. They used approximately 4,000 faculty responses from those who regularly taught undergraduate students, combined for all four types of Carnegie institutions. The researchers based their analyses on the Biglan (1973) classification of academic disciplines into "hard" versus "soft" (the degree of consensus or paradigm development, high versus low respectively), "pure" versus "applied" (the extent of practical application), and "live" versus "nonlive" (the presence or absence of involvement with living objects or organisms). Findings are that "hard" or "applied" disciplines placed greater importance on knowledge application (depth of knowledge, and its application to career development) than did their colleagues in "soft" or "pure" disciplines respectively. On the other hand, faculty in "pure" disciplines placed greater importance on knowledge acquisition (the acquisition of multidisciplinary knowledge that most often makes up the general education component of undergraduate programs) than did faculty in applied fields. No differences were found between "live" and "nonlive" academic domains.

To summarize, each of these four studies listed different goals for the respondents to choose, and approached a different population of higher-education institutions. All studies identified disciplinary differences regarding these goals. The present study examines research university faculty perceptions regarding the most comprehensive list of instructional goals (21 goals under two main categories), identified from these prior studies.

<u>(d) What are the Teaching Methods and Practices That University Professors Most Frequently Use</u>?

This question aims to find out how university instructors actually teach in their classes and to identify disciplinary differences in instructors' perceptions of their teaching methods and classroom activities. Thielens (1987) looked into a variety of sources on teaching methods in higher education institutions (surveys, systematic classroom observations, and interviews), in the US, England, and Scotland. Findings uniformly showed lecturing to be far more prevalent than all other methods whereas "only the discussion method is in any widespread use, with the niches occupied by recitation, Socratic techniques, seminars, etc., proving very small." (p. 2). He also interviewed 81 professors in a variety disciplines in a variety of US universities and identified disciplinary differences in teaching methods and practices. Instructors in the sciences lectured in more than 90% of their classes whereas in the SS it was 81% and in the humanities, a distinctly lower 61% (ibid). Franklin and Theall (1992) found that engineering, math, and science courses mostly relied on lectures, quizzes, computer-assisted instruction, and laboratory activities whereas courses in humanities relied rather on guest lecturers, audiovisual media, homework papers and reports, independent projects, group discussions, team or collaborative projects, and oral presentations.

The present survey used Thielens' and Franklin and Theall's lists of teaching methods and practices as well as a few additional ones identified through class observations.

(e) What are University Professors' Perceptions of the Material They Present?

Stodolsky and Grossman (1995) identified five salient features of high school subject matter, and showed these features to have important curricular consequences. Two of these subject-matter features that may affect teaching at the undergraduate level are: degree of sequence, and characterization of subject as either static or dynamic. Degree of sequence refers to the extent of the need to cover topics in a particular order either within an individual course or across courses. Subject-matter with a high degree of sequentially is termed as being of a hierarchical or vertical structure whereas a low degree is associated with horizontal structure (Theall, 1993). Regarding a subject being perceived as static or unchanging versus dynamic, "More dynamic fields are those with active production of new knowledge and a continuing need to stay up to date. In contrast, the content of more static school subjects may change less rapidly. Dynamic subjects may more readily present opportunities for change in instructional goals, curricular content, approaches, and technique" (Stodolsky & Grossman, 1995, p. 230). Several survey items ask about the extent of hierarchy either in the internal structure of the current course the respondent was teaching, or in its external structure and about the "oldness" of the material currently taught by the respondents.

Additional issues related to the material taught that were examined are: the extent that the course material is based on mathematics or on problem-solving activities, and the extent instructors present in their lessons the "culture" of the domain, i.e., its historical, sociological, or philosophical aspects.

These five survey questions are examined here for the whole population of instructors, and are also broken down on three major identifiers of university instructors: discipline, academic rank, and teaching experience. Gender differences are also examined.

Method

Teacher thinking, perceptions and beliefs are tacit and not directly observable. Thus, they can only be studied through getting teachers' oral or written responses to related questions. This study uses the survey method in order to get a relatively broad range of written responses from faculty members of different departments and to enable statistical testing for disciplinary differences. The survey, which included closed and open questions, was administered to faculty members in several major schools at an Ivy league, private research university in the USA.

The items chosen for the survey were based on the research literature described above and on two previous surveys of thinking about instruction administered to faculty at a research university in Israel. The items for the first survey (Hativa, 1993), administered to faculty in math, physics and chemistry, were formulated through the analysis of interviews with over 20 faculty members. They were tried out by several faculty members and were modified following their feedback. The second survey

(Hativa, 1994) was administered to faculty in almost all schools at the same university. The interview form, a modification of the one used in the first survey plus additional questions, included 170 items, which proved to be too long. The present form is a modification of the latter form (with some additional items from the research literature) with 68 items. The reduction and adjustment of the questions to US faculty were done in consultation with several professors from the School of Education at the US university. The modified form was then tried out by five faculty members from additional schools at that university and was further modified for its final version.

A previous survey on grading policy based on a 20-item questionnaire, that was administered to faculty members of the same US university in 1988 by a university committee, had a return rate of 23.5%. To get a higher return rate for the questionnaire of this study, an effort was made to improve the appearance the survey form-- to make it eye-friendly and attractive--as well as the procedures for administering the questionnaire, by following the "total design method" (Dillman, 1978).

The deans of the participating schools at the university (education, engineering, humanities, sciences, and SS) gave their consent and support for the survey administration. Subsequently, a letter was sent to all faculty in these schools explaining the rationale for administering the questionnaire, its objectives and the procedures of its administration, asking for their consent to participate. To increase motivation, the addressees were assured of the confidentiality of their responses and were promised to get a copy of the final report of the survey. They were also informed that copies would be sent to the respective departments' chairpersons, school deans, and other university administrators. The letter assigned a deadline for return and included a self-addressed postcard to the author (to an address at that university) with the sender's agreement to participate. On receipt of the postcard, the survey form was promptly mailed. A follow-up letter was sent to those faculty who did not return the postcard three weeks after sending it, encouraging them to do so as yet. A reminder was sent to each faculty member who received the questionnaire form and did not return it within a month.

Results

The Respondents

The survey was answered by 115 out of 500 faculty members in the participating schools who were teaching courses during that academic year, which makes for a disappointing 23% return rate, surprisingly similar to the return rate of the 1988 survey. In spite of the low return, this survey may still be representative of faculty views regarding teaching issues[1]. This notion is further supported by comparison of the survey respondents to the general population who received the questionnaire, each broken down by school, gender, and academic rank (Table 1).

Insert Table 1 About here

As indicated in Table 1, the proportions of respondents to the survey and of the faculty population, as broken down by the different categories, are very similar. Indeed, the Chi squared test shows no significant differences at the .05 level between the groups on either one of the three breakdown categories. Thus, the sample is representative of the respective faculty population in terms of school, gender, and academic rank. Still, generalizations to other research universities, and certainly to other higher-education institutions, on the basis of these results should be made with caution.

The items under each of the five questions are next presented, along with the results of the descriptive statistics of the quantitative analysis and with some of the more illuminating or typical written responses. ANOVA statistics was used to identify differences among all participating schools except Education[2], and Scheffe Test at the 5% level was used for pairwise comparisons.

Question 1: How Did the Professors Learn to Teach?

The survey question presented participants with 15 possible sources contributing to current teaching, and was formulated in two parts: (a) Has this source contributed to your current teaching? [options: Yes or No]; and (b) if Yes, how large was its contribution? [rating on a scale from 1 through 5]. The results are summarized in Table 2, arranged by decreasing proportion of respondents who in part (b) rated the contribution of the source as either large (4) or very large (5), that is, as of substantial contribution to their current teaching. Presenting the results in this form rather than by means and standard deviations seems more informative for this question, particularly when ANOVA produced no statistically significant differences among the different schools on any one of the 15 sources.

Insert Table 2 About here

For analysis of part (a), Table 2 indicate that five of the 15 sources were experienced by more than 90% of the respondents and the subsequent five, by more than 2/3 of the respondents. Faculty in M/NS seem to differ from all others in that they less frequently discuss matters of instruction with peers, collaborate less in teaching a course with other faculty, experience less departmental-based "apprenticeship" or superior's feedback, and they experience teaching as TAs and individualized consultation more frequently. Humanities seem to collaborate on teaching a course more than others, and to receive peers' feedback after visiting a class less than all others. Humanities and engineering observe peers' classes more often than others. For analysis of part (b), Table 2 reveal three sources that stand out. The largest contributions are trial-and-error in one's own teaching, self-evaluation of teaching, and to a somewhat lesser extent students' feedback. In fact, these three sources overlap substantially-- professors develop their pedagogical knowledge primarily through trial-and-error that is based on reflection on student feedback and on self-evaluation. As one of the respondents explains:

> I have found that learning by doing and being very self-critical are the best ways to be more successful with students in the classroom.

A fourth source which contributed to current teaching for approximately one half of the respondents is having observed one's own university instructors. Written comments reveal that former instructors serve as (good or bad) models[3] and that the respondents learned from them methods for presenting the material, patterns of classroom teaching behaviors, behaviors towards students, and methods for testing and grading.

The remaining 11 sources contributed considerably less to current instruction and almost one half (seven) of the 15 source made only a minor contribution to faculty members (contributing substantially for less than 20% of the Notably, although 93% of all respondents experienced discussions with peers on matters of instruction, 86% teaching as TAs, 70% sharing teaching a course with peers[4], 77% observing peers' classes, and 65% teaching in other contexts than the university before becoming professors[5], only a small proportion of them did perceive these experiences to have contributed much to their current teaching practices. Similarly, although almost 40% of the respondents experienced some departmental or university support, most of them perceived this support to have made only a minor contribution to their current teaching so that of all 15 items, departmental and institutional support shows to make the smallest contribution to faculty members' teaching.

behaviors of interaction and rapport with studentsrespondents).Written comments identified additional sources for acquiring pedagogical knowledge: (a) outside the university context: making oral project presentations in high school; participation in debating competitions; teaching in church, Sunday school, and adult education, or GRE to immigrants; getting drama training; and giving scientific lectures at an industrial research companies; (b) within the university context, before becoming a professor: giving some course lectures while serving as a postdoctoral fellow or instructor; and presenting scientific papers at meetings during graduate studies.

Question 2: What Motivates Professors to Invest Time and Effort in Their Teaching?

The eight options for rewards that were listed in the form are arranged in Table 3 in decreasing order of their mean ratings on motivating power.

Insert Table 3 About here

Table 3 indicates that the two factors that have the highest motivating power, overwhelmingly chosen by almost all respondents, are intangible, internal rewards: personal satisfaction from a job well accomplished, and students' favorable feedback to the instructor. Surprisingly, the external reward of using teaching evaluation in tenure, promotion, and salary considerations take only the third and fourth places, although they still show a high potential for motivating instructors. The fifth item, rated still considerably high, is again an internal, intangible factor: the department's encouragement of quality teaching. It seems that faculty members feel personally rewarded by complying with and supporting the department's policy. The two external rewards that involve publicizing the results of evaluation-- through either student ratings or teaching awards--are favored by a relatively low proportion of the respondents. Most surprisingly is the ranking of cash awards, which is far lower than all other motivating factors.

The low motivational power of tangible rewards is explained in the following respondents' comments:

- Given the outside opportunities for income available to most faculty in this university, cash prizes or raises will have minimal effect. Peer pressure from fellow faculty is more effective.
- Teaching awards always come after the fact. I was pleased to receive them, but they obviously were not motivating factors.
- Cash incentives strike me as defaulting on professional obligations.

Following are additional illuminating comments regarding motivating factors:

- Many of these motivating factors exist at our university. They will encourage those whose passion is to teach. They may not work so well on those who have been convinced that research and only research matters.
- I am here to 'serve' my students, and teaching well is one way to do this.
- I think most satisfactions are internal.

Regarding disciplinary differences, professors in the different schools show similar motivations regarding instruction. The only significant disciplinary differences identified are that engineering professors, when compared with humanities instructors, regard the external, tangible rewards, as having a significantly lower motivational power.

Complying with a department's policy of the importance of providing good instruction has shown to have a high motivating power. To find out whether departments do have clear policies in this regard and whether these policies are implemented and made known to the faculty, participants were asked to answer with yes or no to the following special question: "Do the chairman and leading faculty in your department transmit the message of the importance of good instruction to other faculty members?" Two thirds (67%) of respondents answered YES--humanities 57%; SS: 56%; education 44%; M/NS 76%; and engineering 92%. Thus, the proportion is relatively large for M/NS and very large for engineering.

Although two-thirds of faculty members feel their department does communicate the importance of providing good instruction, written comments reveal that many of them regard this as no more than lip service, illustrated by the low weight of teaching as compared with research in faculty evaluations and promotion considerations.

- It is perfectly clear to everyone that research counts 80%; teaching, 20% or less.
- It is all bullshit for alumni and parents. No status for teaching well.

- They say teaching is important, but if you want tenure, you'd better publish, and publish a lot. An assistant professor spends (wastes) a lot of time agonizing over these conflicting messages.

Several comments describe conflicting demands of trying to achieve excellence in both research and teaching.

- My main frustration is the sense that teaching has to suffer or be compromised in order for research to happen. There don't seem to be enough hours in the day.
- If you people keep this [importance of teaching] up, my research career will be destroyed. It's my ability to squeeze money out of Washington that is vulnerable. Perhaps you could include in your report an estimate of the cost of improved teaching in constant dollars. I estimate the cost to the university in my case to be about $100,000, integrated over my time here.
- I like to teach, and I spend a very substantial amount of time trying to do it well. However, the pressures on an assistant professor are not conducive to good teaching, since our professional survival depends largely on research performance. I cannot help feeling that the time I spend on teaching is wasted as far as my career is concerned.

Question 3: What Are Professors' Conceptions of Goals of Undergraduate Instruction in Their Department?

In answering this question respondents were asked to refer to a particular undergraduate course they were teaching during the quarter or the year of the survey and to rate 21 goals in teaching. These are listed in Table 4 under two categories, in decreasing order of the mean ratings.

Insert Table 4 About here

Table 4 reveals that in the first category of promoting knowledge and functioning in the academic domain and in daily life, the highest-rated goal by far is "conveying the basic body of knowledge in the domain". This is followed by three, still very high-rated goals, two of them related to the first goal: "conveying the structure and organization of knowledge, and the 'tools' of the domain". The third is the general goal of "conveying knowledge necessary for an educated and intelligent person".

Examining disciplinary differences, there is high agreement among the disciplines involved regarding the first four highest rated goals. Humanities more than others seem to appreciate the "contribution of their discipline to humanity". Engineering faculty are involved in all significant differences in this category. They assign the highest priority of all others to "promoting knowledge needed for professional work", and the lowest priority to the "promotion of learning of research methods in the domain".

Two thirds of the goals in the second category, i.e., promoting students' motivation, aptitudes and skills in the domain, are perceived by all respondents as very important. The most important goal, "promoting students' ability to apply methods and principles", is followed by promoting students' independent, objective, critical thinking, their cognitive skills, and habits of work and thinking typical to the domain.

There is a high agreement among all participating departments regarding the first five goals rated highest. The three following goals and the fifth one are appreciated by humanities' professors more than by all other professors. Humanities rate significantly higher than M/NS "developing students' skills of oral and written expression" and "openness to a variety of ideas and points of view" and significantly higher than engineering "originality and creativity in thinking" and "aesthetic appreciation of the material and the human endeavor in the domain", and they rate the latter goal significantly higher than SS. M/NS also rate this goal very high, significantly higher than engineering faculty.

Question 4: What Teaching Methods and Practices Are Most Frequently Used?

The items in this question are divided into two main categories. Results are summarized in Table 5.

Insert Table 5 About here

I. Classroom Teaching Methods

Lecturing is the most prevalent teaching method in the university undergraduate classes. Primarily this is strictly lecturing, with hardly any student participation other than clarifying questions. Only about 40% of the lecturing classes also allow for discussion with students. The Socratic method of developing topics through questioning is used by less than 30% of the instructors.

The only significant disciplinary difference emerges in the form of humanities integrating discussion with students into lecturing whereas M/NS and engineering almost totally avoid class discussion. Written comments by humanities and education respondents suggest that they use additional methods not included in this question. However, they are included in the next category.

II. Teaching and Learning Activities During Classtime

The classroom teaching activities most prevalent in the lessons, in approximately one half of the classes, are those of the teacher deriving solutions to problems and writing intensively on the chalkboard. Approximately 40% of the instructors frequently allow students to work on activities during classtime.[6] Respondents to this item were asked to underline each activity in a given list that they used. Results show four types of learning activities to be frequently experienced during classtime in more than one third of the courses: student problem solving (41%), working individually (41%), working on own project (39%), and working in small groups (33%). All other options are used much less frequently. Breaking down these answers on department show that humanities emphasize work on projects (41%), class discussions (34%), individualized work (34%), and work in small groups (31%). SS do a lot of individualized work during classtime (50%), work on projects (47%), in small groups (46%), and class discussion (38%). M/NS use mostly problem solving in class (65%), and engineering also do this but to a lesser degree (39%), while also employing computer assignments in class (32%).

Approximately one third of the instructors use overhead projectors with transparencies, and one third present case analyses in class. Use of the other teaching tools listed in Item 9[7] is much more infrequent-- between 17% and 23%.

Significant differences between disciplines show on three activities. Professors of M/NS and of engineering, more than of SS and significantly more than of humanities, solve problems, M/NS professors write intensively on the chalkboard significantly more than of humanities and SS, and in engineering classes there is significantly more frequent use of overhead with transparencies.

Question 5: What Are Faculty Perceptions of the Material Taught

Perceptions regarding four aspects of the material presented are examined, as summarized in Table 6.

Insert Table 6 About here

(a) The "culture" of the domain. Historical, philosophical, and sociological[8] aspects of the domain are frequently presented by about 50%, 40%, and less than 30% of the instructors respectively. Humanities instructors are the most frequent presenters of historical aspects of their domain, they do so significantly more than their colleagues in M/NS or engineering.

(b) The era of development of knowledge presented in the course. Providing students with the most current domain-related knowledge (Item 7) is not highly rated as a goal in teaching undergraduates. Most of the material presented in class by far was developed between 1950-1980 and, to a slightly lesser extent, between 1980-1990.

Humanities and SS present knowledge developed primarily between 1950-1990 whereas M/NS instructors, more than any of the others, teach "old" knowledge: some which is pre- 20th century, and most of it developed in the first half of this century. Engineering instructors concentrate on knowledge developed during 1950-1980 and to a lesser extent during 1980-1990. SS teach the most recent material of all others, i.e., from 1980 on, and significantly more than engineering or M/NS.

(c) Reliance on problem solving and on knowledge of mathematics. About one half of the courses involve problem solving activities and 43% are based on knowledge of mathematics. Obviously, M/NS and engineering rely significantly more on mathematics and use significantly more problem solving activities in their lessons than humanities or SS.

(d) The hierarchical organization (sequentiality) of the material. Almost two thirds of the courses are hierarchical in their internal structure[9] but only one third is hierarchical in terms of the curriculum.[10] M/NS and engineering are more significantly more hierarchically organized than humanities or SS in both aspects.

Statistically Significant Differences Related to Gender, Academic Rank, Teaching Experience, and School

Gender Differences

The t-test for unpaired comparisons produced only three (out of 68) items on which gender differences are statistically significant at the 5% level. Results are summarized in Table 7.

Insert Table 7 About here

Although we can expect a chance occurrence of three items that show significant differences in a 68-item survey (5% of 68 is 3.4), the three items in Table 7 that make significant differences seem not to be random because they hinge on the same issue: Female professors tend to interact more with students during lectures than male professors. They promote students' collaboration (group work) more than do men, conduct more discussions, and pose more questions to students.

Academic-Rank Differences

The statistical procedure ANOVA was used to identify differences related to the three levels of academic rank, and the post-hoc Scheffe Test at the 5% level was used to perform pairwise comparisons for these three levels. Table 8 presents the four items that show statistically significant academic-rank differences.

Insert Table 8 About here

Again, although it is only reasonable to expect three items showing significant differences, the responses to items (a) and (b) in Table 8 suggest that they are not random because they support our intuition. The motivational power of internal satisfaction from a job well accomplished is significantly lower for assistant professors than for their more academically established colleagues. Understandably, assistant professors are more motivated by the use of evaluation of instruction in tenure and promotion considerations. Item (b) clearly indicates a decrease in the motivational power of promotion and tenure consideration for investing in good teaching, when moving up from assistant professor to full professor.

Less interesting are findings of Items (c) and (d) indicating that assistant professors perceive the goal of promoting knowledge needed for professional work and career skills as being much less important than do their more experienced colleagues. They use overhead projectors in their lessons much less than all other professors, and significantly less than associate professors.

Experience Differences

ANOVA with post-hoc Scheffe test at the 5% level produced only two items with significant differences on experience; results are summarized in Table 9.

Insert Table 9 About here

Again, statistically significant differences on two out of the 68 comparisons is less than what would expect (3.4). However, the only two items for which these significant differences were produced are actually the same, only worded differently. This outcome validates the significance of differences, suggesting that the more experienced the professor, the greater his or her tendency to present the most recent domain-related knowledge.

Disciplinary Differences

Tables 2 through 6 present the results of ANOVA and Scheffe tests for disciplinary differences on all items in the questionnaire. Of the 68 items, 19 (28%) produced significant differences on school/discipline background, with 36 Scheffe's pairwise comparisons attaining statistical significance at the .05 level. The major differences are apparent between humanities and M/NS (11, i.e., 31% of all comparisons that show significant differences) and between humanities and engineering (10, i.e., 28%). Differences between SS and M/NS (22%) and between SS and engineering (11% for each comparison) are less frequent. The lowest frequency of school-based differences is between M/NS and engineering (6%) and such differences between humanities and SS are almost non-existent (3%). These results indicate that the four schools involved in the analysis of disciplinary differences may be clearly divided into two separate groups on the basis of similarity in faculty perceptions of teaching issues: the humanities and SS, and the M/NS and engineering. The proportion of pairwise significant differences between these two groups is 92% as compared with 8% of within-group significant comparisons.

Summary and Conclusions

This section summarizes the results of the survey under the five questions, and presents conclusions related to the issues raised in the introduction.

(a) How do university professors acquire their pedagogical knowledge?

The large majority of the professors did not receive any orderly, systematic preparation for university teaching. Contrary to expectations, neither observing their own university teachers when they were students, nor their TA-ing experience served as their main source of learning to teach, as expected.

Learning from observing their own teachers. Only approximately one half of the respondents perceive the example set by their own former teachers as contributing much or very much to their current instruction. A suggested explanation is that:

> Being a student probably rarely entails the reflective and systematic study that such terms [observing teaching through "participant observation"] imply. Instead, it seems more likely that some crucial experience or some particularly influential teacher produces a richly-detailed episodic memory which later serves the student as an inspiration and a template for his or her own teaching practices. (Nespor, 1987, p. 320).

Learning from TA-ship. The large majority of the professors does not perceive TA-ing experience as substantially contributing to their current instruction. Several explanations are possible: (a) students working as TAs generally did not receive a good systematic preparation for teaching as TAs; (b) their TA-ing experience did not include frontal classroom instruction but rather consisted of work as laboratory guides, providers of individualized help for students, or checkers of homework assignments; and (c) TAs who did conduct classes experienced a form of instruction which was very different from the kind of teaching expected from professors (e.g., in M/NS it was mostly recitation classes of solving problems, rather than lecturing).

Learning from classroom experience. This emerges as the primary source for professors' existing pedagogical knowledge in teaching undergraduate classes. The very large majority of university professors, lacking any appropriate pedagogical preparation, learn to teach through trial-and-error using reflection. These findings suggest that until university professors become experts in teaching, generations of students suffer from the "error" aspect of the trial-and-error.

The role of teacher reflection. The beneficial role of self-reflection in learning to teach and in improving instruction shows here to be even of a much stronger effect than suggested by that literature presented above. This study reveals that reflection based on internal feedback (self evaluation that follows a process of trial-and-error) and on external feedback (students' ratings and interactions) is the main source for faculty learning to teach.

Institutionalized support for teaching. Most respondents who did experience university or departmental initiatives for teaching improvement or such as peers' and superiors' feedback after class visits, apprenticeship with a senior faculty member, or workshops on university teaching methods, perceive that experience as having made only few contribution to their current instruction. Even discussion with peers about teaching-related matters, which almost all respondents have engaged in, is not very highly rated as a contributing factor and observing peers' classes, also experienced by many respondents, is rated even lower. These findings suggest that almost all initiatives taken by the university and the departments for teaching improvement are perceived by faculty as largely unsuccessful for this particular aim. However, it is very possible that they do nevertheless contribute to faculty's current teaching in indirect or subtle ways of which respondents are not aware. For example, these initiatives may promote faculty understanding of their teaching or of teaching-effectiveness techniques, or they may promote faculty reflection on their classroom instruction. We need to further inquire in depth into how these experiences affect faculty teaching-related activities and how to make them be explicitly perceived as beneficial for teaching improvement.

Teacher isolation. This phenomenon, widely identified on the pre-college level, is only inconclusively supported here for the university level. On one hand, most external features of teacher isolation are not in evidence: Almost all faculty report they have discussed matters of instruction with peers, and a sound number of faculty have experienced visiting peers' classes, received peers' and superiors' feedback after visiting their classes, or sharing teaching with peers. However, the fact that only few faculty members perceive these experiences as beneficial to their current instruction suggests that either these experiences are rare--forming an evidence to teacher isolation--or that they are provided in a way that does not contribute to improving instruction. Teacher-isolation phenomena should be further studied for the college level and new ways to decrease it should be looked into. Indeed, in recent years there have been some initiatives in this direction in the form of using colleagues to help improve teaching (Paulsen & Feldman, 1995). Strategies offered for this aim are team teaching (Baldwin & Austin, 1995), mentoring (Boice, 1992) or collegial coaching (Keig & Waggoner, 1994).

To conclude, the research-university professors in this survey feel that they have not received adequate preparation for the major role of teaching, and that the dominant assumptions regarding this issue (on learning from observing own teachers as students and from TA-ship) are largely mistaken. In addition, because these professors achieve their positions on the basis of their research performance which is only remotely, if at all, related to their teaching abilities, some of them may lack some of the basic abilities required for sound teaching. Nevertheless, they are required to teach well and they are judged on their teaching performance for a variety of important purposes, such as promotion. The widely accepted notion that "everybody can teach well provided he or she puts enough time in lesson preparation" is definitely a myth (Hativa, 1995a). Teaching, like any other profession, requires in addition to motivation and effort, certain specific abilities and established, specific knowledge (Shulman, 1986; 1987).

(b) What Motivates University Professors to Invest Time and Effort in Teaching?

Similarly to pre-college teachers who get their professional rewards from students rather than from the institution (Jackson, 1968; Feiman-Nemser & Floden, 1986) internal satisfaction from a job well accomplished and students' personal feedback shows here to serve as the strongest motivation for university professors to invest their resources in teaching. In sharp contrast with university administrators' belief in the motivating power of tangible external rewards, such rewards show here to play only a secondary motivating role, with cash awards being the least effective. For engineering faculty, cash awards show the lowest motivation power than for all other faculty members. This is probably because most engineering professors in this university hold well-paid consulting jobs in the local high-technology area. One possible explanation for the low motivational power of cash awards is that only few faculty members can expect to get them as they are awarded only to highly excelling instructors. Many faculty believe that even as long as they invest a large amount of time and effort in lesson preparation, this will not lead them to be of top excellence in teaching as long as they do not have inherent teaching abilities. Since most university instructors feel their teaching abilities are less than perfect, they assume they can never do better than those who have such abilities.

Departments' insistence on the importance of providing good instruction shows to be a relatively strong motivating factor for investing in teaching. However, although two thirds of the instructors say they do get this type of a message from their department, some of them feel it is not quite genuine. In the particular university studied, the School of Engineering, followed by the M/NS, put a substantially greater weight on the need for good teaching than other participating schools-- SS, humanities and education. This greater emphasis on the need for good instruction in engineering and M/NS may result from the considerable difficulties students face in learning in courses in these schools, indicating that teaching there is more problematic than in other domains. To support, college students' ratings show very consistently that instructors in engineering and M/NS domains are rated lower than instructors in the other domains (e.g., Marsh, 1987; Theall, 1993).

(c) Goals in Teaching

In the first category of promoting knowledge and functioning in the academic domain and in daily life, the most highly rated teaching goal by far is conveying the basic body of knowledge in the domain. This is followed by conveying the structure and organization of knowledge, and the "tools" of the domain. Faculty in humanities emphasize more than others the goal of contribution to humanity, and engineering faculty especially promote knowledge needed for professional work and daily life. This latter finding was expected since engineering is an "applied" field whereas all other fields participating in this study are "pure", in Biglan's (1973) classification.

Goals in the second category, i.e., of promoting students' motivation, aptitudes, and skills in the domain and generally, are regarded as very important by faculty in all disciplines involved. Humanities faculty appreciate the goals in this category more than faculty of all other disciplines, as found also in previous studies of teaching goals in higher education. Humanities particularly value promoting students' aesthetic appreciation of the material and of human endeavor in the domain, their originality and creativity in thinking, openness to different points of view, and oral and written expression. SS faculty rate the goals in the same order of importance as humanities, but rate lower "promoting students' aesthetic appreciation". M/NS faculty appreciate promoting aesthetic appreciation of the material and of human endeavor, as well as the ability to self study. Engineering and M/NS faculty would primarily promote students' abilities to apply methods and principles. However, it is possible that both, being respectively "applied" and "pure" disciplines, assign different interpretations to the meaning of "applying methods and principles". To illustrate, a case study of two classes (Hativa, 1995b) found that in the physics class the notion of "application" referred to mathematical derivations in solving problems whereas in engineering it meant understanding how devices work.Altogether, these results support and enhance both Cross's (1991) and Franklin and Theall's (1992) findings that engineering, science and math teachers focus on teaching facts, principles and concepts, and problem solving whereas humanities and SS instructors stress the promotion of creativity, oral and written communication, social skills, and groupwork.

(d) Teaching Methods and Practices

Findings of this survey support previous findings on the centrality of the lecture method in undergraduate instruction. The large majority of classes in this university are based on lecturing, and usually include students' questions. Discussions are not frequently included and the Socratic questioning is used even much in less.Other teaching methods were also identified but were used to a much smaller extent.

More than others, M/NS and engineering faculty concentrate on lecturing and include hardly any discussion with students. In their classes they do problem solving activities and demonstrations and they write intensively on the chalkboard. They base their material on knowledge of mathematics and use physical models and transparencies with overhead projectors. Methods used by humanities and SS professors are students' assignment to work: in small groups, or individually, conducting class discussions and using short films and videotapes. These results are very similar to those of Franklin and Theall's (1992) survey and are also supported by than arts and humanities.

Murray and Renaud (1995) who found that SS and M/NS instructors exhibited higher frequency of organization and pacing of instruction, which usually reflects strict lecturing with little student participation, and lower frequency o

(e) Perceptions of the Material Taught

This issue produced the most disciplinary differences of all five questions examined. Humanities, SS, and education professors transmit the "culture" of their domain-- its historical, philosophical, and sociological aspects-- more frequently than M/NS and engineering professors.Humanities, SS, and education professors also present their students with more recent knowledge than their colleagues in engineering or M/NS. SS present the most current knowledge whereas M/NS present the "oldest". Thus, in accordance with Stodolsky and Grossman's (1995) terms, the undergraduate curriculum is the most dynamic for SS and the least dynamic (or the most static), for M/NS. M/NS courses are also perceived as significantly more hierarchical in their internal structure and in terms of the departmental undergraduate curriculum than courses in humanities or SS. This hierarchical structure of the knowledge taught in M/NS departments necessitates, in the first years of university studies, the buildup of basic knowledge, developed in the first half of the 20th century and even earlier. This knowledge serves as a basis for understanding the more current knowledge which is presented only in advanced undergraduate courses and primarily in graduate courses. For this reason, in these departments very little of the most current knowledge, is presented in undergraduate classes. These findings match Stodolsky and Grossman's (1995) findings for high school teachers of mathematics who perceive their topic to be highly sequential but static. They also find SS teachers to perceive their topic as of low sequentiality but highly dynamic, same as found in this study. However, science high school courses are perceived by teachers as of low sequentiality and highly dynamic, in contrast with university science courses that are perceived here as of highly sequential and static. I have not found an established explanation for this difference.

The curricular implications of sequentiality and dynamism are that sequential subjects, as compared with less sequential ones, allow teachers less control of curricular content, elicit more consensus about the material to be taught, put more pressure on teachers for coverage of the curriculum of each course, and induce course rotation among instructors, whereas dynamic subjects more readily present opportunities for change in instructional goals, curricular content, approaches, and technique, than static subjects (ibid). Indeed, the M/NS departments in the university studied here maintain the curricular implications of being hierarchical and static. In these departments, most undergraduate courses have a departmental-based decision about curricular content rather than teacher-based, there is a lot of pressure on teachers to cover the full curriculum of each basic course, and faculty take turns in teaching basic courses (Hativa, 1995a). This course rotation is based on the implicit belief that "everybody can teach" courses with "old" material, as this material, being the basis for all other courses, would have been mastered by all faculty members during their own studies.To complete the list of disciplinary differences regarding perceptions of the material taught, M/NS and engineering courses present material that is based on knowledge of mathematics and on problem-solving activities significantly more than the other disciplines involved here.

Gender, Academic Rank, and Experience-Related Differences

Female professors show much more interaction with students and encourage collaborative work more than do male professors. This finding agrees with the findings of Murray (1997) that college university female teachers, significantly more than males, encouraged student participation and showed concern for student progress.

Main differences in terms of academic rank and experience in the present study were that when moving up from assistant to full professor, there was a gradual decrease in the motivational power of promotion and tenure considerations in investing in good teaching, which is as expected. Another, unexplained findings is that the more experienced the professor, the greater his or her tendency to present the most up-to-date knowledge in the domain.

Disciplinary Differences

Cross (1991) found that the most frequent significant differences in teaching roles emerged across fields of study. This study arrives at the same conclusion. Of all the differences examined (academic rank, gender, etc.), those between the academic schools produce the largest impact on instructors' perceptions, attitudes, teaching behaviors, etc. This suggests that the four main participating schools can be clearly divided into two groups, on the basis of similar approaches and attitudes towards teaching: the humanities-social sciences group; and the M/NS and engineering group. The two distinct disciplinary groups that emerge from this study match Biglan's (1973) classification of academic disciplines into "soft" versus "hard" and thus provide additional support for this classification. The School of Education seems to fit in neither of the two groups. This may be due to the small number of respondents from education or the fact that they teach only relatively few undergraduate students.

In conclusion I would like to reemphasize the main limitation of this study--the use of a single university and the relatively small proportion of respondents. The results should be treated cautiously even though there are indications that the sample is representative of the full university population. However, the results of this study identify several important issues which researchers might wish to further explore.

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[1] For the 1988 survey, the return had been deemed too small to be representative and a second survey on the same issue (but with different items) was distributed again in 1993 with special oral and written encouragement from department heads to answer the form. This time the return rate was higher (35%). A follow-up questionnaire was sent then to a stratified random sample of the non-respondents and was answered by 7% of the total population. No significant differences were found in attitudes towards the issues of the survey between the initial and the follow-up respondents. In the present case, faculty selected as a random sample of the non-respondents were contacted by phone, resulting in a large number of refusal to either fill out the survey form or to be interviewed on the questions. Most referred to time constraints when explaining their refusal. Thus, it was impossible to obtain a random sample of non-respondents.

The rate of return of the present survey is comparable to that of the 1988 faculty survey and is lower than that of the 1993 survey. The reasons for the lower return rate may be the length of the present questionnaire (68 items) and the fact that it was not university sponsored. The evidence of the 1993 follow-up survey suggests that the non-respondents in the present survey do not belong to a different population of the one formed by those who answered the survey and thus,

[2] The School of Education at the university is a graduate school and only a small number of undergraduate students take its courses. Because many of the survey questions referred to undergraduate instruction, only a small number of education faculty could answer these questions. In addition, the School of Education has the smallest number of faculty members of the participating schools and thus the smallest number of respondents (9). Therefore, it was excluded from the Scheffe tests and also from those disciplinary comparisons and discussions presented below, in which the teaching of undergraduates is a central issue. However, the means and standard deviations of education faculty are included in the tables for the readers' information.

[3] E.g., "My poor professors convinced me that I should never be like them."

[4] As came out from written comments, in these shared teaching more than one instructor taught a unit in the course but usually those sharing teaching did not attend to one another's lectures.

[5] As detailed in the question: in pre-college schools, summer camps, army, workshops, tutoring peers or younger students.

[6] These activities, as detailed in the questionnaire form, are: computer assignments; playing a simulation; problem solving; discussing & summarizing issues; working on own projects; independent learning; working in pairs; small groups; and individual work.

[7] Several options for answer were included in Item 9: short films; video clips; computer presentations, and physical models.

[8] Explained in the questionnaire as presenting, for example, specialized jargon, shortcuts, slang, humor, speaking or thinking style.

[9] Explained in the form as understanding of each topic in the course is based on understanding of the previous topics/concepts.

[10] Explained in the form: the curriculum of your course is based on knowledge from previous courses in same or different domain.

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Table 1: Respondents' Data and Comparison to the General Population

	School						Gender		
	Hum.	SS	M/NS	Eng.	Educ.	Total	M	F	Total
# of Respondents	32	24	20	27	9	113	93	19	112
% of Respondents	29	21	18	24	8	100	83	17	100
# of Faculty Members	208	109	95	176	38	626	517	109	626
% of Faculty Members	33	17	15	28	6	100	83	17	100
Chi Squared			3.05 (p=.55)					.01 (p=.91)	

	Academic Degree				Number of Years of Teaching Experience				
	Assis	Assoc	Full	Total	1-5	6-10	11-19	20+	Total
# of Respondents	25	20	66	111	20	23	22	47	112
% of Respondents	23	18	59	100	17	21	20	42	100
# of Faculty Members	128	102	396	626	No information available				
% of Faculty Members	20	16	63	100					
Chi Squared		.58 (p=.75)							

Table 2: How Did University Professors Learn to Teach?

Source	Those who experienced source / Percent of: Full population (115)			Hum (32)		SS (26)		Educ (9)		Math/NS (20)		Eng. (28)	
	a	b	c	a	c	a	c	a	c	a	c	a	c
1. Trial-and-error	100	86	86	100	97	100	88	100	56	100	75	100	86
2. Self-evaluation of teaching	99	84	83	97	81	100	88	100	78	95	65	100	93
3. Students' feedback	99	74	73	100	69	100	69	100	22	90	60	100	79
4. Observing former university instructors	100	56	56	100	66	100	31	100	56	100	50	100	54
5. Observing "star" lecturers in same field	88	28	24	84	22	88	27	89	22	85	20	89	29
6. Discussions with peers (matters of instruction)	93	21	20	94	25	100	19	89	11	75	20	96	18
7. TA training or experience	86	23	20	84	16	77	31	78	11	90	25	93	11
8. Teaching a course together with another faculty	70	22	16	91	6	65	23	78	33	50	15	64	14
9. Other contexts than the university	65	19	12	48	13	58	12	44	22	14	10	71	11
10. Observing peers' classes	77	15	11	84	16	62	4	56	0	70	15	93	14
11. Peers' feedback (after visiting class)	58	9	5	20	3	50	8	67	11	70	10	50	0
12. "Apprenticeship" with a senior faculty member	37	12	4	41	9	31	0	44	0	25	5	46	4
13. Superiors' feedback (after visiting class)	37	5	2	41	3	35	0	44	11	30	0	39	0
14. Consultation by an expert[1]	39	0	0	41	0	35	0	22	0	85	10	50	7
15. Workshop/course for univ. teaching methods	36	0	0	9	0	42	4	22	0	25	5	39	0

Rating scale: Have you had the following experiences? If YES, to what extent have they contributed to your instruction in the current course?

1: almost none; 2: small; 3: medium; 4: large; 5: very large

[a] Those who experienced this source out of the population of the respondents

[b] Those who rated the contribution as either large (4) or very large (5) out of those who experienced this source (answered YES)

[c] Those who rated the contribution as either large (4) or very large (5) out of the population of respondents, calculated as the product of the two first columns

[1] [Faculty written responses revealed that they referred in this item to occasional instructional help by either an excellent instructor of their department or an expert on teaching from outside the department. Item 12 refers to a systematic continuous work with an expert from the department]

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Table 3: What Motivates Professors to Invest Time and Effort in Their Teaching?

	All		School (Means)					ANOVA			
Item	%[1]	Mean (SD)[2]	Hum	SS	Educ	M/NS	Eng.	F	P	Between	Scheffe Signif.
n=		115	32	26	9	20	28				
1. Internal satisfaction from a job well accomplished	98	4.82 (0.43)	4.9	4.9	4.9	4.6	4.8				
2. Students' personal feedback	96	4.51 (058)	4.5	4.5	4.8	4.3	4.6				
3. Use of evaluation of instruction in tenure/promotion considerations	81	4.18 (0.87)	4.2	4.6	4.1	4.1	3.9				
4. Use of evaluation of instruction in salary considerations	81	4.11 (0.85)	4.1	4.4	4.1	4.0	3.9				
5. Messages by chairman and leading faculty as to the importance of providing good isntruction	68	3.88 (1.06)	3.8	3.8	4.1	3.8	3.9				
6. Teaching awards	58	3.61 (1.03)	3.7	3.7	3.2	3.7	3.6				
7. Published student ratings of their instructors	61	3.56 (0.94)	3.6	3.9	3.1	3.4	3.6				
8. Cash awards	44	3.21 (1.14)	3.6	3.5	2.1	3.4	2.8	3.16	.025	Hum & Eng	P=.040

[1] Percent of those who chose either "agree" (4) or "definitely agree" (5), out of all respondents
[2] Rating scale: What would motivate you to invest more than the minimal time and effort to teach?
1: definitely disagree; 2: disagree; 3: neutral; 4: agree; 5: definitely agree

Table 4: Professors' Conceptions of Goals of Undergraduate Instruction in Their Department

Item	All		School (means)					ANOVA			
	%[1]	Mean (SD)[2]	Hum.	SS	Educ.	M/NS	Eng.	F	P	Between	Scheffe Signif.
n=		115	32	26	9	20	28				
I. Promoting knowledge and functioning in the academic domain and in daily life											
1. The basic body of knowledge in the domain	91	4.39 (0.71)	4.3	4.3	4.0	4.6	4.6				
2. The structure/organization of knowledge in the domain	74	4.03 (0.84)	4.0	4.1	4.2	4.0	4.0				
3. The "tools" of the domain	70	3.93 (0.95)	3.9	3.9	3.6	4.1	3.9				
4. Knowledge necessary for any educated/intelligent person	69	3.90 (1.04)	4.0	4.0	3.2	3.7	4.0				
5. Knowledge needed for professional work	62	3.67 (0.96)	3.7	3.2	3.4	3.8	4.1	3.13	.013	SS & Eng.	P=.017
6. The most current body of knowledge in domain	51	3.51 (0.87)	3.5	3.7	4.0	3.4	3.3				
7. Methods of research in the domain	44	3.40 (1.00)	3.7	3.6	3.4	3.6	2.7	6.72	.000	Hum & Eng SS & Eng M/NS & Eng	P=.032 P=.009 P=.023
8. Contribution of academic discipline to humanity	44	3.37 (1.07)	3.8	3.2	2.8	3.3	3.1				
9. Knowledge needed for functioning in work and daily life conditions	40	3.26 (0.94)	3.2	3.2	2.8	3.2	3.5				
II. Promoting students' motivation, aptitudes, and skills in the domain											
10. Ability to apply methods and principles	88	4.34 (0.85)	4.3	4.1	3.8	4.5	4.5				
11. Independent, objective and critical thinking	80	4 30 (0.95)	4.6	4.4	4.2	4.2	3.9				
12. General cognitive skills	80	4.19 (0.88)	4.4	3.9	3.4	4.4	4.3				
13. Habits of work& thinking appropriate to domain	81	4.16 (0.93)	4.3	3.9	3.2	4.4	4.2				
14. Interest, curiosity, and motivation to continue studying in this domain	78	4.14 (0.86)	4.4	4.1	4.0	4.1	3.9				
15. Originality and creativity in thinking	76	4.04 (0.89)	4.4	4.0	3.8	3.9	3.7	2.89	.023	Hum & Eng	P=.032
16. Openness to a variety of ideas and points of view	70	4.02 (0.94)	4.4	4.0	3.6	3.6	3.9	3.69	.015	Hum & M/NS	P=.019
17. Skills of oral and written expression	71	3.96 (0.97)	4.5	3.8	3.6	3.4	3.8	5.81	.001	Hum & M/NS	P=.003
18. Ability to self-study	70	3.96 (1.05)	4.2	3.6	3.0	4.4	3.8				
19. Aesthetic appreciation of the material and the human endeavor/ achievement in the domain	61	3.68 (1.09)	4.3	3.3	3.0	4.0	3.1	8.43	.000	Hum & SS M/NS & Eng Hum & Eng	P=.008 P=.045 P=.001
20. Decision-making skills	49	3.53 (1.00)	3.6	3.3	2.8	3.7	3.7				
21. Collaboration skills (group work)	30	3.07 (1.01)	3.1	2.8	3.0	3.1	3.3				

[1] Those who rated the level of importance as either high (4) or very high (5)

[2]: Rating scale: What is the level of importance of this goal to your teaching in this course? 1: very low; 2: low; 3: medium; 4: high; 5: very high

Table 5: Teaching Methods and Practices Most Frequently Used and Faculty Perceptions of the Material Taught

Item	%[1]	All	School (Means)					ANOVA			
		Mean (SD)	Hum.	SS	Educ.	M/NS	Eng.	F	P	Between	Scheffe Signif.
n=		115	32	26	9	20	28				
I. Classroom teaching methods											
1. Lecturing with answering students' questions	78	4.17 (1.06)	3.9	4.3	3.4	4.4	4.4				
2. Lecturing with separate recitation classes (either by you or by TAs)	65	3.57 (1.51)	3.4	4.0	2.3	4.0	3.3				
3. Lecturing integrated with discussion with students	41	3.19 (1.20)	3.8	3.3	3.6	2.6	2.6	7.93	.000	Hum & M/NS Hum & Eng	P=.003 P=.002
4. Developing topics through questioning the students (the Socratic method)	29	2.65 (1.16)	3.0	2.4	2.4	2.4	2.6				
II. Teacher activities during classtime											
5. Solving problems	55	3.39 (1.26)	2.8	3.1	3.0	4.0	4.1	7.48	.000	Hum & M/NS Hum & Eng	P=.006 P=.003
6. Writing intensively on the chalkboard	53	3.35 (1.47)	3.0	3.0	2.6	4.9	3.5	4.66	.005	Hum & M/NS SS & M/NS	P=.017 P=.019
7. Enabling students to work on activities	41	3.14 (1.32)	3.0	3.0	3.8	3.1	3.4				
8. Presenting case analyses	36	2.79 (1.28)	2.7	3.0	3.0	2.9	2.4				
9. Using other teaching tools for demos/illustration	28	2.76 (1.36)	2.6	2.8	3.0	2.6	2.6				
10. Present demonstrations	27	2.65 (1.32)	2.6	2.5	2.2	3.0	2.8				
11. Using overhead with transparencies	34	2.64 (1.49)	2.1	2.8	3.0	2.6	3.3	2.94	.026	Hum & Eng	P=.034
12. Enabling students to submit homework in pairs/ groups	21	2.24 (1.32)	2.3	2.2	2.6	1.9	2.4				

[1]: Percent of those who used the method either frequently (4) or almost always (5)

[2]: Rating scale: You have used the method in your lessons: 1: Almost never; 2: Seldom; 3: Moderately; 4: Frequently; 5: Almost always

Table 6: Faculty Perceptions of the Material Taught

Item	All		School (Means)					ANOVA			
Item	%[1]	Mean (SD)	Hum.	SS	Educ.	M/NS	Eng.	F	P	Between	Scheffe Signif.
n=		115	32	26	9	20	28				
I. The "culture" of the domain											
1. Presenting historical aspects of the domain	51	3.47 (1.17)	4.3	3.4	3.2	3.0	2.7	10.93	.000	Hum & Eng	P=.000
										Hum & M/NS	P=.001
2. Presenting philosophical aspects of the domain	42	3.19 (1.27)	3.7	3.1	3.2	2.7	2.9				
3. Presenting sociological aspects of the domain	28	2.84 (1.19)	3.1	3.1	3.0	2.4	2.4				
II. The era of development of knowledge											
4. During the years 1950-1980	64	3.74 (1.04)	3.8	4.0	3.4	3.1	3.9				
5. During the years 1980-1990	59	3.55 (1.29)	3.7	4.2	4.2	2.5	3.2	5.39	.001	Hum & M/NS	P=.047
										SS & M/NS	P=.001
6. During the years 1900-1950	41	3.15 (1.21)	3.1	3.0	2.2	4.0	2.9	3.52	.017	SS & M/NS	P=.047
7. After 1990	39	2.95 (1.49)	3.0	3.5	4.0	2.3	2.3	3.42	.022	SS & M/NS	P=.042
										SS & Eng	P=.049
8. Before the year 1900	21	2.54 (1.24)	2.8	2.1	1.6	3.1	2.4				
III. Reliance on knowledge of mathematics and on problem solving											
9. Knowledge of mathematics	43	3.00 (1.45)	1.8	2.1	2.4	4.4	3.8	30.73	.000	Hum & M/NS	P=.000
										Hum & Eng	P=.000
										SS & Eng	P=.000
										SS & M/NS	P=.000
10. Activities of problem solving	53	3.48 (1.18)	2.7	3.2	3.6	4.2	4.0	9.55	.000	Hum & M/NS	P=.000
										Hum & Eng	P=.001
										SS & M/NS	P=.032

[1]: Percent of those who used the method either frequently (4) or almost always (5)

[2]: The rating scale: You have used the method in your lessons: 1: Almost never; 2: Seldom; 3: Moderately; 4: Frequently; 5: Almost always

IV. The level of hierarchy/sequentiality of the material											
11. Hierarchical in its internal structure	61	3.67 (0.98)	3.6	3.4	2.0	4.4	3.9	4.71	.003	Hum & M/NS	P=.035
										SS & M/NS	P=.005
12. Hierarchical in terms of its curriculum	30	2.73 (1.15)	2.4	2.5	2.3	3.4	3.1	4.22	.004	Hum & M/NS	P=.020
										SS & M/NS	P=.046

[1]: percent of those who rated the level of hierarchy of the material as either high (4) or very high (5)

[2]: Rating scale: Rate the level of hierarchy of the material of the course: 1: Almost none; 2: Low; 3: Medium; 4: High; 5: Very high

Table 7: Gender Differences

Item	Gender				
	All Mean (SD) n	Male Mean (SD) n	Female Mean (SD) n	t-value	P-value
(a) Table 4 Item 21: Goals in undergraduate instruction: Promoting students' collaboration skills (group work)	3.07 (1.01) 101	3.00 (.97) 84	3.59 (1.06) 17	2.25	.027
(b) Table 5 Item 3: Lecturing integrated with discussion with students	3.19 (1.20) 97	3.07 (1.23) 81	3.94 (.77) 16	2.69	.008
(c) Table 5 Item 4: Developing topics through questioning the students (the Socratic method)	2.65 (1.16) 95	2.56 (1.14) 79	3.25 (1.07) 16	2.24	.027

Table 8: Academic Degree Differences

Item	Academic Degree: All Mean (SD) n	Assist. Prof. Mean (SD) n	Assoc. Prof. Mean (SD) n	Full Prof. Mean (SD) n	ANOVA: F	P	Between	Scheffe Signif.
(a) Table 3 Item 1: Motivation for investing in teaching--internal satisfaction from a job well accomplished	4.82 (.43) 110	4.60 (.65) 25	4.90 (.31) 20	4.89 (.31) 65	4.96	.009	Assist. & Assoc. Assist. & Full	.012 .012
(b) Table 3 Item 3: Motivation for investing in teaching--use of evaluation of instruction in tenure/promotion considerations	4.18 (.87) 105	4.56 (.65) 25	4.21 (.86) 19	3.98 (.92) 61	4.08	.020	Assist. & Full	.020
(c) Table 4 Item 5: Goal in instruction: promoting knowledge needed for professional work (professional and career skills)	3.67 (.96) 103	3.04 (1.07) 23	3.89 (.58) 18	3.86 (.90) 62	7.46	.001	Assist & Assoc. Assist.& Full	.014 .002
(d) Table 5 Item 11: Methods of instruction: using overhead with transparencies	2.64 (1.49) 97	1.80 (1.32) 20	3.21 (1.51) 19	2.71 (1.43) 58	5.06	.008	Assist.& Assoc.	.011

Table 9: Experience Differences

Item	Years of Experience					ANOVA			
	All Mean (SD) n	0-5 Mean (SD) n	6-10 Mean (SD) n	11-19 Mean (SD) n	20 and more Mean (SD) n	F	P	Between	Scheffe Signif.
(a) Table 4 Item 6: Goals in instruction--presenting the most current body of knowledge in the domain, the "forefront" of science	3.51 (.87) 105	3.00 (.69) 18	3.41 (1.05) 22	3.52 (.81) 21	3.70 (.79) 44	3.06	.032	"1-5" and "20 and more"	.035
(b) Table 6 Item 7: The scientific knowledge presented in your course was developed (approximately) after 1990	2.95 (1.49) 75	2.46 (1.20) 13	2.13 (1.64) 15	2.77 (1.36) 13	3.44 (1.40) 34	3.59	.018	"6-10" and "20 and more"	.037

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