



U.S. University Leader Pronouncements on Women and STEM Fields

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ABSTRACT

How has the topic of women in science, technology, engineering, and mathematics (STEM) fields been framed and presented by university leaders in the contemporary United States (U.S.)? How have these leaders addressed questions of gender equity and representation in STEM fields? Given current calls in the political and economic arenas for enhancing STEM education and building the related workforce, such questions have become increasingly important not only in the U.S., but worldwide. Based on arguments positing the salience of leadership buy-in and agenda-setting, we conduct a discourse analysis of speeches and other public pronouncements by university leaders drawn from a representative sample of U.S. universities over the 1992-2008 period. Our analysis demonstrates that topics of gender equality and equity increasingly appear in university leader statements in reference to matters of societal concern associated with various issues of fairness and justice, but are usually constrained by clearly defined institutional and epistemic contexts.

KEYWORDS

Women; Higher education; STEM; Leadership



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INTRODUCTION

Claims of gender disparities in representation, degree attainment, and faculty presence in the science, technology, engineering, and mathematics (STEM) fields are not new on the campuses of colleges and universities in the United States (U.S.) today and elsewhere. Indeed, gender disparities in student experiences and in the career trajectories of scientists and engineers, and the factors that may contribute to them, have been the subject of a continually growing body of research.¹ However, for the most part, it was not until 1999 with the leak of the report 'The Status of Women Faculty in the MIT School of Science' that this issue gained primary importance on academic policy agendas. Documenting gender disparities in the treatment of faculty in the School of Science at the Massachusetts Institute of Technology (MIT), the report expressed for MIT and the world what many women faculty and others throughout the country had long known — i.e., that gender discrimination was alive and thriving in many universities and continuing to hinder women's advancement (Valian, 1999; NAS, 2007). Of particular note were the introductory remarks made by then-MIT president Charles Vest, giving public recognition to the gender bias in the academy:

I have always believed that contemporary gender discrimination within universities is part reality and part perception. True, but I now understand that reality is by far the greater part of the balance.

Coming from the president of MIT — recognized internationally as one of the leading research institutions not only in the U.S., but in the world — these words were given unparalleled weight in both academia and society more broadly. President Vest further went on to invite the leaders of eight other top universities to join a collective effort to examine and eliminate gender discrimination from their institutions.²

Moreover, in the same year, the National Science Foundation (NSF) in the U.S. launched ADVANCE, a multi-million dollar grant program explicitly aimed at increasing the participation and advancement of women in academic STEM careers. The principal goal was to stimulate institutional change and transformation to facilitate the career advancement of qualified women STEM faculty. The large grants offered under the ADVANCE program stoked the interest of a wide variety of tertiary institutions, including some of the largest and most prestigious research universities in the country.³

However, the issue of gender disparities in STEM fields peaked in 2005 when Lawrence Summers, the then-president of Harvard University, one of the most prominent institutions of higher learning in the world, publicly remarked that innate gender differences might explain why women were not leaders in the sciences and engineering among the nation's top universities. Summers' statement ignited a firestorm that spread across the country and around the world, eventually costing him his position and producing a swell of academic presidential proclamations in support of advancing women in science and technology fields.

These situations brought us to a point where we can consider the public pronouncements and speeches of university leaders as a means for determining the extent to which women in STEM, and diversity in general, have become principal concerns on the institutional agendas of colleges and universities in the U.S. today (Hopewell et al., 2009). Academic leaders are charged with representing the interests of their institutions to not only the academic community, but also to the non-academic community with the aim of garnering support and maintaining institutional legitimacy (Brint, 2002). Institutional agendas develop as leaders confront internal and external constraints and pressures and, as in organizations in general, the power and influence of the leaders are determined in part by the definition of their offices (Scott, 1998). To set the tone for their leadership, university leaders publicly espouse selected values and goals to which they and the broader community believe the institution should aspire (Bowen and Shapiro, 1998; McLaughlin and Riesman, 1990).⁴ These values and goals, in turn, establish and frame the institutional climate and organizational culture of the university. The communication of these values is accomplished through the leaders' public remarks and addresses, statements on selected issues, and publicly outlined strategic plans.

So, how have university leaders addressed questions of gender equity and representation in STEM fields? What have been the general positions and attention given related topics on institutional agendas? How has the topic of STEM women been framed and presented in academia and beyond? Such questions are of particular importance given current calls in the political and economic arenas for enhancing the STEM workforce and related education. In response, we provide an analysis of the public statements and pronouncements of university leaders, looking to the consistency with which certain values are expressed within them as a means for revealing and translating the aims and principles that college and university leaders posit as institutional goals (cf. Liu, 2007).

Building upon and expanding related research in this area (Hopewell et al., 2009; Liu, 2007), we examine public communications from leaders at various universities to gain insight into institutional values and environments relative to women and their participation and advancement in STEM and other fields. To that end, after a brief discussion of related theoretical issues that inform and frame our inquiry in light of broader institutional and cultural considerations, we present

our overall research strategy, delineating the basic data and methods engaged for this study. In general, we look to discursive analytic methods to examine university leader speeches and other public pronouncements and communication documents drawn from a representative sample of U.S. universities. We then present and discuss the analysis and findings, considering the various features of the communication documents for gauging leadership attention to concerns regarding women and diversity in general in academic STEM fields. In the final section, we provide an overall summary and related conclusions, along with directions for future inquiry.

THEORETICAL BACKGROUND

As the public representatives of their institutions, university leaders are institutional focal points. University presidents, chancellors, and provosts are, in effect, the custodians of university visions and traditions, in addition to having responsibilities for sustaining the foundational epistemes that inform the very notion of the university, and also of its role in society in general. At its ideological core, academia acts to nurture, develop, and disseminate knowledge, ideas, and analytical thinking, and academic leaders must present goals for their institutions using the currency of academia to gain both internal and external support. As such, leaders can be conceived as legitimating and substantiating agents based on their attention to related issues and institutional objectives, and legitimating frames are built upon official discourse delivered by the recognized representatives. Thus, as McLaughlin and Riesman (1990, p. 14) argue in their discussion of university presidents,

As the chief spokesperson for their institutions, all presidents have the opportunity to set a tone or style of operation; to help their institutions learn about their environment and their particular niche in this environment; to help develop and articulate agendas for their institutions; to affect quality; to mentor and educate, energize, frustrate, or enervate those who work with them.

In this instance, because university presidents often serve as the primary spokespersons for their universities, their public speeches and pronouncements constitute an important discourse on current social issues from the perspective of academia. Consequently, university presidents typically must engage multiple audiences (Delanty, 2001; Brint, 2002). For example, within their universities, they are expected to address the concerns of their faculties, students, alumni, and boards of trustees. Looking beyond their universities, they also are expected to address potential donors and civic and political leaders, usually to increase funding and enhance the reputation and prestige of their institutions. Effective leaders set institutional agendas, identifying action areas for their organizations and, before different constituencies, university presidents not only elucidate the roles, missions, and objectives of their respective universities, but, in doing so, they also delineate their universities' responses to important issues affecting or occurring in society at large.

Note that we here attach many of the same arguments to university leaders in general, whether referencing specific titles such as president, chancellor, or provost (Hopewell et al., 2009). Depending on the university or university system in which they serve, similar roles can be variably delineated and assigned. However, they all imply levels of leadership in the tertiary educational arena, with some displaying more or less emphasis on internal academic leadership (e.g., provosts) and others with duties emphasizing external relations and representation (e.g., presidents). While these may vary in internal and external focus, the underlying concern here is the overall role of leadership.

As institutions, universities are morphologically similar, sharing at some level a set of common norms based on an overarching mission of education and research (Frank and Gabler, 2006). Moreover, they operate within a broadly common institutional and cultural context and are affected by related pressures and dynamics (Martin, 2002; Thomas et al., 1987). Leaders look to the concerns and practices of others in similar positions and, therefore, we would expect to see the diffusion of similar topics across their agendas. Also, leaders become agents for particular issues, legitimating and substantiating related goals through the public attention that they give to related topics. Accordingly, we would expect that speeches and other public statements made by university leaders will contain institutional and public agenda-driven issues which, in this case, refer to controversies surrounding women and diversity in general in STEM fields.

Frankly, while actual occurrences might vary in terms of frequency, the prominence of these topics has reached such a degree in social, political, and legal significance that university leaders would appear irresponsible if they did not at least show cognizance of them as critical institutional concerns. We suggest a shift in the boundaries of institutional discourse reflecting the presence of related themes and responses. To that end, we would expect their statements to share a common lexicon and a common set of themes, which, collectively, reflect a public dialogue on gender and diversity in the sciences, technology, engineering, and mathematics as delineated and practiced in academia (Hopewell et al., 2009).

Given these considerations, we posit a two-pronged exploratory approach for this inquiry. First, we analyze university leaders' speeches as episodes in a societal discourse on gender and diversity as related to such epistemes as the sciences, engineering, and mathematics. Second, we explore the extent to which the speeches that constitute this discourse reflect a semantic and even mimetic convergence in the same way that similar organizational features are found across universities. Hence, examination of the public statements of university leaders can yield insight into the precise ways that discourse is connected to both symbolic and practical goal mobilization in the academic arena.

DATA AND METHODS

As mentioned above, for this study we explore the degree to which issues of gender and diversity are raised in public speeches and other discussions and pronouncements of university leaders, referring primarily to presidents, but also including other recognized institutional leadership roles, such as chancellors and provosts. More to the point, we explore the extent to which gender and diversity are addressed relative to STEM disciplines in higher education. The basic unit of analysis for our investigation is the 'speech event', referring to a public pronouncement made by a university leader, as previously described. The study uses 1,563 speech events made between 1992 and 2008 by leaders from a representative sample of 58 primarily research intensive universities from across the U.S.

The speech events were organized according to three time periods: 1992-1998, 1999-2004, and 2005-2008. The 1992-1998 period, with a sampling of 69 communication documents, provides a view of speech events prior to Vest's revolutionary statement recognizing gender discrimination in the STEM fields, which begins the second period encompassing 423 documents from 1999-2004. The bulk of the speech events, represented by 1,071 communication documents, were taken from the 2005-2008 period, based on Summer's controversial comments of 14 January 2005 being viewed as something of a watershed moment.⁵ Note that these periods are not presented as longitudinally comparative. Rather, we use them to provide period snapshots based on data availability from which we can glean discursive indicators of leader pronouncements. The data include speeches and other statements given by university leaders on such public occasions as state-of-the-university messages; addresses to the faculty senate; convocation and commencement addresses; university orientation addresses; various topical announcements (e.g., on the value and mission of the university in a globalized world); as well as news conferences. Collectively, instances of these different types of speech events provide a robust textual corpus, or body of texts, in terms of variety and quantity. We encoded each of the 1,563 communication documents or speech events with a string of six categorical variables pertaining to the university (name, regional location, and public or private status⁶) and communication identifiers (year, type, and source). All communication documents were located and collected through intensive internet searches and reviews of the 58 individual university websites and were sorted according to the categorical variables for analytical application.

Employing both deductive (involving categorical coding processes) and inductive (involving thematic identification based on close readings approaches) (cf. Liu, 2007), our examination of the speech events was informed by discursive analytic methods. Used for analyzing texts and large corpora of related documents, discourse analysis allows for the identification of textual patterns and makes replicable, valid inferences from the data to their context (Baker, 2006; Schiffrin et al., 2001; Krippendorff, 1980). Accordingly, our analysis of the texts of pronouncements of university leaders was aimed at identifying the presence and

forms of analytically relevant discursive elements and practices (Fairclough, 2005). We take a hermeneutic approach to discourse analysis in the sense that we systematically developed a basis for speech event data interpretation by identifying specific characteristics of the related texts in terms of *lexicon* (vocabulary), *syntax* (arrangement), and *morphology* (derivation/structure).

From this common set of features, we derived various indexing and classification schemes that provided links to specified items both within and across texts, thus allowing us to make *thematic inferences* that link the contents of specific speech events to their institutional and societal contexts. These classifications or categories helped us to make sense of the institutional agenda reflected in or directed by the public pronouncements. For example, one category by which we classified speech events from an institutional perspective was based on university affiliation and whether the university leader giving the speech represented a public or private university. Similarly, we categorized speeches according to type of speech (e.g., commencement address or state of the university address).

We also established a basic analytical lexicon of *lemma* terms. A lemma is the foundational linguistic term from which other terms are derived. Thus, for example *speaks* and *speaking* are forms of the same lexeme that has *speak* as its lemma. Similarly, we determined keywords or terms indicating the semantic typology of the different speeches. Thus, for example, we designated keywords such as *woman(-en)*, *science*, *engineering*, *commitment*, *diversity*, *equity*, *minority(-ies)*, and so on, which we then used to perform different occurrence, co-occurrence and association, and concordance analyses. Basic analysis included determination of word frequencies drawn from occurrence values relative to a list of 1500 lexical units or words, including various elements of speech (e.g., nouns, verbs, adjectives, adverbs, etc.). Word *frequencies*, *associations*, *concordances*, and *specificity* constitute the primary analytical components of the study (Baker, 2006). Word associations show keywords and their significant one-to-one relationships with other words within the textual corpus. Shared associations are based upon the selection of word pairs in which each word reflects a set of elementary contexts in which they are present. Concordances involve the examination of actual occurrence contexts, and specificity references explicit word usage.

Furthermore, based on identified categories, we carried out a more detailed critical analysis of the pronouncements, delineating representative forms of argumentation and narrative to provide a more finely "textured" discursive representation and understanding of the leader pronouncements and institutional agenda. This point means recognizing discourse as an important element in institutional processes, especially given the overall institutional responsibilities and representation encompassed in the roles of university leaders. Accordingly, using the speech events as documentary data, we examine and derive specific remarks that act to encapsulate thematic trends for analytical direction (Fairclough, 2003, 2005). Close reading and textual mining techniques were used

to illuminate related goals, aims, functions, purposes, uses, ideas, and philosophies of universities as educational institutions.

ANALYSIS AND DISCUSSION

In general, if university leaders were addressing issues concerning women and STEM fields, we would expect to find evidence of the identification and discussion of related topics at greater length and in relation to one another with increased frequency. Using content analysis of the speeches and other public pronouncements of university leaders, we examined their references to items associated with topics such as women, diversity, equity, and STEM fields. Accordingly, we looked to determine associations among words and terms and their variations in the related discourse of individual speakers in their roles as key university representatives. Co-occurrence tests were performed on the data in order to explore the terminological usage and patterns among the university leaders relative to the concerns of this study.

We first consider word associations, examining a variety of specific keywords — *women, diversity, science, and engineer* — selected based on conceptual relevance and preliminary textual mapping, which were then used to identify other lexical units occurring in the same contexts. On that basis, shared associations were determined to reveal frequencies in the appearance of specific word pairs. In addition, differences between the occurrence rates of keywords and word pairs were examined to ascertain the terms with which they were most likely to be used in conjunction.

Also, in light of the overall focus of the study, concordance analyses were run for four keywords — *women, diversity, minority, and equality* — selected as indicated above, as means for considering the contexts of specific word usage. Specificity analyses were conducted to enable observation and comparison of differences in the usage of specific words within distinct subsets of the textual corpus. In particular, comparisons of terminological usage and expression by public and private university leaders were performed to examine divergence and convergence in practice. We analyzed word frequencies and associations within the speech events and communication documents of university leaders to gain insight into institutional attention to issues of women and diversity in STEM fields.⁷

As discussed above, the text corpus was divided into time-framed sub-corpora for the 1992-1998, 1999-2004, and 2005-2008 periods. The 69 communication documents of the 1992-1998 subcorpus contained 10,581 words, 4,273 contexts, and 7,901 lemmas. The 423 documents of the 1999-2004 subcorpus had 28,801 words, 24,989 contexts, and 22,540 lemmas. The 1,071 communication documents of the 2005-2008 subcorpus contained 39,629 words, 28,623 contexts, and 31,751 lemmas. To ensure statistical reliability, the threshold for inclusion was a minimum of 8 occurrences for the first corpus and 9 for the second and third.⁸

Tables 1a, 1b, and 1c describe the prevalence of selected terms in relation to the whole of the textual corpus for each time period. For our purposes, the relatively common occurrence of words related to science is particularly notable. "Science" itself (or sciences) was the 26th during 1992-1998, the 33rd for 1999-2004, and the 16th most used word for the 2005-2008 period (occurring 2,707 times, science accounted for 6.8% of words in the 2005-2008 subcorpus). The "engineer" lemma (and related words, e.g., engineered, engineering, and engineers) and "technology" occurred 519 and 1,185 times respectively during the 1999-2005 period, and 1,226 and 1,162 times respectively during the 2005-2008 time period. However, *significantly less prevalent for all time periods were the terms related to "woman" and "diversity."* The point here is that the common use or strength of terms such as "science" and even "woman" potentially reflects internal organizational attention or shifting goals that are voiced by the university leaders in order to garner approval or indicate commitment.

Table 1a. Words by Occurrence, 1992-1998

Rank	Lemma	Occurrences
1	university	8649
2	student	5544
6	research	2881
7	faculty	2803
14	community	1742
26	science	1354
32	technology	1185
134	engineer	519
168	woman	437
239	diversity	341

Table 1b. Words by Occurrence, 1999-2004

Rank	Lemma	Occurrences
1	state	1075
2	student	867
6	faculty	595
8	research	537
14	community	369
20	technology	301
33	science	231
152	engineer	91
207	diversity	68
288	woman	50

Table 1c. Words by Occurrence, 2005-2008

Rank	Lemma	Occurrences
1	university	12858
2	student	9632
4	research	4741
5	faculty	4498
12	community	3042
16	science	2707
66	engineer	1226
71	technology	1162
87	woman	1010
119	diversity	843
1007	equity	139

Word Associations

The strength of association was measured for particular words in order to examine the lexical units with which they were associated or co-occurred within the textual corpus. This type of examination aids in determining contextual meanings of the selected words. We looked especially to word associations with the aforementioned selected keywords — *science*, *engineer*, *woman*, and *diversity* — whose frequencies lend support to notions positing their potential substantiation of related issues.

Word association radial diagrams for the selected keywords for each period (Figures 1a-4c) depict the strength of association between each central lemma (in this case, *science*, *engineer*, *woman*, and *diversity*) and the lemmas most significantly associated with it on a one-to-one basis, i.e., indicating words with high degrees of associations with the keywords.⁹ The distance from the central lemma represents strength of association, with numerical values corresponding to the indicated similarity coefficients. These coefficients are utilized to analyze the co-occurrence of terms within the context by employing binary data that captures the relative presence/absence of the two terms and reflect a value range of 0 to 1.

As shown in Figures 1a, 1b, and 1c and 2a, 2b, and 2c, high level word associations for terms related to *science* and *engineer* follow traditional lines of thinking. For example, as expected, *science* and *engineer* have the strongest relationships with one another. Additionally, references containing the keywords *science* and *engineer* followed traditional assumptions referencing the field and including words such as *technology*, *scientist*, *research*, and *mathematics*. Of course, this finding would be as predicted since university leaders tend to discuss issues related to the various disciplines, such as biology, mathematics, medicine, physics, and engineering, within the larger context of science itself. For the 1992-1998 periods, agriculture had a strong relationship with both *science* and *engineering*, which did not show up to the same extent in later periods. However, whether this finding reflects changing institutional agendas or is an artifact of the data would require further exploration.

Figure 1a. Associations with Science, 1992 - 1998

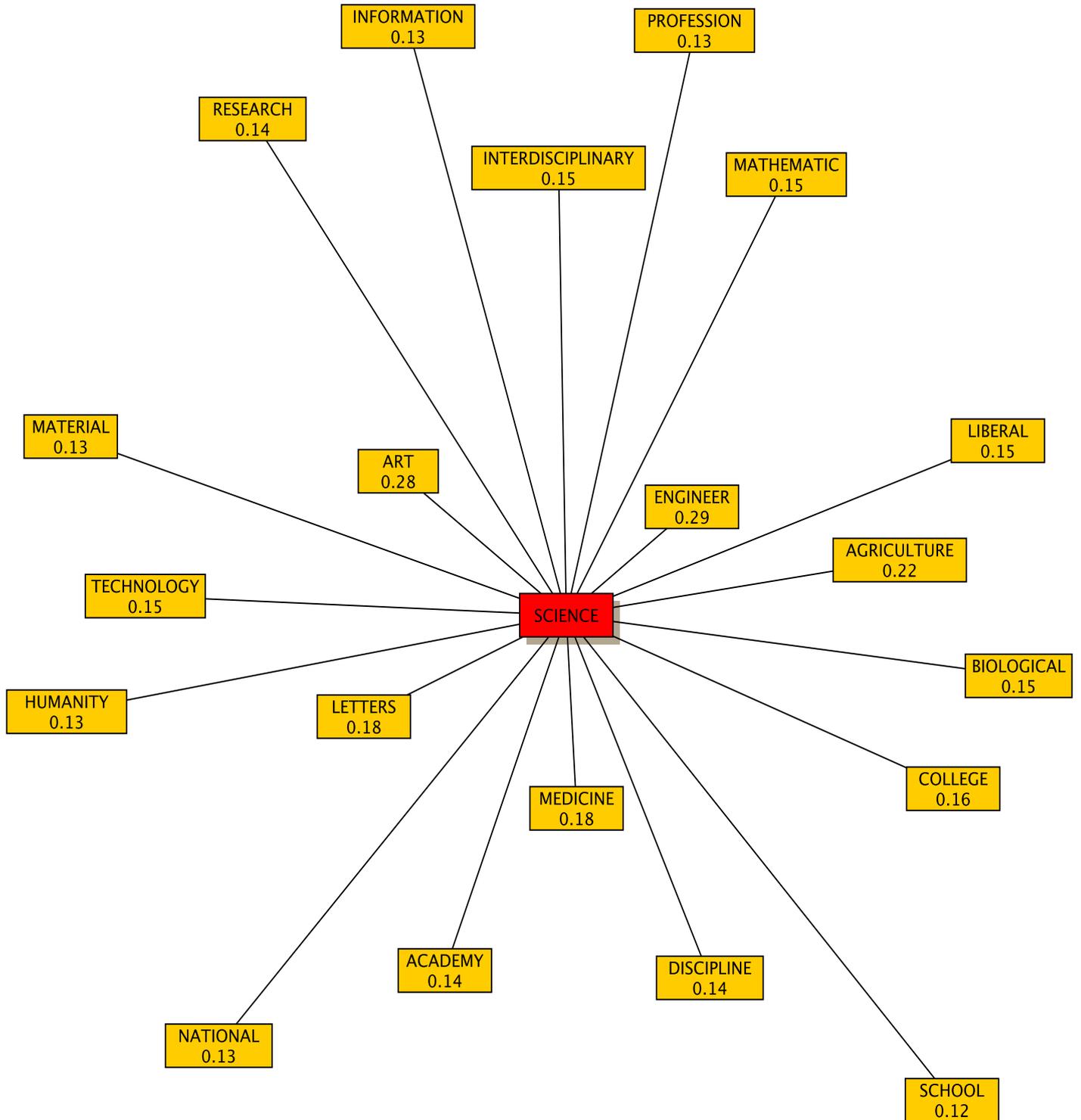


Figure 1b. Associations with Science, 1999 - 2004

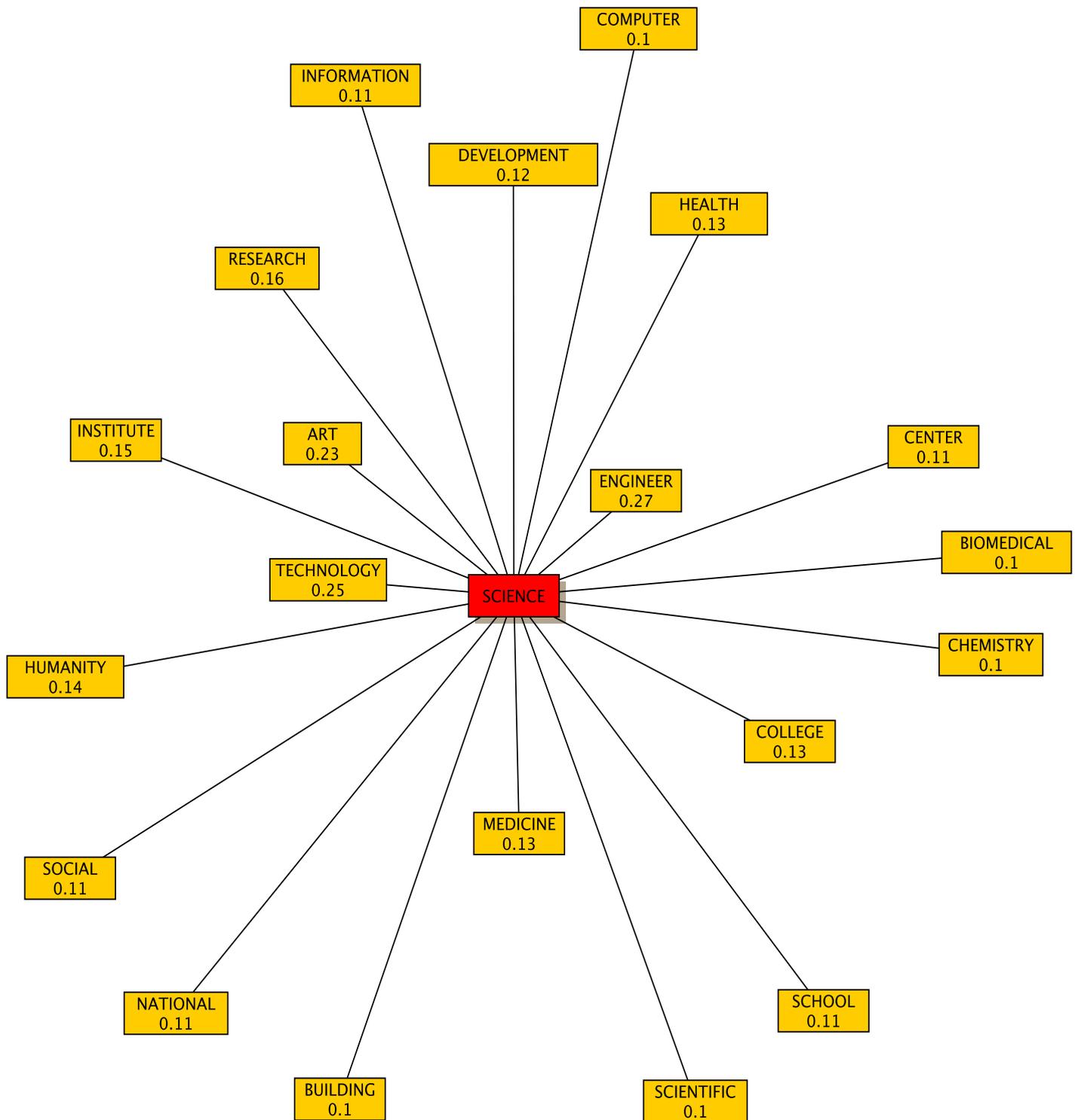


Figure 1c. Associations with Science, 2005-2008

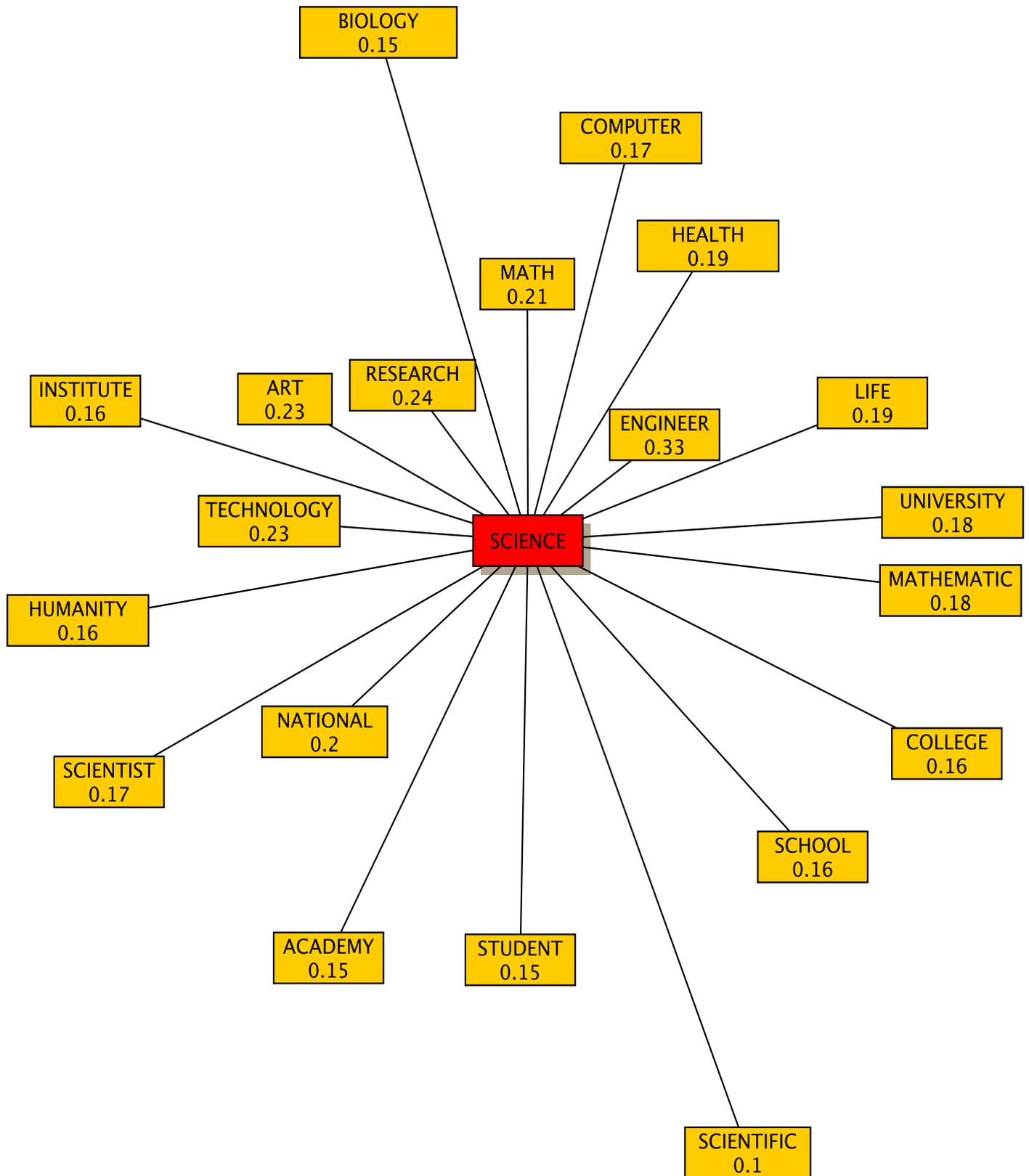


Figure 2a. Associations with Engineer, 1992-1998

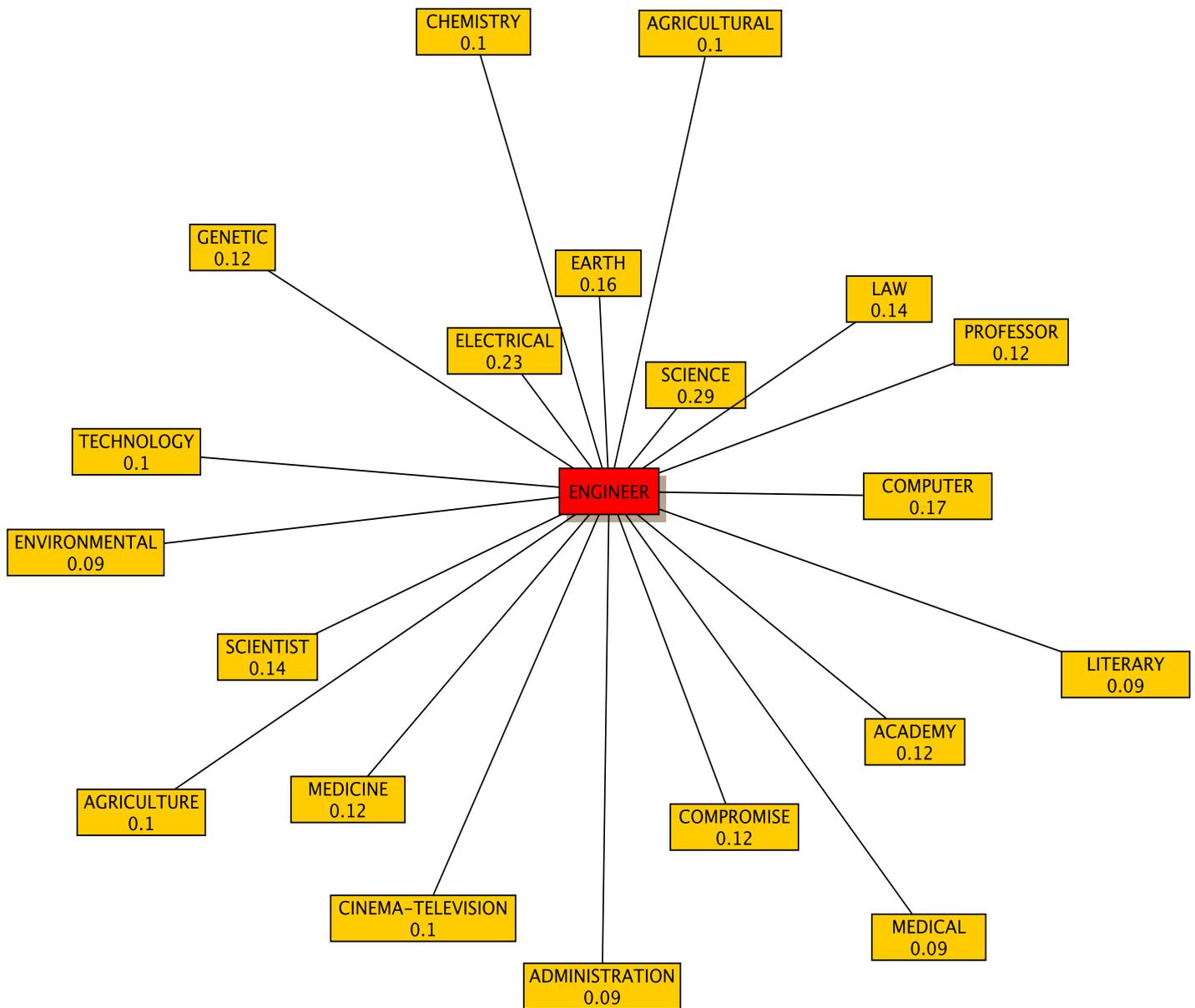


Figure 2b. Associations with Engineer, 1999-2004

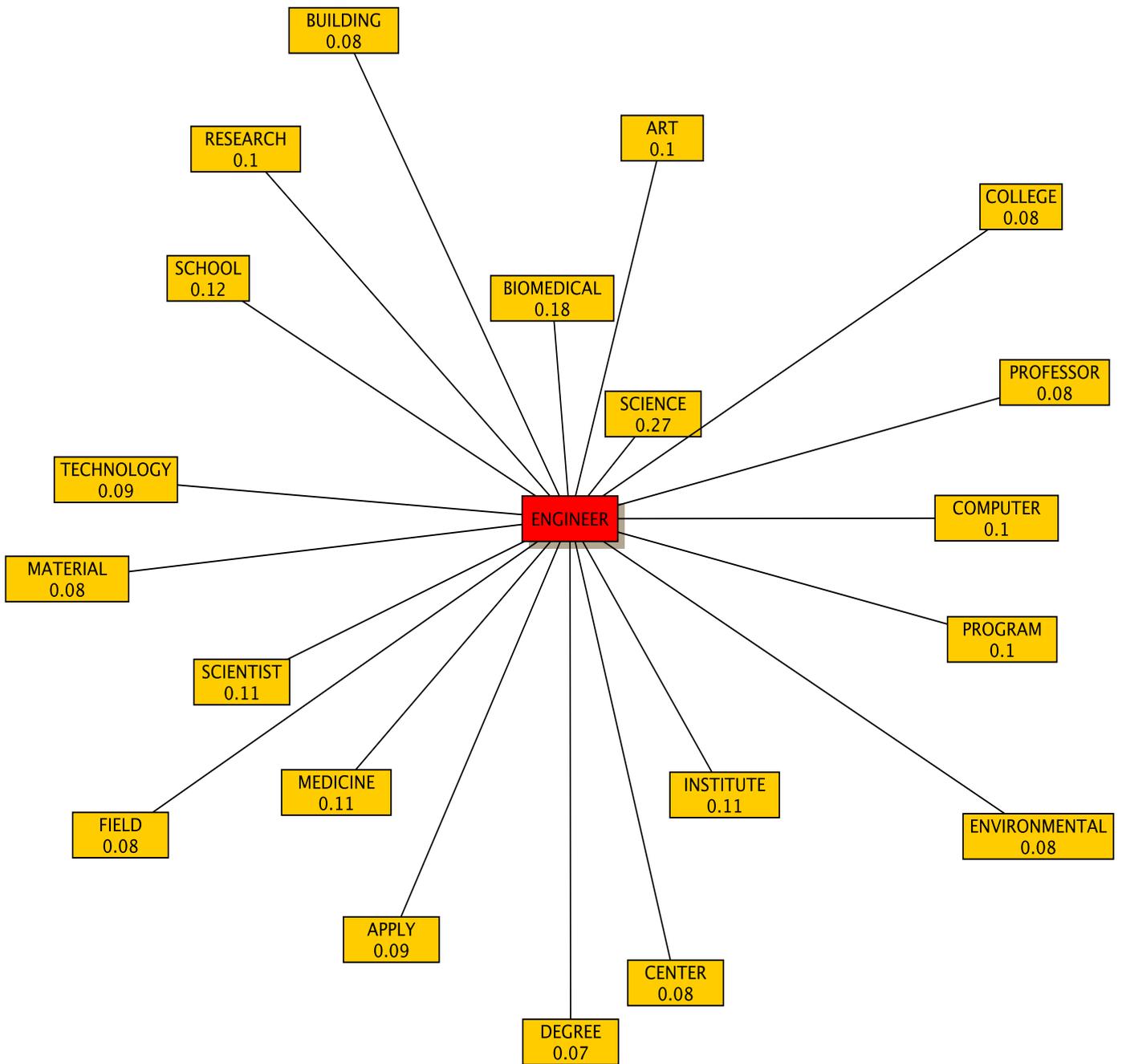
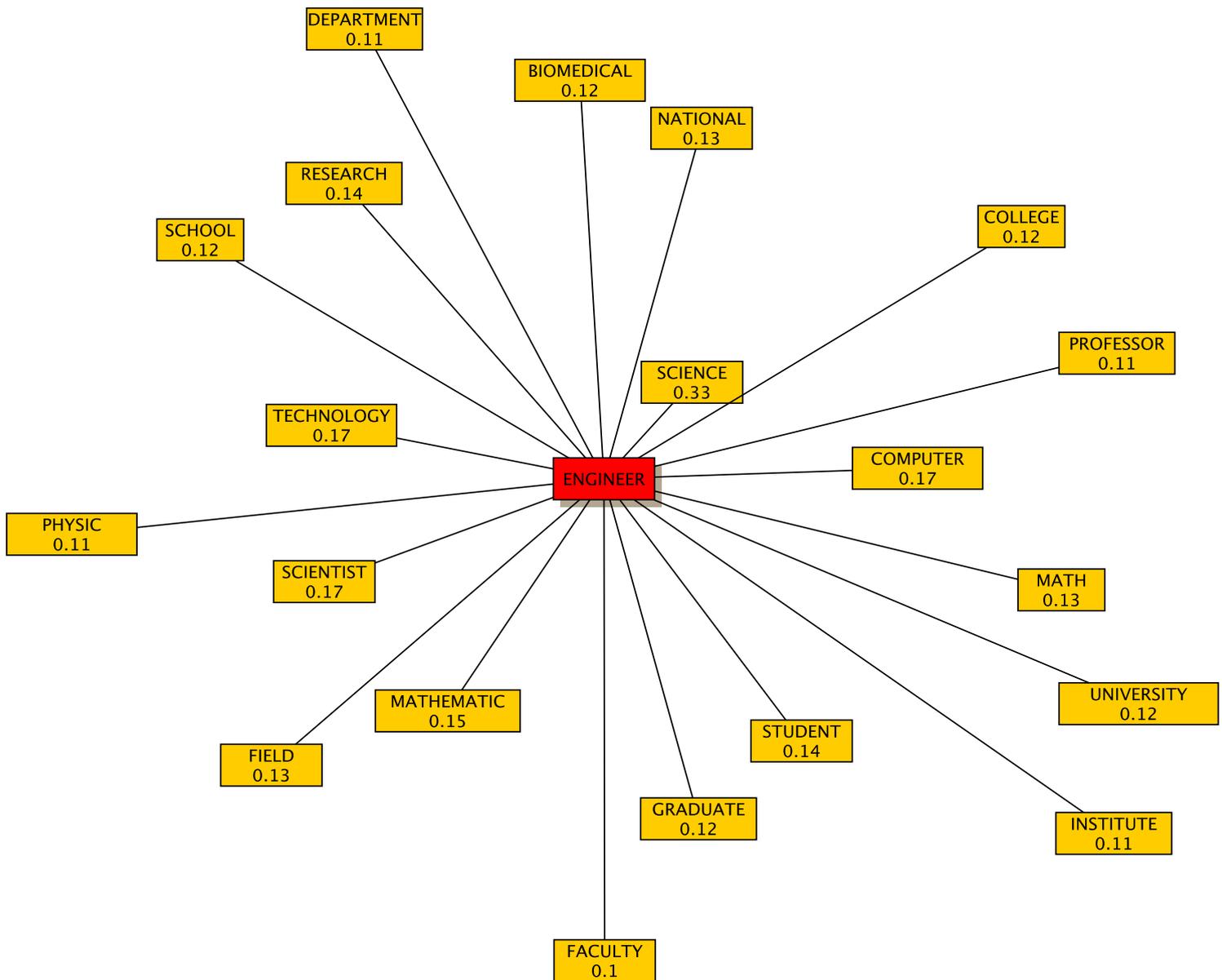


Figure 2c. Associations with Engineer, 2005-2008



The keyword *woman* had different associations with the corpus, as shown in Figures 3a, 3b, and 3c. *Women* typically were presented by university leaders as a defined identity group within the campus community and were also visible through co-occurrences with the words *minority*, *student*, and *race*. However, the *woman* lemma was also used to reference development through links to words such as *opportunity*, *leadership*, *faculty*, and *equality*. Each time period had several different high level associations which might suggest possible changes in agendas. For 1992-1998, *women* were discussed in relation to *domestic* and *entrepreneur*; in 1999-2004, *health* and *athletics* were emphasized and, for 2005-2008, *change* and *world* appear. Note in particular that utterances from university leaders for 2005-2008 indicated strong associations of the keyword *woman* with, for example, *science* and *engineer*. Nevertheless, *although university leaders acknowledged and discussed women in relation to science and engineering, these connections were not strong enough to appear in reverse at the same level of association*. That is, while university leaders speaking of women often referenced science and engineering, the reverse was not the case; leaders speaking primarily of science or engineering did not usually mention women.

Figure 3a. Associations with Woman, 1992-1998

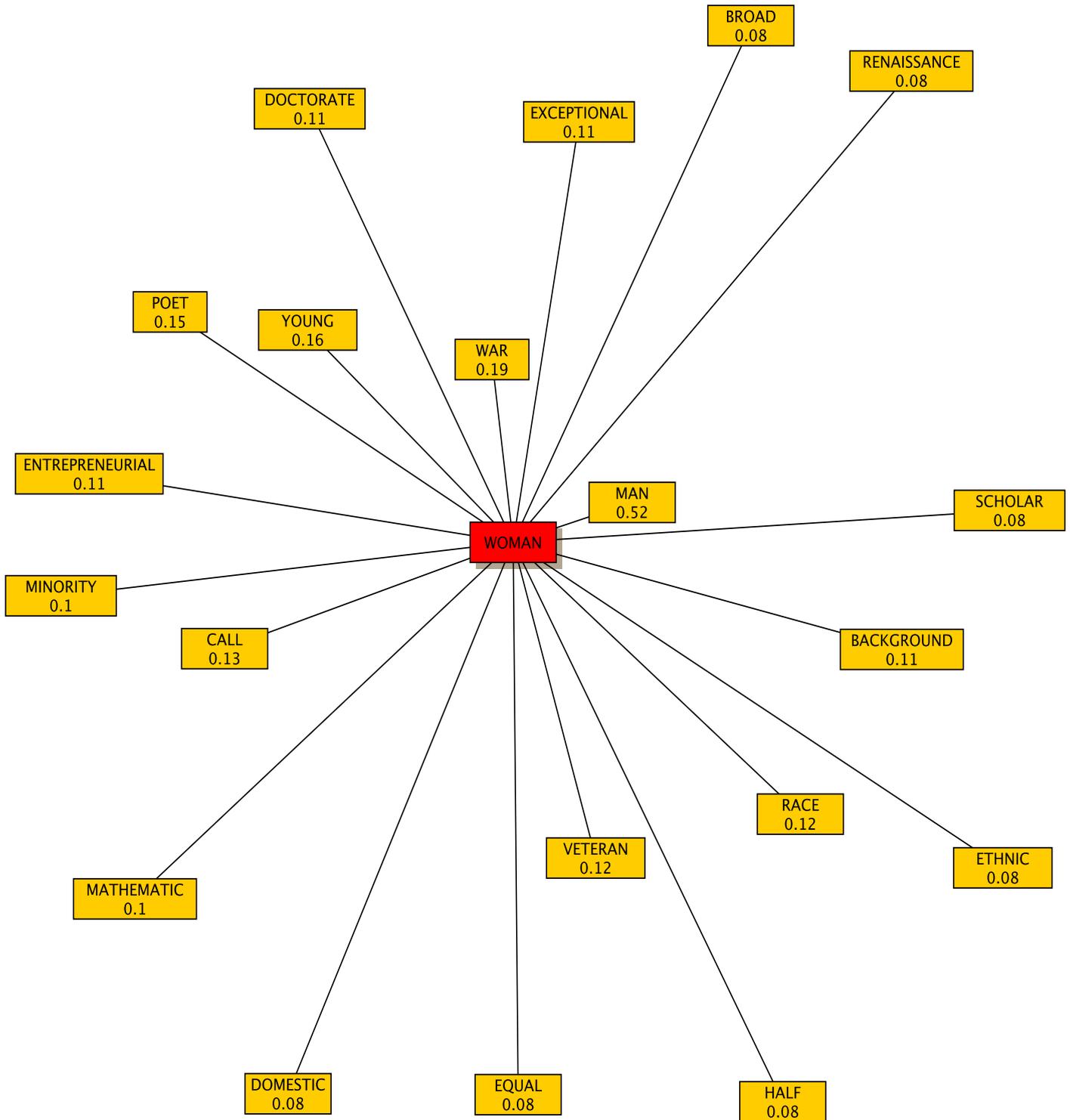


Figure 3b. Associations with Woman, 1999-2004

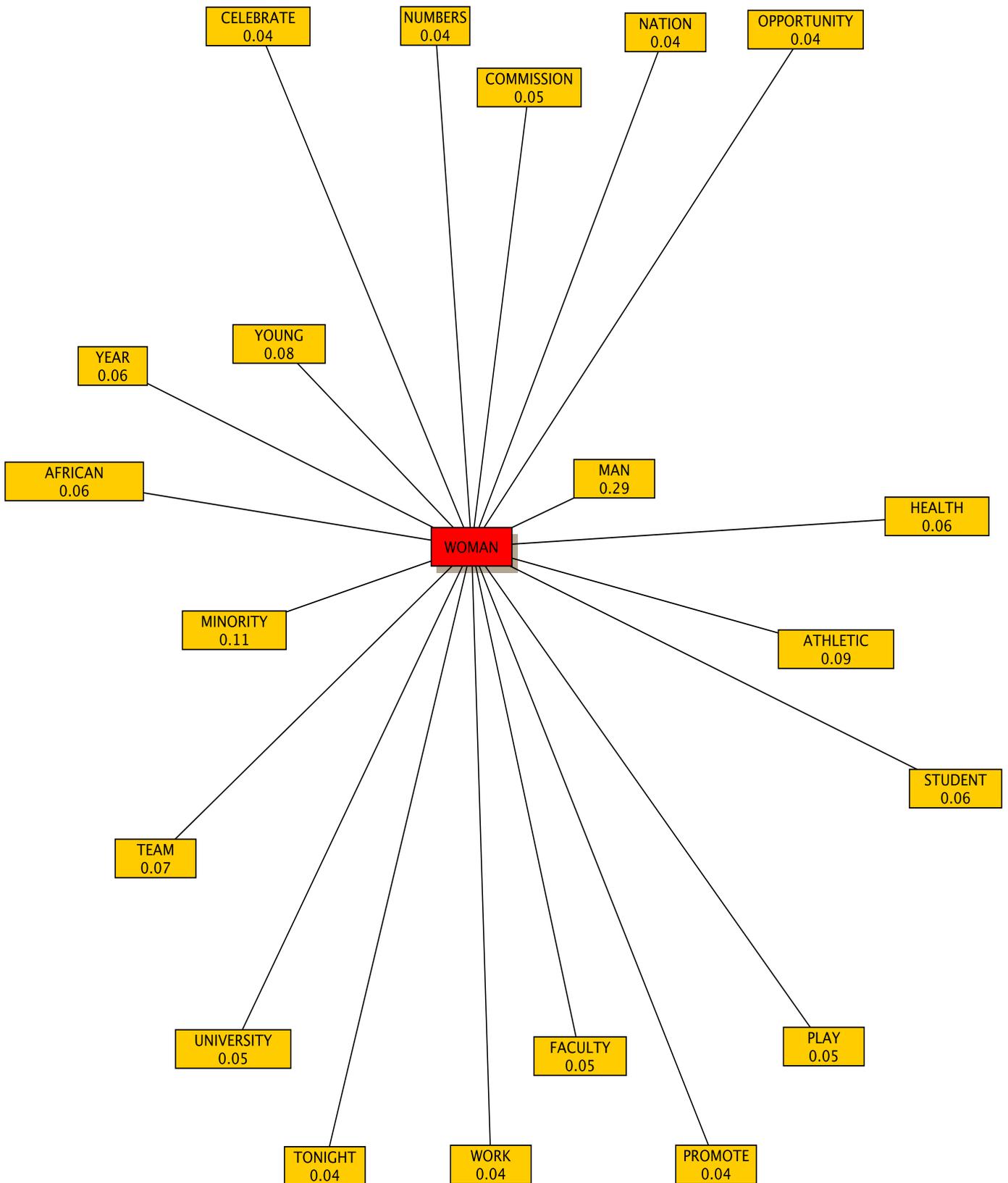
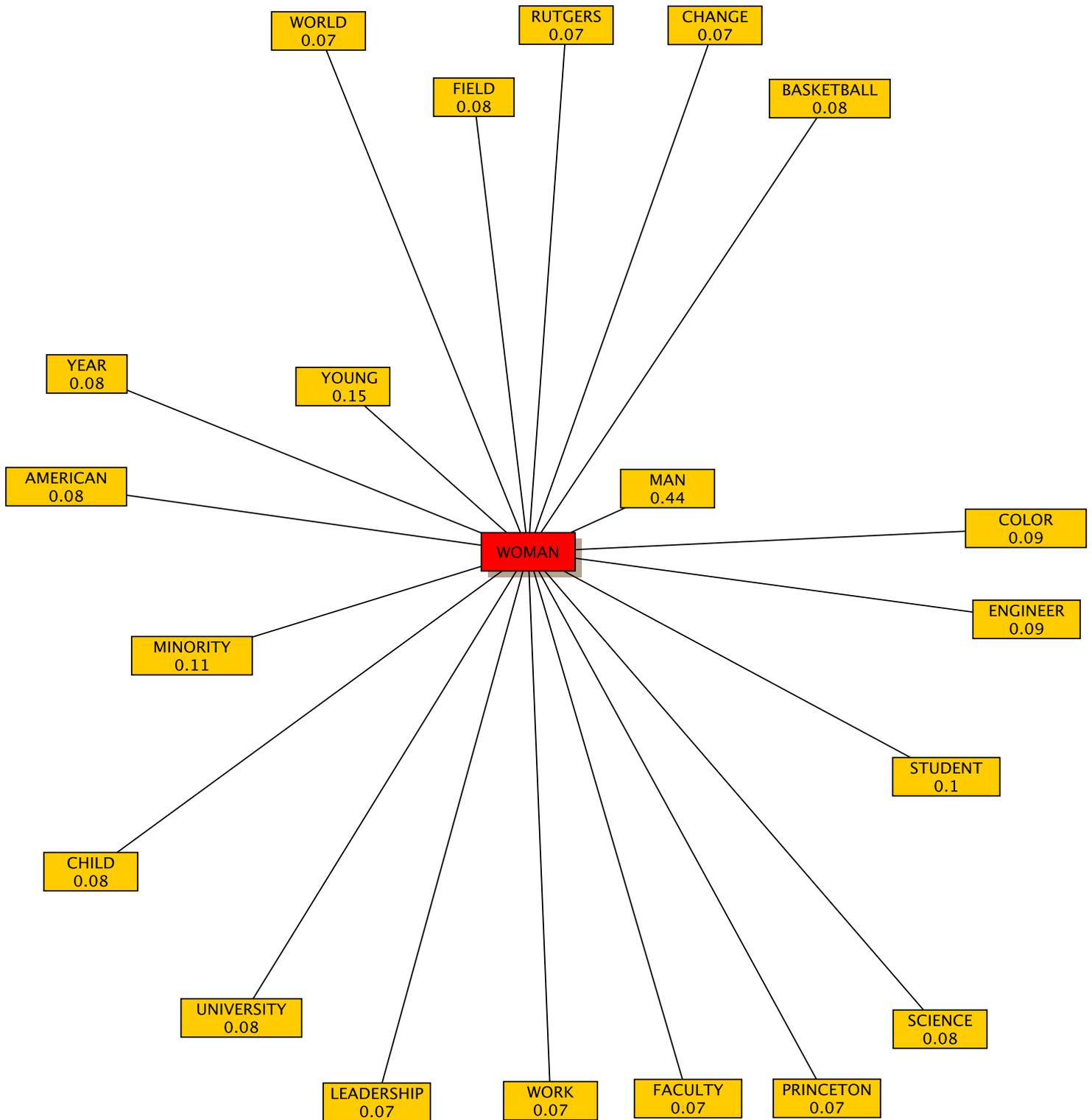


Figure 3c. Associations with Woman, 2005 - 2008



Particularly revealing were strong associations with the term *diversity*, with leaders placing rhetorical emphasis on furthering diversity within the universities. Moreover, as shown in Figure 4c the word *diversity* has strong associations with terms such as *value*, *enhance*, *promote*, *foster*, and *commitment* and these associations also work in reverse. However, while attention to diversity was prominent in university leader speeches, these references did not necessarily

indicate, in direct terms, concern with women, minorities, and faculty or students of color. Rather, in these cases, university leaders were talking not only about diversity in terms of community or identity group demographic profiles, but in more encompassing terms of intellectual diversity as well. Overall, the speeches of university leaders indicated a placement of value on diversity occurring within the broader university and socio-political context.

Figure 4a. Associations with Diversity, 1992 - 1998

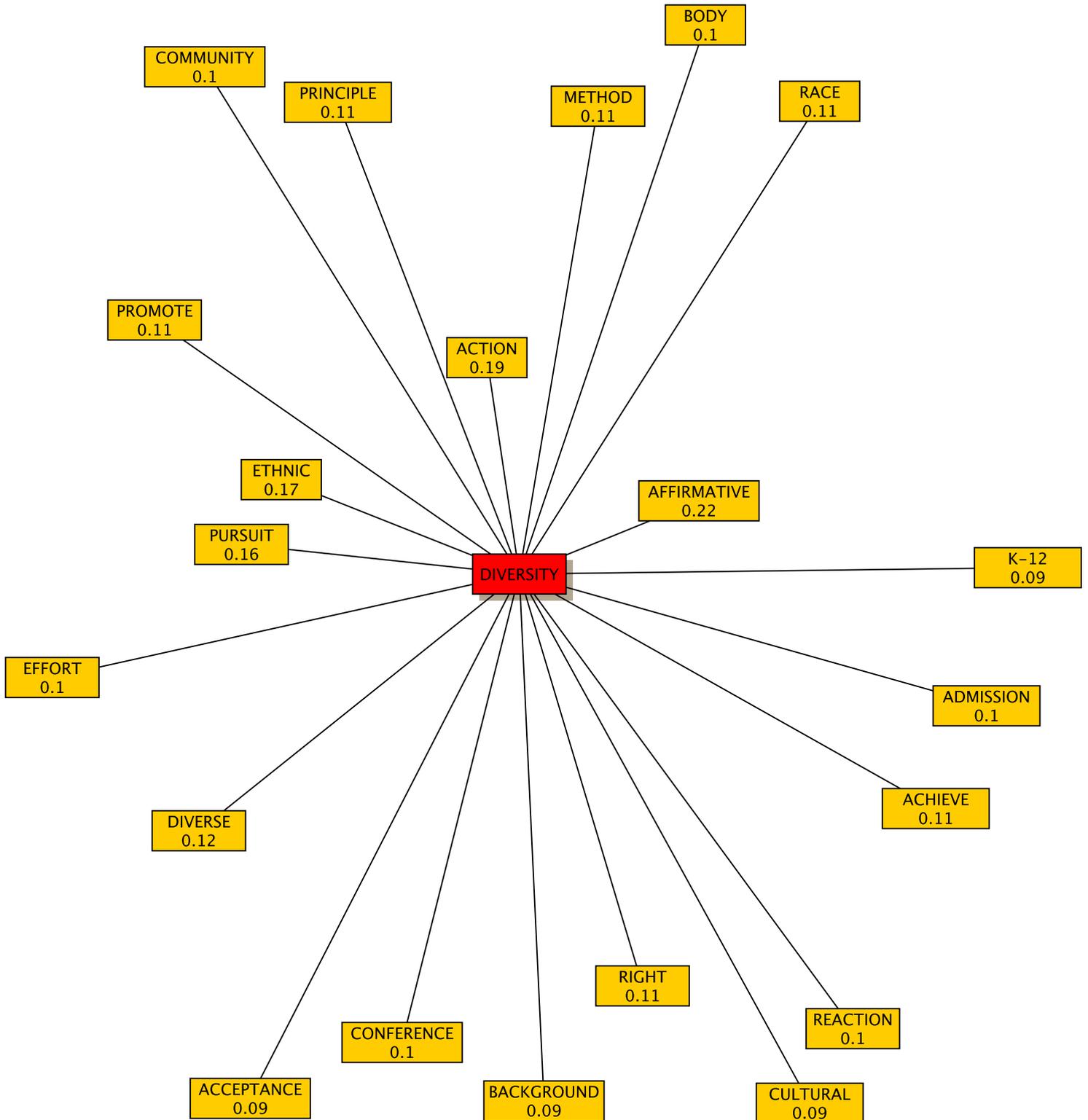


Figure 4b. Associations with Diversity, 1999 - 2004

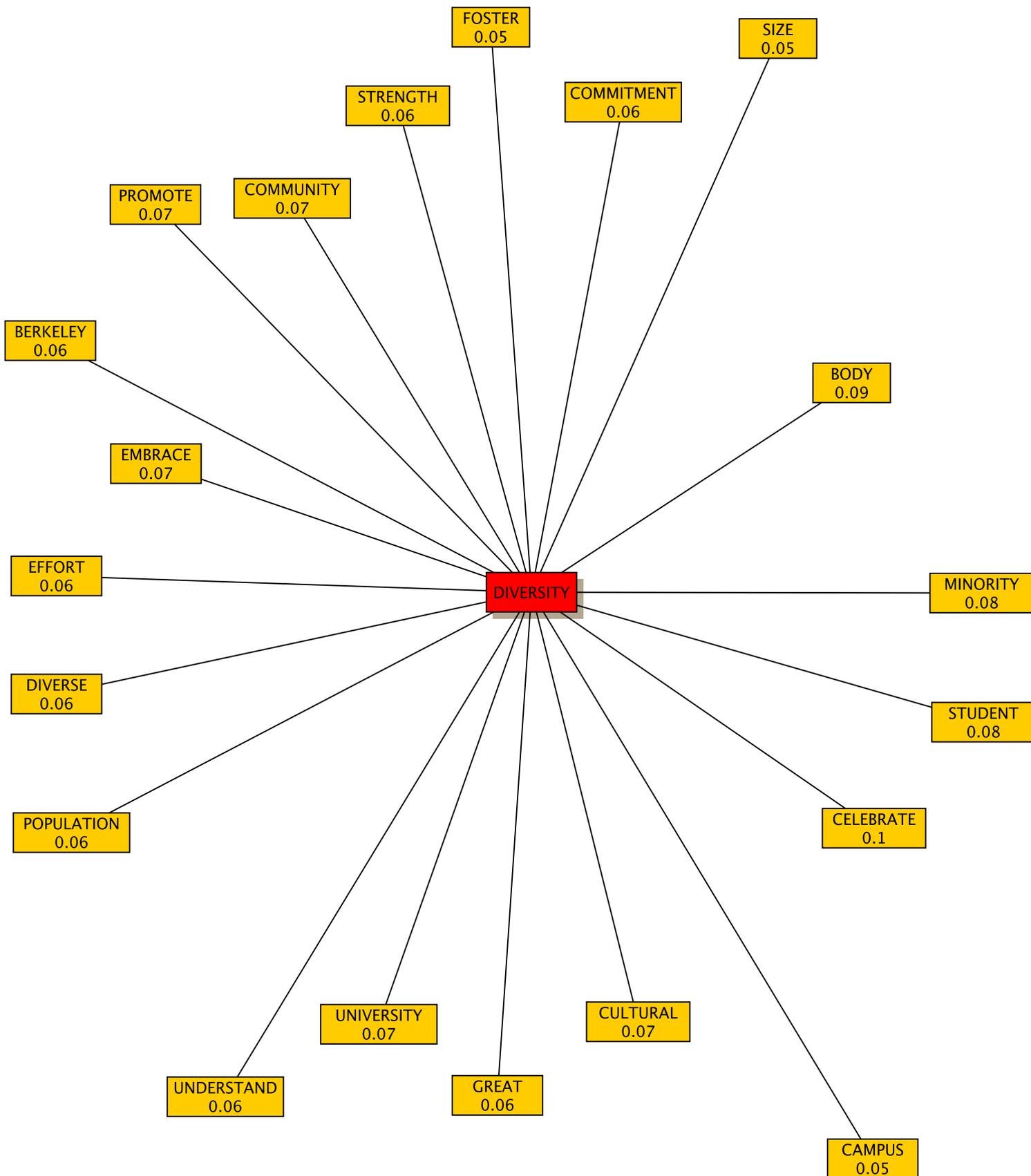
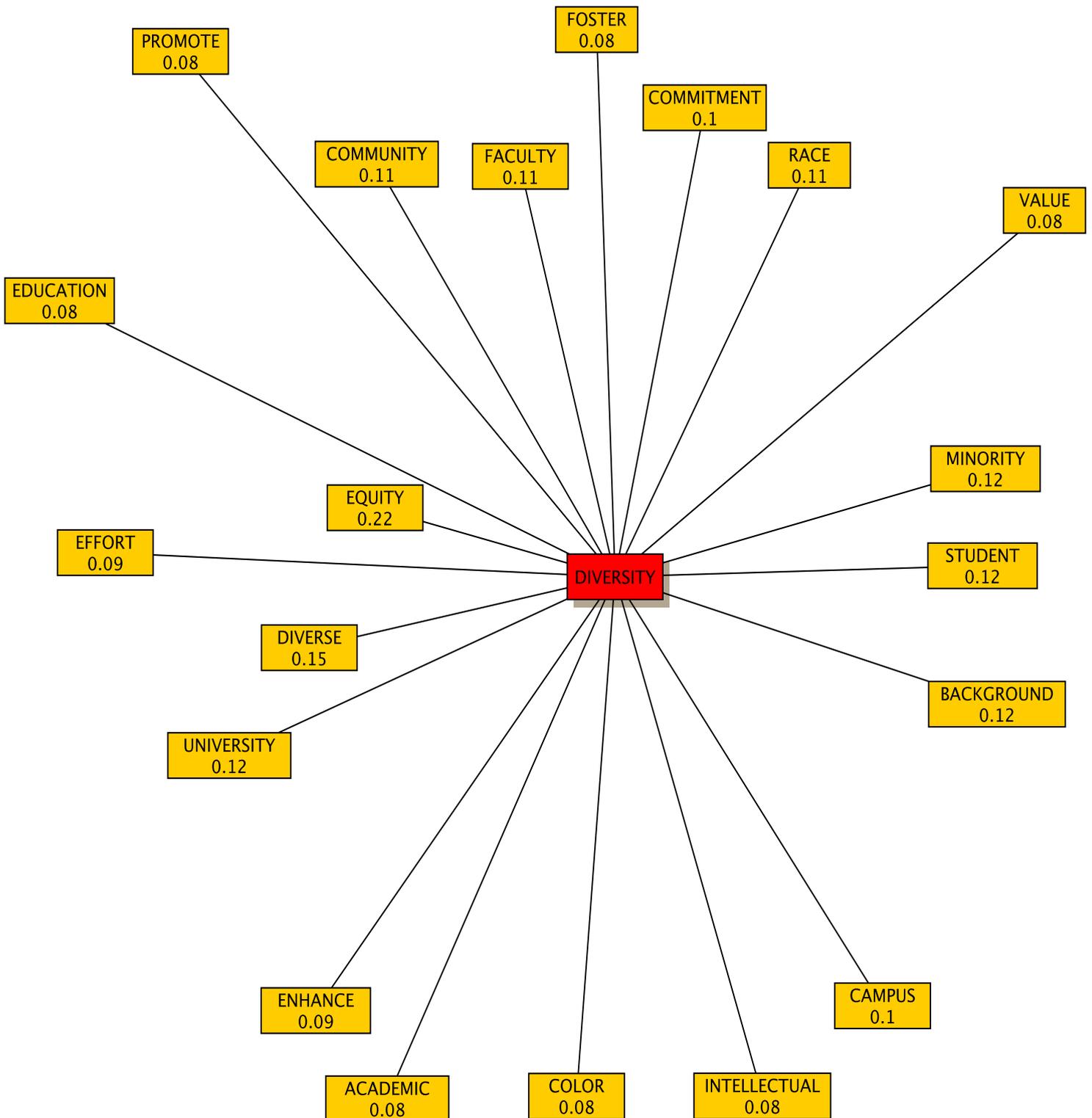


Figure 4c. Associations with Diversity, 2005 - 2008



Shared Associations

While the individual word associations affirmed that university leaders were discussing issues related to science, women, and diversity, they revealed only those terms in relation to those most closely associated with them. To more fully capture whether those keywords were being addressed in conjunction with each other, we also considered their shared associations. The word associations revealed in Figure 3c for *women* suggested a relationship between women and science in the discourse of university leaders, but the absence of a reverse relationship pointed to the need to consider additional issues. For a more detailed examination of this relationship, comparisons between pairs of keywords were conducted. That is, we compared the basic contexts in which selected pairs of keywords were present.

To determine the shared associations between keyword pairs, words were selected that shared a common lexicon and strength of importance, thereby providing a sense of the emphasis that university leaders place on certain issues.¹⁰ For example, the comparison between *woman* and *minority* revealed numerous statistically significant associations at a .05 confidence level. For 2005-2008, *woman* appeared in 703 contexts, while *minority* was only present in 210 contexts. However, the words *diversity*, *student*, *retention*, *university*, *enhance*, and *faculty* all had stronger associations with *minority* than with *woman*. These were all statistically significant at the .05 level. While terms such as *science*, *scientist*, *engineer*, *math*, and *mathematics* all were more strongly associated with *woman* than with *minority*, none were statistically significant. (*Engineer* was the exception, reflecting a stronger association to *minority*, although still lacking statistical significance.) Thus, although university leaders were more apt to speak about science and its associated topics in relation to women, they also were likely to do so in relation to minorities and when discussing 'minority issues'. While some associations were present for the earlier time periods, there was a notable lack of association between either *woman* or *minorities* in relation to *science* and *engineer* for the 1992-1998 period.

Considering shared associations between *diversity* and *science* for 2003-2008, *diversity* appeared in 621 contexts, and *science* appeared in 1,889. As expected, for all time periods terms such as *mathematics*, *engineer*, and *technology* were significantly associated with *science* at the .05 level, while terms such as *commitment*, *minority*, *goal*, and *responsibility* had stronger significant associations with *diversity*. This point arguably supports the idea that university leaders are concerned with diversity, especially given increasingly diverse academic communities. However, the same significant relationship was not found between *diversity* and *science*. Similarly, *woman* also had a stronger significant association with *diversity* than it did with *science*. Relative to shared associations between *woman* and *diversity* for 2005-2008, *woman* appeared in 703 contexts and *diversity* in 621. Terms such as *commitment* and *value* had a significantly stronger association with *diversity* than with *woman* alone, suggesting an overall discussion in the community that 'covers the bases' under the more inclusive rubric. In contrast, note that *science*, *scientific*, *mathematics*, and *medicine* were

significantly more likely to be used in conjunction with *woman*, as we might expect in light of the events placing this relationship in a prominent position on the public agenda. For 1999-2004, terms such as *science* and *mathematics* were more likely to be used in conjunction with *woman* but the relationship was not statistically significant and, for 1992-1998, was largely absent.

Although university leaders might be likely to discuss science in relation to women and minorities with comparable emphasis, their propensity for discussing science in relation to diversity is significantly less. A possible explanation for this might rest on basic definitions and the idea that women and minorities are specifically defined groups within the university community that leaders might be expected to recognize and encourage, while diversity describes a more general state of being. Thus, while the encouragement of diversity in STEM might also be noted, it might not engender the same potential support, either politically or economically, as support explicitly aimed at women and minorities in related fields.

Concordances

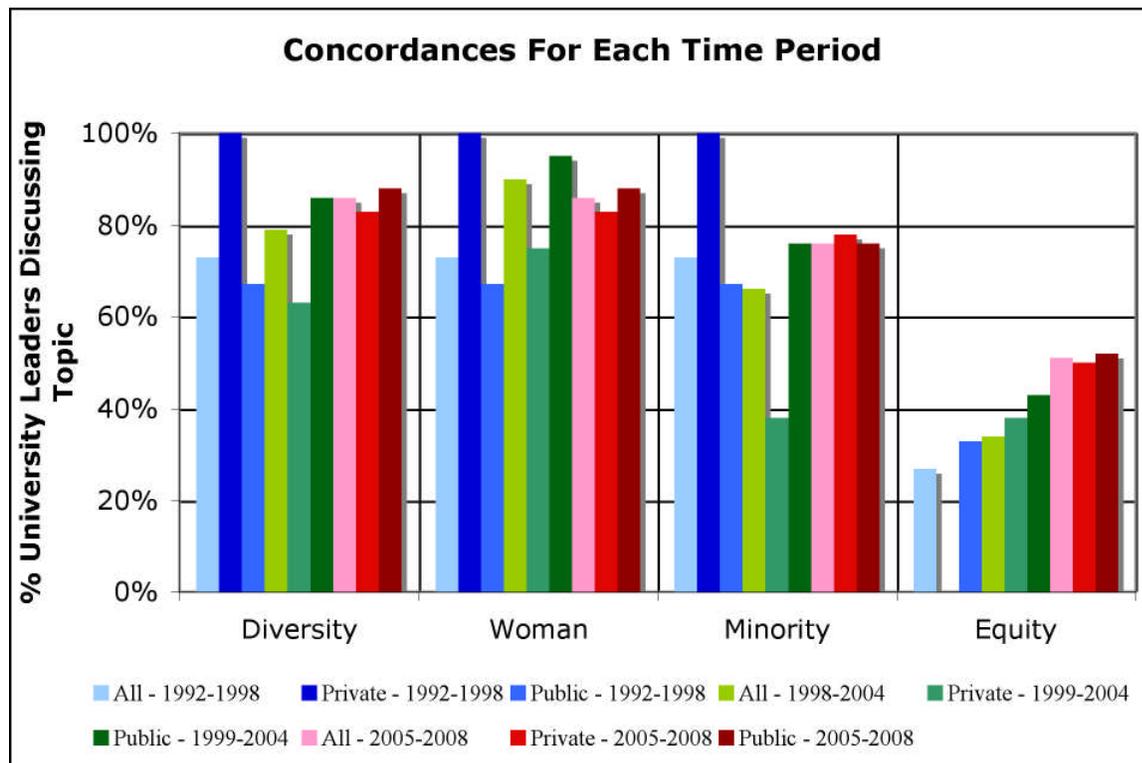
To further facilitate our interpretation of terminological significance within the context of university leader pronouncements, a concordance analysis — consisting of keyword in context searches — was performed on *woman*, *diversity*, *minority*, and *equity*. *Woman* and related words were present in 45 documents in 1992-1998, in 346 in 1999-2004, and in 735 for 2005-2008. *Diversity* was present in 56, 279, and 623, respectively; *minority* in 20, 188, and 217; and *equity* in 9, 39, and 127. Aside from simply understanding the number of documents in which these terms were present which alone raises questions of data availability and thus reliability, this analysis also included a calculation of the percentage of university leaders employing them. For 1992-1998, out of 11 leaders 8 mentioned *woman*, *diversity*, and *minority* (although not necessarily the same 8), and 3 referenced *equity*. For 1999-2004, out of 32 universities, 30 leaders referenced *women*, 27 *diversity*, 20 *minority*, and 12 *equity*. For 2005-2008, out of 51 universities examined, 44 leaders referenced *women*; *diversity* was referenced by 44 leaders; *minority* was mentioned by 39; and 26 indicated *equity*.

As shown in Table 2, for 1992-1998, 73% of university leaders addressed *women*, *diversity*, and *minority* (not necessarily in conjunction with one another) and 27% mentioned *equity*. For 1999-2004, 93% discussed *women*, 84% addressed *diversity*, 63% *minority*, and 38% *equity*. For 2005-2008, almost 90% of all the university leaders mentioned *women* and *diversity* (not necessarily in conjunction with one another), while approximately 75% referenced *minority* and approximately 50% indicated *equity*. Leaders from private universities were slightly less likely to use these terms than those from public institutions for the latter two time periods, with the exception of the word *minority* for 2005-2008, as can be seen in Figure 5. A particularly striking feature of this analysis was the level of similarity with which university leaders on the whole — from both public and private institutions — were discussing these issues.

Table 2. Concordances, Percentage of Leaders Discussing Topics

Period	Universities	N	Diversity	Women	Minority	Equity
1992-1998	All	11	73%	73%	73%	27%
	Private Universities	2	100%	100%	100%	0%
	Public Universities	9	67%	67%	67%	33%
1999-2004	All	29	79%	90%	66%	34%
	Private Universities	8	63%	75%	38%	38%
	Public Universities	21	86%	95%	76%	43%
2005-2008	All	51	86%	86%	76%	51%
	Private Universities	18	83%	83%	78%	50%
	Public Universities	33	88%	88%	76%	52%

Figure 5. Concordances Across Universities by Period



To gain some insight on whether university leaders are discussing these issues in equal measure across the country, we also considered the results by region.¹¹ Figures 6a, 6b, and 6c depict the breakdown of keyword usage by region. For 2005-2008, university leaders in the East North Central area of the Midwest (Ohio, Indiana, Illinois, Michigan, and Wisconsin) were the most consistent in addressing related issues, as can be seen in Figure 6c. Leaders from all of the institutions in this area addressed diversity, women, and minorities in their communications. However, a great deal of variation appears over the three time periods and across some regions in the speeches in regard to the issues in question.

Figure 6a. Concordances Across Universities by Region and University Type, 1992-1998

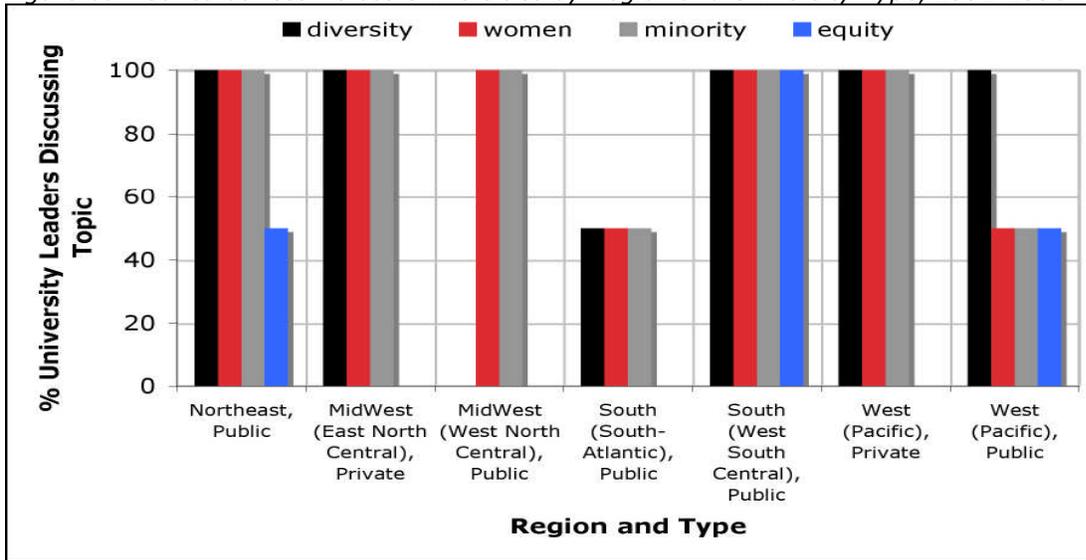


Figure 6b. Concordances Across Universities by Region and University Type, 1999-2004

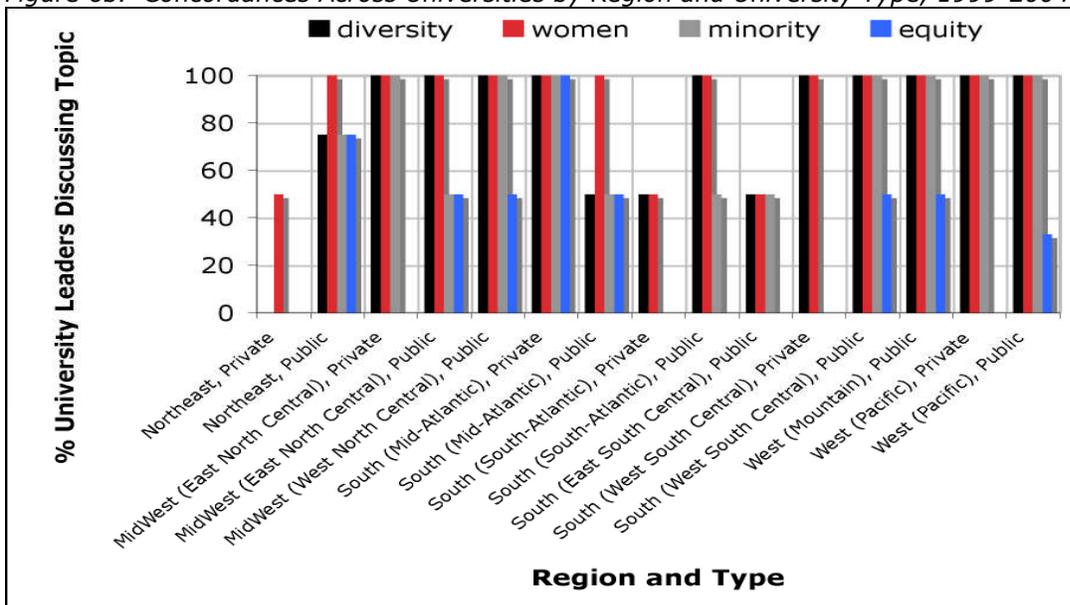
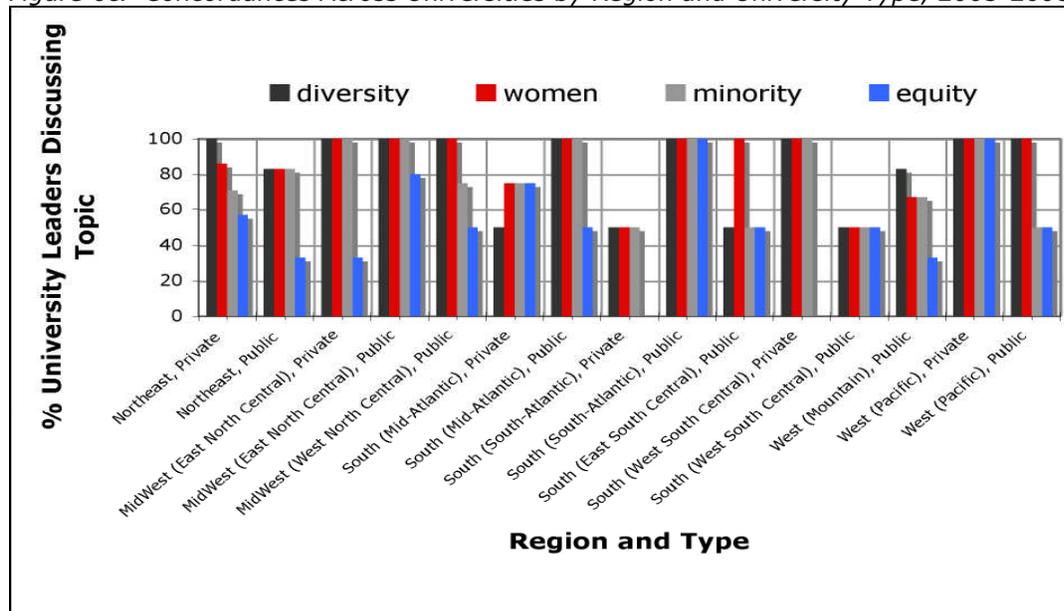


Figure 6c. Concordances Across Universities by Region and University Type, 2005-2008



Looking more closely at these regional differences, further distinctions emerge in the terminological indicators employed by the leaders from public and private institutions. For the 1992-1998 period, all private university leaders employed the terms *diversity*, *minority*, and *woman*, although none mentioned *equity* per se. Private university leaders during the 1999-2004 period were most apt to use the term *woman* and least likely to employ the terms *minority* and *equity*. Leaders from all of the sample public universities in the South-Atlantic and from all of the sample private universities in the West employed all four terms in their communications during the 2005-2008 period. On the whole, it was more common to find all of the public university leaders in a region raising a particular issue than it was to find all the private university leaders doing so. This may be because public institutions are more accountable to the public at large and have to appear responsive to both public and political pressures.¹²

Woman

The term *woman* was used by the university leaders primarily to discuss gender issues applied to women as a group. For instance, statements or claims might be made expressing the need or desirability for women in the professoriate:

We need more *women* on the faculty in many areas, and more faculty of color everywhere. (President McCormick, Rutgers, 2007)

Some tout accomplishments or improvements in the number of female faculty:

From 1981 to today, the percentage of women with tenure at Penn State has more than doubled, reaching 25 percent of all faculty, and the number of female faculty now stands at 35 percent of our faculty ranks. (President Spanier, Pennsylvania State University, 2006)

They might also be applied to specific women (particularly those in positions of power), whether members of the faculty or of the administration. Likewise, *woman* is used contextually here to speak about related disciplinary or programmatic issues such as, for example, women's studies programs:

The field of *women's* studies is an essential component of any large research university. (President Machen, University of Florida, 2006)

Communication documents also contained references to women's clubs, archives, committees, and resources, to name a few. Instances of *women* also were often paired with *minority*. References too were made to the history of women as a group, as well as to specific women in history. Moreover, we might also note the fairly significant number of instances where *women* were mentioned in conjunction with athletics.¹³ Statements about athletics in relation to women were particularly prevalent over the 1999-2004 period. For both 1992-1998 and 1999-2004, but especially the former, *woman* was commonly used to denote issues related to gender and equality.

It is not surprising to find university leaders discussing women in a myriad of ways given that they have become a prominent part of the university community in ever-growing numbers and capacities. Furthermore, it is particularly important to note that women are commonly appearing as an identity group in relation to discussions of equity, presence, and importance. Another common theme that is striking is that of women relative to athletics, emphasizing the possible influence of specific policies on the university environment and the role of leaders in noting their organization's respective achievements¹⁴.

Diversity

As was also obvious in the rhetorical utterances of the university leaders, the term *diversity* has held a prominent place in public dialogue on education today. Diversity was not only invoked as a way to describe the campus community and intellectual environment, it also was regularly promoted and assigned value with commitments and statements about the future of diversity in the academic context. Thus, for example, a typical kind of statement might tout excellence in diversity and related goals:

Our campuses continued to show more diversity. We welcomed 3,193 students of color, second largest on record. We also have record high numbers of minority and women faculty. We have increased minority faculty by 54 percent over the last 10 years and increased women faculty by 33 percent. (President Hemenway, University of Kansas, 2008)

Diversity was also used in relation to job and committee titles, as well as commonly appearing in conjunction with the terms *equity* and *inclusion*. *Diversity* also was used in reference to institutional variety, such as the '*diversity* of the

American higher education system'. Moreover, some statements used references to diversity as broader societal comments:

In the year 2000, the full-time instructional, research, and public service faculty number 1,838. Of those, a number somewhat below 30% of the total are women. The diversity of the faculty does not in any measurable way match the diversity of the student body; 88% of our faculty are Caucasian Americans and we differ as a faculty from the students we teach in many ways, but one is in that sort of basic assessment of what we are as a human community. (President Casteen, University of Virginia, 2000)

Diversity almost always carried a positive connotation in the communication documents, which is not surprising given its role in current public dialogue.

Minority

University leaders regularly referred to *minorities*, *minority groups*, and *underrepresented minorities*, as in the following statement:

It is increasingly important that we reach out to under served and under represented students. By 2020, more than 40 percent of college-age students will be of African, Hispanic, Asian, or other non-European descent. Currently African Americans, Hispanics, and other ethnic racial minorities account for only 6 percent of the science and engineering workforce — a figure far below their demographic presence. (President Brody, Johns Hopkins University, 2005)

The term *minority* was most commonly used as a demographic referent describing a segment of the university population whether in relation to the faculty, the students, or the university population as a whole:

For this reason, the Board of Trustees last year endorsed a goal of doubling the enrollment of underrepresented minorities on the Bloomington campus by 2013-2014. (President Herbert, Indiana University, 2007)

Minority was also joined to *women* in numerous instances, as illustrated here:

Purdue has a significant opportunity to address what has been called the Quiet Crisis, the dearth of women and *minorities* entering science and engineering, as students and as professors. (President Cordova, Purdue University, 2007)

Minority was also often used in reference to enrollments and expected changes in study body profiles. Less common were mentions of *minority* as part of a job title or committee or office name, *minority* used in conjunction with the poor or disadvantaged, and, more generally, *minority* in reference to being in the minority. As with women, it has become increasingly important for university

leaders to show cognizance of equity issues in relation to the presence of ethnic and minority groups on their campuses.

Equity

The term *equity* appeared in several different contexts over the three periods. Identified as an especially pressing issue in gender comparisons, equity was invoked as a matter of course relative to faculty salaries, as in the following statement:

Inequities between the salaries of men and women in academia have been well and widely documented. (Chancellor Bishop, University of California, San Francisco, 2003)

However, it was not necessarily presented as a straightforward issue:

We will continue to aggressively review the *equity* of faculty salaries; however, smaller changes in the salary differences are expected until we are successful at increasing the representation of women faculty across all our disciplines, especially fields with higher market-based salaries. (President Brown, Boston University, 2006)

Along the same lines, *equity* was also commonly paired with *inclusion*, pointing to diversity in terms of experiences, backgrounds, and perspectives:

One of the things that I'd like to emphasize is that *equity* and inclusion are about more than just numbers. (Chancellor Birgeneau, University of California, Berkeley, 2006)

Equity was also commonly used to refer to committee, council, or office titles. In this context, it was usually paired with *diversity*, *community*, or *inclusion*. *Equity*, in relation to campus groups, whether faculty or student, has become an increasingly prevalent issue on institutional agenda in the last decade. However, university leaders appear to be exceptionally cautious when articulating related information and often do so only when they have a particularly positive change to highlight. This potentially explains the large disparity between the number of leaders addressing *woman* and *diversity* versus those discussing *equity* per se.

Specificity

After noting the differences in the percentage of leaders conveying information on issues by region and type (see Figures 6a, 6b, and 6c), we conducted terminological and textual comparisons of communications emanating from leaders of private universities with those originating in public universities for the most recent time period (2005-2008), based on its critical timing and greater data availability, to determine whether these differences were statistically significant — as, in fact, were revealed in the results.

The private university leaders were significantly more likely to engage words linked to *woman* than their public counterparts, which might, in turn, suggest that they were more likely to address issues related specifically to women in general. They also use the terms *science*, *scientists*, and *mathematics* with significantly greater frequency. In contrast, public university leaders are significantly more apt to use the terms *diverse*, *diversity*, and *equity*, as well as *sexual orientation*, *Hispanic*, *Mexican*, *African American*, and *demographics*. In general, the private university leaders were linked more to the use of terms pertaining to *woman*, while the statements of the public university leaders explored in the study more often reflected terms related to *diversity* and *demographics*. However, much of this may reflect simple terminological choice, more than issue relevance. Thus, for example, usage of the word *minority* does not actually differ significantly between the private and public university leaders. Interestingly, while we make no related value judgment or value-framed interpretation here, the speeches of private university leaders tended to include more *science* related terms than the public university leader speeches, which were more likely to reference *technology*.

The divergent placement of emphasis by public and private university leaders is somewhat interesting. Perhaps public universities are combining women within the category of diversity, thus explaining the disparity in discussion. The emphasis on diversity in public universities is not that surprising given the need for public universities to respond to legislative directives against discrimination and to address issues on the general public agenda. Why private university leaders appear to address women and science with greater frequency might have to do with their connections to funding opportunities or alumni interests. In any case, across the entire 1992-2008 period of the speech events examined here, there was a statistically significant increase in the frequency of terminological references made by university leaders as a whole to *women* and *science*, and there also was a greater reference to *diversity* in general. However, there was no significant difference in the number of iterations of the words *equity* and *minority*. This result might suggest that university leaders are hesitant to publicly address certain politically charged issues until they are certain that they have external support from various stakeholders and parties of influence, such as alumni, business groups, and policy makers. However, lack of discussion does not necessarily mean an absence of action on the part of the organization, and a deeper investigation into the sequencing of events on campuses might provide a better understanding of related observations.

CONCLUSION

Speeches and other such public pronouncements are cultural symbols of the institutions that produced them. Consequently, they tend to be thematically, structurally, and lexically formulaic. Universities are no exception in this regard. Our findings indicate that university leaders address issues of gender relative to STEM issues only in conjunction with other topics, which raises questions regarding their position on gender equality as a separate topic in its own right. This attitude is, of course, subtly re-enforced by the hortative nature of the speech events, with their emphasis, both implicitly and explicitly, on *ought* and

should general statements. Our primary aim has been to explore whether and how university leaders have raised issues of gender and diversity in their public pronouncements, especially in relation to the STEM fields and related equity issues. However, as a topic, the term is constrained by epistemic contexts, as indicated by word associations of *women* with terms such as *science* and *engineer*, by institutional contexts denoted, for example, by terminological association with *faculty*, and by more general social contexts indicated by such terms as, for example, *diversity* and *minority*. Indeed, the analysis indicated that *diversity* functions as an important contextual marker (with less importance placed on its denotative contents) in university leader pronouncements, linking them to public discourse on issues that affect society as a whole. Thus, we find terms such as *diversity* linked to terms as exclusive as *intellectual* and as inclusive as *community*.

The work presented here, which expands upon previous research, is meant to be a stimulus for thinking about institutional agenda relative to broader gender relations in terms of STEM disciplinary and workforce issues. We saw that public pronouncements by leaders reflect narratives that tie institutional positions to policy objectives, drawing upon particular legitimizing discourses as both internal and external strategies. Our analysis demonstrates that topics of gender equality and equity increasingly appear in the speeches of university leaders in reference to matters of societal concern associated with various issues of fairness and justice. However, discussions of these topics are usually constrained by clearly defined institutional and epistemic contexts. Issues of gender equality and equity find their way into the discourse of university leaders, represented in their public representations of their universities or of their institutional commitments or goals. For example, the analysis suggests that the term *woman*, as a metonymy for gender equity, is an important topic in the university. Accordingly, our analysis paints an interesting picture of the level of importance university leaders place on women as a defined category, especially in relation to STEM fields. Also, it is obvious that diversity is an important item on the institutional agenda, as espoused in the rhetoric of university leaders. Note too that such issues regarding institutional conditions and questions of gender diversity and, in particular, women in the STEM workforce have become increasingly important around the world. In both developing and developed countries and in various international organizations, related topics are prominent in policy discussions. Thus, more comparative research across national and institutional contexts is needed to advance our knowledge and inform related concerns, especially as regards social and economic progress.

In the end, this research points to the need for further study in order to gain a fuller understanding of how and the extent to which university leaders perceive the importance of women and diversity in STEM fields. Empirical issues, such as increased sample size, expanded time periods, and more detailed university characteristics would allow for finer grained and more focused analyses into the nature of differences and similarities in the rhetoric of different institutions under different conditions. Moreover, while the nature of the data limited this analysis

to period snapshots, true longitudinal data (in terms of the timing of speech events and universities) and related analyses would provide a more in-depth and comparative understanding of societal trends and institutional agenda setting as captured in discursive patterns referencing women, STEM, and equity issues. Another fruitful avenue for consideration is the delineation of the policy implications of the topics addressed in the university leader statements. Speeches and other public pronouncements are symbolic of the institutions and leaders that produce them. Therefore, it would be useful to analyze whether they are signifiers of measurable institutional changes or whether their contents signify no more than an institutional decoupling between speech acts and university policies.

In general, questions remain to be answered about concrete institutional commitments and responses relative to its achievement. Furthermore, in addition to the relatively short time period covered here, the data is limited in its necessary reliance on those documents that universities *choose* to publish for public consumption. Yet, even so, the findings indicate the public face and position of the university embodied in its leaders, which also suggests strategic policy directions and public accountability.

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ENDNOTES

¹ E.g., see Rossiter, 1982, 1995; Rayman and Brett, 1993; Long, 2001; NSF, 2004; Mason and Goulden, 2002; Ginther, 2001, 2006.

² Stanford University, California Institute of Technology, University of Pennsylvania, University of Michigan, Princeton University, Yale University, Harvard University, University of California at Berkeley, MIT.

³ Since 2001, NSF has given awards to 37 institutions of higher learning to develop transformation projects (<http://www.nsf.gov/crssprgm/advance/itwebsites.jsp>).

⁴ In actuality, despite representing these goals as their own and attributing them to their colleges and universities, academic leaders must express many ideas and make statements on a plethora of issues to which they might have varying degrees of belief and commitment (Cohen and March, 1974).

⁵ Also, data were more readily attainable from some universities than from others and was not always available by type of address for all years within a given time period, limiting their suitability for panel data analysis. Thus, framing our analysis in terms of period snapshots filled practical as well as theoretical requirements.

⁶ Sometimes referred to as 'ownership status', U.S. public universities are largely state-supported, i.e., supported by one of the 50 individual states (not the federal government). U.S. private universities arguably enjoy greater financial flexibility and 'do not depend on state legislatures for funding, but draw their resources from alumni, philanthropic foundations, and scientific and other professional organizations' (Wagner, 2005, p. 6). Note that, in actuality, there is a great deal of overlap in sources of support across the two types.

⁷ We employed T-Lab Pro 6.0 textual analysis software to perform the analysis (<http://www.tlab.it>).

⁸ T-Lab determines the threshold value choice using an algorithm based on low frequency range detection relative to the corpus size.

⁹ The radial diagrams are presented in graphML format in order to show the structural properties of the graph.

¹⁰ However, if the words are too close — e.g., diversity and equity — statistical significance would be confounded in most associations.

¹¹ See Appendix for table indicating the U.S. regional distribution of universities for which communication documents were collected.

¹² However, we must note that some variation also may be due to the different proportions of public and private universities within the sample.

¹³ With a nod to Title IX legislation prohibiting gender bias.

¹⁴ Again we see such references particularly in recognition of Title IX requirements prohibiting gender bias (Pieronek, 2005).

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APPENDIX

Regional distribution of U.S. universities for which study communication documents were collected.

U.S. Region*	Universities								
	Public			Private			Total		
	1992-1998	1999-2004	2005-2008	1992-1998	1999-2004	2005-2008	1992-1998	1999-2004	2005-2008
<i>Northeast:</i> Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania	2	4	6		2	7	2	6	13
<i>Midwest</i>	1	4	9	1	1	3	2	5	12
<i>East North Central:</i> Ohio, Indiana, Illinois, Michigan, Wisconsin		2	5	1	1	3	1	3	8
<i>West North Central:</i> Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas	1	2	4				1	2	4
<i>South</i>	4	8	8		4	7	4	12	15
<i>Mid-Atlantic:</i> Delaware, Maryland, Washington-District of Columbia, Northern Virginia, West Virginia	1	2	2		1	4	1	3	6
<i>South Atlantic:</i> Virginia (not including Northern VA), North Carolina, South Carolina, Georgia, Florida	2	2	2		2	2	2	4	4
<i>East South Central:</i> Kentucky, Tennessee, Alabama, Mississippi		2	2					2	2
<i>West South Central:</i> Arkansas, Louisiana, Oklahoma, Texas	1	2	2		1	1	1	3	3
<i>West</i>	2	5	10	1	1	1	3	6	11
<i>Mountain:</i> Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada		2	6					2	6
<i>Pacific:</i> Washington, Oregon, California, Alaska, Hawaii	2	3	4	1	1	1	3	4	5
All	9	20	33	2	9	18	11	29	51

*Based on the U.S. Census Bureau Coding System for Regions and Divisions