DISCIPLINARY, INSTITUTIONAL, AND INDIVIDUAL FACTORS INFLUENCING FACULTY TEACHING AND RESEARCH PRODUCTIVITY

by

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(Under the Direction of James C. Hearn)

ABSTRACT

The problem to be addressed by this study consists of interrelated questions: (1) How can faculty productivity of research and instruction be measured? (2) What individual and institutional attributes influence the faculty productivity? (3) What is the relative contribution of individual, disciplinary, and institutional variables to the faculty productivity? (4) What is the disciplinary classification to account for the difference in the faculty productivity? To investigate the first research question, exploratory factor analysis to create factor scores regarding faculty productivity of research and teaching was employed. To explore the second and third research questions, HLM analysis was employed. The HLM analysis used the two factor scores of publication and student-centered teaching as the dependent variables and additional variables as explanatory variables. Finally, a cluster analysis to classify twenty disciplinary fields was employed to answer the last question. The data from the 2004 National Survey of Postsecondary Faculty were used for this study.

This study used two sets of variables regarding faculty outcomes of teaching and research. The first set of outcome variables focused on research, and consisted of seven question items on recent publication activity of an individual faculty member. The second outcome variables focused on teaching, and consisted of ten items on teaching and evaluation methods that an individual faculty member has used for an undergraduate class. HLM analyses suggested that

faculty outcomes of publication and teaching were simultaneously affected by institutional type, disciplinary fields, and employment conditions. As HLM analyses indicated that there were significant differences in faculty work among most of the disciplinary fields, the twenty disciplinary fields were classified into a small number of groups based on the two factor scores of publication and teaching that varied significantly across disciplinary fields. Four clusters were selected by using K-mean cluster analysis. The clustering result illustrates similarity and dissimilarity of faculty work across disciplinary fields. As the clustering analysis is based on measures of faculty research and teaching behaviors, it provides a new clustering result different from Biglan's (1973a) classification and Becker's (1994) disciplinary grouping that were based on faculty perception survey.

INDEX WORDS: faculty productivity, 2004 National Survey of Postsecondary Faculty, Biglan's classification

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A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2010

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December 2010

Acknowledgements

I would like to my deep thanks to my mentors, Drs. Libby V. Morris and Seock-Ho Kim for their special help which made possible the beginning of the my learning in the Institute of Higher Education and the College of Education at the University of Georgia. I offer my sincerest gratitude to Dr. Karen Webber, who has inspired and nurtured my dissertation study through co-working opportunity with her. I am most indebted to Dr. James C. Hearn. Without his wisdom, guidance, encouragement, and support, this dissertation would not have been possible. Appreciation is extended to Austin Lacy and Jaynefrances W.Nabawanuka who had effectively aided in my dissertation proofreading.

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Chapter 1

Introduction

American higher education institutions are continually pressured to become more productive. Increasing constraints of financial sources have provoked public interest in higher education productivity (Middaugh, 2000). Nationwide concerns about clarifying faculty work and assessing faculty productivity have been greater than before (Banta, 2002; Kreber, 2002). Due to the labor-intensive nature of higher education (Daigneau, 2001), faculty productivity is recognized as a primary topic ahead of student learning productivity and administrative productivity. The public concern about faculty productivity of research and teaching is related to accountability issues within higher education. In order to improve faculty productivity, it is necessary to know about faculty work, careers, and what conditions affect their scholarly work. Though general research on faculty work has assumed more similarities than differences among faculty members, it is important to take into account the multiplicity of faculty work and the diversity of the American higher education system for a more in-depth study on faculty productivity.

For example, when exploring the multiplicity of faculty work, Boyer (1990) identified four elements of faculty scholarly work, namely: discovery, integration, application, and teaching of knowledge. He argued that all four areas of scholarship should be appropriately rewarded. Although Boyer's conceptualization has not displaced the traditional model that consists of teaching, research, and service, it is nevertheless useful for understanding the multivariate nature built in the concept of faculty productivity. Most debates on faculty productivity focus on research and teaching activities. By focusing on the relationship between the two activities, Bok (1992) emphasized that higher education institutions need to gain a better

balance between teaching and research in order to recover public trust. Empirical research on the special relationships between the multiple products of faculty work can help policy makers redefine faculty roles and assess productivity.

Understanding the diversity of the faculty population is also critical for higher education policy making and research (Hearn & Anderson, 1998). Faculty diversity originates from three levels, diversity in higher education institutions, diversity across academic disciplines, and diversity among individual faculty members. Each institution is fairly different from the others in terms of institutional characteristics such as history, mission, discipline groups, organizational structures, student body, and financial sources. The faculty population is segmented according to not only type of institution, but also culture differences among the discipline groupings. Faculty members perform their work in a matrix place where institutional policies and discipline cultures are overlapped (Alpert, 1989). The scholarly activity and working conditions of faculty members considerably vary across disciplines (Becher, 1989). It is also necessary to consider the diversity of faculty members in terms of individual characteristics such as gender, academic rank, and experience. What conditions affect productivity of an individual faculty member? Who is more productive than others? These questions are related to the investigation on the diversity of faculty population and their workplace. There is insufficient analysis to differentiate faculty productivity patterns across discipline groupings or among institutional types. Additionally, the differing relationships between multiple scholarly outcomes have not been analyzed.

Statement of the Problem

The problem on which this study focuses directly originates from the above statements. Focusing on environmental determinants of faculty productivity, this study ascertains the degree to which individual faculty productivity of teaching and research is influenced by the characteristics of the employing institution and a disciplinary domain to which each belong. The

problem to be addressed by this study consists of interrelated questions: What is the measure for faculty productivity of research and instruction? What individual, disciplinary, and institutional attributes influence the faculty productivity? If the attributes' influences are significant, what is the relative contribution of individual, disciplinary, and institutional attributes to the faculty productivity? If the faculty productivity is varying substantially across disciplinary fields, what is the disciplinary classification to account for the difference in the faculty productivity? The data from the 2004 National Survey of Postsecondary Faculty (NSOPF: 04) provides an opportunity to explore these questions and expand our understanding of faculty scholarly practices. The goal of this study is to address to what extent variance in faculty productivity occurs at the individual, disciplinary, and institutional level by using multilevel and multivariate statistical techniques.

Significance of the Study

By better understanding of how institutional and disciplinary work contexts influence faculty work activities, faculty members and institutional leaders can better manage the contexts to accomplish the main two purposes of higher education, research and teaching. Identifying specific variables that affect faculty productivity can be helpful for designing institutional policy to promote research productivity and facilitate staff development. The empirical research on the relationship between faculty productivity and university characteristics may help academic administrators predict potential faculty productivity. Information on the relationship will enable higher education researchers to further explore a typology system of American higher education institutions in terms of faculty productivity. The results of this study will also enrich the selection of institutional peers by providing institutional research officers with practical information on the components of institutional characteristics that are associated with faculty productivity.

This study will build upon the research led by Blackburn and Lawrence (1995). Blackburn and Lawrence noted that the NSOPF data may provide further understanding of the

individual characteristics and environmental conditions that influence faculty scholarly activities. This study will also update the research literature on the diversity and differences among faculty members in terms of their productivity by using the most recent data from NSOPF: 04. Analysis of the comprehensive and national dataset of NSOPF: 04 presents significant opportunities to explore faculty scholarly practice across all disciplines and institutional types (Webber & Lee, 2009).

The modeling of this study that distinguishes the individual and environmental influences on faculty productivity provides a schema to capture the differences in undergraduate instruction across disciplines and institutional types. The hierarchical linear modeling (HLM) technique is useful to partition simultaneous influences of individual and environmental variables related to faculty productivity. Additionally, little is known about the multiplicity of faculty product which this study also focuses on. In addition, the study will employ multivariate statistical methods such as factor analysis and cluster analysis to explore the properties of the multiplicity of faculty work.

Many studies on faculty differentiation have focused on effect of disciplinary culture because disciplinary affiliations are considered as important as the institutions that employ faculty. Understanding of the varying disciplinary cultures is critical to institutional policy making. Several classifications of academic discipline fields have been used for the understanding of disciplinary differences. Multivariate and multilevel modeling methods in this study make it possible to examine the traditional classification systems.

Chapter 2

Literature Review

Three lines of prior research contribute to the analysis: conceptions of faculty productivity, theoretical frameworks for examining faculty work, and classification methods to differentiate academic disciplines in higher education research.

Faculty Productivity

Productivity is a complex issue in higher education. Considering that many legislators view higher education as unproductive and unaccountable (Meyer, 1998), an analysis of the factors that affect faculty scholarly productivity can provide valuable information to higher education leaders who are increasingly pressured to focus on maximizing productivity. The concept of productivity in higher education is hard to define because of the difficulty in defining outputs of the colleges and universities (Webber, 2010). Firstly, literature on measuring faculty performance in the traditional roles of research and teaching is reviewed.

In his synthesis of the faculty research productivity literature in higher education, Creswell (1985) found that the three most frequent measures of faculty research performance were publication counts, citation counts, and peer and colleague ratings. According to Creswell, each of these performance measures addresses a different dimension of faculty research productivity. While publications counts measure the quantity of an individual's research output, citations assess the quality of the publications and peer or colleague ratings measure the contributions to the discipline. Faculty publication counts can either be straight counts or weighted counts (Collins, 1993). Weights can be based upon the reputation of a particular journal, number of coauthors, authorship position, type of publication, the kind of peer review process, or combinations of these approaches (Print & Hattie, 1997). Cole and Zuckerman (1984) found a highly inter-correlated relationship between publication counts, citation counts, and peer or colleague ratings. There are other ways which have been used to measure scholarly productivity, such as research grants obtained, appointments to editorial boards, and the development of

patents, improved processes, new products, or new analytic methods (Seldin, 1984; Centra, 1983).

Teaching productivity is more difficult to define than research productivity because there is no acceptable definition of 'good' teaching. Although assessing what is taught seems simple, it is not easy to evaluate what is learned by the students or to determine when the learning should be assessed. There are several measurements consistently used in an attempt to quantify this rather intangible concept, such as student credit hours (per full time equivalent), contact hours, and number of courses taught. Faculty/student ratio is used as a measure of institutional quality (Yuker, 1984). For determining the quality of teaching, Blackburn and Lawrence (1995) suggested another method to determine the amount of effort faculty allocate to teaching by examining the percentage of time spent in class, preparation, grading, and working with students.

Another measurement to assess teaching practices of faculty members is the use of student-centered teaching methods in the undergraduate classroom. As an approach to improve the teaching productivity of faculty, many studies on college instruction appreciate instructional innovations of faculty members to revamp the traditional classroom lecture methods (Caprio & Micikas, 2002; Cusick, 2002; Landis et al., 1998). One of the innovative methods for encouraging student involvement is called student-centered instruction (Centra, 1993; Collins & O'Brien, 2003). The student-centered instruction approach includes active learning (Bonwell & Eison, 1991), collaborative learning (Bruffee, 1984), cooperative learning (Johnson, Johnson, & Smith, 1991), peer instruction (Mazur, 1997), problem- or project-based learning (Barron, 1998), and team-based learning (Michaelson, Knight, & Fink, 2004). These student-centered teaching methods improved knowledge acquisition, critical thinking, problem solving (Pascarella & Terenzini, 2005). Some studies suggested individual characteristics of a faculty member, disciplinary field, and institutional characteristics significantly influenced the use of student-

centered teaching methods (Blackburn & Lawrence, 1995; Einarson, 2001; Fairweather & Rhoads, 1995).

Boyer (1990) was concerned over the threats to higher education from faculty considering research and publication as scholarship superior to teaching. There have been three different perspectives about the relationship between teaching and research of faculty. The first view proposes that the research and teaching are complementary and mutually supportive (Schmitt, 1965). The second view proposes that time spent on one work means sacrifice of time on another work (Clark, 1987). Fairweather (1996) found that when faculty research activities are increased, faculty instructional activities are decreased. Blau (1994) argues that the tension between teaching and research cannot be resolvable theoretically. The third view suggests that there is no relationship between research productivity of faculty members and their teaching effectiveness. Feldman (1987) found that there is a very small positive association between research productivity and teaching effectiveness.

Resource dependency theory may help explain faculty behavioral changes involving time allocations for research and teaching (Johnson, 1998). By establishing reward system for faculty, each institution has assigned the primary functions of teaching and research to the different institutional types. Institutional mission would influence how individual faculty members organize the time spent on their professional workload. Higher education leaders assume that faculty allocation of work time is congruent with the missions of the universities where faculty are employed. However, the relationship between the faculty roles of research and teaching would differ across disciplinary fields or depending on individual characteristics of faculty members. There is little evidence about disciplinary or individual differences in the time allocation of faculty.

Theoretical Framework for Examining Faculty Work

Becher (1994) suggested a framework to examine three levels of characteristics that contribute to the differentiation among academic activities of faculty: macro level of an institution, meso level like an academic department, and micro level of individual characteristics. Institutional mission is a macro level variable that influences the way faculty members are expected to allocate their time among teaching, research, and service. At the micro level, individual characteristics differently affect the perceptions and experiences of faculty members. As the academic departments within the organization of the university have distinct subcultures to influence the daily experience of faculty, departmental affiliation can be considered a meso level variable between institutional and individual variables. Many of the individual and institutional characteristics are found to be related to the faculty scholarly productivity. Bland, Center, Finstad, Risbey and Staples (2005) also identified the three levels of variables that affect research productivity: individual characteristics, institutional environment, and leadership of academic department. As the theoretical framework for this study consists of individual, institutional, and disciplinary factors, this section reviews literature on the three factors.

Firstly, the literature on the individual factors (e.g., race, gender, foreign, degree, rank) are reviewed for this study. Fairweather (2002) found White males were more productive than females and minorities after controlling for institution type. Liddle, Westergren and Duke (1997) illustrated that faculty having more time for research activities are more productive. Bellas and Toutkoushian (1999) observed that women and minorities spent less time on research activities measured by publication counts. Mamiseishvili and Rosser (2010) concluded international faculty members were significantly more productive in research, but less productive in teaching and service than their U.S. citizen colleagues. Flanigan et al. (1988) pointed out that doctoral

degree holders are likely to produce more research outputs. Wanner, Lewis, and Gregorio (1981) found that the relationship between academic rank and productivity of articles was strong among natural scientists and social scientists, but weak among humanities faculty. Bailey (1992) stated that tenure status was a significant predictor for the number of articles. Wanner, Lewis, and Gregorio (1981) found that there is a strong relationship between the number of grants received and articles published by natural scientists.

Some of the individual background characteristics have an accumulative effect on research productivity. Allison and Stewart (1974) used the concept of accumulative advantage to explain why productive researchers tended to be more productive in the future. The concept of accumulative advantage is based on the "Matthew effect" described by Merton (1968). Previous achievements of a researcher lead to next publications and increase access to resources, which in turns have a positive effect on future productivity. Creswell (1985) found that the number of contacts with colleagues is a determinant of research productivity. McGinnis and Long (1988) revealed that the predictor of a substantive productivity is the faculty member's productivity during graduate training. Becher (1989) indicated that the prestige of doctoral institution where scientists had been trained was an important factor in getting published. Fairweather (1995) found a positive correlation between research productivity and faculty base salary.

Secondly, organizational factors have been explored in higher education literature. Bland and Ruffin (1992) described twelve important organizational factors that positively influenced faculty research productivity: clear goals, research emphasis, distinctive research culture, climate balancing between respect and intellectual jostling, assertive participative governance, a decentralized organizational structure, frequent communication, accessible resources, diversity of research groups, reward structure for research, a focus on recruitment and selection, and

leadership by those with research expertise. Dill (1986) showed that faculty workload assignments, research budgets, compensation, promotion and tenure policies, and level of research leadership in the departments affect faculty research productivity strongly. Blackburn, Behmeyer, and Hall (1978) found that researchers affiliated with more highly prestigious institutions had higher productivity than their counterparts at less prestigious institutions. The missions, various policies and norms regarding research, organizational structures, and management and allocation of research resources is critical to research productivity of faculty (Creswell, 1985). Blau (1994) investigated how the organizational structure and resource of a higher education institution affected faculty members' performance and orientation to teaching and research. Dundar and Lewis (1998) found that departmental culture, such as number of full professors, research support, and ratio of graduate student to faculty, were significant determinants of faculty productivity.

A comprehensive research frame to examine both individual and institutional factors on faculty work was addressed by Blackburn and Lawrence (1995). They defined faculty product and behavior and identified the following factors that influenced them. While typical instances of the faculty product are published articles, teaching awards, and research grants, faculty behavior means the time spent on various professional activities such as teaching, conducting research, and publishing articles and books.

The authors integrated four individual and three institutional constructs into a comprehensive framework. The four individual constructs are socio-demographic characteristics, career characteristics, self-knowledge, and social knowledge. Socio-demographic characteristics include age, race, ethnicity, and gender. The career construct includes graduate school education, academic discipline, career year, and prior accomplishment. Self-knowledge includes

psychological attributes of efficacy, commitment, and motivation. Social knowledge includes perceptions of intellectual climate, leadership support, and institutional policy. The three environmental constructs are environmental conditions, environmental response, and social contingencies. Environmental conditions include institutional characteristics, such as mission, fiscal resources, location, and student body. The environmental response construct includes feedback of faculty performance like tenure, rewards, and support for research. Social contingencies include daily life events, such as family obligations, and child care. The authors explained how these seven constructs affect each other and impact faculty behavior and product as shown in Figure 1.

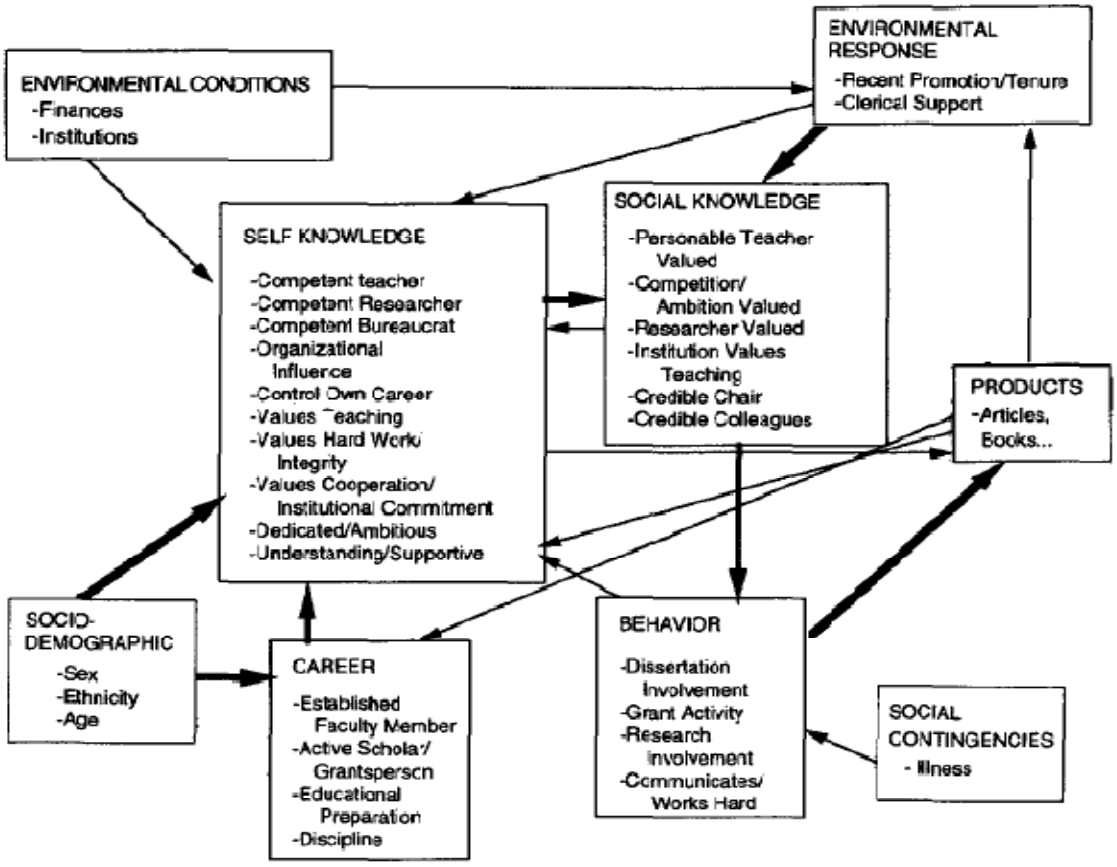

Figure 1. Theoretical Framework by Blackburn and Lawrence to Assess Faculty Work
Source: Blackburn & Lawrence, 1995, p.123.

Since Blackburn and Lawrence's framework provides the most extensive consideration of individual psychological attributes, institutional characteristics and sociological factors that could affect faculty work, it serves as a foundation for this study. As the effects of disciplinary field or academic department on faculty work were not considered a major factor in Blackburn and Lawrence's framework, more literature on the disciplinary field factor need to be reviewed.

Thirdly, in order to understand the faculty productivity at the disciplinary field level, higher education studies on academic departments are reviewed. An academic department in American higher education institutions serves as the fundamental unit of organization where institutional and disciplinary contexts intersect. The structure of departments developed with the expansion of knowledge and increased disciplinary specialization. These shifts facilitated the evolution of the department as the key unit in academic life (Alpert, 1989). It is noticeable that the structural evolution of academic departments in higher education organization is a unique American contrivance. Instead of segregating institutions for undergraduate education and graduate education, the American system developed a single alternative organization to combine them into an academic department. The department system allows faculty members to do research by assigning its graduate students to teach its undergraduates (Clark, 1995).

Hearn (2007) illustrates six major topics of sociological studies on the academic department as a social organization: the structuring of academic work; competition, conflict, and change within departments; resource dependencies and power relations; organizational implications of disciplinary differences; compositional patterns; and departments as contexts for student development and socialization. The concepts of social structure and culture within an academic department help many sociologists explain organizational behaviors of faculty and policies of an institution.

One of the sociological findings is that most of the variances in the climate within the organization are accounted for at the department-level (Moran & Volkwein, 1988). As an

organizational differentiation is formalized among academic departments, each academic department is characterized by different practices and beliefs (Blau, 1994). The social climate within an academic department affects productivity of faculty members because this climate includes relationships with departmental colleagues and flow of academic information among the members of the department (Mateo & Fernandez, 1995). The intellectual culture and social structure within the department are significant factors to affect every professional work of faculty. Since the unit of academic department is concurrently nested in both an institution and a disciplinary field, making a distinction between influences of institutional culture and disciplinary culture on the departmental culture is necessary for research on academic department organization.

With attention to the interconnectedness of disciplines across universities, Mintzberg (1979) characterized universities as professional bureaucracies, where professionals are given considerable control over their own work and relative independence from their colleagues. Colleges and universities become internally differentiated around knowledge domain rather than bureaucratic division while the bureaucratic mode of organization has been developed to coordinate the work of faculty in various disciplines. Professional specialty enables faculty members to insist on considerable autonomy in their work. Professors are likely to identify themselves with their profession as well as the institution where they work.

Professional specialization affects the coherence of an institution and tends to fragment it rather than unify it. As faculty members identify more eagerly with their profession than as a university employee, the community of faculty is fractured by the different kinds of professional groups represented by various disciplines. Gouldner (1957) pointed out that faculty orientation may be primarily directed either toward their academic discipline or their institutions. Gouldner's terms "cosmopolitans" and "locals" represent the two poles on this faculty

orientation continuum. Cosmopolitan commitment of faculty to their disciplinary professions may conflict with local loyalty to their institution.

The disciplinary organizations are an important influence in the working lives of faculty members. The external disciplinary organizations give faculty members the means to establish national reputations through scholarship and research and extend their influence outside the institution. Many academic disciplinary associations have become authoritative communities to manage their own membership, publications, and collegiate networks within the same discipline (Clark, 1987). The disciplinary associations are necessary for faculty to stay informed of the latest research trend and to provide outlets for publishing their research through peer-reviewing processes.

Alpert (1989) proposed the matrix model that each department was located on a row corresponding to a specified university community and in a column corresponding to a specified discipline community as shown in Figure 2. In his matrix model, an academic department has a common campus culture and institutional mission with the horizontal community at the same time while sharing professional missions and research activities with the vertical community. Alpert viewed a university as a loosely coupled system of the horizontal and vertical communities to explain the organizational duality of higher education institutions beyond the independent functions of the institutional community and discipline community. For example, while the purpose of the campus community is to carry out the undergraduate teaching mission of the institution, the purpose of the disciplinary community might focus on discipline-based research. An individual faculty member at a large university would be more familiar with the vertical disciplinary community than the horizontal institutional culture. Alpert's matrix model is a useful framework to explain organizational relationship between an academic department and discipline.

By using National Survey of Postsecondary Faculty (NSPOF) data, Einarson (2001) examined the influence of the individual, disciplinary, and institutional factors on teaching methods of faculty. She added a disciplinary field factor to Blackburn and Lawrence's (1995) model for building her research framework to combine personal characteristics, disciplinary affiliations, and institutional context. Though her research focused on the teaching role of faculty activity except the research role, she expanded Blackburn and Lawrence's frame by integrating a new construct of disciplinary difference into the frame. This study will adopt the three-level framework including disciplinary field level as well as individual and institutional levels.

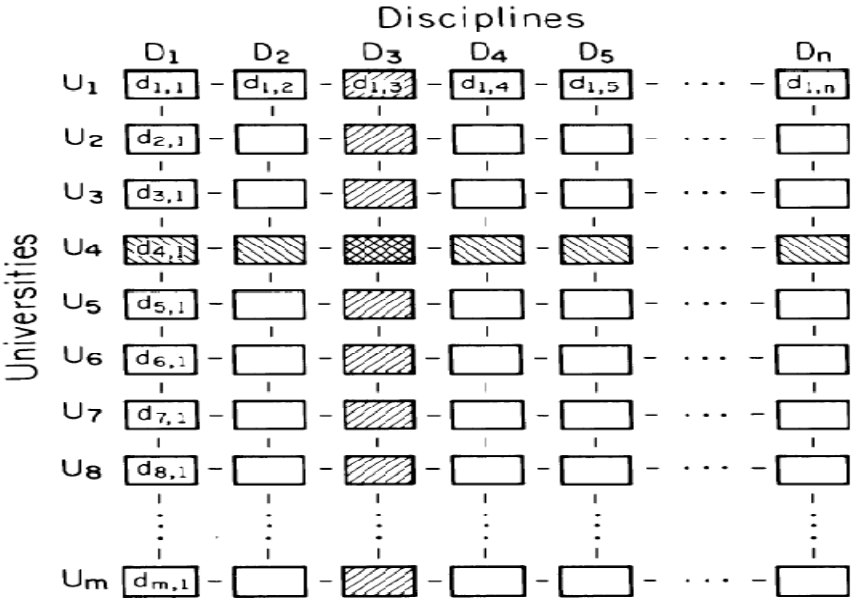

Figure 2. Alpert's University Organizational Matrix
Source: Alpert, 1985, p.250.

Classification Methods to Differentiate Academic Disciplines in Higher Education Research

Classification is a fundamental method for the study of any given set of individuals and subjects including the basic data summary, statistical analysis, or even qualitative language coding. Many higher education researchers are using classifications models for empirical studies on differences between groups of students, groups of faculty members, groups of institutions, or

groups of state governments. Without a classification model, it would be impossible for the researcher to build a sampling frame and draw any meaningful analysis. For example, the Carnegie classification system of institutions (Carnegie Foundation for the Advancement of Teaching, 2001) has played a role in institutional research for evaluating institutional effectiveness and performance. Another exemplary classification system for higher education research or practice is the Classification of Instructional Programs (CIP). It is a taxonomic model to classify instructional programs of higher education level and a statistical coding system to facilitate the organization and reporting of fields of study in postsecondary education institutions. Under the assumption that a better classification system is necessary for the more advancement of higher education research, this literature review addresses the history of classification theory and practices of disciplinary classification in the higher education field.

History of science is characterized by its classificatory efforts. There are several advantages that make classification necessary for scientific research (Bailey, 1994). Classification is useful for description because it reduces complexity through identification of similarities and differences. Classification research shows a comprehensive set of types and sets of dimensions on which the types are based to list and compare the full set of types. Beyond purely descriptive tools, classification methods provide intuitive knowledge for the further study of relationships among types and opportune tools for measurement for the more empirical study. Valid classification schemes help a researcher establish scientific hypotheses and propositions.

The history of classification techniques in the social sciences has developed through distinct stages (Bailey, 1994). The conceptual classification method is the first type of typology construction without the use of computers based upon investigating the qualities of organizations, individuals or objects. The next type of classification method is empirical taxonomies based solely upon quantitative and continuous variables. The classification methods of the current period include the utilization of such statistical techniques as systems analysis, multiple

discriminant analysis, factor analysis, and multidimensional scaling. Though these quantitative methods are considered more scientific than the early subjective and qualitative typological methods, it is often difficult to interpret quantitative taxonomies created from empirical data without a conceptual framework. The meaningfulness of information from quantitative methods is still limited by the original conceptual classification framework. Bailey supports utilization of the operational classification method to combine between conceptual qualitative evaluation and empirical classification techniques.

Hoffmann & Chamie (1999) clarify a set of basic principles and steps for the development, adoption, maintenance and revision of statistical classifications. The list of conceptual tasks that they suggest is useful to understand a typical classification modeling procedure: 1) Defining the scope of a classification, 2) Defining the primary variables of the classification, 3) Identifying the primary statistical units of the classification, 4) Designing the structure, 5) Formulating the detailed rules for classifying units to the same categories, and 6) Formulating similarity criteria for defining higher level categories.

Although higher education literature had described differences in faculty practices based on discipline (Caplow & McGee, 1958; Weisz & Krutybosch, 1982), Snow (1959) began to document the cultural differences between scholars in natural science and social science. Lodahl and Gordon (1972) explored differences among disciplines using the concept of paradigm development proposed by Kuhn (1962). Their study explored how the structure of knowledge in scientific fields might affect the activities of individual scientists. These concepts of disciplinary difference were more empirically proved by Biglan (1973a). Biglan surveyed the perceptions of academic faculty at one large university and one small college to estimate similarities and differences among 35 different academic disciplinary fields through a statistical classification method. Using the multidimensional scaling technique, he found three dimensions for classification of academic disciplines, such as the hard-soft dimension (existence of a single

paradigm), the pure-applied dimension (extent of application), and the life-nonlife dimension (the focus on living versus nonliving objects). Table 1 and Figure 3 is a representation of the Biglan model with some examples.

Table 1. Biglan Discipline Classifications

	Hard		Soft	
	Nonlife system	Life system	Nonlife system	Life system
Pure	● Astronomy ● Chemistry ● Geology ● Math ● Physics	● Botany ● Entomology ● Microbiology ● Physiology ● Zoology	● English ● German ● History ● Philosophy ● Russian ● Communications	● Anthropology ● Political science ● Psychology ● Sociology
Applied	● Ceramic engineering ● Civil engineering ● Computer science ● Mechanical engineering	● Agronomy ● Dairy science ● Horticulture ● Agricultural economics	● Accounting ● Finance ● Economics	● Educational administration and supervision ● Secondary and continuing education ● Special education ● Vocational and technical education

Source: Biglan, 1973b, p. 207.

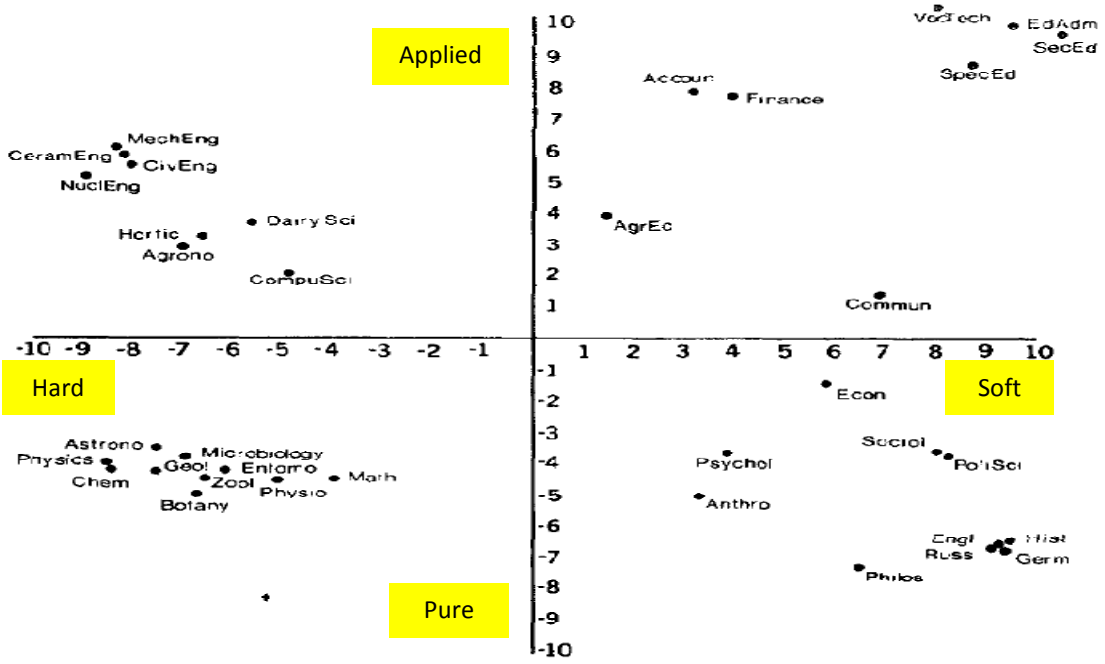

Figure 3. Biglan Disciplinary Classifications on Quadrants
Source: Biglan, 1973a, p. 198.

Biglan's subsequent study (l973b) applied the three dimensions to the study on the organizational characteristics of departments and the professors' commitment to teaching, research, administration and service. The faculty members in the hard disciplines were found to be more socially connected, more involved in research, and more likely to publish in the form of journal articles than the faculty in the soft disciplines. The professors in the applied areas were more socially connected, more involved in service activities, and more likely to publish in the form of technical reports than the professors in the pure areas. The scholars in the life areas were more socially connected and more involved in research than the scholars in non life pure fields.

Researchers have confirmed the validity of the Biglan model as a means of differentiating academic disciplines in higher education (Collins, 1975; Smart & Elton, 1975; Cresswell & Bean, 1981; Stoecker, 1993). Whereas these studies focused on faculty's perceptions, Kolb (1981) examined differences across academic disciplines from the perspective of the students. Using a classification similar to the Biglan model, Kolb also found that each disciplinary community has formed an academic norm about the nature of truth, the way of inquiry, and the style of communication differently from the other discipline groups. He revealed the differences in how knowledge is reported (numerical symbols versus words), in inquiry methods (experiments versus logical analysis), and in criteria for evaluation (practical significance versus statistical significance). His classification dimensions of Concrete/Abstract and Active/Reflective are related to the criterions of Hard/Soft and Pure/Applied in the Biglan model. Kolb classified a nearly identical list of disciplines in his classification system as Biglan. For instance, while Biglan's hard disciplines corresponded with Kolb's abstract-reflective disciplines, soft disciplines corresponded to concrete-active ones. Similarly to the Biglan model, Kolb concluded that the commonly accepted classification division, the scientific/artistic, or abstract/concrete could be complemented by other dimensions, actively/reflective or applied/basic.

Becher (1989) extended the Biglan model through conducting extensive qualitative study. After interviewing 221 graduate students and faculty from twelve academic disciplines at universities in California and in the United Kingdom, he illustrated the cultural process through which a different set of norms was established within a disciplinary community and the relationship pattern between knowledge forms and the social structure of the communities. For instance, clear definition of boundaries and competition for funding among scholars of the physics field are different from a loosely structured culture of the English field. Becker found that disciplinary "differences in the modes in which arguments are generated, enveloped, expressed and reported, and to tease out the epistemological implications of the ways in which others' work is evaluated" (p. 23).

Though in previous research the culture of each discipline seems to imply that the faculty having different specialties would share a unified viewpoint, Becher (1989) accentuates that there is sub-disciplinary specialism within given disciplines. Specialism in one discipline may share more common features with specialism of another discipline. For example, intellectual compatibility and academic identity of faculty who were trained in different specialties but associated with a single applied field to promote greater interdisciplinary understanding in a new applied field may be undermined.

Smart, Feldman, and Ethington (2000) suggested that the different attitudes and practices of faculty members across academic disciplines influence student behaviors and educational outcomes. They recommended the use of Holland's theory over the Biglan model for reviewing differences in teaching and learning across disciplines since they believed that Holland's theory has practical application to better explain variation among faculty in their thought and behavior. With regard to vocational careers choice, Holland (1973) proposed that most individual personalities resemble one of the six types, such as realistic, investigative, enterprising, social, artistic, and conventional types. On the hexagon of the six types to illustrate the different types

and their relationships to one another, types next to one another are those most similar to each other. Holland's classification of academic disciplines is based on his typology of six personalities and their corresponding environments as shown in Table 2.

Table 2. Academic Disciplines by Holland's Type

Holland's Type	Disciplines Represented by Faculty
Realistic	● Industrial Arts ● Military Science
Investigative	● Allied Health (Medical Technologies) ● Biological/Life Sciences ● Economics ● Geography ● Mathematics/Statistics ● Physical Sciences
Artistic	● Architecture/Environmental Design ● Fine Arts (Art, Drama, Music) ● Foreign Languages
Social	● Area/Ethnic Studies ● Home Economics ● Humanities (Literature, History, Philosophy, Religion, Theology, Rhetoric) ● Library Science ● Physical and Health Education ● Psychology ● Social Sciences (Anthropology, Political Science, Social Work)
Enterprising	● Business/Management ● Communications/Journalism ● Computer/Information Science ● Law ● Public Affairs
Conventional	None
Not in Holland's classification	● Agriculture/Forestry ● Natural Resources ● Education (including Administration and Counseling) ● Engineering ● Health Professions (Dentistry, Medicine, Nursing, Veterinary) ● Vocational/Technical Training ● Other Discipline

Source: Smart, Feldman, & Ethington, 2000, pp. 59-60.

Holland (1997) suggested colleges should restructure their arrangement of academic departments whose orientations are markedly different by using his classification of academic disciplines. Holland's classification is based on his typology of six personalities and their corresponding environments. Smart et al. (2000) supported Holland's suggestion for restructuring higher education to "improve the professional stability, satisfaction, and success of faculty within these institutions" (p. 253). However, few higher education institutions have followed Holland's recommendations for restructuring their academic departments. One of the reasons would be that Holland's classification is a vocational typology for career counseling rather than an academic theory on knowledge content like the previous classification models. Some of academic disciplines are not included in Holland's classification, such as the fields of agriculture and education, in Table 2. These shortcomings limit application of Holland's classification to this study.

Summary

The literature review presented a number of views on the concepts of faculty productivity, theoretical frameworks for examining faculty productivity, and disciplinary field classification methods in higher education. Faculty productivity was viewed as a multifaceted outcome of faculty activity. The literature review indicated that individual, institutional, and disciplinary field factors are associated with faculty productivity. The three factors contribute to build the research questions about how the three factors affect faculty productivity as described in the next chapter. The theoretical framework for this study is derived from Blackburn and Lawrence (1995). In order to examine the disciplinary field factor that was not a major factor in Blackburn and Lawrence's framework, extensive literature on the disciplinary field classification was reviewed. Biglan's (l973) classification provides an understanding of how to differentiate and categorize disciplinary fields based on difference in faculty activities. Figure 4 below is a graphic

representation of this study's theoretical framework. The elements in the squares represent various characteristics of individual, institutional, and disciplinary field factors and outcome variables of faculty activity.

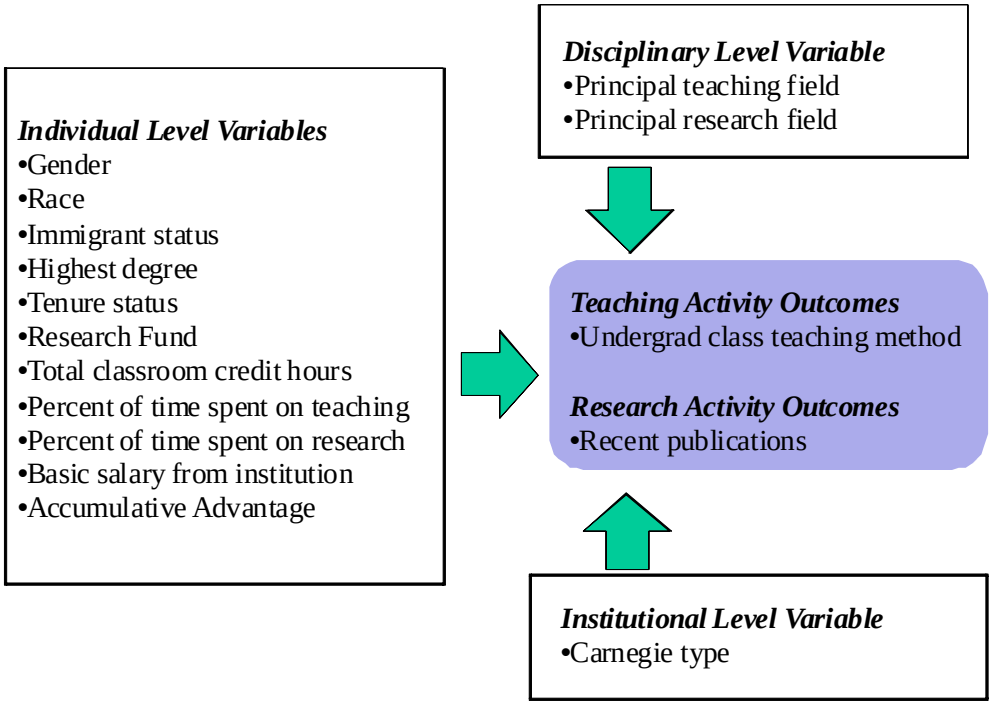

Figure 4. Theoretical Framework for This Study

Chapter 3
Research Design

Research Questions

The purpose of this study is to explore the characteristics of individuals, institutions, and academic disciplines that determine or influence faculty productivity of teaching and research. This study answers the following general research questions:

1. How can faculty productivity of research and instruction be measured?
2. What individual and institutional attributes influence the faculty productivity?
3. What is the relative contribution of individual, disciplinary, and institutional variables to the faculty productivity?
4. What is the disciplinary classification to account for the difference in the faculty productivity?

Data and Variables

The dataset from the National Studies of Postsecondary Faculty (NSOPF) is one of the most comprehensive information sources regarding faculty work at two-year, four-year, doctorate-granting, and other public and private not-for-profit institutions in the United States. This study uses data from the fourth cycle of the NSOPF conducted by the U.S. Department of Education's National Center for Education Statistics (NCES) in 2003–04. NSOPF provides a national profile of faculty and instructional staff and information of institutions where they work, such as professional backgrounds, responsibilities, workloads, salaries, and institutional background characteristics. The 2004 National Study of Postsecondary Faculty (NSOPF:04) consisted of a sample of over 35,000 faculty and instructional staff across a sample of 1,080 institutions in the 50 states and the District of Columbia (Heuer et al. 2005). As Table 3 shows, 26,110 of the sampled faculty members completed the survey (76.1% unweighted response rate).

Table 3. Counts of Sampled, Eligible, and Responding NSOPF:04 Faculty

	Faculty count*			Response rate (percent)	
Institution type	Sampled	Eligible	Responding	Unweighted	Weighted
All faculty	35,630	34,330	26,110	76.1	75.6
Institutional sector					
Public					
Doctoral	9,830	9,500	7,460	78.6	78.1
Master's	3,490	3,350	2,620	78.1	78.5
Baccalaureate	690	680	510	75.4	67.4
Associate's	9,130	8,770	6,420	73.1	73.7
Other	140	130	110	73.7	73.3
Private not-for-profit					
Doctoral	4,650	4,470	3,160	70.8	68.2
Master's	3,020	2,890	2,270	78.6	78.5
Baccalaureate	3,220	3,120	2,520	80.8	78.7
Associate's	240	240	190	79.8	91
Other	1,220	1,160	850	73.1	70.6

*The count values were rounded.

SOURCE: National Center for Education Statistics, NSOPF:04.

The NSOPF: 04 employs a two-stage stratified and clustered sample design for selection of eligible faculty members. The first sampling stage consists of all eligible institutions, which is identified in the 2001–02 Integrated Postsecondary Education Data System (IPEDS) Institutional Characteristics Survey that matched the criteria of public or private not-for profit institutions in Title IV of the Higher Education Act. NSOPF: 04 does not include private for-profit or less-than-2-year institutions. The institution universe for the NSOPF: 04 is stratified based on institution control distinguished between public and private not-for-profit, and level of degree offered used the 2000 Carnegie Classification system (Table 4). The second sampling stage consists of faculty and instructional staff in the institutions selected at the first stage. The target sampling group covers faculty members regardless of instructional responsibilities and instructional staff regardless of faculty status.

The Restricted Use NSOPF:04 Data File is needed to complete this study on relationships between institutional characteristics and individual faculty productivity. The restricted dataset includes non-aggregated responses to two questionnaires: Institution Survey

and Faculty Survey. The institution questionnaire asked information on the policies and compensation that affected faculty and instructional staff. The faculty questionnaire had seven subsections, such as nature of employment; academic and professional background; instructional responsibilities and workload; scholarly activities; job satisfaction; compensation; background characteristics; and opinions (Heuer et al. 2005). This study focuses on the individual, disciplinary and institutional variables identified through the NSOPF surveys to be determinants of faculty scholarly work. Table 5 show the variables selected from NSOPF: 04 in this study.

Table 4. Distribution of NSOPF:04 Institution Universe and Sample

Carnegie Classification [1]	Total		Public		Private not-for-profit	
	Universe	Sample	Universe	Sample	Universe	Sample
Total	3,380	1,080	1,700	680	1,680	400
Doctoral	300	300	190	190	110	110
Master's	590	200	270	120	320	80
Baccalaureate	570	160	90	30	480	130
Associates	1,180	350	1,030	340	150	10
Other	730	70	110	10	620	60

*The count values were rounded.
SOURCE: National Center for Education Statistics, NSOPF:04.

[1] The definition of each category in the 2000 Carnegie classification system is as following:

- Doctoral/Research Universities—Extensive: they awarded 50 or more doctoral degrees per year across at least 15 disciplines.
- Doctoral/Research Universities—Intensive: they awarded at least 10 doctoral degrees per year across three or more disciplines, or at least 20 doctoral degrees per year overall.
- Master's Colleges and Universities: they awarded 20 or more master's degrees per year across three or more disciplines.
- Baccalaureate Colleges: they are undergraduate colleges with major emphasis on baccalaureate programs.
- Associate's Colleges: they offered associate's degree and certificate programs but, with few exceptions, award no baccalaureate degrees.
- "Other" type category includes theological seminaries, medical schools, schools of engineering and technology, schools of business and management, schools of art, music, and design, schools of law, teachers colleges, and tribal colleges and universities (Carnegie Foundation for the Advancement of Teaching, 2001).

Table 5. Selected Variables from NSOPF:04

Variable	Question Label	Question #	Scale
1. Individual Characteristics			
Employment Characteristics			
	Faculty status	Q03	(categorical)
	Principal activity	Q04	(categorical)
	Employment status (full or part time)	Q05	(categorical)
	Year began current job	Q09	(continuous)
	Academic rank	Q10	(categorical)
	Tenure status	Q12	(categorical)
	Scholarly activity, any funded	Q55	(dichotomous)
Demographic Characteristics			
	Gender	Q71	(categorical)
	Age, year of birth	Q72	(continuous)
	Race, White	Q74	(categorical)
	Born in United States	Q80	(categorical)
	Highest degree	Q17A1	(categorical)
Work Time Allocation			
	Percent time spent on instruction, undergraduate	Q32A	(categorical)
	Percent time spent on instruction, graduate/first-professional	Q32B	(continuous)
	Percent of time spent on research activities	Q32C	(continuous)
Accumulative Advantage			
	Income: basic salary	Q66A	(continuous)
	Career articles, refereed journals	Q52AA	(continuous)
	Career articles, nonrefereed journals	Q52AB	(continuous)
	Career book reviews, chapters, creative works	Q52AC	(continuous)
	Career books, textbooks, reports	Q52AD	(continuous)
	Career presentations	Q52AE	(continuous)
	Career exhibitions, performances	Q52AF	(continuous)
	Career patents, computer software	Q52AG	(continuous)
2. Disciplinary Variable			32 general,
	Principal field of teaching-general code	Q16CD2	142 specific
	Principal research field-general code	Q54CD2	categories
3. Institutional Variable			
	2000 Carnegie code (7 category)	X120Q0	(categorical)
4. Teaching Outcomes			
	Undergrad class, multiple choice midterm/final exams	Q38A	(categorical)
	Undergrad class, essay midterm/final exams	Q38B	(categorical)
	Undergrad class, short answer midterm/final exams	Q38C	(categorical)
	Undergrad class, term/research papers	Q38D	(categorical)
	Undergrad class, multiple drafts of written work	Q38E	(categorical)
	Undergrad class, oral presentations	Q38F	(categorical)
	Undergrad class, group projects	Q38G	(categorical)
	Undergrad class, student evaluations of each others' work	Q38H	(categorical)
	Undergrad class, laboratory/shop/studio assignments	Q38I	(categorical)
	Undergrad class, service learn/co-op interactions with business	Q38J	(categorical)
5. Research Outcome			
	Recent publications: refereed or juried publications	Q52BA	(continuous)
	Recent publications: nonrefereed or nonjuried publications	Q52BB	(continuous)
	Recent publications: published reviews of material	Q52BC	(continuous)
	Recent publications: books: monographs: and reports	Q52BD	(continuous)
	Recent presentations	Q52BE	(continuous)
	Recent exhibitions, performances	Q52BF	(continuous)
	Recent patents, computer software	Q52BG	(continuous)

Statistical Methods

In order to answer the research questions, descriptive and inferential statistical methods are employed. A set of preliminary analyses were conducted to provide a demographic profile of the respondents, to describe the data in terms of means and standard deviations, and to identify sources of statistically significant differences through analysis of variance (ANOVA). The inferential analysis involves three analytical procedures: 1) exploratory factor analysis for reduction of dependent variables; 2) Hierarchical Linear Modeling (HLM) analysis; and 3) cluster analysis to explore a new disciplinary classification. For conducting these analyses, statistical software programs, SPSS 17.0 and HLM 6.06 (Raudenbush, Bryk, Cheong, & Congdon, 2004) are used.

ANOVA is used to uncover the main and interaction effects of two categorical variables, institutional type and disciplinary field, on individual demographic distributions and outcome variables of teaching and research. The key statistics in ANOVA are the F-ratio to test difference in means among institutional types and disciplinary fields and the effect size measures to describe the degree of relationship between predictors and dependent variable. Common effect size estimates reported in statistical analysis includes eta-squared and omega-squared (Strang, 2009). Partial eta-square indicates the proportion of total variation attributable to the factor after controlling for the other factors in the model. Partial eta-squared is reported in SPSS GLM output. Partial omega-squared is also calculated for comparing with partial eta-squared in this study.

To identify the latent variables which are contributing to the common variance in a set of measured variables and to detect their structure, this study performs an exploratory factor analysis (EFA) on items of dependent variables. The EFA employs principal axis factoring technique to use the variability in an item that it has in common with the other items (Fabrigar, Wegener, MacCallum, & Strahan, 1999). To answer the research question, how many latent

dimensions can be identified in individual variables and outcome variables, this study compare through five steps of examination; the usual procedure of deciding number of factors (i.e., eingenvalue>1 and scree test), comparing amount of explained variance, communalities comparison, loading pattern comparison, and correlation comparison. To find factors and calculate factor scores for two sets of outcome variables, research activity and teaching style are motivated for hierarchical linear modeling and classification analysis.

The nested nature of the two-stage sampling design in the NSOPF: 04 brings a design effect. The clustered sample may be biased since it has a greater homogeneity than a simple random sample. The result of greater homogeneity is that estimates of variance are underestimated. There is increased likelihood of Type I errors without a correction for the design effect (Thomas & Heck, 2001). Another aspect of the complex sampling design in the NSOPF dataset is the oversampling of certain analysis elements with higher probability of selection in order to ensure that there is a sufficient number of the analysis element to allow for analysis (Heuer et al. 2005). Sample weights are used to correct the disproportionate measurement of oversampled elements and make statistical analysis results that are representative to the national target population. To control such clustering effects and weighting, HLM technique is used[2]. This study tests three basic models successively from Model 1 to 3 for cross-sectional analysis on institutional or disciplinary effects:

Model 1. One-Way ANOVA with Random Effects

Level-1 model: $Y_{ij} = \beta_{0j} + \varepsilon_{ij}$ No predictor

Level-2 model: $\beta_{0j} = \gamma_{00} + \mu_{0j}$ No predictor

Model 2. Mean-as-Outcomes Regression

Level-1 model: $Y_{ij} = \beta_{0j} + \varepsilon_{ij}$ No predictor

[2] The NSOPF:04 data provides two sample weights for the faculty population (WTA00) and for the institution population (WTB00) (Heuer et al., 2005). For this study, while the series of ANOVA tests employ only WTA00 because the unit of analysis is individual faculty member, the series of HLM analyses use both weights because the data has a multilevel structure.

Level-2 model: $\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + \mu_{0j}$ W=Predictor(s)

Model 3. One-way ANCOVA with Random Effects

Level-1 model: $Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + \varepsilon_{ij}$ X=Predictor(s)

Level-2 model: $\beta_{0j} = \gamma_{00} + \mu_{0j}$ No predictor

Level-2 model: $\beta_{1j} = \gamma_{10}$ No predictor (fixed)

While EFA groups variables, cluster analysis groups objects. By using cluster analysis, the 32 general and 142 specific fields of disciplines in the questionnaire are classified based on within-cluster homogeneity and between-cluster heterogeneity with respect to faculty demographic and productivity variables. Cluster analysis reduces the information from entire discipline fields to information about smaller number of subgroups. To find a final cluster classification, these steps are conducted: 1) Select analysis units (i.e., 32 general or 142 specific discipline fields); 2) Select sets of faculty demographic and productivity variables based on EFA results; 3) Select similarity index; 4) Select cluster method; 5) Determine initial cluster typology; and 6) Test cluster validity and cluster differences (Huberty, Jordan & Brandt, 2005).

Limitations of the Study

An appropriate interpretation of this study depends upon the following assumptions and limitations. The first limitation is that the study will not be able to determine cause and effect relationship between faculty productivity and specific individual and environmental characteristics because the study will not eliminate the assumption that there may be a reciprocal relationship between them.

The second limitation emanates from the data (NSOPF-04). The quality of the responses in the NSOPF limits this study. Many of the NSOPF questions about faculty work depend on faculty members' own retrospective estimates. Their responses to the survey questions may reflect quantification based on their personal memory, which can be different from information

obtained through a structured observation. Some participants might have inflated various responses or failed to fully complete the survey. Nevertheless, this study assumes that the respondents answered the survey in an accurate manner.

Because quality of faculty work is difficult to define in higher education, this study focuses on faculty commitments to teaching and research activities as proxies for faculty productivity. Numbers of credit hours and research publications might be inadequate measures of faculty commitment because they do not reflect difference in the difficulty of faculty performance. The faculty productivity measured in this study is confined to the number of output units per input units with no consideration of product quality.

Departments have their own culture, governance, and policies. Faculty work is influenced by their departments. However, because the NSOPF does not contain information reported by individual departments, this study cannot identify departmental characteristics that affect faculty productivity.

Chapter 4

Results

This chapter summarizes the results obtained from the descriptive statistics, exploratory factor analysis, two-way analysis of variance (ANOVA), HLM, and cluster analysis for full-time faculty respondents participating in the 2004 NSOPF study. The chapter includes these main parts:

- Description of case selection procedure to determine categories of disciplinary fields and institutional types
- Results from two-way ANOVA to examine differences in faculty demographic and work product variables among disciplinary fields and institutional types
- Results from factor analysis to explore a valid measurement of faculty productivity
- Results from HLM analyses to examine how individual, disciplinary, and institutional variables affect faculty work
- Results from cluster analysis to suggest a disciplinary classification based on faculty work

Case Selection Procedure

This study focuses only on full time faculty members in order to avoid any undue influence of part-time faculty's different workload. Prior to statistical analysis, this study selects a subsample of full time faculty cases after excluding non-faculty or part-time cases from the NSOPF:04 data. The weighted number of the selected sample is equivalent to 656,500 full time faculty population working at 3,100 American higher education institutions in 2003. Table 6 shows the unweighted sample from NSOPF:04, which consists of 26,100 total cases. After

excluding the groups of part time/non-faculty status (4.1%), part time/faculty status (27.9%), and full time/non-faculty status (2.3%), 17,100 full time faculty status cases (65.7%) are selected for this study. Table 7 presents the weighted data, where 656,500 full time faculty status cases (54.2%) of 121,200 cases are selected for this study.

Table 6. Excluded Cases of Unweighted Sample

Unweighted N=26,100	Non-faculty status	Faculty status
Part time	4.1%	27.9%
Full time	2.3%	65.7%

SOURCE: National Center for Education Statistics, NSOPF:04.

Table 7. Excluded Cases of Weighted Sample

Weighted N=121,200	Non- faculty status	Faculty status
Part time	5.7%	38.0%
Full time	2.1%	54.2%

SOURCE: National Center for Education Statistics, NSOPF:04.

The proportion of the full time faculty varies across disciplinary fields[3] and Carnegie institutional types as shown in Table A-1 and Figure A-1[4] in Appendix. As the majority of faculty members in associate's institutions are not full-time, a statistical analysis based only on full-time cases would not be representative to the whole faculty population in associate's institutions. This disciplinary and institutional difference in distributions of full time faculty should be considered when the following statistical results of this study are generalized to whole faculty population.

[3] The NSOPF:04 questionnaire asks a respondent to point out a disciplinary field of teaching and research separately. As 97.9% of respondents who report disciplinary fields of both teaching and research choose the same general field, this study does not make a distinction between the two variables of teaching and research fields.

[4] The line charts help recognize the disciplinary, institutional, and interaction effect on a variable of interest. In all of the following line charts, the five different lines indicate the five institutional types. The vertical movement within each line signifies the difference among 20 disciplinary fields within the same type of institutions. The gap between lines conveys the difference among institutional types. The disciplines in the line charts are arranged in order of decreasing group mean values of each discipline across all types of institutions for quicker comparison.

Table 8 includes a summary of the faculty distribution by disciplinary fields and Carnegie institutional type. The total of 656,500 full time faculty members included 236,700 (36.05%) from doctoral-extensive institutions, 68,100 (10.37%) from doctoral-intensive, 25,400 (3.87%) from medical, 133,900 (20.40%) from master's, 51,600 (7.86%) baccalaureate, 119,100 (18.14%) associate's, and 21,600 (3.29%) from the other Carnegie classification type institutions. Through examining the sample size per cell in Table 8, some categories have too few observations, such as medical and the "other" institutional types and the several disciplinary fields like architecture and related services and area/ethnic/cultural/gender studies. Those categorical values are not used for statistical comparison because the small cell sample limits the statistical analysis of institutional and disciplinary factors. After the highlighted institutional and disciplinary categories are excluded, a final distribution of cases used for this study is summarized by institutional types and disciplinary fields in Table 9.

It is noticeable that the proportion of faculty in each disciplinary field varies across institutional types as shown in Table 9. For instance, the proportion of faculty members who teach or research biological/biomedical sciences or health professions/clinical sciences in doctoral-extensive institutions is much larger than that of faculty working in the same fields in the other type institution. This unbalanced distribution implies that different distribution of each disciplinary field among institutional types would be related to difference in faculty work among institutional types. Therefore, a statistical method like two-way ANOVA to simultaneously control for both disciplinary and institutional factors on demographical distributions as well as faculty work outcomes is required instead of an aggregate comparison among institutional types.

Table 8. Disciplinary Field * Carnegie Institutional Type Cross Tabulation

Disciplinary Field –General Classification	Carnegie Institutional Type							Total	
	Doctoral-Extensive	Doctoral-Intensive	Medical	Master	Baccalaureate	Associate	Other		
Agriculture/natural resources/related	7,700	800	-	700	400	1,400	-	11,100	1.69%
Architecture and related services	2,200	300	-	500	100	500	-	3,500	0.53%
Area/ethnic/cultural/gender studies	1,500	200	-	600	400	200	200	3,200	0.49%
Arts-visual and performing	11,900	3,900	-	10,600	5,400	7,000	3,600	42,300	6.44%
Biological and biomedical sciences	28,900	5,900	7,600	5,800	2,500	5,900	300	56,900	8.67%
Business/management/marketing/related	11,600	5,000	-	12,800	2,800	8,400	1,300	42,100	6.41%
Communication/journalism/comm. tech	3,300	1,900	-	4,300	1,300	3,000	700	14,600	2.22%
Computer/info sciences/support tech	5,900	2,000	100	4,800	1,900	8,300	300	23,300	3.55%
Construction trades	100	100	-	100	-	1,400	-	1,600	0.24%
Education	10,900	5,000	200	15,400	3,900	8,700	1,400	45,500	6.93%
Engineering technologies/technicians	17,800	4,400	200	3,800	900	4,200	1,500	32,800	5.00%
English language and literature/letters	7,600	3,400	-	8,800	4,400	12,300	800	37,300	5.68%
Family/consumer sciences, human sciences	2,600	500	100	900	100	900	100	5,100	0.78%
Foreign languages/literature/linguistics	9,100	1,700	-	3,500	3,400	1,800	100	19,700	3.00%
Health professions/clinical sciences	40,200	8,900	14,800	9,800	1,800	14,400	1,900	91,800	13.98%
Legal professions and studies	3,900	1,800	100	1,300	200	500	1,700	9,500	1.45%
Library science	2,500	700	200	2,200	500	1,500	-	7,800	1.19%
Mathematics and statistics	8,500	3,000	200	6,500	2,400	9,200	1,000	30,900	4.71%

Mechanical/repair technologies/techs	-	100	-	200	-	2,600	-	2,900	0.44%
Multi/interdisciplinary studies	900	400	100	900	600	500	-	3,300	0.50%
Parks/recreation/leisure/fitness studies	1,900	1,200	100	3,800	1,500	2,800	600	11,800	1.80%
Precision production	-	-	-	-	-	600	-	600	0.09%
Personal and culinary services	100	-	-	-	-	1,300	100	1,500	0.23%
Philosophy, religion & theology	4,100	1,400	-	3,800	2,500	1,700	2,700	16,200	2.47%
Physical sciences	15,000	3,900	100	8,100	3,500	4,100	900	35,600	5.42%
Psychology	7,700	2,500	600	5,400	2,800	4,100	600	23,700	3.61%
Public administration/social services	2,800	1,100	-	2,500	400	500	200	7,600	1.16%
Science technologies/technicians	300	100	-	200	100	300	-	1,000	0.15%
Security & protective services	300	300	-	1,100	300	1,300	-	3,300	0.50%
Social sciences (except psych) & history	22,800	6,500	200	14,000	6,900	8,300	800	59,600	9.08%
Transportation & materials moving	200	100	-	400	-	400	600	1,700	0.26%
Other	600	100	-	500	100	900	100	2,400	0.37%
{Legitimate skip}	3,900	1,200	600	600	100	-	-	6,500	0.99%
Total	236,700	68,100	25,400	133,900	51,600	119,100	21,600	656,500	100.00%
	36.05%	10.37%	3.87%	20.40%	7.86%	18.14%	3.29%	100.00%	

*The cases of the highlighted categories will be excluded in the flowing analyses. The count values were rounded.

SOURCE: National Center for Education Statistics, NSOPF:04.

Table 9. Proportion of Final Selected Cases by Disciplinary Field within Carnegie Type

Weighted N= 574,800	Carnegie Institutional Type					Total
	Doctoral-Extensive	Doctoral-Intensive	Master	Baccalaureate	Associate	
Agriculture/natural resources/related	3.4%	1.3%	0.6%	0.9%	1.3%	1.9%
Arts-visual and performing	5.3%	6.0%	8.2%	10.9%	6.4%	6.7%
Biological and biomedical sciences	12.9%	9.0%	4.6%	5.0%	5.4%	8.5%
Business/management/marketing/related	5.2%	7.7%	10.0%	5.7%	7.8%	7.1%
Communication/journalism/comm. tech	1.5%	2.9%	3.4%	2.7%	2.8%	2.4%
Computer/info sciences/ support tech	2.6%	3.1%	3.8%	3.8%	7.7%	4.0%
Education	4.9%	7.7%	12.1%	7.8%	8.0%	7.6%
Engineering technologies/technicians	7.9%	6.8%	3.0%	1.8%	3.9%	5.4%
English language and literature/letters	3.4%	5.3%	6.9%	8.9%	11.3%	6.4%
Foreign languages/literature/linguistics	4.1%	2.6%	2.8%	6.9%	1.7%	3.4%
Health professions /clinical sciences	17.9%	13.7%	7.7%	3.6%	13.3%	13.1%
Legal professions and studies	1.8%	2.8%	1.0%	0.4%	0.5%	1.3%
Library science	1.1%	1.1%	1.7%	1.1%	1.4%	1.3%
Mathematics and statistics	3.8%	4.6%	5.1%	4.9%	8.5%	5.2%
Parks/recreation/leisure/ fitness studies	0.8%	1.8%	2.9%	3.0%	2.6%	1.9%
Philosophy, religion & theology	1.8%	2.1%	2.9%	5.1%	1.6%	2.3%
Physical sciences	6.7%	6.0%	6.3%	7.1%	3.8%	6.0%
Psychology	3.4%	3.9%	4.2%	5.7%	3.7%	3.9%
Public administration/social services	1.2%	1.7%	1.9%	0.8%	0.5%	1.3%
Social sciences (except psych) & history	10.2%	10.1%	10.9%	13.8%	7.7%	10.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

SOURCE: National Center for Education Statistics, NSOPF:04.

Two-way ANOVA Results on Demographic and Employment Variables

Tables A-2 through 8 and Figures A-2 through 8 present two-way cross tabulation tables on demographic and employment variables, such as gender, race, national origin, doctoral degree, scholarly fund, rank, and tenure[5]. Table A-2 shows two-way comparison in the proportion of male members among full time faculty by institutional types and disciplinary fields. Overall, the proportions of male full time faculty members in the doctoral-extensive or intensive institutions are higher than in the other type institutions.

The result of the two-way ANOVA to test equal proportion of male faculty confirms the differences among Carnegie institutional types, among disciplinary fields, and interactions between the two factors exist significantly ($F=799.42, 2600.53, 195.48$, respectively; all $p<.001$) as shown in Table 10. The table reports values of partial eta-squared and partial omega-squared as effect size measures[6] with each AVOVA result. Cohen (1977) calls omega-squared "large" when over .15, "medium" when .06 to .15, and otherwise "small." The medium effect size of the disciplinary factor on proportion of male faculty (0.079) indicates that the proportion substantially varies depending on disciplinary field. Figure A-2 illustrates the medium effect size graphically by showing the maximum difference among disciplinary fields within an institutional

[5] The NSOPF:04 survey questions on these variables are originally asking respondent to choose one among several categories. The categories variables are recoded into dichotomous variables to illustrate proportions of traditional majority groups like male, White, American-born, doctoral degree holder, scholarly fund earner, full professor, or tenured faculty groups.

[6] They are the percent of total variance in the dependent variable accounted for by the variance among groups of independent variable. They are called partial because they reflect the factor effect after controlling for other variables in the two-way ANOVA model. Though omega-squared is known to provide a relatively unbiased estimate of the variance explained rather than eta-squared, there is hardly difference in the two values of effect size due to the large size of sampling in this analysis.

type is over 70%. As the gap between lines on the figure is narrow and fluctuating across disciplinary fields, the effect sizes of institutional and interaction factors are small.

Table A-3 includes the proportions of White full time faculty. Overall, the proportions of White faculty in doctoral institutions are 5% lower than ones in the baccalaureate or associate's type institutions. Though the maximum difference among disciplinary fields is generally less than 20%, the proportion of White faculty in the field of computer/info sciences/support tech or engineering technologies/technicians in doctoral extensive or intensive institutions is fairly lower than in the other fields in Figure A-3. Table A-4 and Figure A-4 reveal the proportion of faculty members born in a foreign country in the fields related to science, technology, engineering, and mathematics (STEM) is much higher only in doctoral type institutions. The two-way ANOVA results for equal proportions of White or American-born faculty report the differences among Carnegie institutional types, among disciplinary fields, and interaction between the two factors exist significantly (F= 189.48, 364.55, 113.41for White; F=1448.47, 972.39, 160.45 for American-born, respectively; all $p<.001$) as shown in Table 10. The small effect sizes of institutional and disciplinary factors on proportion differences of White and American-born faculty (0.0013 to 0.0311) imply that the proportion differences are not substantial.

A clear difference among institutional types appears in Table A-5 that illustrates proportions of doctoral degree holding faculty. Across all fields, the proportion of doctoral degree holders in the associate's institutions is far lower than in the other type institutions. The two-way ANOVA result to test equal proportions of faculty who have doctoral degree shows all of institutional types, disciplinary fields, and interaction effects are significant (F=17944.51, 5297.39, 332.34, respectively; all $p<.001$) as shown in Table 10. Both of the institutional and disciplinary factors substantially affect the proportion (omega-squared= 0.1109, 0.1488).

Table A-6 presents the difference among institutional types in proportion of faculty members who have scholarly activity funded. The proportion of the funded faculty in the doctoral extensive type institutions is higher than in the other type institutions across most of the fields. The two-way ANOVA result reports all of institutional types, disciplinary fields, and interaction effects are significant (F= 5517.78, 723.23, 238.87, respectively; all p<.001) as shown in Table 10. Neither the institutional nor disciplinary factor has a substantial effect size. (omega-squared=0.0233, 0.0305).

Table A-7 reveals that the proportion of full professors in doctoral extensive institutions is higher than in the other types. The proportion in legal studies is higher than in the other fields. Table A-8 displays that the proportion of faculty who are tenured or on the tenure track in the master's institutions is higher than in the other types and that the proportion in the field of social sciences & history is higher than in the other fields. The two-way ANOVA results in Table 10 for the proportion of the two variables verify that the institutional type and disciplinary factors are significant (F=393.83, 468.81, 71.28 for full professor; F=681.32, 793.35, 117.13 for tenured, respectively; all p<.001), but their effect sizes are small.

Table 10. Two-Way ANOVA Table for Equal Distribution Tests of Demographic and Employment Variables

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Partial Omega Squared
Proportion of Male Faculty	Corrected Model	19589.69	99	197.88	984.68	0.00	0.1449	
	Intercept	82533.29	1	82533.29	410705.81	0.00	0.4165	
	Carnegie	642.59	4	160.65	799.42	0.00	0.0055	0.0055
	Discipline	9929.20	19	522.59	2600.53	0.00	0.0791	0.0790
	Carnegie * Discipline	2985.49	76	39.28	195.48	0.00	0.0252	0.0250
	Error	115630.78	575407	0.20				
	Total	358335.00	575507					
	Corrected Total	135220.47	575506					
Proportion of White Faculty	Corrected Model	2537.65	99	25.63	213.37	0.00	0.0354	
	Intercept	162097.40	1	162097.40	1349288.55	0.00	0.7010	
	Carnegie	91.05	4	22.76	189.48	0.00	0.0013	0.0013
	Discipline	832.11	19	43.80	364.55	0.00	0.0119	0.0119
	Carnegie * Discipline	1035.44	76	13.62	113.41	0.00	0.0148	0.0146
	Error	69126.78	575407	0.12				
	Total	491613.00	575507					
	Corrected Total	71664.43	575506					
Proportion of Faculty Born in USA	Corrected Model	9340.03	99	94.34	670.35	0.00	0.1034	
	Intercept	151564.49	1	151564.49	1076930.30	0.00	0.6518	
	Carnegie	815.42	4	203.85	1448.47	0.00	0.0100	0.0100
	Discipline	2600.19	19	136.85	972.39	0.00	0.0311	0.0311
	Carnegie * Discipline	1716.22	76	22.58	160.45	0.00	0.0208	0.0206
	Error	80981.35	575407	0.14				
	Total	463314.00	575507					
	Corrected Total	90321.38	575506					
Proportion of Faculty with Doctoral Degree	Corrected Model	53386.74	99	539.26	3863.86	0.00	0.3993	
	Intercept	74778.46	1	74778.46	535796.79	0.00	0.4822	
	Carnegie	10017.70	4	2504.43	17944.51	0.00	0.1109	0.1109
	Discipline	14047.27	19	739.33	5297.39	0.00	0.1489	0.1488
	Carnegie * Discipline	3525.12	76	46.38	332.34	0.00	0.0420	0.0419
	Error	80306.65	575407	0.14				
	Total	364308.00	575507					
	Corrected Total	133693.40	575506					
Proportion of Faculty with Research Fund	Corrected Model	21745.497a	99	219.65	1197.03	0.00	0.1708	
	Intercept	16985.13	1	16985.13	92563.70	0.00	0.1386	
	Carnegie	4049.97	4	1012.49	5517.78	0.00	0.0369	0.0369
	Discipline	2521.50	19	132.71	723.23	0.00	0.0233	0.0233
	Carnegie * Discipline	3331.28	76	43.83	238.87	0.00	0.0306	0.0305
	Error	105585.24	575407	0.18				
	Total	190171.00	575507					
	Corrected Total	127330.74	575506					
Proportion of Faculty with Full Professor Rank	Corrected Model	5224.93	99	52.78	260.08	0.00	0.0428	
	Intercept	18256.80	1	18256.80	89968.88	0.00	0.1352	
	Carnegie	319.67	4	79.92	393.83	0.00	0.0027	0.0027
	Discipline	1807.51	19	95.13	468.81	0.00	0.0152	0.0152
	Carnegie * Discipline	1099.31	76	14.46	71.28	0.00	0.0093	0.0092
	Error	116763.62	575407	0.20				
	Total	175518.00	575507					
	Corrected Total	121988.56	575506					
Proportion of Faculty with Tenured or on the track	Corrected Model	8030.29	99	81.11	441.10	0.00	0.0705	
	Intercept	115977.00	1	115977.00	630684.14	0.00	0.5229	
	Carnegie	501.16	4	125.29	681.32	0.00	0.0047	0.0047
	Discipline	2771.90	19	145.89	793.35	0.00	0.0255	0.0255
	Carnegie * Discipline	1636.97	76	21.54	117.13	0.00	0.0152	0.0151
	Error	105812.04	575407	0.18				
	Total	419226.00	575507					
	Corrected Total	113842.33	575506					

SOURCE: National Center for Education Statistics, NSOPF:04.

Tables A-9 through 12 on faculty work time variables describes the most obvious differences among institutional types regardless of disciplinary field. These results indicate that the faculty work time allocation is a valid proxy measurement to capture how the differing missions of Carnegie classification type institutions determine an individual faculty work. The separate lines on Figures A-9 through 12 explain the hierarchical stratification among the five types. Full time faculty members in the doctoral-extensive institutions allocate the smallest percent of their work time to undergraduate class teaching than in the other type institutions while they assign the highest percent to research activity. In terms of the absolute amount of total class hours taught per week, faculty in the doctoral-extensive institutions have the lowest level of teaching workload. Faculty in the fields of English language and literature/letters or arts-visual and performing tend to spend more percent time on teaching undergraduate than on graduate/first-professional classes, whereas those on the fields of legal professions and studies, public administration/social services, or health professions/clinical sciences are likely to spend more percent time teaching graduate/first-professional than undergraduate classes.

The two-way ANOVA results to test equal mean of faculty work time variables report the differences among institutional types, among disciplinary fields, and interaction among the two factors are significant according to F-ratio values as shown in Table 11 (all $p<.001$). The statistics of effect size also imply that the institutional type effect is substantial for accounting for mean differences of all the four variables while the disciplinary effect is not. Especially, the effect size on the mean difference in percent time spent on undergraduate instruction among institutional types is “large” (.2079) according to Cohen’s standard. The variable has the largest effect size to explain an empirical difference among institutional types most distinctly than the

other variables in this study. Figure A-9 illustrates the distinct difference among institutional types graphically.

The correlations among the four variables regarding faculty work time in Table 12 suggests that the percent time spent on undergraduate class instruction has negative relationships with the other percent time variables (-.541, -.551; all $p<.001$), but a positive relationship with the variable of total class hours (.529, $p<.001$). The percent time spent on undergraduate class instruction seems to limit the percent time for graduate class teaching or research activity. However, it is noticeable that the percent time spent on graduate class instruction is not substantially related to the percent time on research activity (.050, $p<.001$).

Mean values in amount of salary income from institution as shown in Table A-13 and Figure A-13. However, the average salary of faculty in some disciplinary fields, such as legal professions and studies or health professions/clinical sciences, in the doctoral institutions has a distinctively higher level than that in the other fields in the same type institutions. The result of the two-way ANOVA to test equal mean of salary income reports the differences among institutional types, among disciplinary fields, and interaction among the two factors are significant according to F-ratio values as shown in Table 13 (all $p<.001$).

In summary, the descriptive and two-way ANOVA statistics on all of these demographic and employment variables suggest that both institutional type and disciplinary field factors affect differences in the demographic distributions and employment conditions of faculty. This finding confirms the reason why these individual demographic and employment variables should be controlled for simultaneously with disciplinary and institutional factors in the statistical model to predict faculty work product. For example, female faculty members tend to work in English fields or in non-doctoral institutions where average publication rate of individual faculty is lower.

In order to investigate whether there is a gender difference in faculty publication productivity, it is necessary to control for institutional and disciplinary effects on publication productivity. The following HLM technique allows this study to examine a net effect of individual variables regarding demographic and employment characteristics on individual faculty productivity through controlling for institutional and disciplinary factors.

Table 11. Two-way ANOVA Table for Equal Mean Tests of Time Allocation Variables

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Partial Omega Squared
Percent time spent on instruction, undergraduate	Corrected Model	318881699.51	99	3221027.27	4912.44	0.00	0.4592	
	Intercept	558652531.71	1	558652531.71	852010.20	0.00	0.5980	
	Carnegie	98595133.54	4	24648783.39	37592.27	0.00	0.2080	0.2079
	Discipline	18918717.09	19	995721.95	1518.59	0.00	0.0480	0.0479
	Carnegie * Discipline	21060501.86	76	277111.87	422.63	0.00	0.0531	0.0530
	Error	375516883.40	572707	655.69				
	Total	1892990766.00	572807					
	Corrected Total	694398582.91	572806					
Percent time spent on instruction, graduate/first-professional	Corrected Model	59840298.13	99	604447.46	2046.90	0.00	0.2614	
	Intercept	29132091.36	1	29132091.36	98652.64	0.00	0.1469	
	Carnegie	16556774.07	4	4139193.52	14016.93	0.00	0.0892	0.0891
	Discipline	7549986.10	19	397367.69	1345.64	0.00	0.0427	0.0427
	Carnegie * Discipline	5556557.04	76	73112.59	247.59	0.00	0.0318	0.0317
	Error	169120187.80	572707	295.30				
	Total	336206606.00	572807					
	Corrected Total	228960485.93	572806					
Percent time spent on research activities	Corrected Model	97967556.45	99	989571.28	2490.38	0.00	0.3009	
	Intercept	57860806.79	1	57860806.79	145613.77	0.00	0.2027	
	Carnegie	26954730.37	4	6738682.59	16958.72	0.00	0.1059	0.1059
	Discipline	6170586.45	19	324767.71	817.32	0.00	0.0264	0.0264
	Carnegie * Discipline	9104367.36	76	119794.31	301.48	0.00	0.0385	0.0383
	Error	227569749.89	572707	397.36				
	Total	562261203.00	572807					
	Corrected Total	325537306.34	572806					
Total class hours taught per week	Corrected Model	7989532.54	99	80702.35	2424.45	0.00	0.2966	
	Intercept	17609875.09	1	17609875.09	529034.27	0.00	0.4817	
	Carnegie	2443946.92	4	610986.73	18355.21	0.00	0.1142	0.1142
	Discipline	681205.62	19	35852.93	1077.09	0.00	0.0347	0.0347
	Carnegie * Discipline	1245777.66	76	16391.81	492.44	0.00	0.0617	0.0616
	Error	18950726.26	569316	33.29				
	Total	68006682.00	569416					
	Corrected Total	26940258.80	569415					

SOURCE: National Center for Education Statistics, NSOPF:04.

Table 12. Pearson Correlations between Faculty Workload Variables

	Percent time spent on instruction, undergraduate	Percent time spent on instruction, graduate	Percent time spent on research activities	Total class hours taught per week
Percent time spent on instruction, undergraduate	1			
Percent time spent on instruction, graduate	-.541**	1		
Percent time spent on research activities	-.551**	.050**	1	
Total class hours taught per week	.529**	-.145**	-.362**	1

**. Correlation is significant at the 0.001 level (2-tailed).
SOURCE: National Center for Education Statistics, NSOPF:04.

Table 13.Two-way ANOVA Table for Equal Mean Tests of Salary Income

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Partial Omega Squared
Corrected Model	160223946264939.00	99	1618423699645.85	1641.97	0.00	0.2203	
Intercept	829,753,865,193,360	1	829,753,865,193,360	841823.37	0.00	0.5940	
Carnegie	22,236,265,393,752	4	5,559,066,348,438	5639.93	0.00	0.0377	0.0377
Discipline	16,597,507,534,760	19	873,553,028,145	886.26	0.00	0.0284	0.0284
Carnegie * Discipline	28,510,768,130,331	76	375,141,685,925	380.60	0.00	0.0479	0.0477
Error	567,157,199,392,718	575407	985,662,669				
Total	3,364,072,464,771,780	575507					
Corrected Total	727,381,145,657,658	575506					

SOURCE: National Center for Education Statistics, NSOPF:04.

Factor Analyses on Two Outcome Variables of Faculty Productivity

The first outcome variable for this study consists of seven question items on recent publication activity of an individual faculty member. Tables A-14 through 20 include mean values of those variables by institutional type and disciplinary field. Except recent exhibition and performance, faculty members in the doctoral institutions have the higher level of publication activities than those in the other type institutions according to the tables. It is meaningful to compare a disciplinary difference among the different publication variables as well as an institutional difference within a publication variable. For instance, faculty members in the fields of physical sciences and biological and biomedical sciences publish more articles in referred

journals than faculty in the other fields. In contrast, faculty in philosophy and social science publish more book reviews and chapters than in the other fields. Faculty members affiliated to different disciplinary fields seem to favor different types of publication. Preferences for certain kinds of publication media may depend on epistemological characteristics and communication traditions of disciplinary fields.

The correlation values among the seven items are lower than 0.3 except between recent (non)referred journal article and recent presentation as shown in Table 14. The Cronbach's alpha coefficient estimate for the seven items indicates internal consistency reliability among them is low (alpha= .442). As the low values of the statistics imply that publication number in a certain type is not strongly related to publication number in another type of media, it is not reasonable to choose a single representative from the seven items in order to operationally define a comprehensive publication productivity measure of an individual faculty subject across all of disciplinary fields. Instead of using a raw or composite score of the seven items, this study will use a factor score of them as a single outcome variable in order to consider the multivariate and multidimensional psychometric property of the publication activity items. Most of factor analysis methods provide a set of coefficients for calculating a factor score. In Table 14, the correlations among the seven publication activity items have an approximate range of correlation values (-.004 to .412), which is wide enough to employ the following factor analysis method.

The second outcome variables consists of the ten items on teaching and evaluation methods that an individual faculty member has used for undergraduate class, such as multiple choice midterm/final exams, essay midterm/final exams, short answer midterm/final exams, term/research papers, multiple drafts of written work, oral presentations, group projects, student evaluations of each others' work, laboratory/shop/studio assignments, and service learn/co-op

interactions with business. Tables A-21 through 30 contain mean values of these variables by institutional type and disciplinary field. These descriptive statistics suggest that differences in teaching and evaluation methods occur across fields rather than institutional type. A teaching method preferred by faculty group in a disciplinary field seems to reflect epistemological characteristics or pedagogical culture of the disciplinary field. For instance, faculty members in the fields of English and education tend to use the student-centered teaching methods like multiple drafts of work or peer student evaluation, whereas faculty members in the field of mathematics and physical science rarely use the student-centered methods in undergraduate classes. The correlation values among the ten items are low in Table 15, as is the Cronbach's alpha coefficient estimate for the ten items (alpha= .563). Similar to the publication activity items, these statistics shows that the teaching method items have a multivariate and multidimensional property. This study will use another factor score of teaching method outcome variable in the same way as the factor score of publication activity.

Table 14. Correlation between Publication Measurements and Publication Factor Score

	Recent articles, refereed journals	Recent articles, nonrefereed journals	Recent book reviews, chapters	Recent books, textbooks, reports	Recent presentations	Recent exhibitions, performances	Recent patents, computer software	factor score for publication
Recent articles, refereed journals	1							
Recent articles, nonrefereed journals	.278**	1						
Recent book reviews, chapters, creative works	.278**	.181**	1					
Recent books, textbooks, reports	.141**	.197**	.128**	1				
Recent presentations	.412**	.321**	.223**	.179**	1			
Recent exhibitions, performances	-.039**	.017**	.022**	-.004**	.024**	1		
Recent patents, computer software	.223**	.136**	.055**	.087**	.153**	.012**	1	
Publication factor score	.913**	.527**	.410**	.300**	.653**	-.007**	.306**	1

**. Correlation is significant at the 0.01 level (2-tailed).
SOURCE: National Center for Education Statistics, NSOPF:04.

Table 15. Correlation between Teaching Method Measurements and Student-centered Teaching Factor Score

	Multiple choice	Essay midterm/	Short answer	Term/research	Multiple drafts	Oral presentations	Group projects	Student evaluations	Laboratory/shop	Service learn	Student-centered teaching factor score
Multiple choice exams	1										
Essay exams	.012**	1									
Short answer exams	.110**	.211**	1								
Term/research papers	-.001	.261**	.038**	1							
Multiple drafts of written work	-.140**	.192**	-.013**	.377**	1						
Oral presentations	-.038**	.144**	-.029**	.317**	.280**	1					
Group projects	.029**	.097**	.048**	.247**	.217**	.432**	1				
Student evaluations of each others' work	-.037**	.081**	-.039**	.194**	.291**	.380**	.357**	1			
Laboratory/shop/studio assignments	.074**	-.144**	.025**	-.108**	-.060**	.055**	.138**	.085**	1		
Service learn/co-op interactions with business	.084**	.029**	-.034**	.176**	.154**	.263**	.276**	.203**	.124**	1	
Student-centered teaching factor score	-.001	.193**	-.014**	.508**	.519**	.766**	.759**	.647**	.179**	.491**	1

**. Correlation is significant at the 0.01 level (2-tailed).

SOURCE: National Center for Education Statistics, NSOPF:04.

Factor analysis is a technique for identifying latent variables which are contributing to the shared variance in a set of measured items. The measured items will be aggregated into a measurement model to represent underlying concepts by using factor analysis. This study performs factor analyses on the two sets of publication and teaching activity items. For factor analysis on the publication activity items, descriptive statistics including the skewness and kurtosis are examined in Table 16. None of the seven publication activity items has a normal distribution, with skewness and Kurtosis values greater than |2|. Every publication activity item has an over-dispersion of count data distribution in that mean value is smaller than the standard deviation. As the distributional assumption of normality is not required for most types of exploratory factor analysis (EFA), this study can use one of the EFA methods, Principal Factor Analysis (PFA) [7].

Table 16. Descriptive Statistics for Publication Activity Measurements

	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Recent articles, refereed journals	0	30	2.21	3.977	3.427	15.707
Recent articles, nonrefereed	0	30	1.13	2.873	5.514	41.132
Recent book reviews, chapters	0	20	.78	1.828	4.890	34.865
Recent books, textbooks, reports	0	20	.49	1.503	7.055	70.419
Recent presentations	0	50	4.37	6.442	3.576	17.540
Recent exhibitions, performances	0	65	.97	5.432	8.728	86.553
Recent patents, computer software	0	10	.09	.516	10.119	142.472

SOURCE: National Center for Education Statistics, NSOPF:04.

Kaiser-Meyer-Olkin (KMO) and Bartlett's test are carried out to test the correlation matrix of the seven items. The KMO statistics is 0.72, indicating the correlation matrix has

[7] The PFA extraction method is called principal axis factoring in SPSS. The PFA is employed with an oblique promax rotation which was set at Kappa=4

sufficient values for factor analysis[8]. Bartlett's Test for Sphericity also shows the correlation matrix is sufficient for factor analysis, indicating that the correlation matrix is not an identity matrix whose items are completely uncorrelated with each other (Chi-Square=365265; df=21; p<.001). To determine how many factors should be extracted, two decision rules of eigen-value-greater-than-1 and the scree plot test are used. Both of the methods suggest two factors to be retained.

The oblique rotation yields both a pattern matrix and a structure matrix. The factor structure and pattern coefficients are presented in Table 17. The structure matrix represents the variance explained by a factor. The pattern matrix contains coefficients which just represent unique contributions, partialing out the other factors. As a rule of thumb, factor loadings larger than .25 in absolute value can be considered significant loadings. Both of the rotation matrixes show the six highlighted items share the first factor in Table 17. This study assumes that the first factor would signify the latent variable of faculty recent publication activity.

Table 17. Exploratory Factor Analysis Matrix for Publication Activity Measurements

	Structure Matrix		Pattern Matrix	
	Factor 1	Factor 2	Factor 1	Factor 2
Recent articles, refereed journals	.800	-.497	.717	-.290
Recent presentations	.573	-.005	.623	.175
Recent articles, nonrefereed journals	.461	.179	.560	.340
Recent book reviews, chapters, creative works	.360	-.034	.382	.076
Recent patents, computer software	.268	-.065	.332	.239
Recent books, textbooks, reports	.263	.143	.272	.014
Recent exhibitions, performances	-.006	.080	.018	.085

SOURCE: National Center for Education Statistics, NSOPF:04.

[8] Convention says the KMO stat needs to be greater than .5.

EFA procedure provides a factor score, which is a linear combination of the observed measurements through partitioning of shared variance and unique variance. A regression factor score has a standardized scale like Z-score (mean=0, SD=1) to show the location of each sampled subject on the latent variable. The regression factor score on the first factor will be used as the single outcome variable to illustrate publication activity of an individual faculty member for the following HLM and cluster analyses. The publication factor score has high correlation values with the six items loaded on the first factor in Table 14. Table 18 summarizes two-way comparison in the mean of the publication factor score by institutional types and disciplinary fields. The faculty publication factor score has the obvious difference among institutional types. The separate lines on Figure 5 clarify a comprehensible stratification among the five institutional types. It is also observed that the publication factor score in several fields, such as agriculture, engineering, physical science, and biological science, in the doctoral institutions is prominently higher than in the other disciplinary fields.

Table 18. Mean of Publication Factor Score by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	0.90	0.65	0.26	-0.10	-0.42	0.63
Arts-visual and performing	-0.13	-0.07	-0.30	-0.28	-0.38	-0.24
Biological and biomedical sciences	0.65	0.45	-0.26	-0.33	-0.49	0.33
Business/management/marketing/related	0.06	0.00	-0.14	-0.42	-0.50	-0.16
Communication/journalism/comm. tech	0.02	-0.24	-0.14	-0.34	-0.41	-0.19
Computer/info sciences/support tech	0.42	0.27	-0.19	-0.31	-0.50	-0.12
Education	0.16	-0.01	-0.14	-0.35	-0.44	-0.13
Engineering technologies/technicians	0.82	0.42	-0.17	-0.27	-0.54	0.43
English language and literature/letters	0.03	-0.14	-0.05	-0.18	-0.39	-0.17
Foreign languages/literature/linguistics	0.02	-0.14	-0.22	-0.44	-0.56	-0.17
Health professions/clinical sciences	0.39	0.19	-0.27	-0.43	-0.54	0.08
Legal professions and studies	-0.07	-0.12	-0.24	-0.32	-0.55	-0.15
Library science	-0.09	-0.33	-0.31	-0.43	-0.46	-0.28
Mathematics and statistics	0.21	0.14	-0.40	-0.28	-0.53	-0.20
Parks/recreation/leisure/fitness studies	-0.01	-0.02	-0.34	-0.31	-0.44	-0.27
Philosophy, religion & theology	0.22	-0.04	-0.06	-0.21	-0.34	-0.03
Physical sciences	1.00	0.55	-0.13	-0.27	-0.52	0.38
Psychology	0.58	0.51	-0.10	-0.32	-0.41	0.12
Public administration/social services	0.18	-0.07	-0.25	-0.34	-0.46	-0.08
Social sciences (except psych) & history	0.18	-0.06	-0.20	-0.23	-0.46	-0.08
Total	0.38	0.13	-0.19	-0.30	-0.47	0.01

SOURCE: National Center for Education Statistics, NSOPF:04.

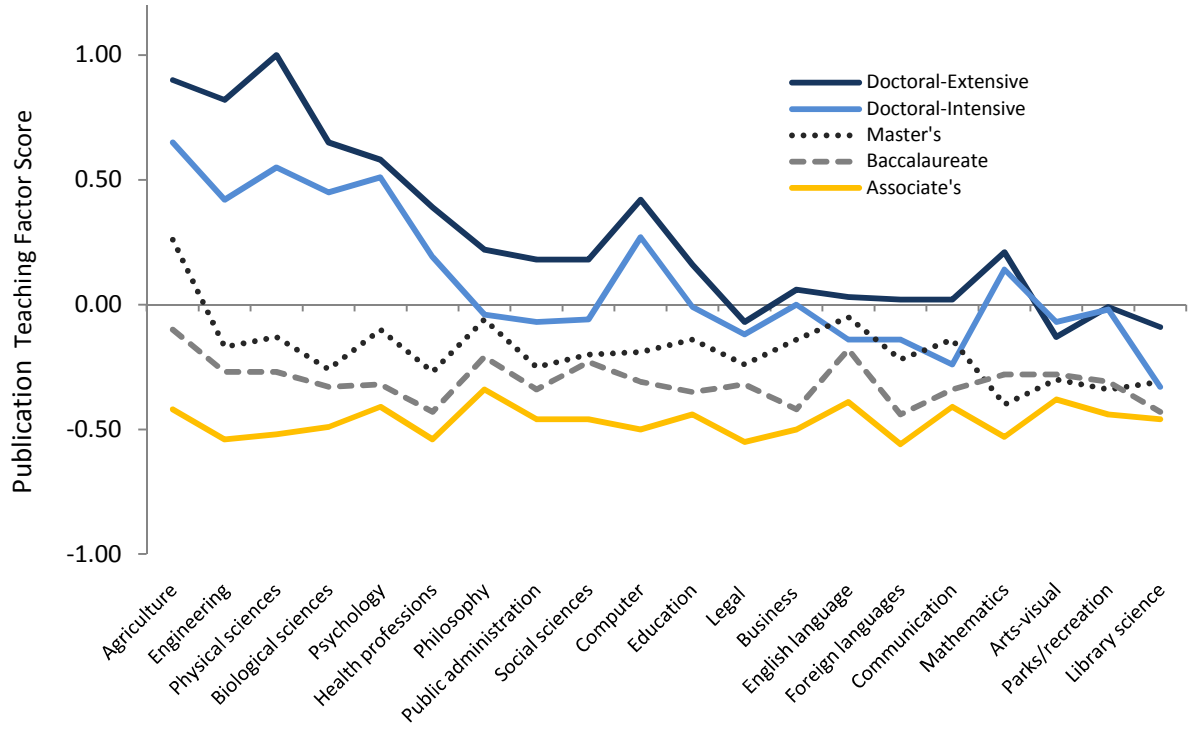

Figure 5. Mean of Publication Factor Score by Carnegie Type and Disciplinary Field

Another process of factor analysis is performed on the set of teaching method items. The teaching method items have a normal distribution without high values of skewness and Kurtosis in Table 19. The results of KMO test (.738) and Bartlett's Test for Sphericity (Chi-Square=504566; df=45; p<.001) show that the correlation matrix of the ten items is sufficient for factor analysis. The decision rules of eigen-value-greater-than-1 and the scree plot test propose three factors to be retained. The PFA extraction method with an oblique promax rotation is also used.

In Table 20, the structure and pattern matrixes report the four items of oral presentations, group projects, student evaluation of each others' work, and service learning are loaded on the first factor and the other two items of term/research papers and multiple drafts of written work have significant amounts of variance on the first factor. This study assumes the first factor can be labeled as a latent variable to measure how frequently a faculty member uses student-centered teaching methods to facilitate student involvement into constructivist learning at an undergraduate class. The regression factor score on the first factor will be used as a single outcome variable to compare relative frequency of student-centered teaching.

In Table 15, the student-centered teaching method factor score has high correlation values (.491 to .766) with the six items that are loaded on or highly related to the first factor. Table 21 contains two-way comparison in the mean of the student-centered teaching factor score by institutional types and disciplinary fields. The overlapping or transposing lines on Figure 6 show there is not a distinct difference in the teaching factor score among institutional types across all disciplinary fields while an obvious difference in the publication factor score exist among institutional types on Figure 5.

Table 19. Descriptive Statistics for Teaching Method Activity Measurements

	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Undergrad class, multiple choice midterm/final exams	1	3	1.88	0.877	0.231	-1.661
Undergrad class, essay midterm/final exams	1	3	1.87	0.864	0.248	-1.616
Undergrad class, short answer midterm/final exams	1	3	1.94	0.858	0.107	-1.633
Undergrad class, term/research papers	1	3	2.24	0.809	-0.458	-1.326
Undergrad class, multiple drafts of written work	1	3	1.63	0.805	0.758	-1.043
Undergrad class, oral presentations	1	3	1.94	0.827	0.108	-1.529
Undergrad class, group projects	1	3	1.85	0.834	0.283	-1.506
Undergrad class, student evaluations of each others' work	1	3	1.56	0.775	0.941	-0.698
Undergrad class, laboratory/shop/studio assignments	1	3	1.74	0.846	0.531	-1.397
Undergrad class, service learn/co-op interactions with business	1	3	1.38	0.662	1.476	0.805

SOURCE: National Center for Education Statistics, NSOPF:04.

Table 20. Exploratory Factor Analysis Matrix for Teaching Method Measurements

	Structure Matrix			Pattern Matrix		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Multiple Choice Midterm/Final Exams	-.001	-.114	.320	.077	-.108	.316
Essay Midterm/Final Exams	.165	.526	.217	-.030	.570	.280
Short Answer Midterm/Final Exams	-.012	.135	.423	-.044	.204	.442
Term/Research Papers	.435	.549	-.083	.258	.447	-.002
Multiple Drafts of Written Work	.444	.515	-.278	.270	.385	-.203
Oral Presentations	.656	.318	-.117	.625	.066	-.040
Group Projects	.650	.183	.056	.694	-.078	.124
Student Evaluations of Each Others' Work	.553	.218	-.151	.547	-.009	-.091
Laboratory/Shop/Studio Assignments	.153	-.283	.130	.324	-.397	.121
Service Learn/Co-Op Interactions with Business	.420	.074	.013	.468	-.105	.053

SOURCE: National Center for Education Statistics, NSOPF:04.

Table 21. Mean of Student-centered Teaching Factor Score by Carnegie Type and Disciplinary Fiel d

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	0.04	0.44	0.10	0.21	0.05	0.11
Arts-visual and performing	0.06	-0.03	0.01	0.14	0.04	0.04
Biological and biomedical sciences	-0.36	-0.29	-0.18	0.46	-0.30	-0.21
Business/management/marketing/related	0.25	0.18	0.35	0.28	-0.12	0.19
Communication/journalism/comm. tech	0.39	0.53	0.45	0.67	0.55	0.50
Computer/info sciences/support tech	-0.22	0.16	-0.03	-0.03	-0.11	-0.08
Education	0.65	0.68	0.81	0.78	0.34	0.67
Engineering technologies/technicians	-0.17	-0.10	-0.11	-0.31	-0.14	-0.15
English language and literature/letters	0.41	0.25	0.34	0.50	0.26	0.34
Foreign languages/literature/linguistics	0.01	0.02	0.29	0.11	0.29	0.12
Health professions/clinical sciences	-0.03	0.00	0.17	0.36	0.13	0.11
Legal professions and studies	-0.27	0.15	-0.23	-0.50	-0.36	-0.21
Library science	-0.43	-0.08	-0.23	0.21	-0.16	-0.17
Mathematics and statistics	-0.80	-0.63	-0.72	-0.41	-0.75	-0.71
Parks/recreation/leisure/fitness studies	0.24	0.01	0.20	0.03	-0.13	0.07
Philosophy, religion & theology	-0.55	-0.23	-0.22	-0.22	-0.07	-0.30
Physical sciences	-0.51	-0.52	-0.43	-0.27	-0.54	-0.46
Psychology	-0.19	0.17	-0.12	0.21	-0.11	-0.05
Public administration/social services	0.80	0.63	0.57	0.62	0.70	0.63
Social sciences (except psych) & history	-0.32	-0.23	-0.19	-0.05	-0.13	-0.21
Total	-0.12	-0.02	0.06	0.15	-0.06	-0.01

SOURCE: National Center for Education Statistics, NSOPF:04.

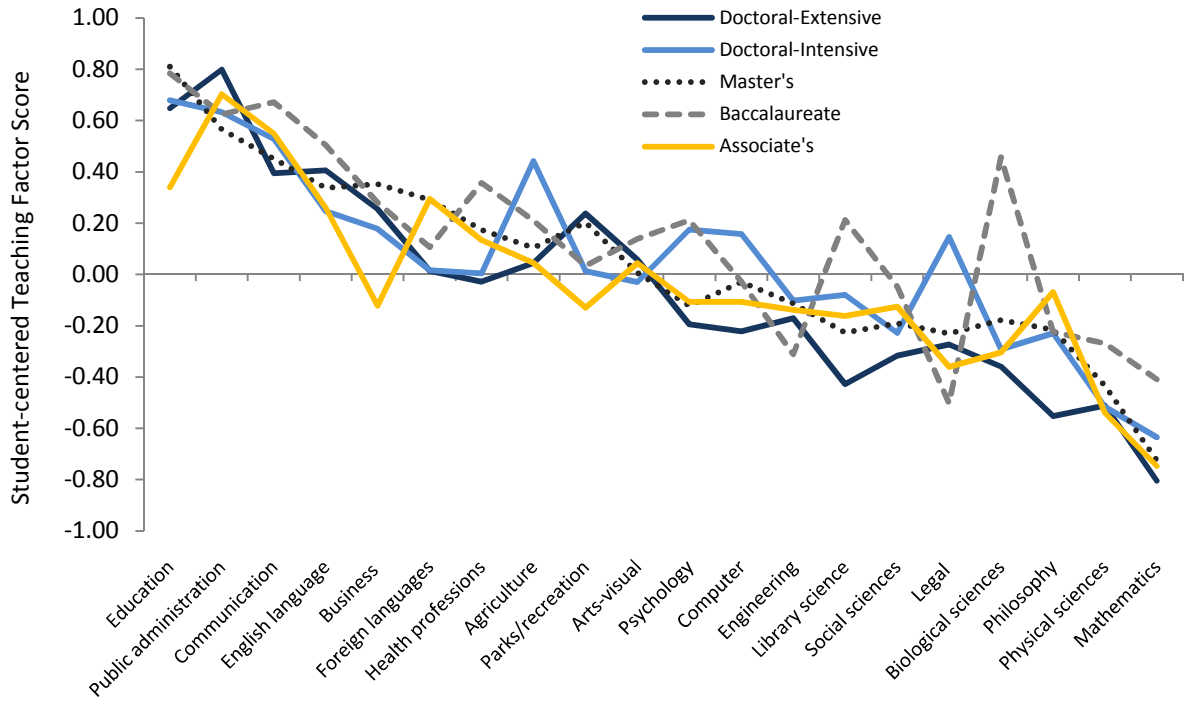

Figure 6. Mean of Student-centered Teaching Factor Score by Carnegie Type and Disciplinary Fiel d

HLM Analyses on Individual, Disciplinary, and Institutional Factors

The application of HLM provides improved estimations of individual level effects and institutional effects, and partitioning of variance components between levels (Raudenbush & Bryk, 2002). HLM helps this study associate institutional level factors with the differences in faculty work outcome affected by individual faculty level factors of demographic and employment characteristics and disciplinary affiliation. Table 22 presents a full list of independent and dependent variables used in this HLM analysis and descriptive statistics of variables. Most of independent variables on the list are already reviewed in the previous section and have statistics consistent with results of two-way ANOVA. Three dummy variables and seven continuous variables are added to the list. The dummy variables describe whether a principal activity of a faculty member is teaching, research, or service. The continuous variables indicate how frequently a faculty member has published annually on an average since her career was started. These career publication activity variables as well as a salary income variable are employed as proxies of individual accumulative advantage to predict current publication outcomes. For the HLM analysis on the outcome variable of publication factor score, seven models are developed according to seven different hypotheses to test as shown in Table 23 and statistical results of the models are presented in Table 24.

Model A-1 is called one-way random effects ANOVA model to examine an intercept coefficient in level-2 equation (γ_{00}), level-2 variance (u_{0j}), and level-1 variance (e_{ij}). The intercept coefficient (γ_{00}) of Model A-1, -0.283, indicates the average value of 3,020 aggregated institutional scores, not the grand mean of 656,500 individual faculty scores. The intercept coefficient (γ_{00}) is fairly lower than the grand mean of the publication factor score, 0.00, reported in Table 24. The difference between the two values is understandable because, on the dataset for

this HLM analysis, the number of individual faculty members working in doctoral institutions (304,800; 46%) is approximately equivalent to those in the other institution (351,700; 54%) while the number of doctoral institutions (250; 8%) is fairly smaller than the other institutions (2,770; 92%). The intercept coefficient (γ_{00}) reflects aggregated scores of non-doctoral institutions over 11 (=92%/8%) times more than doctoral institutions. The intraclass correlation (ICC) is defined as a ratio of the between group variance to the total variance. The ICC value of Model A-1, 0.156 = 0.059/(0.059+0.317), indicates that 15.6% of the total variance in faculty publication factor score is explained by difference among institutions. The individual level characteristics of employment conditions, disciplinary affiliation, and accumulative advantage would account for some of the rest 84.4%.

The coefficients of disciplinary dummy variables in Model A-2 help calculate the mean score of each disciplinary field. As the reference group for the dummy variables is faculty group who answer that they are not affiliated to any research field, the intercept coefficient (γ_{00}), -0.425, indicates group mean score of the non-research-field group. The slope coefficient of each disciplinary field variable shows the gap among the field and the reference group. The predicted score of the faculty group who do research in agriculture field is 0.343 (=-0.425+0.768). The ranking based on the predicted values agrees with the observed ranking among disciplinary fields shown in Figure 31. The slope coefficients imply faculty groups who are doing research in the fields of agriculture, engineering, and physical science have the highest group mean of publication factor score. In Model A-2, disciplinary field variables account for 35.4% [=(0.059-0.038)/0.059] of level-2 variance as well as 5.1% [=(0.317-0.301)/0.317] of level-1 variance in comparison with Model A-1. Though the disciplinary variables are employed at level-1, they explain considerable amount of level-2 variance. The cross-level explanation implies that the

factors of discipline and institution overlap each other to explain the variance of publication factor score. For example, a faculty member who does research in one of the disciplinary fields having a high level of average publication score, such as agriculture, engineering and physical science, tends to work in an institution like a doctoral extensive institution where an average publication score is high as shown in Table 9.

The coefficients of institutional dummy variables in Model A-3 are used to indicate the mean difference across institutional types. As the reference institution type in Model A-3 is baccalaureate, this intercept coefficient (γ_{00}), -0.253, indicates average institutional score of baccalaureate type institutions. The slope coefficient of each institution type signifies the gap among the type and the reference group. The mean score of doctoral extensive institutions equals to 0.429 (=-0.253+0.682). The difference in publication factor score among faculty groups of doctoral institutions and non-doctoral institutions is also proved significant ($p<.001$) in that mean score of doctoral institutions is significantly higher than baccalaureate institutions ($p<.001$) and mean score of baccalaureate institutions is significantly higher than associate's institutions ($p<.001$). In Model A-2, the institutional type variables account for 73.4% [= (0.059-0.016)/0.059] of level-2 variance in comparison with Model A-1. These statistics ascertains that institutional type variables are reliable and powerful predictors to explain difference in publication factor score. As the institutional type variables reduce level-2 variance, the ICC value of Model A-3 (4.7%) become smaller than that of Model A-1 (15.6%).

Model A-4 combines Model A-2 and Model A-3 to examine how both disciplinary field and institutional type factors affect individual publication factor score simultaneously. The intercept coefficient (γ_{00}) of Model A-4, -0.483, indicates the predicted mean score of faculty group who have not reported any research field and work in baccalaureate institutions. For

example, the predicted mean score of faculty members who are doing research in agriculture field in doctoral extensive institutions equals to 0.815 (=-0.483+0.715+0.583). Though the interaction effect among disciplinary and institutional factors would be random, Model A-4 assumes the interaction effect is fixed for parsimony of modeling.

Model A-5 employs a set of demographic and employment characteristics at the individual level as predictors without controlling for disciplinary and institutional characteristics. The intercept coefficient (γ_{00}), -0.389, indicates group mean score of faculty members who are female, non-White, born out of the U.S.A., have no doctoral degree, not tenured or on the track, have a rank of assistant professor, do teaching as principal activity, have no funded research, and do not spend any percent time on undergraduate teaching, graduate teaching, or research. Some coefficients of demographic and employment variables have no statistical significance. The group mean difference in publication factor score between White and non-White is not significant ($p>.0.05$). Percent time spent on undergraduate teaching does not have a linear relationship with publication factor score ($p>.0.05$). The other demographic and employment variables have significant slope coefficients. The variables of principal activity, research funding, and percent time spent on research have the biggest impact on publication of faculty member. For instance, a faculty member who does research as a principal activity, have a research project funded, and spend 100 percent time on research would be of the greatest advantage to others (1.063=0.413+0.250+0.004*100). In Model A-5, demographic and employment variables explain 59.1% of level-2 variance as well as 12.0% of level-1 variance in comparison with Model A-1. That implies that a faculty member who has individual characteristics related to high publication score, such as research as principal activity and high percent time on research is likely to work in doctoral extensive institutions where average publication rate is high.

Model A-6 combines Model A-4 and Model A-5 to examine how disciplinary, institutional, and individual characteristics affect publication factor score simultaneously. In comparison with Model A-1, this model explains 87.8% of the variance between institutions at level 2 and 13.7% of the variance among individuals at level 1. By adding a set of accumulative advantage variables to Model1-6, Model A-7 has reduced 12.4% of level-1 variance more than Model A-6 (=26.1%-13.7%). The level-1 variance explained by the accumulative advantage variables is greater than 12.0% [=(0.317-0.279)/0.317] of level-1 variance explained by the other demographic and employment variables in Model A-5 and 5.1% [=(0.317-0.301)/0.317] explained by disciplinary field variables in Model A-2. Differing from the previous models, the variables of gender, birth place, and doctoral degree are not significant predictors in Model A-7. Model A-7 reveals that the accumulative advantage variables are more reliable and powerful predictors than the other individual characteristics variables. The model shows that the career publication variables regarding per year number of referred, non-referred journal articles, book chapters, and presentation during entire are significant related to the outcome variable of the publication factor score that reflects mainly the same kinds of recent publications as mentioned in Table 14.

Table 22. Descriptive Statistics for HLM Analysis

	Weighted N	Mean	Std. Deviation	Minimum	Maximum
Outcome variable					
Publication factor score	656,500	.00	.876	-.63	8.81
Student-centered teaching factor score	433,800	.00	.856	-1.37	2.16
Level1: Demographic and employment variables					
Gender, Male	656,500	.62	.485	0	1
Race, White	656,500	.85	.356	0	1
Born in USA	656,500	.80	.397	0	1
Doctoral degree	656,500	.61	.488	0	1
Full-time Tenured or on track	656,500	.70	.456	0	1
Rank, Full Professor	656,500	.30	.456	0	1
Rank, Associate Professor	656,500	.23	.419	0	1
Rank, Assistant Professor	656,500	.24	.427	0	1
Rank, Lecturer Professor	656,500	.24	.425	0	1
Teaching as principal work	656,500	.64	.480	0	1
Research as principal work	656,500	.14	.352	0	1
Service as principal work	656,500	.17	.373	0	1
Having Funded research	656,500	.33	.469	0	1
Percent time on undergraduate teaching	653,200	44.70	35.265	0	100
Percent time on graduate teaching	653,200	13.95	20.539	0	100
Percent time on research	653,200	20.34	24.422	0	100
Level1: Cumulative advantage variable					
Salary from institution	656,500	68,234	36,998	1	250,000
Lifetime yearly average articles, refereed	644,100	2.47	7.212	0	20
Lifetime yearly average articles, nonrefereed	645,400	1.41	6.726	0	20
Lifetime yearly average book reviews	645,800	.63	2.348	0	8
Lifetime yearly average books	647,400	.45	2.289	0	8
Lifetime yearly average present	641,800	5.77	16.609	0	50
Lifetime yearly average exhibit	654,200	1.88	16.636	0	50
Lifetime yearly average patents	653,700	.06	.443	0	2
Level1: Disciplinary field variable					
Agriculture	656,500	.01	.108	0	1
Arts-visual	656,500	.05	.212	0	1

Biological sciences	656,500	.07	.256	0	1
Business	656,500	.04	.199	0	1
Communication	656,500	.02	.122	0	1
Computer	656,500	.02	.139	0	1
Education	656,500	.05	.209	0	1
Engineering	656,500	.04	.193	0	1
English language	656,500	.04	.196	0	1
Foreign languages	656,500	.02	.147	0	1
Health professions	656,500	.09	.281	0	1
Legal	656,500	.01	.106	0	1
Library science	656,500	.01	.083	0	1
Mathematics	656,500	.03	.163	0	1
Parks/recreation	656,500	.01	.086	0	1
Philosophy	656,500	.02	.137	0	1
Physical sciences	656,500	.04	.198	0	1
Psychology	656,500	.03	.165	0	1
Public administration	656,500	.01	.090	0	1
Social sciences	656,500	.07	.259	0	1
No research field	656,500	.34	.473	0	1
Level2: Institution type variable					
Doctoral-Extensive	3,020	.05	.217	0	1
Doctoral-Intensive	3,020	.03	.178	0	1
Master's	3,020	.17	.380	0	1
Baccalaureate	3,020	.17	.374	0	1
Associate's	3,020	.34	.473	0	1
Others	3,020	.24	.425	0	1

*The weighted N values were rounded.

SOURCE: National Center for Education Statistics, NSOPF:04.

Table 23. Hierarchical Linear Modeling Models for Publication

Y_{ij}: Dependent variables = Publication factor score

	X_{1n}: Independent variables on level-1	X_{2n}: Independent variables on level-2	Hypothesis to test in HLM analysis	Level-1 Equation	Level-2 Equation
Model A-1	-	-	The average publication factor score varies across institutions.	$Y_{ij} = \beta_{0j} + e_{ij}$	$\beta_{0j} = \gamma_{00} + u_{0j}$
Model A-2	Disciplinary field	-	A disciplinary field where a faculty member affiliates affects her publication factor score.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + u_{0j}$ $\beta_{nj} = \gamma_{n0}$
Model A-3	-	Institution type	An institutional type where a faculty member affiliates affects her publication factor score.	$Y_{ij} = \beta_{0j} + e_{ij}$	$\beta_{0j} = \gamma_{00} + \gamma_{n1}(X_{2n}) + u_{0j}$
Model A-4	Disciplinary field	Institution type	A disciplinary field and an institutional type where a faculty member affiliates affect her publication factor score simultaneously.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + \gamma_{n1}(X_{2n}) + u_{0j}$ $\beta_{nj} = \gamma_{n0}$
Model A-5	Demographic/ employment characteristics	-	Demographic and employment characteristics of a faculty member affect her publication factor score.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + u_{0j}$ $\beta_{nj} = \gamma_{n0}$
Model A-6	Disciplinary, Demographic/ employment characteristics	Institution type	Demographic and employment characteristics, a disciplinary field, and an institutional type where a faculty member affiliates affect her publication factor score simultaneously.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + \gamma_{n1}(X_{2n}) + u_{0j}$ $\beta_{nj} = \gamma_{n0}$
Model A-7	Disciplinary, Demographic/ employment, Cumulative advantage	Institution type	Demographic and employment characteristics, cumulative advantage, disciplinary field, and institutional type affiliates affect her publication factor score simultaneously.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + \gamma_{n1}(X_{2n}) + u_{0j}$ $\beta_{nj} = \gamma_{n0}$

Table 24. Coefficients and Variances of Hierarchical Linear Modeling Models for Publication

		Model A-1	Model A-2	Model A-3	Model A-4	Model A-5	Model A-6	Model A-7
Intercept	γ_{00}	-0.283 ***	-0.425 ***	-0.253 ***	-0.483 ***	-0.389 ***	-0.523 ***	-0.478 ***
Level2: Institution type (reference=Baccalaureate)								
	Doctoral-Extensive			0.682 ***	0.583 ***		0.449 ***	0.470 ***
	Doctoral-Intensive			0.450 ***	0.389 ***		0.331 ***	0.338 ***
	Master's			0.075 ***	0.060 *		0.060 *	0.063 **
	Associate's			-0.137 ***	-0.064 **		-0.010	-0.048 *
	Others			0.139 ***	0.124 **		0.139 ***	0.132 ***
Level1: Demographic and employment variables								
	Gender, Male=1					0.048 ***	0.045 **	0.023
	Race, White=1					-0.035	-0.039	-0.044
	Born in USA =1					-0.061 *	-0.053 *	-0.034
	Doctoral degree=1					0.079 ***	0.057 **	0.037
	Tenured or track=1					0.031 *	0.045 **	0.044 **
	Full Professor (ref=Assistant)					0.156 ***	0.161 ***	0.127 ***
	Associate (ref=Assistant)					0.056 **	0.056 **	0.055 **
	Lecturer(ref=Assistant)					-0.062 **	-0.020	-0.001
	Research as principal (ref=teaching)					0.413 ***	0.336 ***	0.300 ***
	Service as principal (ref=teaching)					0.115 ***	0.078 **	0.032
	Funded research=1					0.250 ***	0.188 ***	0.168 ***
	Percent time on undergraduate					0.000	0.000	0.000
	Percent time on graduate					0.002 ***	0.002 **	0.001 **
	Percent time on research					0.004 ***	0.004 ***	0.004 ***
Level1:Accumulative advantage								
	Salary from institution ($10,000)							0.020 ***
	Average articles, refereed							0.020 ***
	Average articles, nonrefereed							0.013 ***
	Average book reviews							0.022 *
	Average books							0.006
	Average present							0.003 **
	Average exhibit							0.000
	Average patents							0.034
Level1: Disciplinary field (reference=no field)								
	Agriculture		0.768 ***		0.715 ***		0.470 ***	0.406 ***
	Arts-visual		0.161 ***		0.150 ***		0.089 **	0.086 **
	Biological sciences		0.365 ***		0.347 ***		0.063	0.042
	Business		0.262 ***		0.239 ***		0.096 **	0.058

Communication		0.264 **		0.240 **		0.165 *	0.107
Computer		0.323 ***		0.309 ***		0.147 *	0.127 *
Education		0.240 ***		0.223 ***		0.109 ***	0.101 ***
Engineering		0.506 ***		0.457 ***		0.243 ***	0.189 **
English language		0.287 ***		0.282 ***		0.184 ***	0.141 **
Foreign languages		0.123 ***		0.106 **		0.001	0.019
Health professions		0.355 ***		0.344 ***		0.237 ***	0.197 ***
Legal		0.092 *		0.054		-0.069	0.062
Library science		0.136 **		0.119 **		0.121 **	0.127 **
Mathematics		0.176 ***		0.162 ***		0.044	0.030
Parks/recreation		0.182 *		0.154		0.092	0.087
Philosophy		0.270 ***		0.249 ***		0.095 *	0.074
Physical sciences		0.456 ***		0.432 ***		0.180 ***	0.155 ***
Psychology		0.294 ***		0.278 ***		0.109 ***	0.096 **
Public administration		0.180 **		0.148 *		0.049	0.048
Social sciences		0.191 ***		0.175 ***		0.017	0.026
Random Effect	Variance Component						
Variance of $\mathbf{u_{0j}}$ in Level-2	0.059 ***	0.038 ***	0.016 ***	0.010 ***	0.024 ***	0.007 ***	0.008 ***
Variance of $\mathbf{e_{ij}}$ in Level-1	0.317	0.301	0.316	0.300	0.279	0.273	0.234
Explained Level-2 variance		35.4%	73.4%	82.7%	59.1%	87.8%	85.8%
Explained Level-1 variance		5.1%	0.2%	5.3%	12.0%	13.7%	26.1%
Intra-class correlation	15.6%	11.2%	4.7%	3.3%	7.9%	2.6%	3.4%

* p<0.05, ** p<0.01, *** p<0.001,
SOURCE: National Center for Education Statistics, NSOPF:04.

The HLM models on the outcome variables of student-centered teaching for undergraduate classes are developed in the same way as the HLM modeling procedure on publication score except Model A-7. Table 25 includes Model B-1 to 6 on outcome of student-centered teaching according to six hypotheses to test. Table 26 presents results of the HLM analyses. The intercept coefficient (γ_{00}) of Model B-1, -0.046, indicates an average of student-centered teaching factor scores aggregated by each institution. The ICC value of Model B-1, 0.05 = 0.034/(0.034+0.647), indicates that 5% of the total variance in teaching score originates from difference among institutions. The ICC value of Model B-1on student-centered teaching is smaller than ICC value of Model A-1 on publication (15.6%).

In Model B-2, the slope coefficients of disciplinary field variables show the difference among disciplinary fields. For example, the mean score of the faculty group who are teaching in the field of public administration equals to 0.833 (=-0.025+0.858). The slope coefficients imply that faculty members in the fields of public administration, education, and communication have the highest student-centered teaching factor score. The result agrees with the top three disciplinary fields on Figure 32. In Model B-2, disciplinary field variables account for 9.2% of level-1 variance in comparison with Model B-1.

In Model B-3, as the reference institution type is baccalaureate, the intercept coefficient (γ_{00}), 0.200, indicates an average score of baccalaureate institutions. The mean score of baccalaureate institutions is significantly higher than any other type of institutions except master's institutions. For example, the mean score of doctoral extensive institutions is the lowest, -0.075 (=0.200-0.275). In Model B-3, institutional type variables account for 20.2% of level-2 variance from Model B-1. Though Model B-4 integrates Model B-2 and B-3, it does not add anything to findings reported by the two previous models.

Model B-5 employs a set of demographic and employment variables without disciplinary and institutional variables. The coefficients of the variables indicate mean score of faculty

members who are female, have no doctoral degree, have a rank of assistant professor, do service as a principal activity, have research funded, or spend more percent time on graduate teaching is significantly higher than mean score of the others. The variables of gender and principal activity cause the biggest difference in frequency of student-centered teaching method use. The level-1 variance explained by a set of the demographic variables in Model B-5 (7.7%) is smaller than by a set of disciplinary variables in Model B-2 (9.2%). In comparison with the level-1 variance explained in Model A-5 (12.0%) is bigger than in Model A-2 (5.1%), those statistics show that disciplinary factors affect teaching style more than individual factors, whereas individual factors affect publication rate more than disciplinary factors.

The final model, Model B-6, examines how disciplinary, institutional, and individual characteristics affect student-centered teaching method score at a same time. Model B-6 explains 35.28% of the variance among institutions and 14.4% of the variance at level 1 in comparison with Model B-1. In Model B-4, the level-2 variance explained by institutional and disciplinary factors is 23.2% and the level-1 variance explained by the factors is 9.4%. In comparison with Model B-4, Model B-6 explains 18.2% more level-2 variance and 6.7% more level-1 variance by adding a set of demographic and employment variables. While Model A-6 explains 87.8% of institutional variance, Model B-6 explains 35.2% of institutional variance. The comparison reveals that Carnegie classification of higher education institutions explains difference in publication activity of faculty better than difference in teaching style.

In summary of the previous HLM analyses, these HLM results provide an extensive view to compare institutional, disciplinary, and individual factors on faculty academic outcomes. First, the two-level HLM analyses find that the publication factor score and the student-centered teaching factor score vary across institutions (Model A-1 and B-1). Substantial proportions of the variations among institutions in the scores are explained by Carnegie classification variables (Model A-3, B-3). Faculty members in doctoral extensive institutions have a significantly higher

level of a publication rate. Faculty members in baccalaureate institutions use student-centered teaching method for undergraduate classes more frequently than those in any other type institutions. These findings suggest that faculty work outcomes of publication and teaching are closely associated with the mission of the institution where they work.

Second, the demographic characteristics have mixed evidences regarding the effects on faculty work outcome. Some of the demographic variables do not have a significant effect in the final full models (A-7 and B-6) differently from in the previous partial models (Model A-6, and B-5). However, results indicate the individual variables regarding research-oriented conditions of a faculty member, such as doing research as a principal activity, having research fund, and percent time spent on research, are consistently significant influences on faculty publication productivity. The models show that percent time spent on undergraduate teaching is not a significant predictor of publication productivity, whereas percent time spent on graduate teaching is significant. The individual level variables related to accumulative advantage, rank, and tenure status also are consistently significant predictors on faculty publication productivity. These predictors are totally different from the significant predictors on student-centered teaching method, such as being female, having no doctoral degree, and doing service as principal activity.

Finally, the final model results provide solid evidence that there are still significant differences in faculty work outcome among most of the twenty disciplinary fields after controlling for individual and institutional factors. This finding initiates the following cluster analysis based on the notion that the twenty disciplinary fields can be classified into a small number of groups by using the two factor scores of publication and teaching that vary significantly across disciplinary fields.

Table 25. Hierarchical Linear Modeling Models for Student-centered Teaching

Y_{ij}: Dependent variables = Student-centered teaching factor score

	X_{1n}: Independent variables on level-1	X_{2n}: Independent variables on level-2	Hypothesis to test in HLM analysis	Level-1 Equation	Level-2 Equation
Model B-1	-	-	The average student-centered teaching factor score varies across institutions.	$Y_{ij} = \beta_{0j} + e_{ij}$	$\beta_{0j} = \gamma_{00} + u_{0j}$
Model B-2	Disciplinary field	-	A disciplinary field where a faculty member affiliates affects her student-centered teaching factor score.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + u_{0j}$ $\beta_{nj} = \gamma_{n0}$
Model B-3	-	Institution type	An institutional type where a faculty member affiliates affects her student-centered teaching factor score.	$Y_{ij} = \beta_{0j} + e_{ij}$	$\beta_{0j} = \gamma_{00} + \gamma_{n1}(X_{2n}) + u_{0j}$
Model B-4	Disciplinary field	Institution type	A disciplinary field and an institutional type where a faculty member affiliates affect her student-centered teaching factor score simultaneously.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + \gamma_{n1}(X_{2n}) + u_{0j}$ $\beta_{nj} = \gamma_{n0}$
Model B-5	Demographic/ employment characteristics	-	Demographic and employment characteristics of a faculty member affect her student-centered teaching factor score.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + u_{0j}$ $\beta_{nj} = \gamma_{n0}$
Model B-6	Disciplinary, Demographic/ employment characteristics	Institution type	Demographic and employment characteristics, a disciplinary field, and an institutional type where a faculty member affiliates affect her student-centered teaching factor score simultaneously.	$Y_{ij} = \beta_{0j} + \beta_{nj} (X_{1n}) + e_{ij}$	$\beta_{0j} = \gamma_{00} + \gamma_{n1}(X_{2n}) + u_{0j}$ $\beta_{nj} = \gamma_{n0}$

Table 26. Coefficients and Variances of Hierarchical Linear Modeling Models for Student-centered Teaching

		Model B-1	Model B-2	Model B-3	Model B-4	Model B-5	Model B-6
Intercept	γ_{00}	0.046 *	-0.025	0.200 ***	0.140 **	0.398 ***	0.434 ***
Level2: Institution type (reference=Baccalaureate)							
	Doctoral-Extensive			-0.275 ***	-0.270 ***		-0.225 ***
	Doctoral-Intensive			-0.180 **	-0.209 ***		-0.193 ***
	Master's			-0.091	-0.123 *		-0.113 *
	Associate's			-0.233 ***	-0.215 ***		-0.235 ***
	Others			-0.260 **	-0.255 **		-0.232 **
Level1: Demographic and employment variables							
	Gender, Male=1					-0.348 ***	-0.294 ***
	Race, White=1					-0.108	-0.105
	Born in USA =1					0.000	-0.016
	Doctoral degree=1					-0.114 ***	-0.121 **
	Tenured or track=1					0.025	0.040
	Full Professor (ref=Assistant)					-0.078 *	-0.046
	Associate (ref=Assistant)					-0.021	0.001
	Lecturer(ref=Assistant)					-0.120 **	-0.041
	Research as principal (ref=teaching)					-0.217 **	-0.132 *
	Service as principal (ref=teaching)					0.263 ***	0.233 ***
	Funded research=1					0.159 **	0.137 *
	Percent time on undergraduate					-0.001	-0.001
	Percent time on graduate					0.008 ***	0.006 ***
	Percent time on research					0.001	0.001
Level1: Disciplinary field (reference=no field)							
	Agriculture		0.379 **		0.384 *		0.420 **
	Arts-visual		0.140 *		0.128 *		0.115
	Biological sciences		0.019		0.001		0.031
	Business		0.402 ***		0.388 ***		0.388 ***
	Communication		0.583 ***		0.564 ***		0.512 ***
	Computer		-0.013		-0.031		-0.020
	Education		0.794 ***		0.774 ***		0.630 ***
	Engineering		0.017		0.037		0.081
	English language		0.396 ***		0.376 ***		0.339 ***
	Foreign languages		0.229 **		0.193 *		0.179 *

Health professions		0.272 ***		0.271 ***		0.080
Legal		-0.311		-0.324		-0.421 *
Library science		-0.196		-0.219		-0.377
Mathematics		-0.481 ***		-0.489 ***		-0.412 ***
Parks/recreation		0.280 *		0.278 **		0.280 **
Philosophy		-0.165		-0.173		-0.077
Physical sciences		-0.324 ***		-0.352 ***		-0.300 ***
Psychology		-0.046		-0.080		-0.108
Public administration		0.858 ***		0.847 ***		0.727 **
Social sciences		-0.070		-0.095		-0.059
Random Effect	Variance Component					
Variance of $\mathbf{u_{0j}}$ in Level-2	0.034 ***	0.032 ***	0.027 ***	0.026 ***	0.028 ***	0.022 ***
Variance of $\mathbf{e_{ij}}$ in Level-1	0.647	0.587	0.644	0.586	0.597	0.553
Explained Level-2 variance		6.3%	20.2%	23.2%	17.0%	35.2%
Explained Level-1 variance		9.2%	0.3%	9.4%	7.7%	14.4%
Intra-class correlation	5.0%	5.2%	4.0%	4.3%	4.5%	3.8%

* p<0.05, ** p<0.01, *** p<0.001

SOURCE: National Center for Education Statistics, NSOPF:04.

Cluster analysis for Disciplinary Classification

In order to find an empirical typology of the twenty disciplinary fields, k-means cluster analysis is conducted. Cluster analysis is an exploratory technique designed to suggest natural groupings within a dataset and develop taxonomic classification (Hair & Black, 2000). As it establishes clusters by calculating Euclidian distance among cluster means, the process suggests clusters with similar scores on variables of interest. The data of NSOPF: 04 are aggregated by a disciplinary field. The final data used for this cluster analysis consist of 20 subjects because the unit of cluster analysis is a disciplinary field. This study selects two factor scores of publication and student-centered teaching as variables for cluster analysis. The mean values of disciplinary fields are found in Table 27.

As this cluster analysis is used for an exploratory purpose, a series of cluster analyses were conducted. This study runs several analyses with cluster numbers ranging from 2 to 5. After careful review of the results, a four-cluster model was selected to perform the final analysis. The four clusters are labeled as followings:

- More Student-centered teaching, More Publication
- More Student-centered teaching, Less Publication
- Less Student-centered teaching, More Publication
- Less Student-centered teaching, Less Publication

Table 27 shows the result of four-cluster model in the k-means cluster analysis. This model presents a clear discrimination among clusters. Figure 7 illustrates locations and memberships for each disciplinary field on the quadrant. In order to examine face validity, the clustering result is compared with Biglan's classification and Becker's typology. In terms of horizontal scattering, the student-centered teaching method is used more frequently in the applied, soft, or professional fields, such as education, public administration, and communication,

than in the more pure, hard, or academic fields, including mathematics, physical science, and philosophy. In terms of vertical scattering, the publication emphasis appears more often in the hard fields where experimental methodology is used more frequently, such as agriculture, engineer, physical science, biological, and psychology, than in the "soft" fields.

Table 27. Cluster Membership of General Disciplinary Fields

Field	Student-centered Teaching	Publication	Cluster
Agriculture/natural resources/related	0.11	0.63	More Student-centered Teaching, More Publication
Health professions/clinical sciences	0.11	0.11	
Computer/info sciences/support tech	-0.09	-0.12	
Legal professions and studies	-0.2	-0.17	
Library science	-0.18	-0.29	Less Student-centered Teaching, Less Publication
Mathematics and statistics	-0.72	-0.21	
Philosophy, religion & theology	-0.28	-0.06	
Social sciences (except psych) & history	-0.21	-0.08	
Biological and biomedical sciences	-0.21	0.35	
Engineering technologies/technicians	-0.13	0.40	Less Student-centered Teaching, More Publication
Physical sciences	-0.45	0.38	
Psychology	-0.07	0.10	
Arts-visual and performing	0.06	-0.23	
Business/management/marketing/related	0.18	-0.17	
Communication/journalism/comm. tech	0.52	-0.19	
Education	0.66	-0.14	More student-centered Teaching, Less Publication
English language and literature/letters	0.33	-0.17	
Foreign languages/literature/linguistics	0.12	-0.17	
Parks/recreation/leisure/fitness studies	0.03	-0.28	
Public administration/social services	0.65	-0.09	

SOURCE: National Center for Education Statistics, NSOPF:04.

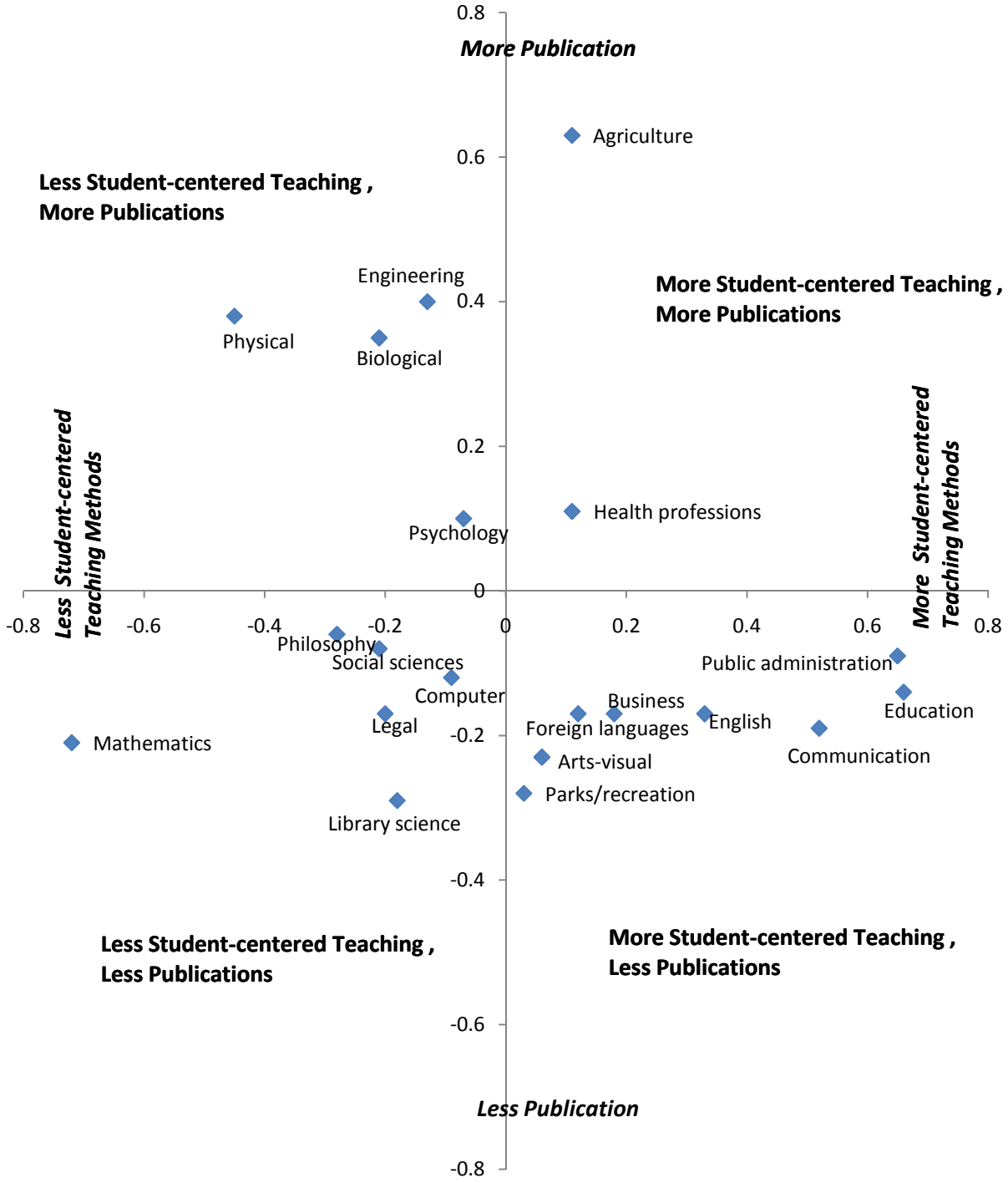

Figure 7. Cluster Membership of General Disciplinary Fields
SOURCE: National Center for Education Statistics, NSOPF:04.

As mentioned in literature reviews, Biglan's classification was created by using faculty members' perception about similarity and dissimilarity among academic programs in a university. Though Biglan used a quantitative method of multidimensional scaling, his classification should be considered normative categorization. For example, Figure 3 shows physics are more "hard" than mathematics in the Biglan classification. However, the numerical difference between the two disciplinary fields does not have any practical meaning because Biglan classification theory does not explain difference between disciplines classified into a same category. Therefore, the dimension labels of pure/applied and hard/soft are not appropriate for explaining the location of the scattered disciplinary fields on the Biglan's quadrant. The result of cluster analysis for this study suggests a new system to compensate the shortcomings of the Biglan classification. Because the new system uses factor scores to reflect faculty teaching and publication behaviors instead of subjective perception about academic identity of each disciplinary field, the location of each discipline on the two continuums is still useful to understand the difference in faculty work behavior between fields of the same cluster.

When a specific disciplinary field variable is used as a unit of analysis, the specific fields are located on the same quadrant based on the two factor scores as shown in Figure 8. The chemical engineering field on the second quadrant (Less Student-centered teaching, More Publication) and mathematics field on the third quadrant (Less Student-centered teaching, Less Publication) are considered extreme outliers. Table 28 provides evidence that there are epistemological or pedagogical differences between specific fields within a same general field. For example, in the general field of arts-visual and performing, some of specific fields are classified into the cluster of "Less Student-centered Teaching, Less Publication" while the others

are into the cluster of “More Student-centered Teaching, Less Publication.” As the number of faculty in the cluster of “Less Student-centered Teaching, Less Publication” (55.4%) is larger than in the cluster of “Less Student-centered Teaching, Less Publication” (44.6%), the general field of arts-visual and performing is classified in cluster of “More Student-centered Teaching, Less Publication”. The general field of health professions/clinical sciences also has great heterogeneousness among specific fields. This empirical information is useful for restructuring of the current disciplinary classification used on NSOPF:04. For instance, the specific fields of educational assessment and special education are separated from the other specific fields in the general field of education. The specific field of educational psychology is separated from the other specific fields in the general field of psychology. However, the specific fields of educational assessment, special education, and educational psychology are located in the same cluster as shown in Table 28.

Table 28. Cluster Membership of Specific Disciplinary Fields

General Filed	**Specific Field**	Publication Score	Student-centered Teaching Score	Number of individual Faculty members	Total	Less Student-centered teaching, Less Publication	Less Student-centered teaching, More Publication	More Student-centered teaching, Less Publication	More Student-centered teaching, More Publication
Agriculture/natural resources/related	Agriculture and related sciences	0.70	0.15	8,300	74.8%				74.8%
	Natural resources and conservation	0.42	0.00	2,800	25.2%		25.2%		
	Total	0.63	0.11	11,100	100.0%		25.2%		74.8%
Arts-visual and performing	Art history, criticism & conservation	-0.12	-0.20	3,100	7.5%	7.5%			
	Design & applied arts	-0.09	0.32	4,400	10.7%			10.7%	
	Drama/theatre arts and stagecraft	-0.41	0.48	5,600	13.6%			13.6%	
	Fine and studio art	-0.16	0.18	7,400	18.0%			18.0%	
	Music, general	-0.22	-0.13	10,200	24.7%	24.7%			
	Music history, literature, and theory	-0.27	-0.40	5,100	12.4%	12.4%			
	Visual and performing arts, other	-0.27	0.14	2,800	6.9%			6.9%	
	Dance	-0.24	0.26	2,600	6.2%			6.2%	
	Total	-0.23	0.06	41,300	100.0%	44.6%		55.4%	
Biological and biomedical sciences	Biochem/biophysics/molecular biology	0.45	-0.30	11,200	19.6%		19.6%		
	Botany/plant biology	0.35	-0.01	3,100	5.5%		5.5%		
	Genetics	0.82	-0.27	3,300	5.8%		5.8%		
	Microbiological sciences & immunology	0.57	-0.21	7,300	12.9%		12.9%		
	Physiology, pathology & related	0.35	-0.37	8,300	14.6%		14.6%		
	Zoology/animal biology	0.08	-0.17	4,900	8.6%		8.6%		
	Biological & biomedical sciences, other	0.18	-0.19	18,800	33.0%		33.0%		
	Total	0.35	-0.21	56,900	100.0%		100.0%		
Business/management/marketing/related	Accounting and related services	-0.24	-0.17	8,400	20.6%	20.6%			
	Business admin/management/operations	-0.18	0.26	8,800	21.6%			21.6%	
	Finance/financial management services	-0.08	0.07	4,800	11.7%			11.7%	
	Human resources management and services	-0.09	0.88	2,500	6.2%			6.2%	
	Marketing	-0.13	0.46	5,500	13.5%			13.5%	
	Business/mgt/marketing/related, other	-0.18	0.28	7,200	17.7%			17.7%	
	Management information systems/services	-0.06	0.25	3,500	8.6%			8.6%	
	Total	-0.16	0.20	40,700	100.0%	20.6%		79.4%	
Communication/journalism/related		-0.18	0.53	13,600	100.0%			100.0%	
Computer science	Computer science	0.08	-0.21	11,700	100.0%		100.0%		
Education	Curriculum and instruction	-0.01	0.80	3,800	12.5%			12.5%	

	Educational administration/supervision	-0.03	0.99	2,800	9.1%			9.1%	
	Special education and teaching	0.01	0.78	3,500	11.3%				11.3%
	Education, other	-0.13	0.44	5,600	18.2%			18.2%	
	Elementary education and teaching	-0.26	0.82	4,600	15.1%			15.1%	
	Secondary education and teaching	-0.12	0.78	2,900	9.5%			9.5%	
	Teacher ed: specific subject areas	-0.14	0.60	5,200	16.9%			16.9%	
	Ed assessment	0.18	0.40	2,200	7.3%				7.3%
	Total	-0.09	0.69	30,600	100.0%			81.4%	18.6%
Engineering technologies/technicians	Biomedical/medical engineering	0.84	0.12	2,100	7.0%				7.0%
	Chemical engineering	1.69	-0.19	1,600	5.5%		5.5%		
	Civil engineering	0.46	-0.19	4,000	13.5%		13.5%		
	Computer engineering	0.13	0.14	1,800	6.0%				6.0%
	Electrical & communications eng	0.40	-0.37	6,600	22.3%		22.3%		
	Environmental/environmental health	0.33	0.27	2,200	7.5%				7.5%
	Mechanical engineering	0.30	-0.15	5,700	19.5%		19.5%		
	Engineering, other	0.48	-0.07	5,400	18.5%		18.5%		
	Total	0.48	-0.14	29,400	100.0%		79.4%		20.6%
English language and literature/letters		-0.17	0.33	37,300	100.0%			100.0%	
Foreign languages/literature/linguistics		-0.17	0.12	19,700	100.0%			100.0%	
Health professions/clinical sciences	Clinical/medical lab science/allied	-0.04	-0.27	2,000	2.4%	2.4%			
	Dentistry	-0.03	-0.28	2,800	3.4%	3.4%			
	Medicine, including psychiatry	0.36	-0.34	35,100	42.9%		42.9%		
	Nursing	-0.37	0.34	19,500	23.8%			23.8%	
	Pharmacy/pharmaceutical sciences/admin	0.48	-0.11	3,300	4.0%		4.0%		
	Public health	0.44	0.04	4,700	5.7%				5.7%
	Rehabilitation & therapeutic professions	-0.15	0.17	5,200	6.3%			6.3%	
	Veterinary medicine	0.53	-0.53	2,300	2.8%		2.8%		
	Health/related clinical services, other	0.32	0.00	7,100	8.6%		8.6%		
	Total	0.14	0.14	81,900	100.0%	5.8%	58.4%	30.1%	5.7%
Law		-0.16	-0.31	8,300	100.0%	100.0%			
Library science		-0.29	-0.18	7,800	100.0%	100.0%			
Mathematics and statistics	Mathematics	-0.26	-0.72	27,500	89.1%	89.1%			
	Statistics	0.25	-0.65	3,400	10.9%		10.9%		
	Total	-0.21	-0.72	30,900	100.0%	89.1%	10.9%		
Health and physical	Health and physical education/fitness	-0.30	0.02	11,100	100.0%			100.0%	
Philosophy, religion & theology	Philosophy	-0.07	-0.37	7,700	59.0%	59.0%			
	Religion/religious studies	-0.06	-0.20	5,300	41.0%	41.0%			
	Total	-0.07	-0.31	13,100	100.0%	100.0%			
Physical sciences	Chemistry	0.15	-0.46	14,500	45.6%		45.6%		
	Geological & earth sciences/geosciences	0.27	-0.21	5,900	18.5%		18.5%		

	Physics	0.57	-0.59	11,400	35.8%		35.8%		
	Total	0.32	-0.46	31,800	100.0%		100.0%		
Psychology	Behavioral psychology	0.06	-0.20	2,500	10.4%		10.4%		
	Clinical psychology	0.22	-0.09	5,300	22.2%		22.2%		
	Education/school psychology	0.04	0.89	1,700	7.4%				7.4%
	Psychology, other	0.08	-0.10	14,200	60.0%		60.0%		
	Total	0.10	-0.07	23,700	100.0%		92.6%		7.4%
Public administration/social services	Public administration	0.10	0.61	1,800	25.2%				25.2%
	Social work	-0.12	0.66	5,300	74.8%			74.8%	
	Total	-0.07	0.65	7,100	100.0%			74.8%	25.2%
Social sciences (except psych) & history	Anthropology (except psychology)	-0.05	-0.06	4,100	7.5%	7.5%			
	Economics	0.01	-0.42	11,600	20.9%		20.9%		
	Geography & cartography	0.02	-0.21	2,700	4.8%		4.8%		
	History	-0.13	-0.24	18,000	32.4%	32.4%			
	Political science and government	-0.15	-0.19	9,900	17.8%	17.8%			
	Sociology	-0.10	-0.02	9,300	16.7%	16.7%			
	Total	-0.09	-0.21	55,600	100.0%	74.3%	25.7%		

SOURCE: National Center for Education Statistics, NSOPF:04.

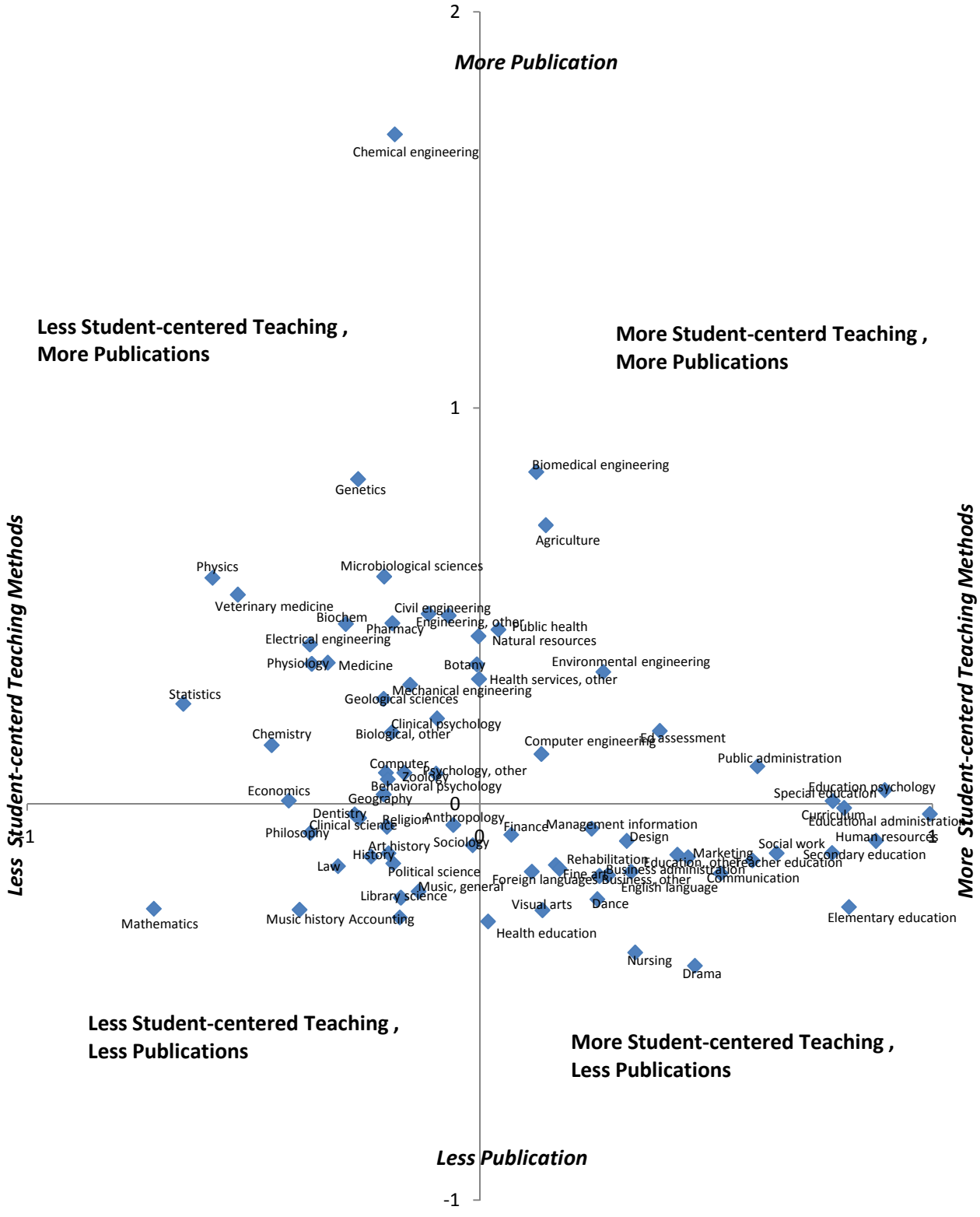

Figure 8. Cluster Membership of Specific Disciplinary Fields
SOURCE: National Center for Education Statistics, NSOPF:04.

Chapter 5

Conclusion

The purpose of this study was to investigate individual and organizational determinants of faculty productivity by employing full time faculty cases from the NSOPF:04 data. This chapter discusses the findings of the statistical analyses in terms of each research question articulated. Implications of the findings for further study and practice are also discussed.

Statistical Analysis Overview

The following were the research questions addressed in this study: (1) How can faculty productivity of research and instruction be measured? (2) What individual and institutional attributes influence the faculty productivity? (3) What is the relative contribution of individual, disciplinary, and institutional variables to the faculty productivity? (4) What is the disciplinary classification to account for the difference in the faculty productivity?

To investigate the first research question, exploratory factor analysis to create factor scores regarding faculty productivity of research and teaching was employed. To explore the second and third research questions, HLM analysis was employed. The HLM analysis used the two factor scores of publication and student-centered teaching as the dependent variables and additional variables as explanatory variables. Finally, a cluster analysis to classify twenty disciplinary fields was employed to answer the last question.

Prior to examining how individual, disciplinary, and institutional variables affect faculty work, a series of two-way ANOVAs tested differences in demographic and employment variables, such as gender, race, national origin, doctoral degree, scholarly fund, rank, tenure, and salary income, among institutional types and disciplinary fields. The ANOVA statistics proved that both factors of institutional type and disciplinary field affect significant differences in the

demographic distributions and employment conditions of faculty. Especially, the proportions of female faculty and doctoral degree holding faculty vary markedly across disciplinary fields in terms of substantial effect size. These findings suggest that the demographic variables should be controlled for simultaneously with disciplinary and institutional factors by using HLM analysis to predict faculty work product.

This study used two sets of variables regarding faculty outcomes of teaching and research. The first set of outcome variables focused on research, and consisted of seven question items on recent publication activity of an individual faculty member, including numbers of refereed journal articles, nonrefereed journal articles, book reviews/chapters, books/textbooks/reports, presentations, exhibitions/ performances, and patents/computer software. The second outcome variables focused on teaching, and consisted of ten items on teaching and evaluation methods that an individual faculty member has used for an undergraduate class, such as multiple choice midterm/final exams, essay midterm/final exams, short answer midterm/final exams, term/research papers, multiple drafts of written work, oral presentations, group projects, student evaluations of each others' work, laboratory/shop/studio assignments, and service learning/co-op interactions with business.

The descriptive analyses on the two sets of items showed that faculty members in different disciplinary fields favor different types of publication and teaching methods because of epistemological characteristics of each disciplinary field. In order to deal with the multivariate relationship among faculty activity items, exploratory factor analyses were used to model faculty productivities of research and teaching as latent variables. By examining dimensions of faculty publication and teaching items, this study generated two weighted factor scores to reflect latent dimensions of publication and student-centered teaching for following HLM analyses.

Seven HLM models on the publication factor score and six HLM models on the student-centered teaching factor score were successively tested to find out how individual, institutional, disciplinary characteristics affect the factor scores separately and simultaneously. HLM analyses suggested that faculty outcomes of publication and teaching were simultaneously affected by institutional type, disciplinary fields, and employment conditions as assumed in the theoretical model of this study (p.23). It is noticeable that the accumulative advantage variables, which are measured by salary income amount and average publication numbers during career years, have the most substantial effect on the publication factor score than the other independent variables. Though these findings are not surprising and would be expected through previous studies, these predictable results give credibility to this study procedure.

As HLM analyses indicated that there were significant differences in faculty work among most of the disciplinary fields, the twenty disciplinary fields were classified into a small number of groups based on the two factor scores of publication and teaching that varied significantly across disciplinary fields. Four clusters were selected by using K-mean cluster analysis. The clustering result illustrates similarity and dissimilarity of faculty work across disciplinary fields. As the clustering analysis is based on measures of faculty research and teaching behaviors, it provides a new clustering result different from Biglan's (1973a) classification and Becker's (1994) disciplinary grouping that were based on faculty perception survey.

Discussion

In this section, the findings for each research question are reviewed and discussed. This study identifies the major determinants of publication rate and student-centered teaching method use through HLM analysis. The determinants encompass individual characteristics of faculty members, organizational characteristics of the institutions, and cultural influences of different

disciplinary fields. Several individual and organizational variables are found to be significant in relation to publication productivity and student-centered teaching method of faculty.

It was expected that being male, foreign-born, and holding a doctoral degree would be positively associated with faculty publication productivity. Previous studies report that male faculty (Long, 1990; Reis, 2002), foreign-born faculty (Corley & Sabharawal, 2007; Mamiseishvili & Rosser, 2010), and doctoral degree holding faculty (Porter & Umbach, 2001) tend to have higher levels of publication productivity. The significant relationship between career status or previous achievement, such as salary, rank, tenure and average annual number of publications during career, and current publication productivity is also another expected finding (Simonton, 2003). However, it is noticeable that the statistical significances of the gender, nationality, and doctoral degree variables disappear after controlling for accumulative advantage variables in the full HLM model. It is likely that minority background of faculty members does not affect their research productivity anymore after they have achieved high level of accumulative advantages or career status.

The HLM results show another predictable finding that faculty members who spend more time on research tend to have a higher level of publication factor score (Bellas & Toutkoushian, 1999). Similarly, faculty members who conduct research as a principal activity tend to have a higher level of publication factor score. Inconsistent with previous research (Clark, 1987; Becher, 1989; Fox, 1992), these HLM results do not suggest that percent time spent on teaching undergraduate students has a significant effect on faculty publication productivity. Different results between this study and previous studies may be caused by different institutional populations used for the studies. While this study included all types of institutions, previous studies focused on doctoral institutions and comprehensive universities excluding associate's

institutions. On the other side, it is interesting that percent time spent on teaching graduate students affects publication productivity positively. The positive relationship between teaching graduate students and conducting research may be due to institutional characteristics of research universities. Faculty members in research universities are likely to have more percent time spent on teaching graduate students and more percent time on research.

This study also explored determinants that influence use of student-centered teaching method in undergraduate instruction. Being female was considered an individual background variable that significantly affected use of student-centered teaching method (Einarson, 2001; Singer, 1996). In this study, female faculty were substantially more likely to use student-centered teaching pedagogy (slope=-0.348, $p<.001$) than male faculty. This result agrees with previous research that argues that female faculty members in the undergraduate class tend to facilitate cooperative learning and student-centered class activities (Einarson, 2001) and women preferred process-oriented instruction to content- oriented teaching (Singer, 1996). The HLM result of this study shows that faculty members who do not hold doctoral degrees are more likely to use student-centered teaching method. It is also similar to previous research that academic background of the instructor significantly affected teaching attitudes and behaviors (Fairweather & Rhoads, 1995).

Previous studies reported faculty members devoting large amounts of time to instruction tended to try a variety of methods in their class instruction (Fairweather & Rhoads, 1995; Paulsen & Feldman, 1995). Unexpectedly, the percent time spent on undergraduate teaching is not significantly related to the use of student-centered teaching in this study. In contrast, spending more percent time on graduate classroom instruction is significantly and positively related to student-centered instruction in this study. Faculty members who have more percent

time on teaching graduate classes tend to adopt student-centered instruction method in undergraduate classes. Though the relationship between research productivity and teaching effectiveness has been debated in the previous studies, results from this study indicate that percent time spent on research does not significantly affect student-centered teaching method use of faculty members. Another unexpected finding of this study was that faculty members who are doing service as a principal activity are more likely to use the student-centered teaching methods in undergraduate classes. One possible explanation for this unexpected result is that faculty members who are doing service as a principal activity would have more positive attitudes to teaching in undergraduate classroom than faculty members who are doing teaching as a principal activity.

The Carnegie institutional type significantly influenced faculty publication rate and use of instructional student-centered teaching methods in the HLM results. The average level of percent time spent on research at doctoral universities is substantially higher than that at any other institutions. The group mean difference in publication factor score across institutional types would result mainly from the difference in the time resource for research. Though literature suggested the inverse relationship between the number of hours spent teaching and the number of research publications (Clark, 1987; Becher, 1989), the HLM results of this study show that the teaching load of each individual faculty member is not a significant predictor of publication productivity within a type institution. Faculty members who believe that research publication is rewarded at their institution or in their disciplinary field are likely to have more research productivity regardless of undergraduate teaching load.

In contrast with publication productivity, the HLM results from this study indicate that research-oriented climate of doctoral institutions had a negative influence on the use of student-

centered teaching methods. In this study, while faculty members in baccalaureate institutions have higher level of student-centered teaching method use than those in doctoral institutions, faculty members in associate's institutions do not have higher levels of student-centered teaching method use than those in doctoral institutions. Student-centered teaching method use may be affected by the reward system and culture of each institution, not directly by undergraduate teaching load of individual faculty members (Blackburn and Lawrence, 1995, emphasized the relationship between organizational culture and faculty teaching behavior.) The reason why faculty members in baccalaureate institutions tend to teach with various student-centered teaching methods is that they may believe that student-centered teaching methods for undergraduate instruction are more appreciated and supported by their institutions.

The study also found significant differences in publication rate and student-centered teaching method use of faculty members among most of the 20 disciplinary fields. Previous research suggested differences in the research outcomes between disciplinary fields (Becher, 1989; Porter & Umbach, 2001). The HLM results from this study indicate that faculty members in the fields of natural science (biological and physical science) and applied science (engineering and agriculture) would publish journal articles and technical reports more frequently. The results are expected because faculty members in these fields tend to invest in expensive research equipment and require a team of researchers to meet the demand for up-to-date reports on progress while faculty members in the fields of humanities and social sciences conduct broader research with wider time-spans and a greater variety of sources (Becher, 1989).

Faculty members in different disciplinary fields differ significantly in their commitment to teaching as well as research (Biglan, 1973b). This study suggests that each discipline has its own preference pattern of teaching methods. The faculty members in the fields of math and

science have lower level of student-centered teaching method use in this study because they may "rely predominantly on structured and formal teaching-learning strategies that are decidedly subject-matter centered, they believe that students learn best by meeting specific, clear-cut a priori course requirements; and they place high value on examination and grades" (Smart et al., 2000, p. 242).

The variance partitioning results of the HLM models imply that most of the effects occurred across Carnegie classification types rather than from differences in individual or disciplinary field variables (Tables 24 and 26). The 2000 Carnegie classification categorical variable used for this study remains a reliable predictor in analysis of differences among institutions even after all of independent variables, including individual demographic and disciplinary field variables, are controlled for. For the comparison between individual demographic and disciplinary field factors, the HLM partitioning results show that disciplinary factors affect use of student-centered teaching methods more than individual factors, whereas individual factors affect publication rate more than disciplinary factors.

A cluster analysis resulted in the emergence of a two-dimension four-cluster typology of twenty disciplinary fields. Faculty members in the dimension of “more student-centered teaching methods” are likely to work in the fields of applied sciences to improve professional practice, such as agriculture, health profession, education, and public administration. Faculty members in the dimension of “more publication” tend to conduct research by experimental scrutiny of relationships between a few carefully controlled variables in the fields of biological and physical sciences, and engineering. However, the clustering of this study does not exactly fit into the categories used in the previous classifications of Biglan (1973a), Becher (1994), and Holland (1973). For example, "hard-pure" category of Biglan includes the fields of biological and

physical sciences. Though this study finds that the fields are located in the cluster of "less student-centered teaching and more publication", it is interesting to note that the cluster includes psychology and engineering as well as the hard-pure sciences. In terms of faculty teaching and research activities, this study implies that psychology is a natural science (hard knowledge) rather than the social science (soft knowledge). Though Biglan (1973a) and Becker (1994) categorized the field of engineering as an applied field, the statistical results for this study indicated that faculty members in engineering have teaching and research behaviors similar to those in the hard-pure science fields. These different results are due to different methodology.

Biglan surveyed faculty opinion about similarity among disciplinary fields, not faculty behavior characteristics, for his classification. The criteria of pure-applied and hare-soft were based on author's qualitative judgment in the previous studies (Becker, 1994; Kolb, 1981; Kuhn, 1962). The Biglan's criteria cannot give solid quantitative information. For example, in the Biglan's classification, a question about which disciplinary field within a same category is "harder" or "purer" cannot be answered by using an empirical behavioral index instead of consciousness or opinion surveyed. A quantitative measurement on the hardness and pureness of Biglan is required for cross-sectional and longitudinal studies to inquire an epistemological attribute of a disciplinary field. The cluster analysis of this study suggests another classification model different from the previous qualitative classifications by employing quantitative measurements of faculty teaching and research behaviors.

Implications

It is important for higher education policy to understand a specific pattern of faculty productivity in the higher education system from major doctoral universities to small community colleges. From previous studies, it was expected that individual characteristics and institutional

and disciplinary affiliations are strongly associated with faculty productivity. Overall results of this study confirm the conventional thinking on faculty productivity issues. In an extension to the existing literature, this study identified the institutional, disciplinary, and individual characteristics that influence research publication rate and student-centered teaching at the undergraduate level. This study contributes to the understanding of faculty productivity and its multiple determinants.

The HLM approach of this study shows that faculty productivity is a multilevel construct by demonstrating the variance partitioning of individual-level and group-level effects. This study recommends a balanced perspective between the emphases given to organizational and individual factors to explain individual faculty productivity. The results of the study are useful as a starting point in the examination and interpretation of the complex relationship between organizational and individual factors on faculty productivity.

This study suggested an alternative means for classifying disciplinary fields and illustrated the highly heterogeneous nature of disciplinary fields in terms of faculty work. Smart et al. (2000) argued higher education institutions should restructure their arrangement of disciplines based on a theory-based understanding of the similarities and differences among academic departments. The disciplinary classification of this study offers the theory-based understanding about how to make distinctions among disciplinary fields so that researchers and administrators can better serve higher education planning and assessment. The differences identified among disciplines can also inform administrators in their efforts to evaluate an individual faculty member at their institutions. Higher education administrators who evaluate faculty productivity should be aware of the differences in research outcome and teaching patterns that exist among disciplines.

Although this study provides some methodological and substantive contributions to increase our understanding of the faculty productivity, further research in this area is still needed. Future studies on faculty productivity may wish to include a mixed method approach to enrich the faculty perspectives that are difficult to capture with multiple-choice survey instruments. It would also be necessary to include variables unavailable for this study, such as individual psychological and cognitive characteristics, institutional support information, and department leadership characteristics. Graduate experience of faculty members would influence their publication rate and teaching methods (Fairweather & Rhoads, 1995; Wulff & Austin, 2004). For, example, further research may focus use interviewing with highly productive experts to determine what research skills and teaching methods should be taught during graduation school.

In conducting this study, the analysis has attempted to move from univariate to multivariate outcome perspectives in our examination of faculty productivity. The factor analysis approach of this study shows that faculty productivity is a multivariate construct having multi-dimensional latent variables. The results of this study provide information on the measurement of faculty productivity. For better understanding of faculty activity and its multiple determinants, it is important to develop more measures of faculty productivity in further research. For example, future studies may wish to consider the number of publication citations and student course evaluations that may more accurately reflect a quality dimension of faculty productivity.

This study provides higher education institution's administrators the means to affect the level of faculty productivity and predict faculty productivity potential. By examining individual and institutional factors, leaders can better allocate resources to increase future productivity and aid individual faculty members, departments, and institutions in enhancing their productivity. Higher education institutions need to base salary, tenure and promotion decisions on innovative

instructional activities of a faculty member as well as research output because the benefit of research to the instruction of undergraduate students is an ongoing debate of higher education accountability issue for many stakeholders. Redefinitions of research productivity, supports to innovative teaching for undergraduate class, and adjusting reward structures may help faculty members meet policymakers' demands of accountability as well as departmental level demand for scholarly output. More research is necessary to determine the effects of higher education reward policies on the research and teaching productivity of faculty members.

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Appendix A

Crosstab tables and line chart figures of independent and dependent variables by disciplinary field by institutional type

List of Tables and Figures

Table A-1. Proportion of Full Time Faculty by Disciplinary Field by Institutional Type

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	93%	93%	95%	94%	70%	90%
Arts-visual and performing	75%	67%	59%	62%	41%	60%
Biological and biomedical sciences	94%	93%	79%	84%	53%	84%
Business/management/marketing/related	82%	69%	62%	60%	50%	64%
Communication/journalism/comm. tech	76%	78%	66%	77%	46%	66%
Computer/info sciences/support tech	82%	72%	61%	77%	47%	61%
Education	80%	63%	55%	66%	42%	58%
Engineering technologies/technicians	90%	82%	77%	77%	61%	81%
English language and literature/letters	79%	73%	66%	71%	43%	60%
Foreign languages/literature/linguistics	81%	68%	67%	80%	35%	67%
Health professions/clinical sciences	84%	81%	74%	76%	50%	73%
Legal professions and studies	73%	63%	53%	40%	21%	56%
Library science	92%	88%	83%	97%	76%	87%
Mathematics and statistics	86%	80%	69%	80%	45%	64%
Parks/recreation/leisure/fitness studies	78%	83%	78%	84%	43%	67%
Philosophy, religion & theology	85%	81%	61%	69%	39%	68%
Physical sciences	92%	86%	78%	85%	51%	80%
Psychology	85%	68%	66%	73%	47%	68%
Public administration/social services	72%	58%	70%	65%	47%	65%
Social sciences (except psych) & history	89%	82%	72%	83%	46%	74%
Total	85%	76%	66%	73%	46%	68%

SOURCE: National Center for Education Statistics, NSOPF:04.

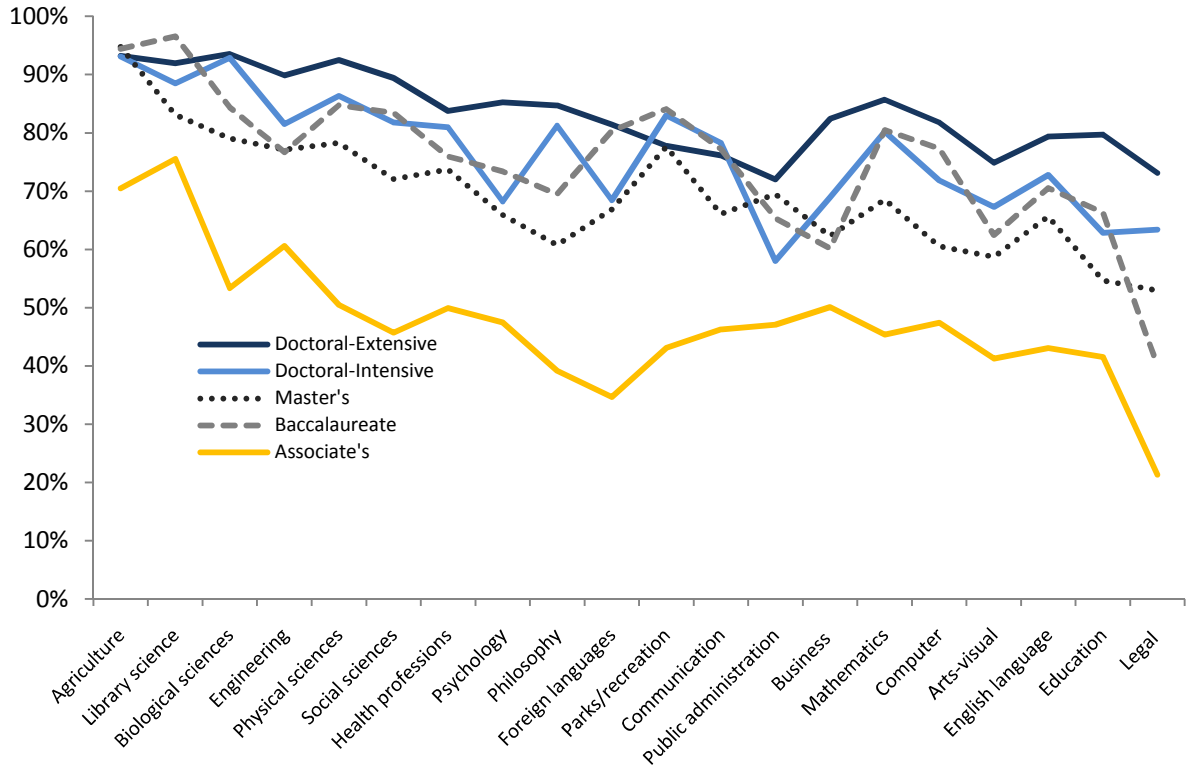

Figure A-1. Proportion of Full Time Faculty by Disciplinary Field by Institutional Type

Table A-2. Proportion of Male Faculty Member by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	80%	81%	100%	64%	91%	82%
Arts-visual and performing	62%	75%	67%	57%	57%	63%
Biological and biomedical sciences	77%	75%	64%	60%	53%	72%
Business/management/marketing/related	74%	70%	76%	68%	53%	69%
Communication/journalism/comm. tech	65%	48%	50%	55%	55%	55%
Computer/info sciences/support tech	81%	73%	81%	69%	53%	69%
Education	51%	38%	38%	33%	31%	39%
Engineering technologies/technicians	92%	92%	81%	100%	99%	92%
English language and literature/letters	53%	49%	49%	41%	35%	44%
Foreign languages/literature/linguistics	54%	68%	47%	38%	41%	50%
Health professions/clinical sciences	62%	48%	20%	17%	17%	45%
Legal professions and studies	64%	65%	58%	70%	48%	62%
Library science	43%	35%	35%	36%	21%	35%
Mathematics and statistics	88%	77%	72%	84%	57%	73%
Parks/recreation/leisure/fitness studies	59%	57%	55%	78%	61%	61%
Philosophy, religion & theology	84%	81%	78%	80%	78%	81%
Physical sciences	86%	86%	79%	81%	78%	83%
Psychology	57%	63%	56%	52%	47%	55%
Public administration/social services	53%	43%	28%	56%	64%	44%
Social sciences (except psych) & history	74%	65%	70%	72%	64%	70%
Total	71%	65%	59%	59%	49%	62%

SOURCE: National Center for Education Statistics, NSOPF:04.

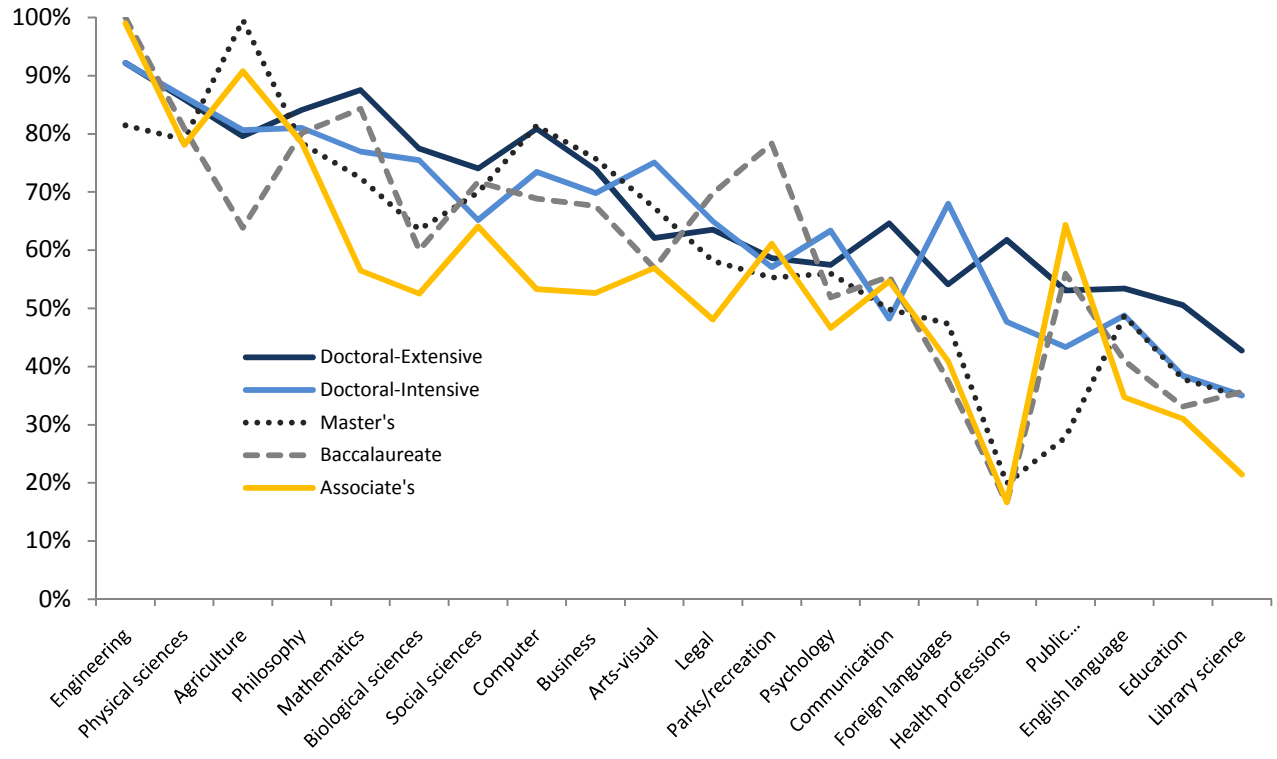

Figure A-2. Proportion of Male Faculty Member by Carnegie Type and Disciplinary Field

Table A-3. Proportion of White Faculty Member by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	94%	89%	76%	100%	96%	93%
Arts-visual and performing	91%	89%	91%	90%	91%	91%
Biological and biomedical sciences	79%	85%	84%	92%	90%	82%
Business/management/marketing/related	80%	77%	82%	91%	95%	84%
Communication/journalism/comm. tech	94%	87%	86%	93%	95%	91%
Computer/info sciences/support tech	70%	78%	72%	89%	87%	79%
Education	89%	85%	87%	86%	80%	86%
Engineering technologies/technicians	76%	57%	62%	81%	90%	74%
English language and literature/letters	91%	90%	87%	90%	90%	89%
Foreign languages/literature/linguistics	87%	91%	85%	90%	85%	87%
Health professions/clinical sciences	81%	86%	94%	87%	92%	85%
Legal professions and studies	88%	84%	87%	97%	85%	87%
Library science	96%	100%	89%	95%	87%	92%
Mathematics and statistics	83%	76%	79%	75%	81%	80%
Parks/recreation/leisure/fitness studies	86%	92%	97%	96%	89%	92%
Philosophy, religion & theology	93%	97%	91%	93%	98%	94%
Physical sciences	84%	87%	81%	90%	92%	85%
Psychology	92%	94%	87%	86%	90%	90%
Public administration/social services	77%	79%	71%	45%	87%	74%
Social sciences (except psych) & history	86%	84%	87%	91%	84%	87%
Total	84%	84%	85%	89%	89%	85%

SOURCE: National Center for Education Statistics, NSOPF:04.

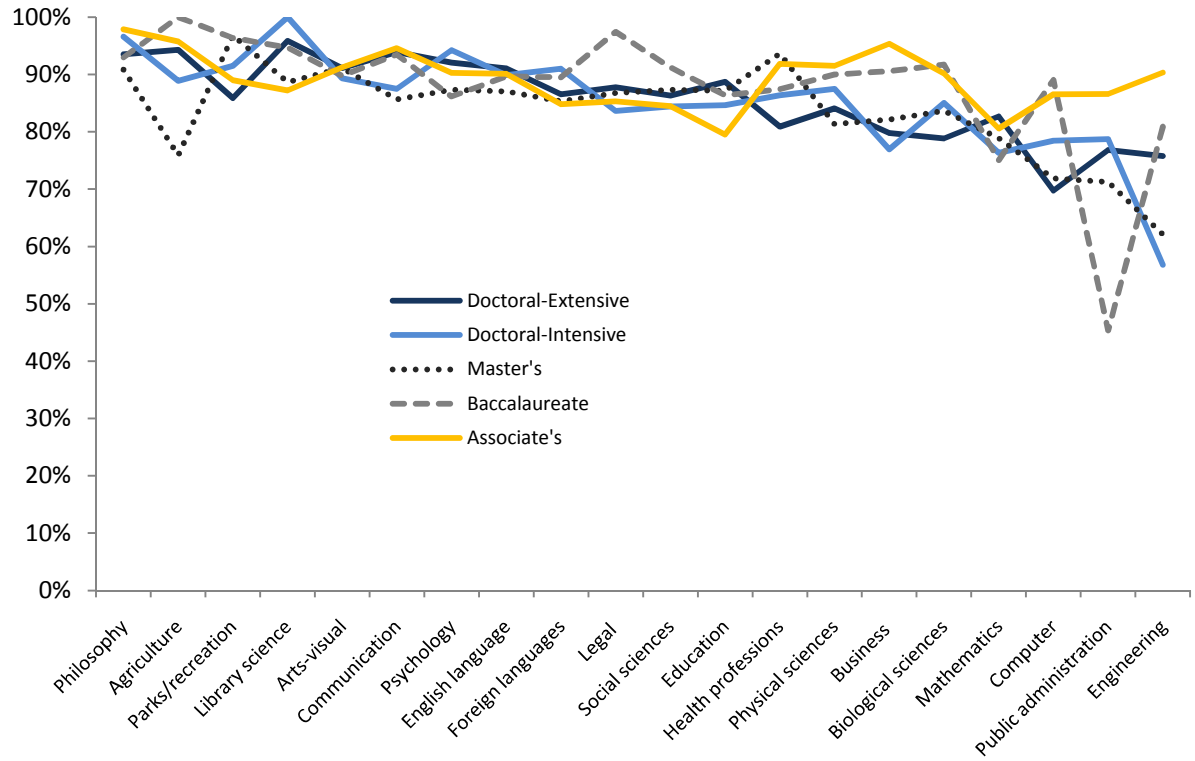

Figure A-3. Proportion of White Faculty Member by Carnegie Type and Disciplinary Field

Table A-4. Proportion of Faculty Member Born in the U.S.A. by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	87%	85%	81%	80%	97%	87%
Arts-visual and performing	85%	88%	89%	89%	94%	89%
Biological and biomedical sciences	62%	72%	80%	90%	92%	71%
Business/management/marketing/related	74%	71%	72%	90%	96%	79%
Communication/journalism/comm. tech	93%	90%	91%	86%	95%	92%
Computer/info sciences/support tech	52%	55%	67%	90%	89%	72%
Education	88%	92%	89%	94%	92%	90%
Engineering technologies/technicians	55%	43%	57%	79%	91%	59%
English language and literature/letters	85%	84%	90%	90%	93%	89%
Foreign languages/literature/linguistics	56%	64%	70%	59%	67%	61%
Health professions/clinical sciences	76%	80%	93%	95%	95%	83%
Legal professions and studies	96%	94%	95%	88%	100%	95%
Library science	89%	89%	93%	95%	90%	91%
Mathematics and statistics	55%	58%	79%	70%	88%	72%
Parks/recreation/leisure/fitness studies	87%	85%	89%	100%	94%	91%
Philosophy, religion & theology	85%	86%	87%	91%	93%	88%
Physical sciences	62%	74%	76%	87%	89%	72%
Psychology	86%	92%	91%	88%	96%	90%
Public administration/social services	89%	85%	94%	98%	90%	91%
Social sciences (except psych) & history	80%	83%	86%	86%	84%	83%
Total	73%	77%	84%	87%	92%	81%

SOURCE: National Center for Education Statistics, NSOPF:04.

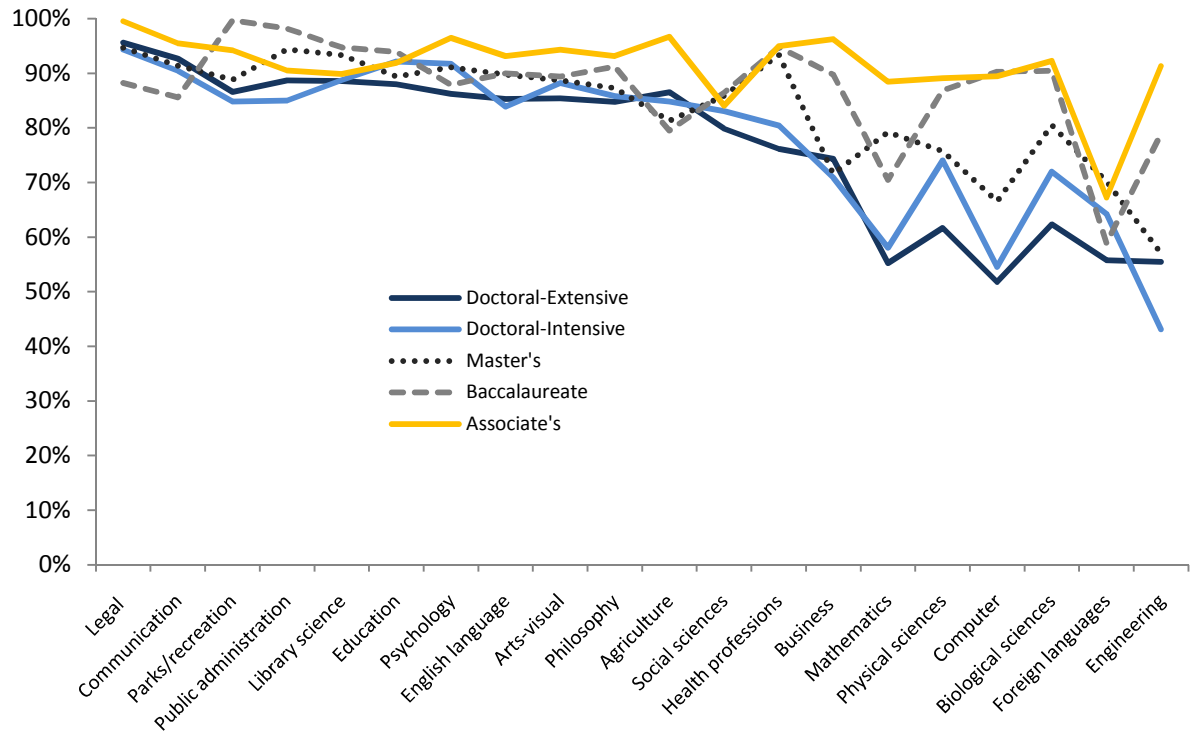

Figure A-4. Proportion of Faculty Member Born in the U.S.A. by Carnegie Type and Disciplinary Field

Table A-5. Proportion of Faculty Member with Doctoral Degree by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	81%	86%	90%	48%	12%	72%
Arts-visual and performing	42%	48%	41%	43%	14%	37%
Biological and biomedical sciences	91%	87%	92%	91%	45%	85%
Business/management/marketing/related	89%	79%	75%	49%	9%	64%
Communication/journalism/comm. tech	67%	68%	64%	54%	12%	53%
Computer/info sciences/support tech	83%	70%	68%	61%	6%	49%
Education	80%	77%	78%	59%	13%	64%
Engineering technologies/technicians	90%	94%	83%	54%	6%	77%
English language and literature/letters	72%	69%	80%	76%	23%	58%
Foreign languages/literature/linguistics	86%	82%	81%	75%	19%	77%
Health professions/clinical sciences	34%	41%	47%	18%	7%	31%
Legal professions and studies	9%	21%	8%	19%	0%	11%
Library science	25%	8%	12%	3%	5%	14%
Mathematics and statistics	91%	83%	79%	78%	16%	63%
Parks/recreation/leisure/fitness studies	65%	61%	47%	20%	15%	40%
Philosophy, religion & theology	97%	84%	91%	93%	41%	86%
Physical sciences	97%	93%	95%	97%	51%	91%
Psychology	99%	97%	95%	97%	49%	88%
Public administration/social services	84%	77%	70%	42%	33%	72%
Social sciences (except psych) & history	95%	92%	92%	94%	40%	86%
Total	74%	73%	73%	69%	20%	63%

SOURCE: National Center for Education Statistics, NSOPF:04.

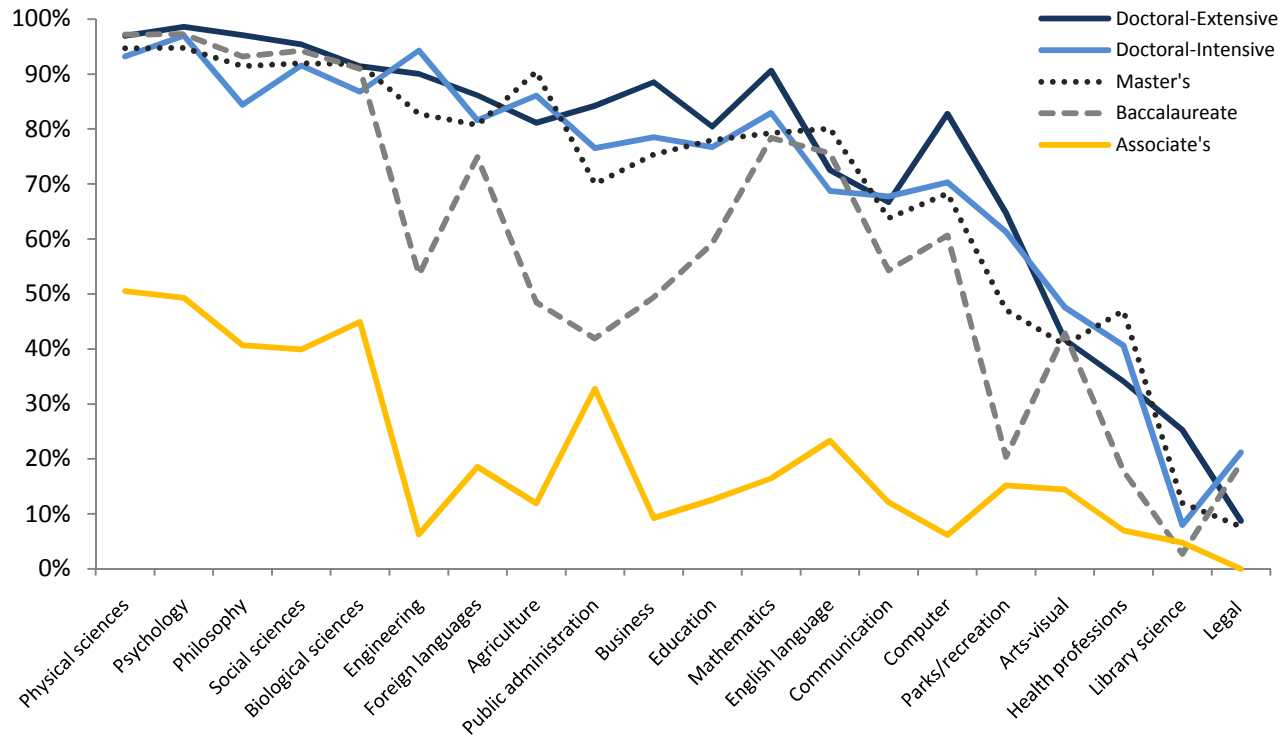

Figure A-5. Proportion of Faculty Member with Doctoral Degree by Carnegie Type and Disciplinary Field

Table A-6. Proportion of Faculty Have Scholarly Activity Funded by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	69%	77%	33%	15%	9%	58%
Arts-visual and performing	34%	26%	23%	30%	14%	26%
Biological and biomedical sciences	69%	63%	43%	45%	10%	57%
Business/management/marketing/related	27%	21%	18%	16%	6%	18%
Communication/journalism/comm. tech	28%	25%	20%	13%	20%	22%
Computer/info sciences/support tech	60%	40%	25%	14%	9%	29%
Education	40%	26%	24%	15%	8%	24%
Engineering technologies/technicians	68%	66%	27%	20%	4%	53%
English language and literature/letters	19%	20%	27%	35%	12%	20%
Foreign languages/literature/linguistics	28%	29%	23%	37%	12%	27%
Health professions/clinical sciences	46%	40%	23%	17%	6%	34%
Legal professions and studies	28%	16%	30%	39%	29%	26%
Library science	14%	19%	16%	8%	13%	14%
Mathematics and statistics	51%	28%	15%	11%	5%	23%
Parks/recreation/leisure/fitness studies	34%	37%	18%	13%	3%	18%
Philosophy, religion & theology	31%	20%	26%	41%	0%	26%
Physical sciences	69%	55%	44%	36%	11%	51%
Psychology	59%	47%	28%	27%	7%	37%
Public administration/social services	51%	29%	31%	16%	23%	37%
Social sciences (except psych) & history	43%	32%	28%	31%	13%	33%
Total	49%	37%	26%	27%	9%	33%

SOURCE: National Center for Education Statistics, NSOPF:04.

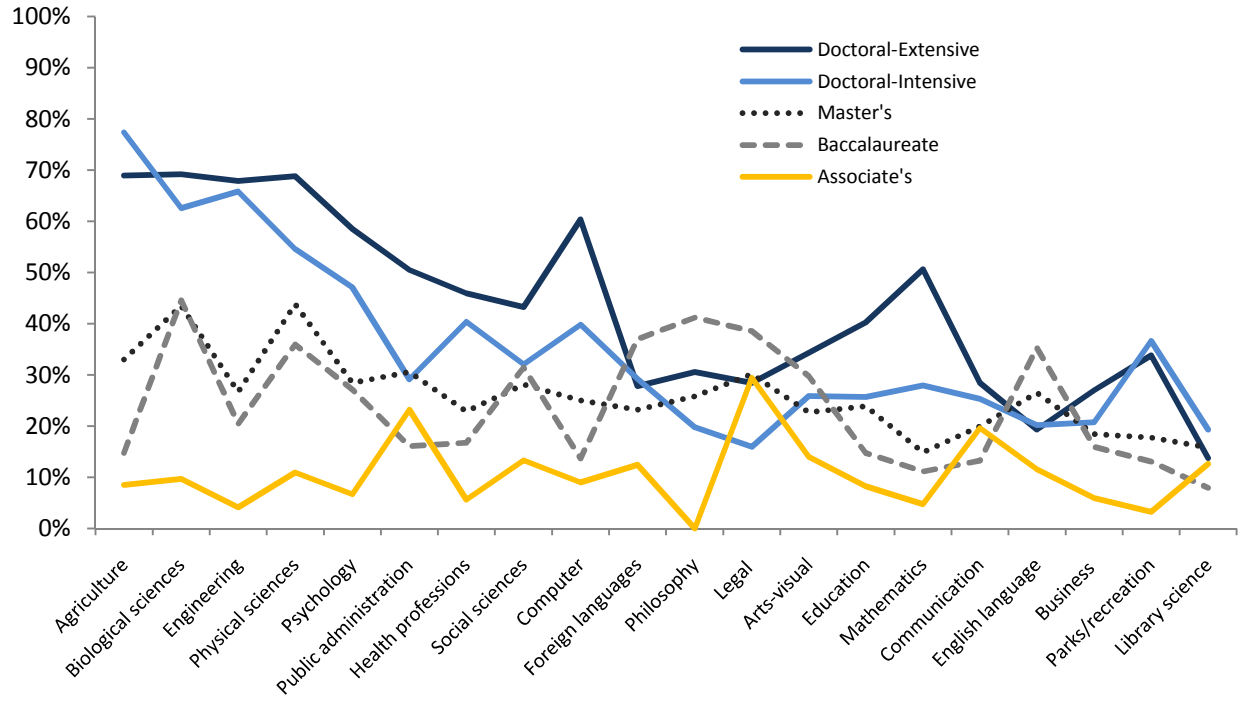

Figure A-6. Proportion of Faculty Have Scholarly Activity Funded by Carnegie Type and Disciplinary Field

Table A-7. Proportion of Faculty Member of Full Professor Rank by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	40%	47%	40%	25%	23%	38%
Arts-visual and performing	30%	31%	28%	30%	30%	30%
Biological and biomedical sciences	38%	37%	40%	25%	35%	37%
Business/management/marketing/related	32%	24%	35%	32%	22%	30%
Communication/journalism/comm. tech	28%	17%	23%	20%	23%	23%
Computer/info sciences/support tech	28%	20%	25%	13%	19%	22%
Education	24%	20%	27%	21%	20%	24%
Engineering technologies/technicians	45%	33%	30%	32%	24%	38%
English language and literature/letters	28%	31%	33%	33%	22%	28%
Foreign languages/literature/linguistics	28%	27%	29%	17%	27%	26%
Health professions/clinical sciences	25%	21%	17%	9%	14%	21%
Legal professions and studies	51%	69%	46%	25%	34%	52%
Library science	8%	13%	11%	6%	13%	10%
Mathematics and statistics	47%	29%	31%	29%	20%	32%
Parks/recreation/leisure/fitness studies	26%	20%	24%	14%	20%	21%
Philosophy, religion & theology	47%	23%	28%	40%	43%	37%
Physical sciences	49%	44%	35%	41%	29%	42%
Psychology	37%	37%	41%	34%	31%	36%
Public administration/social services	27%	32%	23%	10%	43%	27%
Social sciences (except psych) & history	44%	29%	35%	42%	23%	37%
Total	35%	30%	30%	29%	23%	30%

SOURCE: National Center for Education Statistics, NSOPF:04.

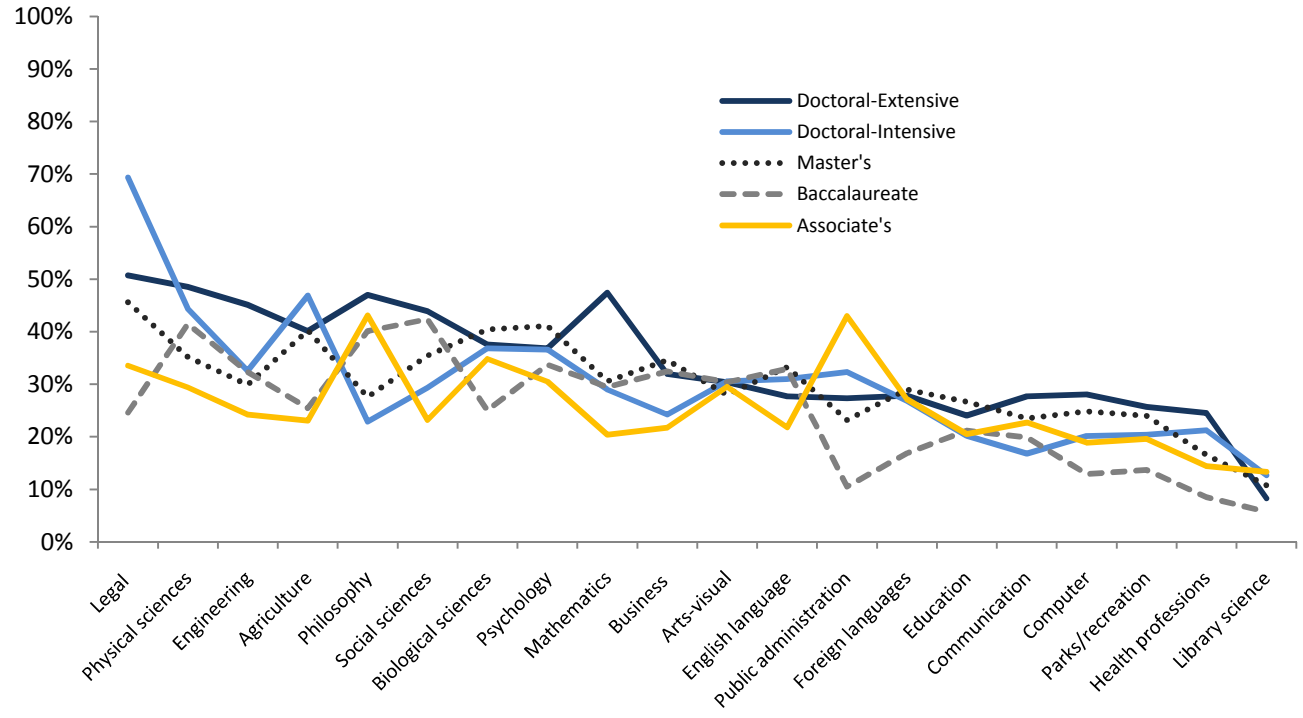

Figure A-7. Proportion of Faculty Member of Full Professor Rank by Carnegie Type and Disciplinary Field

Table A-8. Proportion of Faculty Tenured or on the Tenure Track by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	83%	89%	87%	48%	57%	79%
Arts-visual and performing	78%	82%	81%	78%	69%	77%
Biological and biomedical sciences	69%	70%	91%	80%	82%	74%
Business/management/marketing/related	81%	79%	83%	70%	61%	77%
Communication/journalism/comm. tech	69%	67%	76%	53%	67%	69%
Computer/info sciences/support tech	75%	56%	75%	65%	66%	69%
Education	60%	64%	78%	61%	65%	68%
Engineering technologies/technicians	84%	82%	84%	72%	66%	81%
English language and literature/letters	59%	64%	77%	73%	70%	69%
Foreign languages/literature/linguistics	72%	70%	83%	65%	63%	72%
Health professions/clinical sciences	49%	44%	66%	54%	58%	53%
Legal professions and studies	77%	77%	84%	84%	89%	79%
Library science	77%	77%	86%	41%	75%	77%
Mathematics and statistics	74%	74%	83%	77%	73%	76%
Parks/recreation/leisure/fitness studies	55%	50%	64%	37%	70%	59%
Philosophy, religion & theology	85%	75%	76%	77%	92%	81%
Physical sciences	80%	85%	90%	86%	73%	83%
Psychology	78%	74%	86%	79%	64%	77%
Public administration/social services	80%	81%	79%	87%	69%	79%
Social sciences (except psych) & history	85%	82%	93%	85%	73%	85%
Total	71%	70%	81%	72%	68%	73%

SOURCE: National Center for Education Statistics, NSOPF:04.

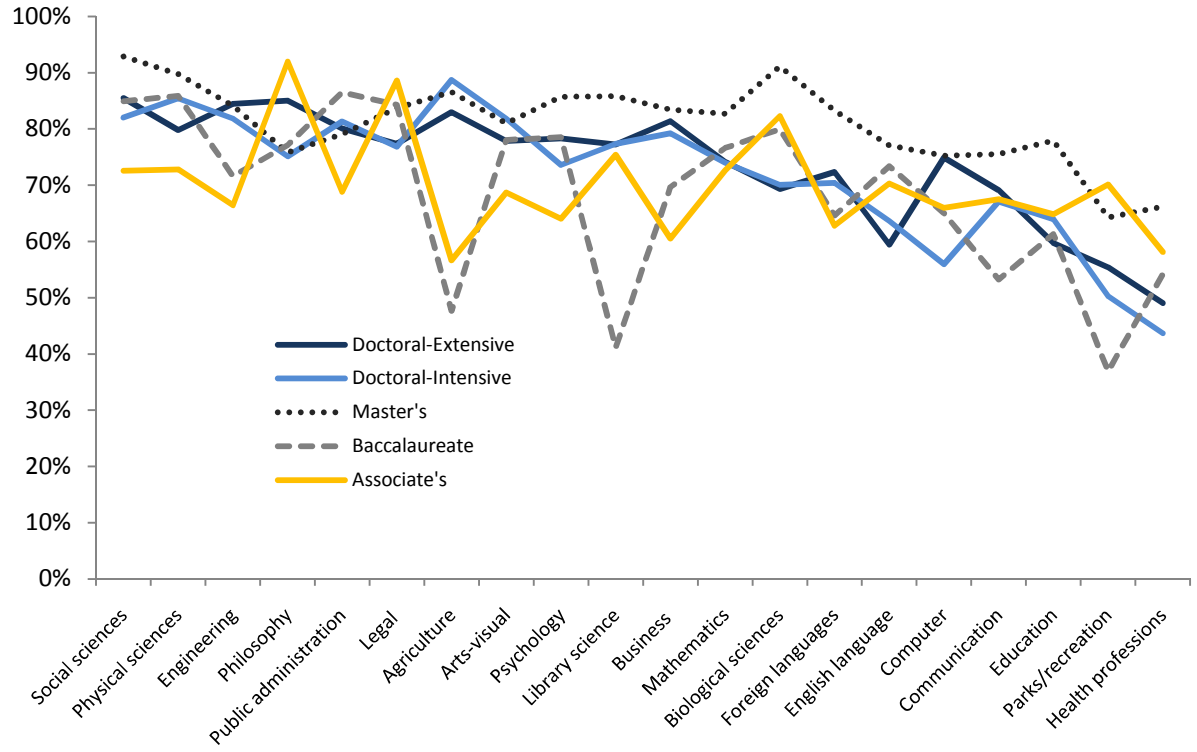

Figure A-8. Proportion of Faculty Tenured or on the Tenure Track by Carnegie Type and Disciplinary Field

Table A-9. Mean in Percent Time Spent on Undergraduate Instruction by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	19.50	34.83	59.28	72.88	77.50	32.61
Arts-visual and performing	47.11	49.40	65.81	64.05	80.73	60.92
Biological and biomedical sciences	13.17	24.59	61.28	68.61	83.93	31.63
Business/management/marketing/related	28.34	38.26	49.79	64.59	81.87	49.89
Communication/journalism/comm. tech	39.62	51.61	62.17	69.90	77.09	59.41
Computer/info sciences/support tech	28.80	41.57	54.30	67.23	82.40	57.86
Education	20.50	32.92	36.92	56.94	70.43	40.72
Engineering technologies/technicians	27.10	36.84	50.92	62.60	82.48	39.90
English language and literature/letters	46.28	52.95	61.64	63.62	77.29	63.07
Foreign languages/literature/linguistics	43.39	51.35	63.99	66.49	83.98	55.55
Health professions/clinical sciences	10.49	22.51	46.42	63.33	83.52	31.93
Legal professions and studies	6.49	9.20	18.27	40.41	65.81	13.83
Library science	8.43	32.22	28.31	21.91	47.11	25.37
Mathematics and statistics	29.66	46.20	69.06	71.25	84.81	60.54
Parks/recreation/leisure/fitness studies	38.30	49.05	57.89	56.61	72.60	57.20
Philosophy, religion & theology	35.42	50.25	59.90	59.79	63.92	51.87
Physical sciences	23.41	39.10	64.24	67.40	84.32	46.44
Psychology	18.90	22.45	45.83	63.60	77.59	41.98
Public administration/social services	8.63	23.66	40.12	54.21	76.39	29.32
Social sciences (except psych) & history	29.96	43.58	56.36	61.27	78.64	48.38
Total	23.72	36.26	53.79	63.28	79.43	45.73

SOURCE: National Center for Education Statistics, NSOPF:04.

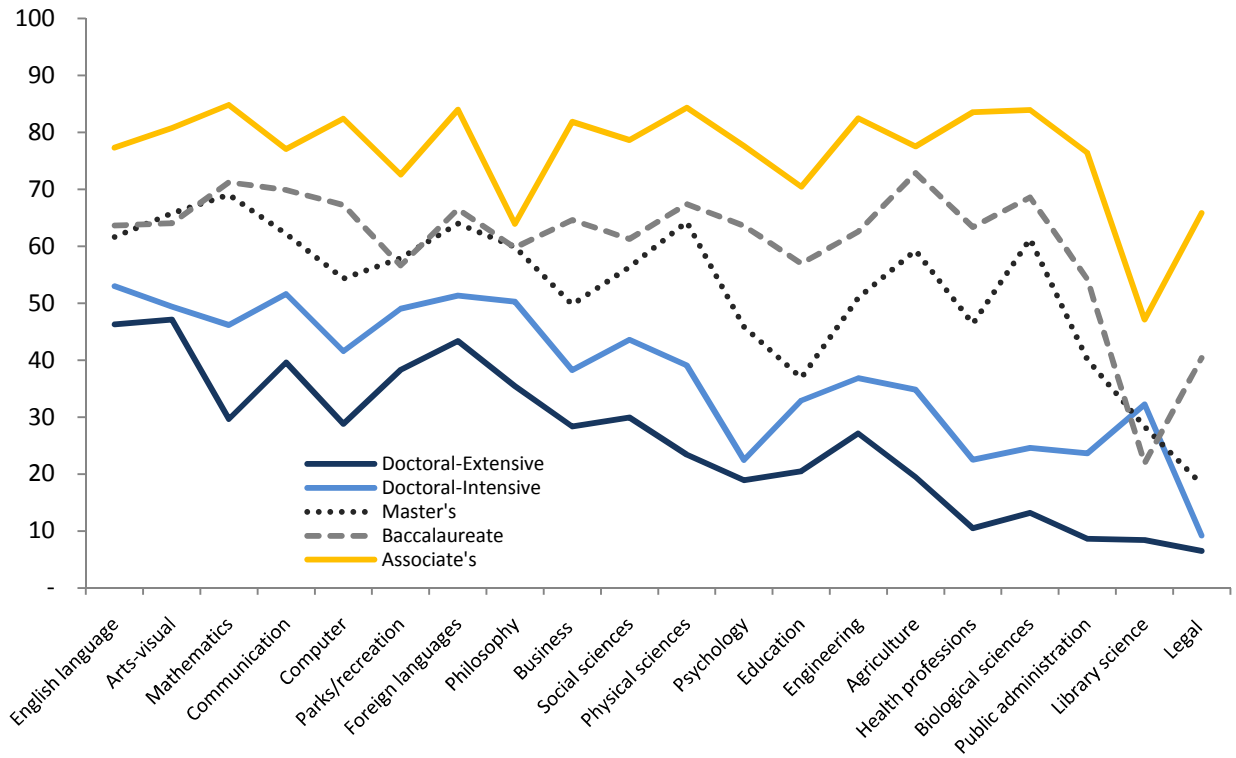

Figure A-9. Mean in Percent Time Spent on Undergraduate Instruction by Carnegie Type and Disciplinary Field

Table A-10. Mean in Percent Time Spent on Graduate Instruction by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	14.02	13.34	5.36	7.05	0.00	11.37
Arts-visual and performing	15.84	11.45	5.15	3.81	0.12	7.94
Biological and biomedical sciences	19.64	16.66	8.46	3.30	0.00	14.75
Business/management/marketing/related	23.14	16.76	15.50	4.69	0.26	13.94
Communication/journalism/comm. tech	19.66	10.23	5.36	1.15	0.00	7.83
Computer/info sciences/support tech	22.62	18.75	14.42	5.39	0.00	10.95
Education	23.56	30.44	28.66	11.56	0.20	20.49
Engineering technologies/technicians	20.94	19.11	15.30	3.62	0.00	16.67
English language and literature/letters	17.32	9.70	6.23	2.12	0.08	6.33
Foreign languages/literature/linguistics	15.13	14.39	5.01	1.81	0.26	9.53
Health professions/clinical sciences	28.45	26.65	23.86	6.79	0.33	21.70
Legal professions and studies	44.72	46.43	29.56	28.21	4.67	39.54
Library science	14.90	15.03	10.59	2.39	0.01	9.71
Mathematics and statistics	19.37	14.89	4.95	3.51	0.00	8.43
Parks/recreation/leisure/fitness studies	12.62	13.22	6.75	3.64	0.00	6.29
Philosophy, religion & theology	16.83	5.98	7.78	5.63	0.29	9.04
Physical sciences	18.83	17.44	5.21	0.95	0.00	11.43
Psychology	22.34	27.75	17.28	5.03	0.01	15.52
Public administration/social services	30.22	35.57	22.84	13.53	0.00	25.26
Social sciences (except psych) & history	16.79	11.36	7.02	2.45	0.00	9.78
Total	21.26	19.04	12.86	4.19	0.13	13.69

SOURCE: National Center for Education Statistics, NSOPF:04.

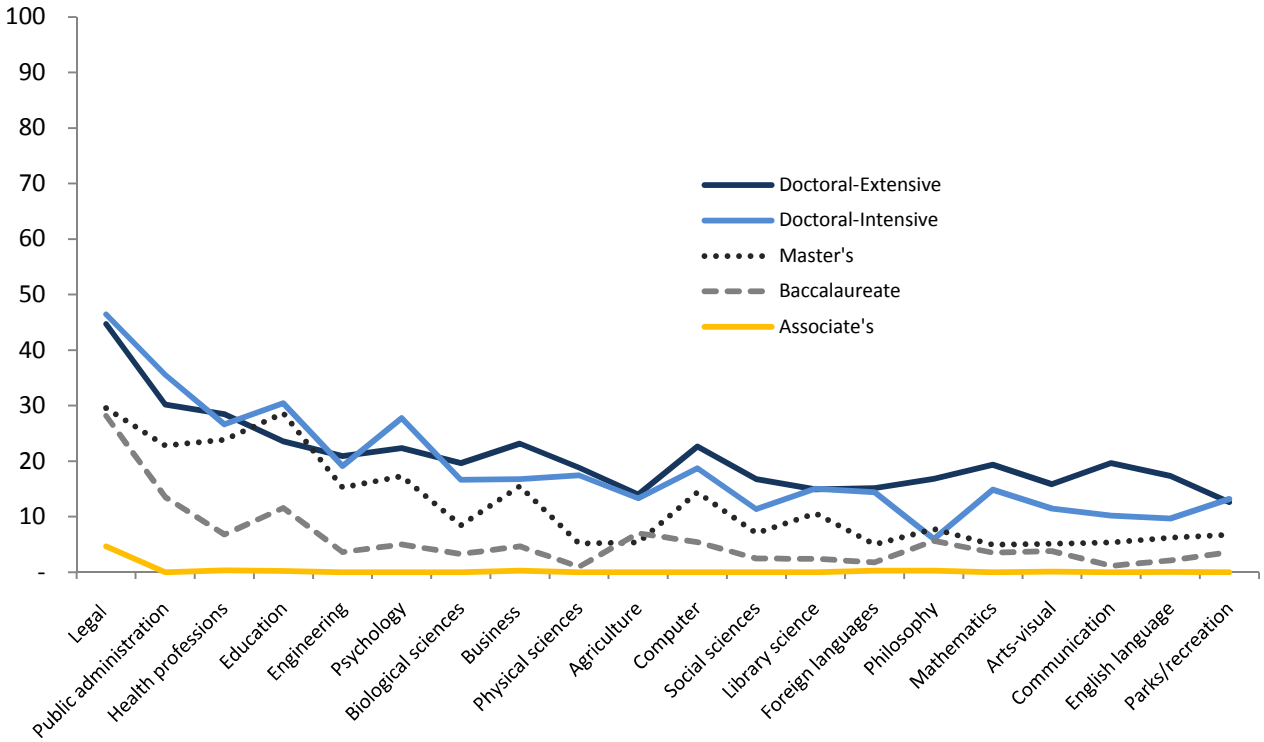

Figure A-10. Mean in Percent Time Spent on Graduate Instruction by Carnegie Type and Disciplinary Field

Table A-11. Mean in Percent Time Spent on Research Activities by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	32.95	24.25	18.11	5.70	0.39	26.18
Arts-visual and performing	19.62	16.87	9.50	13.59	4.05	12.91
Biological and biomedical sciences	51.31	39.76	13.95	14.91	2.93	37.78
Business/management/marketing/related	32.09	26.99	16.80	9.01	3.15	19.07
Communication/journalism/comm. tech	23.52	17.77	12.24	7.05	4.27	13.42
Computer/info sciences/support tech	32.78	24.42	13.66	12.77	3.27	15.68
Education	27.56	14.90	12.69	7.69	4.06	14.51
Engineering technologies/technicians	34.44	26.03	16.12	10.28	2.66	26.01
English language and literature/letters	18.26	16.07	13.16	13.18	6.02	12.12
Foreign languages/literature/linguistics	24.21	17.12	15.30	12.06	4.38	18.06
Health professions/clinical sciences	25.71	18.64	9.76	8.57	1.32	17.68
Legal professions and studies	27.82	20.69	13.23	17.00	11.93	22.37
Library science	14.67	8.61	13.29	8.78	3.45	10.99
Mathematics and statistics	36.48	23.51	11.02	10.09	2.34	16.80
Parks/recreation/leisure/fitness studies	20.39	11.71	9.37	6.18	2.00	9.18
Philosophy, religion & theology	33.35	21.91	14.32	17.56	8.78	20.86
Physical sciences	41.12	25.28	14.73	16.85	2.66	26.12
Psychology	37.48	29.94	16.56	14.54	5.79	23.02
Public administration/social services	32.43	14.00	15.77	11.93	10.02	21.15
Social sciences (except psych) & history	35.23	29.10	18.29	19.53	6.89	24.63
Total	32.80	23.30	13.78	13.14	3.79	20.33

SOURCE: National Center for Education Statistics, NSOPF:04.

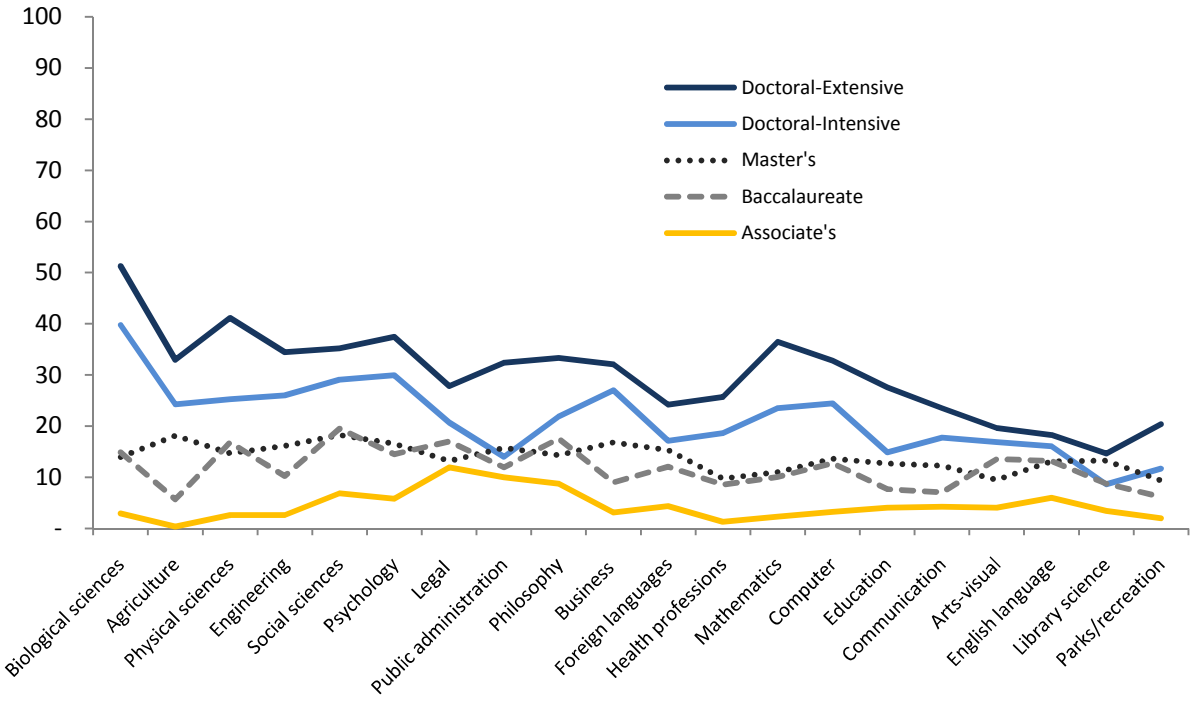

Figure A-11. Mean in Percent Time Spent on Research Activities by Carnegie Type and Disciplinary Field

Table A-12. Mean in Total Class Hours Taught Per Week by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	3.21	6.87	9.05	14.78	19.84	6.26
Arts-visual and performing	8.70	9.10	10.70	10.89	15.84	10.86
Biological and biomedical sciences	4.51	5.02	12.30	11.27	19.63	7.61
Business/management/marketing/related	7.13	8.72	9.91	11.61	14.46	10.00
Communication/journalism/comm. tech	7.19	7.97	10.88	9.95	13.29	10.04
Computer/info sciences/support tech	5.48	7.49	10.44	10.95	16.11	10.91
Education	5.66	7.62	9.36	8.83	6.90	7.71
Engineering technologies/technicians	4.72	7.57	8.69	12.14	18.34	7.51
English language and literature/letters	6.65	8.03	9.55	9.12	11.57	9.43
Foreign languages/literature/linguistics	6.72	8.87	10.56	10.73	14.18	8.99
Health professions/clinical sciences	4.39	6.76	10.49	12.59	15.45	7.69
Legal professions and studies	5.60	6.21	8.38	9.37	12.24	6.62
Library science	1.08	3.12	1.74	0.55	2.08	1.63
Mathematics and statistics	5.07	7.89	10.54	11.75	13.73	9.80
Parks/recreation/leisure/fitness studies	5.68	8.13	9.72	7.29	13.68	9.53
Philosophy, religion & theology	6.14	8.26	10.55	8.51	10.52	8.58
Physical sciences	3.57	8.18	10.98	11.77	15.76	8.08
Psychology	4.41	6.22	9.15	8.90	12.04	7.69
Public administration/social services	4.22	6.35	8.83	8.85	16.24	7.16
Social sciences (except psych) & history	5.16	7.47	9.95	8.50	12.97	8.04
Total	5.14	7.38	9.97	10.01	13.80	8.49

SOURCE: National Center for Education Statistics, NSOPF:04.

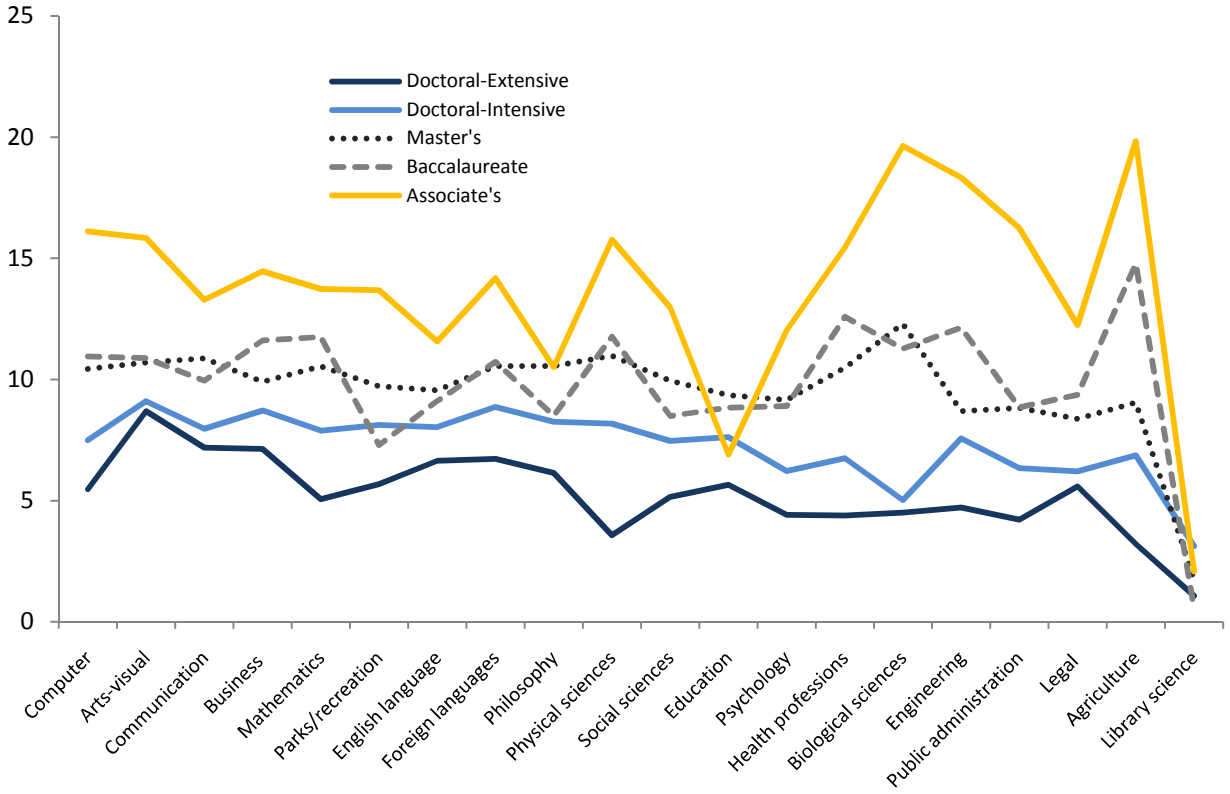

Figure A-12. Mean in Total Class Hours Taught Per Week by Carnegie Type and Disciplinary Field

Table A-13. Mean in Basic Salary of Faculty Member from Institution by Carnegie Type and Disciplinary Field

	Doctoral-	Doctoral-	Master's		Associate's	Total
Agriculture/natural resources/related	73,508	70,018	56,826	51,358	55,265	69,012
Arts-visual and performing	58,278	53,182	50,601	50,066	52,964	53,568
Biological and biomedical sciences	84,895	81,424	60,214	53,768	54,343	76,292
Business/management/marketing/related	95,448	78,719	71,556	62,204	54,733	75,139
Communication/journalism/comm. tech	64,660	53,877	51,907	43,495	52,713	54,557
Computer/info sciences/support tech	81,043	64,150	62,773	55,442	52,402	63,204
Education	66,518	55,158	56,620	50,750	54,914	58,061
Engineering technologies/technicians	87,263	72,623	72,163	70,014	51,317	78,002
English language and literature/letters	59,326	58,945	53,003	56,507	52,424	55,105
Foreign languages/literature/linguistics	58,324	53,090	57,627	51,156	51,143	55,827
Health professions/clinical sciences	105,321	95,040	57,321	47,926	51,131	86,057
Legal professions and studies	107,879	85,928	80,770	73,820	56,768	94,071
Library science	51,601	44,309	49,550	44,488	63,802	52,279
Mathematics and statistics	76,486	66,490	52,852	55,853	50,365	60,462
Parks/recreation/leisure/fitness studies	56,679	55,325	51,674	51,657	54,833	53,710
Philosophy, religion & theology	73,612	51,822	53,631	55,550	58,735	60,568
Physical sciences	81,502	69,229	62,714	55,863	54,534	69,938
Psychology	74,097	67,159	60,742	55,466	51,963	63,773
Public administration/social services	73,884	59,052	63,938	58,836	58,057	66,290
Social sciences (except psych) & history	77,674	58,644	59,269	61,345	55,659	66,091
Total	82,054	69,380	58,841	54,976	53,253	67,693

SOURCE: National Center for Education Statistics, NSOPF:04.

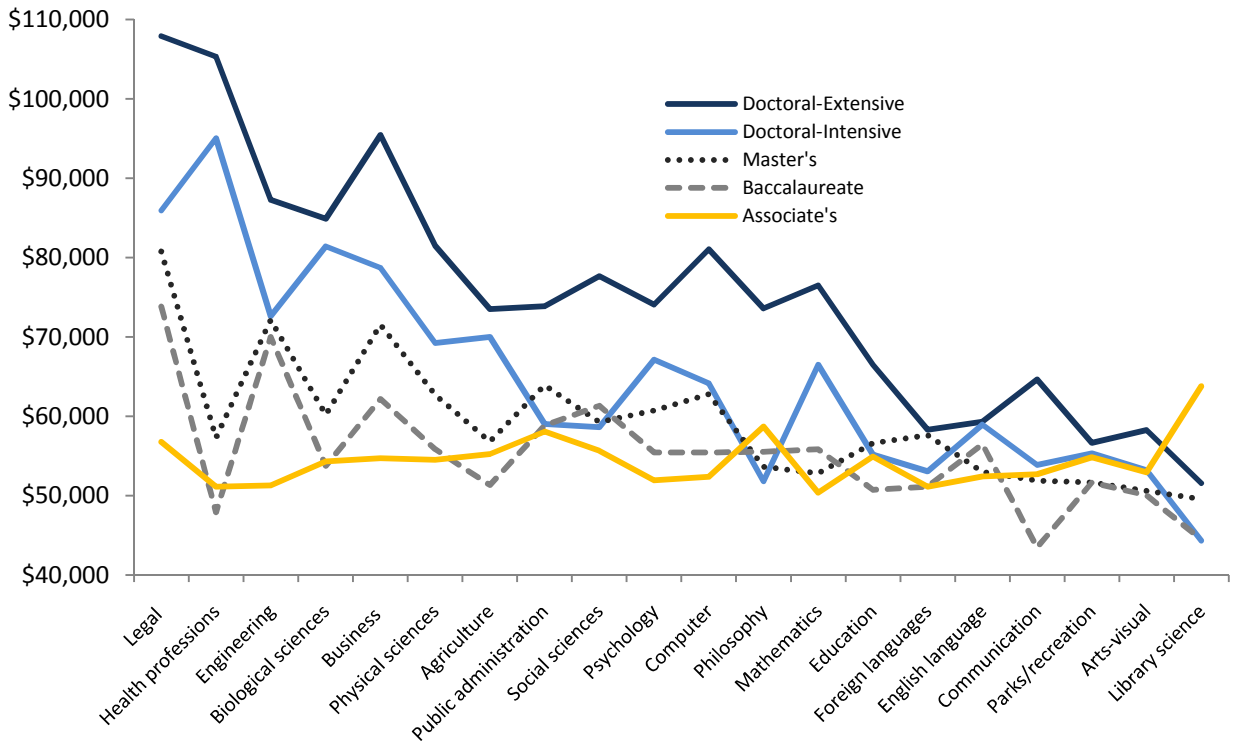

Figure A-13. Mean in Basic Salary of Faculty Member from Institution by Carnegie Type and Disciplinary Field

Table A-14. Average Number of Articles in Refereed Journals Published for Last Two Years by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	4.02	3.46	2.32	1.57	0.10	3.28
Arts-visual and performing	1.36	1.76	0.79	0.82	0.53	1.02
Biological and biomedical sciences	5.96	4.94	1.33	1.10	0.23	4.35
Business/management/marketing/related	2.65	2.53	1.85	0.67	0.14	1.72
Communication/journalism/comm. tech	1.60	0.96	0.86	0.63	0.47	0.94
Computer/info sciences/support tech	4.67	3.65	1.42	0.82	0.09	1.92
Education	2.32	1.52	1.23	0.44	0.13	1.25
Engineering technologies/technicians	5.70	3.95	1.43	0.97	0.09	4.04
English language and literature/letters	2.23	1.65	2.19	1.38	0.63	1.53
Foreign languages/literature/linguistics	2.17	1.41	1.41	0.45	0.05	1.47
Health professions/clinical sciences	3.85	3.00	0.93	0.56	0.08	2.56
Legal professions and studies	1.21	0.93	0.69	0.72	0.00	0.97
Library science	1.46	0.40	0.58	0.48	0.07	0.75
Mathematics and statistics	3.73	3.61	0.67	1.26	0.11	1.72
Parks/recreation/leisure/fitness studies	1.83	1.60	0.72	0.81	0.20	0.88
Philosophy, religion & theology	2.58	1.91	1.59	0.98	0.54	1.68
Physical sciences	7.49	5.33	1.74	1.36	0.24	4.43
Psychology	5.03	4.50	1.69	0.92	0.21	2.78
Public administration/social services	2.87	1.80	0.91	0.95	0.09	1.73
Social sciences (except psych) & history	2.44	1.75	1.15	0.94	0.27	1.57
Total	3.88	2.82	1.30	0.90	0.24	2.24

SOURCE: National Center for Education Statistics, NSOPF:04.

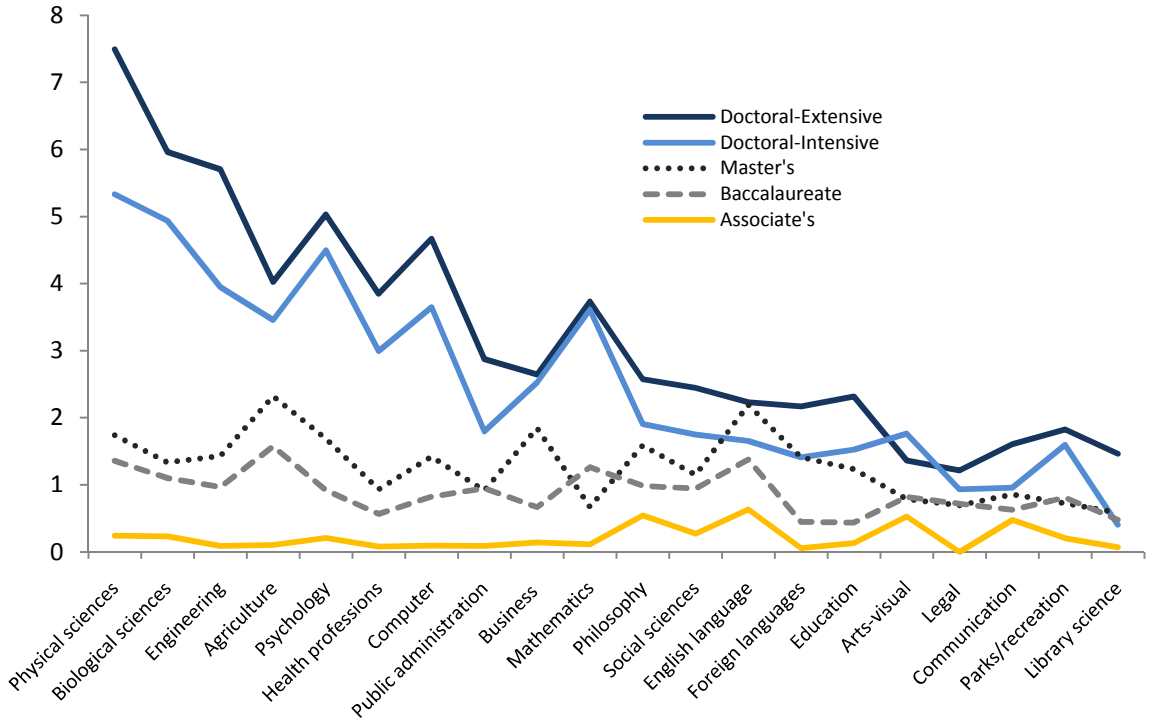

Figure A-14. Average Number of Articles in Refereed Journals Published for Last Two Years by Carnegie Type and Disciplinary Field

Table A-15. Average Number of Articles in Nonrefereed Journals Published for Last Two Years by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	5.64	4.75	4.40	1.08	1.44	4.79
Arts-visual and performing	0.97	1.28	0.92	1.38	0.96	1.04
Biological and biomedical sciences	1.13	0.68	0.50	0.55	0.29	0.87
Business/management/marketing/related	0.98	1.02	0.98	0.45	0.34	0.81
Communication/journalism/comm. tech	1.91	1.14	2.64	1.24	1.08	1.79
Computer/info sciences/support tech	0.96	1.32	1.07	0.65	0.18	0.70
Education	1.30	1.13	1.24	0.67	0.73	1.09
Engineering technologies/technicians	3.11	2.52	1.21	0.61	0.28	2.34
English language and literature/letters	0.82	1.18	1.03	1.16	0.96	0.99
Foreign languages/literature/linguistics	1.51	1.48	0.63	0.27	0.07	0.99
Health professions/clinical sciences	1.36	1.38	0.70	0.58	0.22	1.04
Legal professions and studies	1.30	1.56	1.45	1.23	0.24	1.31
Library science	1.91	0.60	1.17	0.57	1.28	1.34
Mathematics and statistics	0.45	0.69	0.31	0.39	0.20	0.36
Parks/recreation/leisure/fitness studies	1.09	1.57	0.70	1.09	0.54	0.87
Philosophy, religion & theology	1.79	0.72	1.04	0.87	0.46	1.13
Physical sciences	2.05	1.33	1.11	0.51	0.20	1.37
Psychology	0.83	1.42	0.87	0.47	1.02	0.90
Public administration/social services	0.91	1.53	1.18	0.69	0.88	1.08
Social sciences (except psych) & history	1.43	1.11	1.02	0.82	0.56	1.10
Total	1.56	1.29	1.02	0.77	0.53	1.15

SOURCE: National Center for Education Statistics, NSOPF:04.

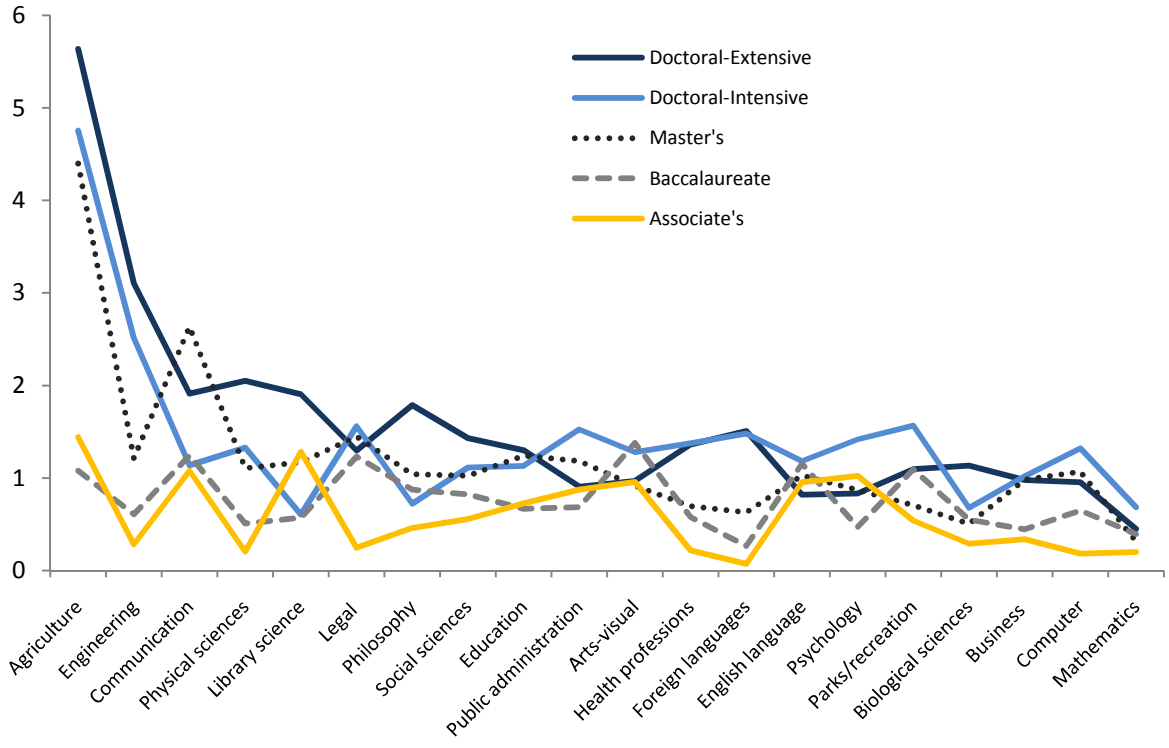

Figure A-15. Average Number of Articles in Nonrefereed Journals Published for Last Two Years by Carnegie Type and Disciplinary Field

Table A-16. Average Number of Book Reviews, Chapters, or Creative Works Published for Last Two Years by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	0.84	0.54	1.92	0.66	0.10	0.79
Arts-visual and performing	1.14	0.76	0.57	0.41	0.16	0.67
Biological and biomedical sciences	1.03	0.73	0.38	0.34	0.50	0.82
Business/management/marketing/related	0.65	0.48	0.46	0.27	0.29	0.47
Communication/journalism/comm. tech	1.52	0.75	0.66	0.32	0.11	0.73
Computer/info sciences/support tech	0.62	0.77	0.36	0.26	0.44	0.48
Education	0.96	0.67	0.38	0.25	0.13	0.49
Engineering technologies/technicians	0.79	0.75	0.43	0.19	0.09	0.63
English language and literature/letters	1.69	1.06	1.20	0.94	0.32	0.96
Foreign languages/literature/linguistics	1.54	1.01	0.86	0.37	0.15	1.04
Health professions/clinical sciences	1.16	0.89	0.46	0.37	0.14	0.82
Legal professions and studies	0.58	1.66	0.80	0.08	0.00	0.81
Library science	1.61	2.26	1.14	0.29	0.09	1.13
Mathematics and statistics	0.82	0.70	0.33	0.63	0.21	0.49
Parks/recreation/leisure/fitness studies	0.97	0.98	0.25	0.08	0.22	0.42
Philosophy, religion & theology	2.20	1.13	1.23	1.57	0.40	1.48
Physical sciences	0.70	1.05	0.25	0.34	0.16	0.53
Psychology	1.56	1.30	0.65	0.44	0.19	0.92
Public administration/social services	1.00	0.90	0.45	0.16	0.21	0.69
Social sciences (except psych) & history	1.90	1.40	1.24	1.46	0.46	1.43
Total	1.15	0.92	0.63	0.62	0.25	0.79

SOURCE: National Center for Education Statistics, NSOPF:04.

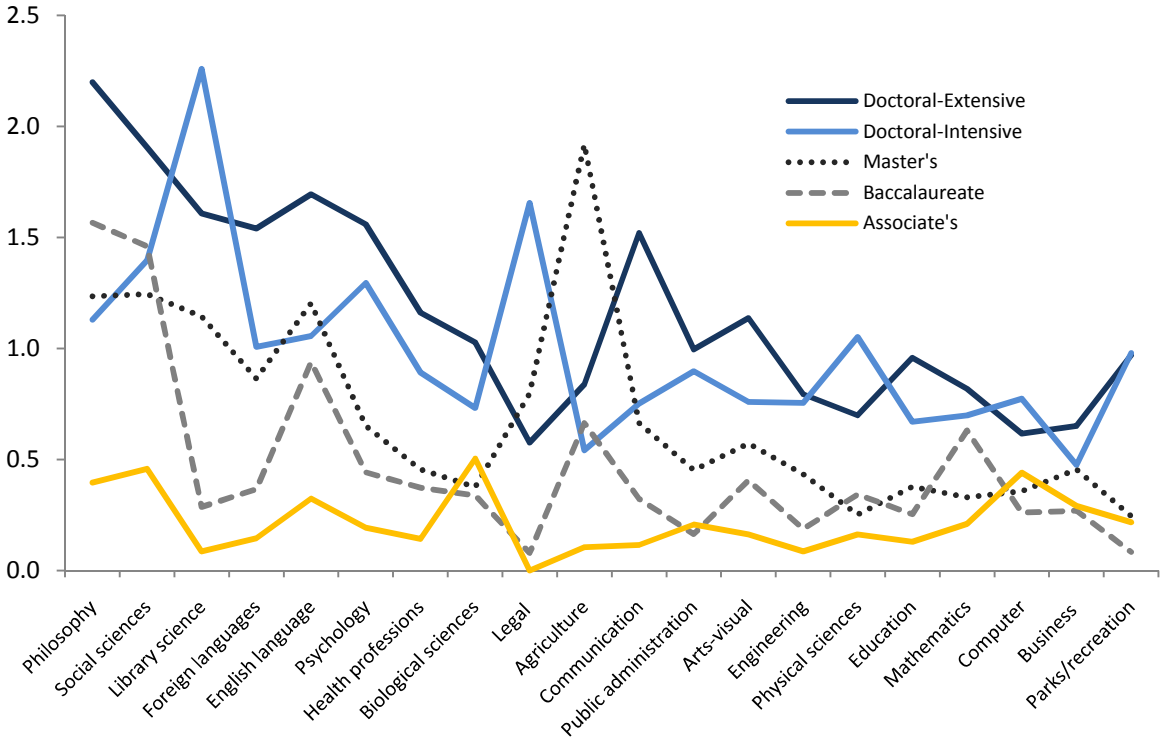

Figure A-16. Average Number of Book Reviews, Chapters, or Creative Works Published for Last Two Years by Carnegie Type and Disciplinary Field

Table A-17. Average Number of Books, Textbooks, or Reports Published for Last Two Years by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.63	0.85	0.30	1.87	0.42	1.35
Arts-visual and performing	0.32	0.57	0.28	0.47	0.33	0.36
Biological and biomedical sciences	0.33	0.29	0.34	0.28	0.41	0.34
Business/management/marketing/related	0.47	0.58	0.41	0.32	0.40	0.44
Communication/journalism/comm. tech	0.82	0.26	0.46	0.33	0.11	0.43
Computer/info sciences/support tech	0.51	0.81	0.50	0.23	0.29	0.43
Education	0.90	0.95	0.48	0.26	0.18	0.56
Engineering technologies/technicians	0.81	1.05	0.64	1.02	0.17	0.75
English language and literature/letters	0.61	0.30	0.35	0.32	0.25	0.36
Foreign languages/literature/linguistics	0.43	0.48	0.25	0.21	0.21	0.34
Health professions/clinical sciences	0.55	0.64	0.48	0.05	0.16	0.46
Legal professions and studies	0.65	0.70	0.95	0.24	0.10	0.67
Library science	0.30	0.10	0.35	0.20	0.36	0.30
Mathematics and statistics	0.33	0.15	0.26	0.23	0.26	0.27
Parks/recreation/leisure/fitness studies	0.74	0.55	0.27	0.28	0.19	0.36
Philosophy, religion & theology	0.83	0.54	0.52	0.40	0.34	0.57
Physical sciences	0.72	0.70	0.40	0.29	0.43	0.57
Psychology	0.69	0.58	0.53	0.49	0.30	0.54
Public administration/social services	0.99	0.73	0.54	0.27	0.16	0.70
Social sciences (except psych) & history	0.79	0.71	0.43	0.61	0.35	0.61
Total	0.62	0.61	0.42	0.38	0.27	0.49

SOURCE: National Center for Education Statistics, NSOPF:04.

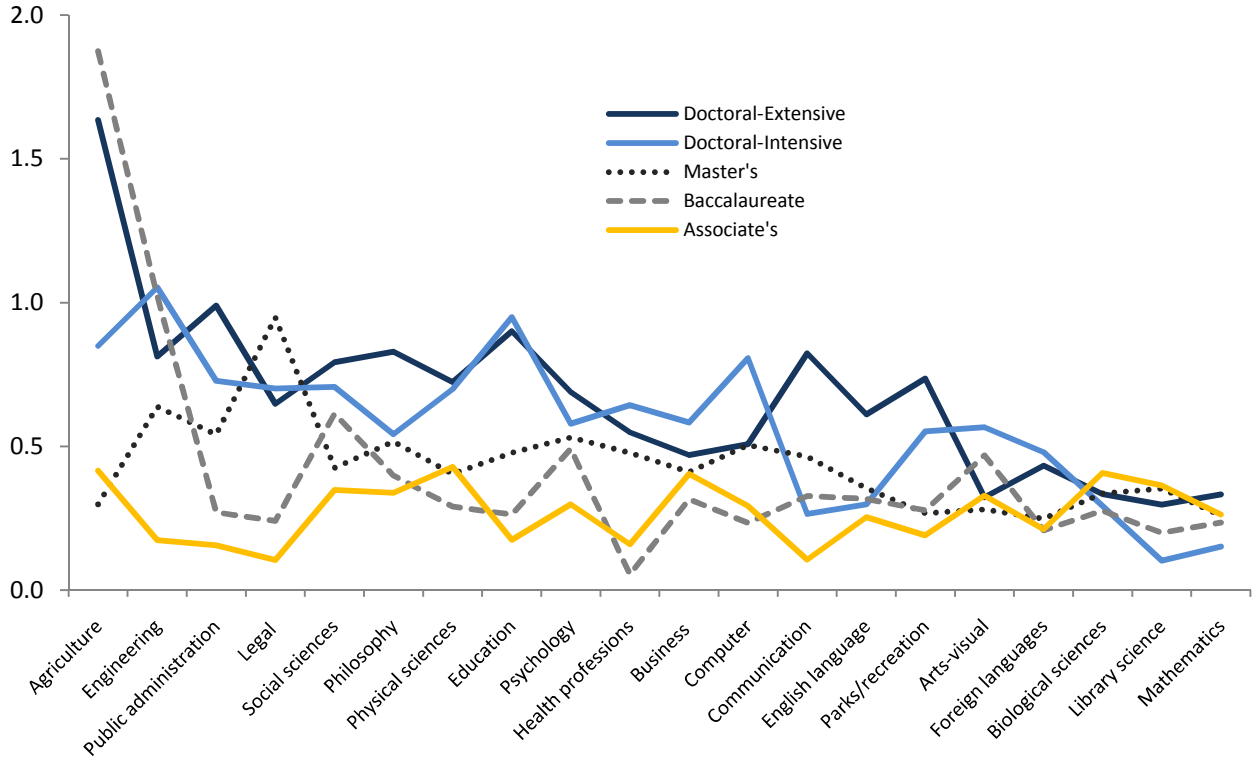

Figure A-17. Average Number of Books, Textbooks, or Reports Published for Last Two Years by Carnegie Type and Disciplinary Field

Table A-18. Average Number of Presentations for Last Two Years by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	12.16	10.94	4.57	2.50	2.10	9.94
Arts-visual and performing	3.84	3.81	2.90	2.58	2.23	3.11
Biological and biomedical sciences	5.76	6.04	2.77	1.76	1.20	4.69
Business/management/marketing/related	4.69	3.62	3.14	1.74	1.56	3.22
Communication/journalism/comm. tech	4.95	3.32	4.01	2.59	2.26	3.62
Computer/info sciences/support tech	5.38	4.37	2.70	3.09	1.67	3.19
Education	7.25	6.54	5.10	4.29	3.37	5.38
Engineering technologies/technicians	7.17	4.99	2.93	3.35	0.90	5.38
English language and literature/letters	4.33	2.97	3.08	3.00	1.81	2.89
Foreign languages/literature/linguistics	3.73	3.00	2.98	2.39	1.24	3.07
Health professions/clinical sciences	7.42	5.82	3.72	1.76	1.64	5.50
Legal professions and studies	6.95	4.46	3.09	3.25	1.81	5.30
Library science	3.02	2.37	2.03	1.80	1.92	2.36
Mathematics and statistics	4.99	3.44	2.41	2.63	1.31	2.93
Parks/recreation/leisure/fitness studies	5.11	5.59	3.40	3.37	3.21	3.87
Philosophy, religion & theology	5.64	5.01	5.19	3.58	4.40	4.91
Physical sciences	7.60	4.73	3.42	2.36	1.08	5.00
Psychology	7.49	8.11	4.78	2.48	2.89	5.45
Public administration/social services	5.99	3.35	3.61	2.62	2.74	4.36
Social sciences (except psych) & history	6.03	3.66	3.11	2.87	1.74	4.08
Total	6.32	4.83	3.49	2.74	1.89	4.38

SOURCE: National Center for Education Statistics, NSOPF:04.

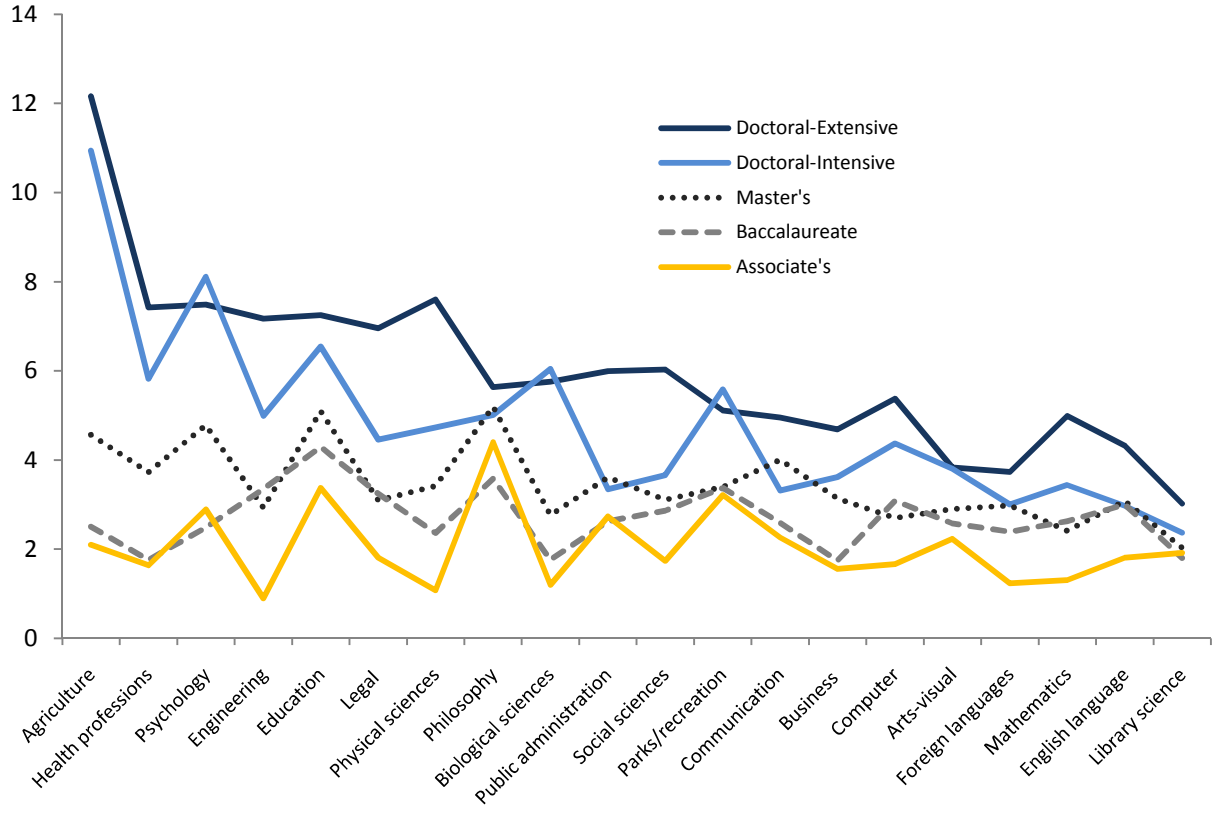

Figure A-18. Average Number of Presentations for Last Two Years by Carnegie Type and Disciplinary Field

Table A-19. Average Number of Exhibitions or Performances for Last Two Years by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	0.05	0.10	0.00	0.06	0.10	0.06
Arts-visual and performing	9.64	10.43	12.46	8.18	7.85	9.96
Biological and biomedical sciences	0.07	0.20	0.06	1.09	0.32	0.17
Business/management/marketing/related	0.00	0.21	0.03	0.03	0.24	0.09
Communication/journalism/comm. tech	0.71	0.21	0.93	0.69	2.64	1.13
Computer/info sciences/support tech	0.14	0.25	0.45	0.00	0.18	0.22
Education	0.35	1.10	0.32	1.94	0.45	0.59
Engineering technologies/technicians	0.05	0.42	0.03	0.00	0.19	0.12
English language and literature/letters	0.92	0.60	0.53	1.18	0.48	0.68
Foreign languages/literature/linguistics	0.12	0.42	0.11	0.28	0.37	0.19
Health professions/clinical sciences	0.08	0.16	0.07	0.00	0.12	0.10
Legal professions and studies	0.03	0.00	0.06	0.00	4.74	0.33
Library science	1.36	1.50	1.78	0.00	0.12	1.15
Mathematics and statistics	0.16	0.03	0.02	0.05	0.63	0.25
Parks/recreation/leisure/fitness studies	0.66	1.40	0.21	0.04	0.22	0.39
Philosophy, religion & theology	0.04	0.27	0.69	0.09	0.06	0.26
Physical sciences	0.54	0.02	0.21	0.08	0.15	0.31
Psychology	0.04	0.10	0.07	0.06	0.87	0.20
Public administration/social services	0.00	0.24	0.02	0.29	0.84	0.12
Social sciences (except psych) & history	0.19	0.14	0.05	0.11	0.31	0.16
Total	0.69	0.92	1.25	1.27	0.90	0.93

SOURCE: National Center for Education Statistics, NSOPF:04.

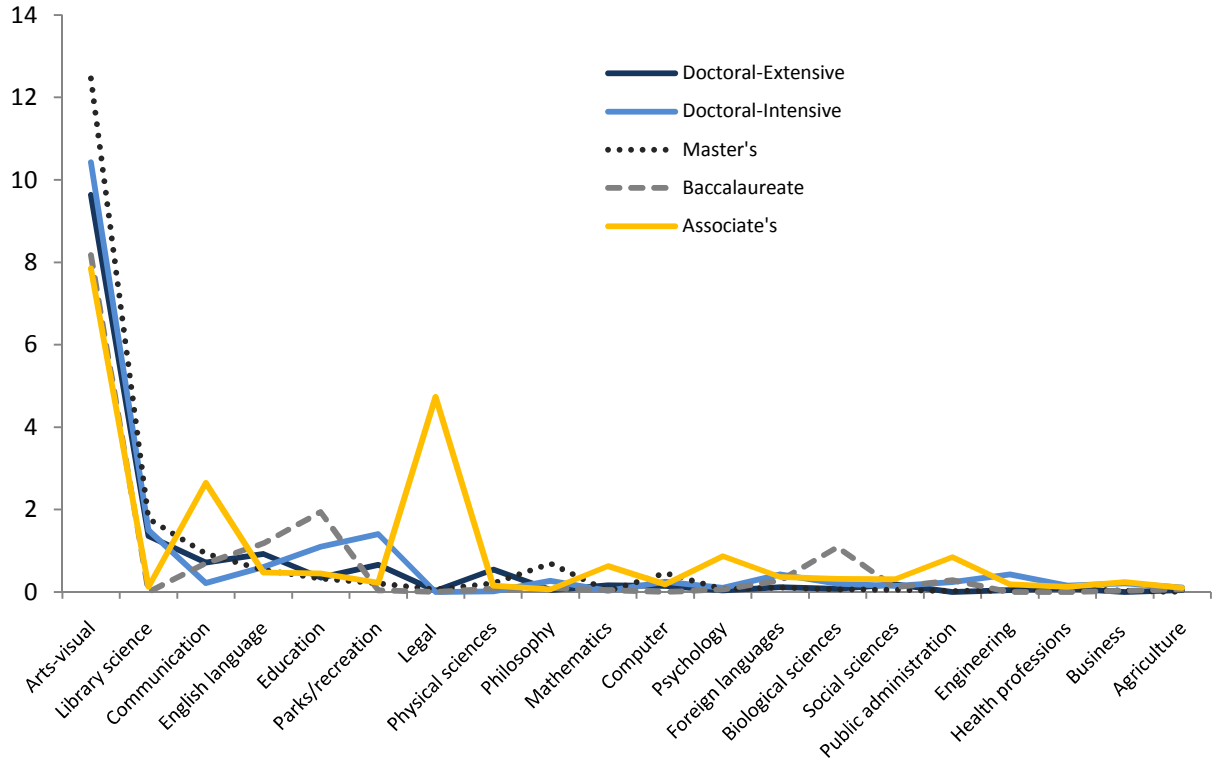

Figure A-19. Average Number of Exhibitions or Performances for Last Two Years by Carnegie Type and Disciplinary Field

Table A-20. Average Number of Patents, Computer Software for Last Two Years by Carnegie Type and Disciplinary Field

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	0.15	0.16	0.00	0.00	0.06	0.13
Arts-visual and performing	0.13	0.06	0.01	0.02	0.00	0.05
Biological and biomedical sciences	0.28	0.24	0.05	0.10	0.01	0.20
Business/management/marketing/related	0.08	0.02	0.03	0.00	0.01	0.04
Communication/journalism/comm. tech	0.01	0.10	0.04	0.00	0.00	0.03
Computer/info sciences/support tech	0.30	0.26	0.19	0.23	0.10	0.20
Education	0.11	0.06	0.08	0.05	0.02	0.07
Engineering technologies/technicians	0.50	0.23	0.17	0.03	0.14	0.36
English language and literature/letters	0.00	0.01	0.01	0.01	0.00	0.00
Foreign languages/literature/linguistics	0.02	0.03	0.01	0.02	0.00	0.02
Health professions/clinical sciences	0.10	0.04	0.03	0.00	0.01	0.06
Legal professions and studies	0.01	0.02	0.00	0.00	0.00	0.01
Library science	0.00	0.00	0.09	0.05	0.00	0.03
Mathematics and statistics	0.17	0.14	0.01	0.03	0.03	0.08
Parks/recreation/leisure/fitness studies	0.13	0.03	0.01	0.00	0.00	0.03
Philosophy, religion & theology	0.03	0.03	0.00	0.00	0.00	0.01
Physical sciences	0.23	0.27	0.17	0.13	0.02	0.18
Psychology	0.14	0.01	0.02	0.09	0.06	0.08
Public administration/social services	0.05	0.00	0.00	0.00	0.00	0.02
Social sciences (except psych) & history	0.01	0.02	0.03	0.00	0.01	0.02
Total	0.15	0.09	0.05	0.04	0.02	0.09

SOURCE: National Center for Education Statistics, NSOPF:04.

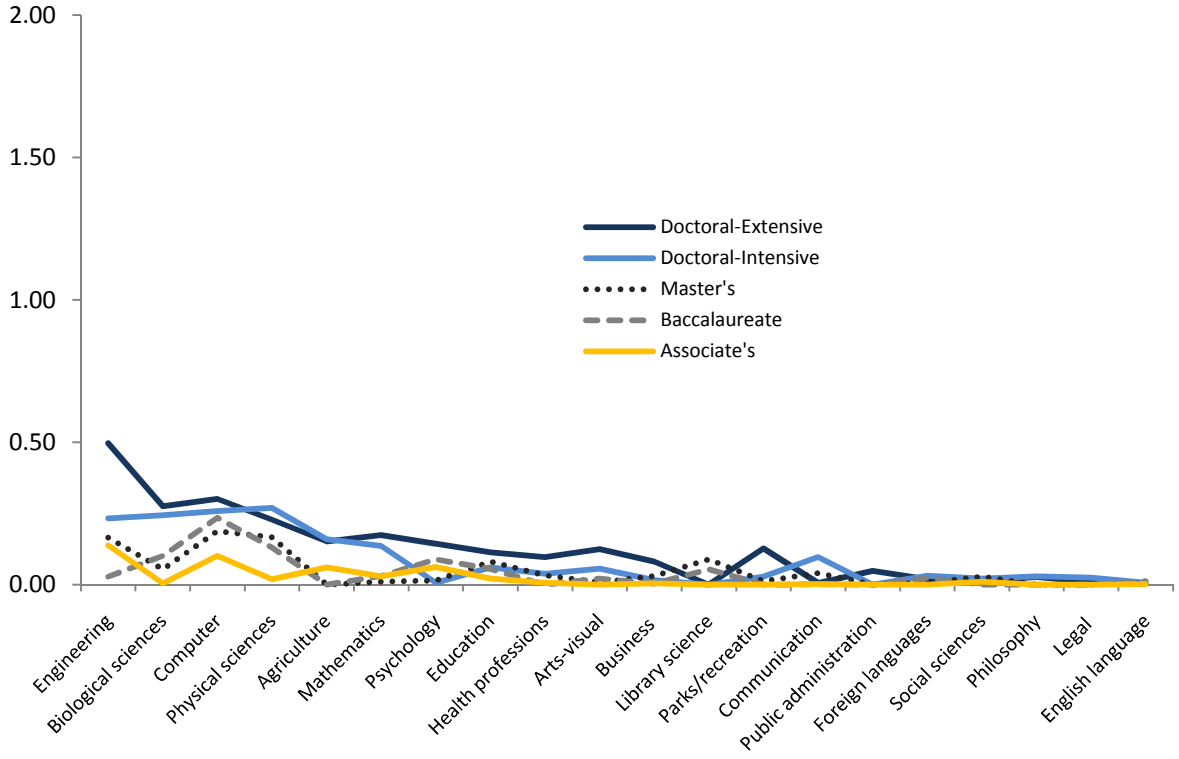

Figure A-20. Average Number of Patents, Computer Software for Last Two Years by Carnegie Type and Disciplinary Field

Table A-21. In How Many Undergrad Classes Are Multiple Choice Midterm/Final Exams Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.90	1.67	2.33	2.00	2.13	1.98
Arts-visual and performing	1.32	1.41	1.53	1.59	1.83	1.53
Biological and biomedical sciences	1.89	2.11	2.31	2.05	2.53	2.18
Business/management/marketing/related	2.08	2.42	2.34	2.18	2.26	2.27
Communication/journalism/comm. tech	1.84	1.94	1.95	2.03	2.27	2.01
Computer/info sciences/support tech	1.88	1.98	1.93	2.03	2.28	2.08
Education	1.66	1.93	1.93	1.72	1.87	1.84
Engineering technologies/technicians	1.43	1.51	1.57	1.73	2.12	1.60
English language and literature/letters	1.19	1.39	1.34	1.29	1.58	1.39
Foreign languages/literature/linguistics	1.34	1.44	1.45	1.34	1.78	1.41
Health professions/clinical sciences	2.25	2.29	2.25	2.46	2.62	2.43
Legal professions and studies	2.05	2.87	2.04	1.98	1.78	2.16
Library science	1.75	1.00	2.04	1.99	1.91	1.86
Mathematics and statistics	1.28	1.37	1.38	1.39	1.63	1.44
Parks/recreation/leisure/fitness studies	2.25	2.55	2.18	2.09	2.24	2.23
Philosophy, religion & theology	1.56	1.56	1.69	1.59	1.54	1.60
Physical sciences	1.84	1.75	1.89	1.76	2.36	1.91
Psychology	2.32	2.23	2.21	2.29	2.62	2.35
Public administration/social services	2.20	2.24	2.23	2.60	2.40	2.29
Social sciences (except psych) & history	1.68	1.74	1.89	1.51	2.42	1.84
Total	1.67	1.84	1.88	1.73	2.15	1.87

SOURCE: National Center for Education Statistics, NSOPF:04.

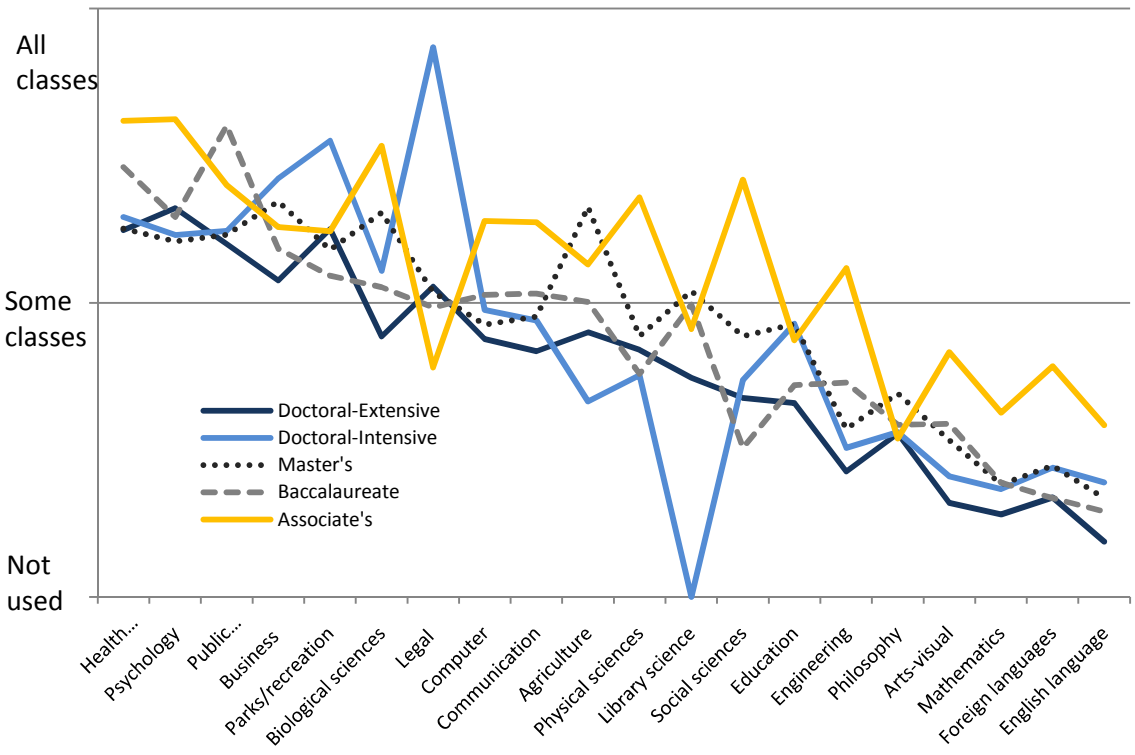

Figure A-21. In How Many Undergrad Classes Are Multiple Choice Midterm/Final Exams Used: Mean by Carnegie Type and Disciplinary Field

Table A-22. In How Many Undergrad Classes Are Essay Midterm/Final Exams Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.91	2.08	1.93	2.10	1.76	1.91
Arts-visual and performing	1.64	1.65	1.58	1.79	1.72	1.66
Biological and biomedical sciences	1.78	1.82	1.96	2.08	1.98	1.91
Business/management/marketing/related	1.91	2.01	2.13	1.94	1.54	1.91
Communication/journalism/comm. tech	2.08	2.07	1.98	2.00	1.81	1.97
Computer/info sciences/support tech	1.80	1.98	1.79	1.72	1.55	1.70
Education	1.95	1.97	2.03	2.02	2.12	2.03
Engineering technologies/technicians	1.61	1.76	1.58	1.71	1.42	1.59
English language and literature/letters	2.10	1.96	2.41	2.26	2.34	2.27
Foreign languages/literature/linguistics	2.21	2.00	2.15	2.03	1.90	2.11
Health professions/clinical sciences	1.58	1.62	1.62	1.68	1.39	1.51
Legal professions and studies	2.24	2.37	2.26	2.62	1.57	2.15
Library science	1.57	1.64	1.56	1.38	1.16	1.39
Mathematics and statistics	1.56	1.40	1.40	1.46	1.32	1.41
Parks/recreation/leisure/fitness studies	2.01	1.70	1.91	1.62	1.70	1.80
Philosophy, religion & theology	2.30	2.28	2.42	2.20	2.41	2.33
Physical sciences	1.50	1.62	1.63	1.86	1.57	1.61
Psychology	1.67	1.82	1.77	2.20	1.89	1.86
Public administration/social services	1.88	2.65	2.28	2.07	2.09	2.24
Social sciences (except psych) & history	2.29	2.42	2.38	2.33	2.17	2.32
Total	1.88	1.91	1.96	2.00	1.75	1.89

SOURCE: National Center for Education Statistics, NSOPF:04.

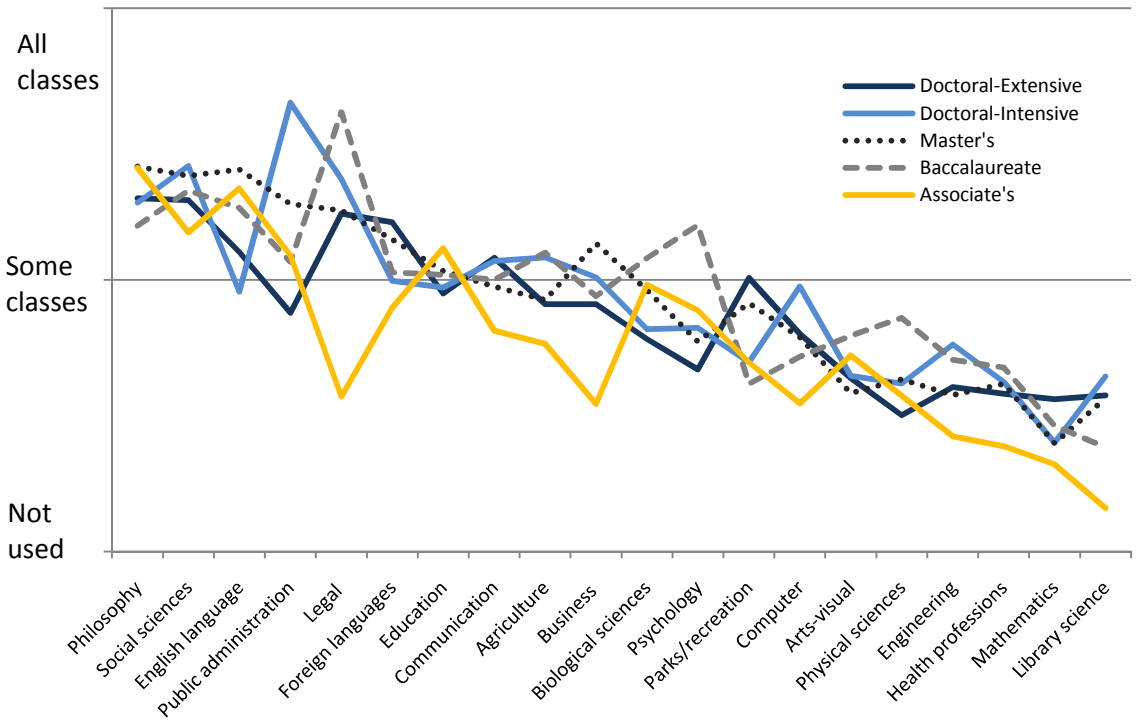

Figure A-22. In How Many Undergrad Classes Are Essay Midterm/Final Exams Used: Mean by Carnegie Type and Disciplinary Field

Table A-23. In How Many Undergrad Classes Are Short Answer Midterm/Final Exams Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	2.38	2.24	2.28	2.34	1.92	2.25
Arts-visual and performing	1.58	1.81	1.73	1.86	1.94	1.76
Biological and biomedical sciences	2.11	2.06	2.29	2.30	2.16	2.18
Business/management/marketing/related	2.03	2.20	2.09	1.85	1.81	2.00
Communication/journalism/comm. tech	1.79	1.76	1.85	2.07	2.04	1.89
Computer/info sciences/support tech	2.49	2.48	2.33	2.30	1.89	2.19
Education	1.68	1.77	1.88	2.13	1.91	1.88
Engineering technologies/technicians	2.01	1.84	1.98	2.20	2.05	2.00
English language and literature/letters	1.75	1.67	1.72	1.77	1.77	1.74
Foreign languages/literature/linguistics	2.14	2.18	2.22	2.14	2.48	2.20
Health professions/clinical sciences	1.87	1.77	1.86	1.75	1.62	1.74
Legal professions and studies	1.58	2.02	1.99	1.55	1.11	1.67
Library science	1.77	2.59	1.71	1.57	2.17	1.98
Mathematics and statistics	2.03	2.10	2.22	2.14	2.11	2.12
Parks/recreation/leisure/fitness studies	2.05	2.27	2.09	2.13	1.71	2.00
Philosophy, religion & theology	1.83	1.62	1.89	1.88	2.07	1.86
Physical sciences	2.15	1.95	2.07	2.24	2.13	2.11
Psychology	1.84	1.97	1.95	1.95	1.77	1.88
Public administration/social services	2.39	1.83	2.03	2.23	2.14	2.08
Social sciences (except psych) & history	2.04	1.89	1.96	1.86	1.94	1.96
Total	1.98	1.95	1.98	2.00	1.90	1.96

SOURCE: National Center for Education Statistics, NSOPF:04.

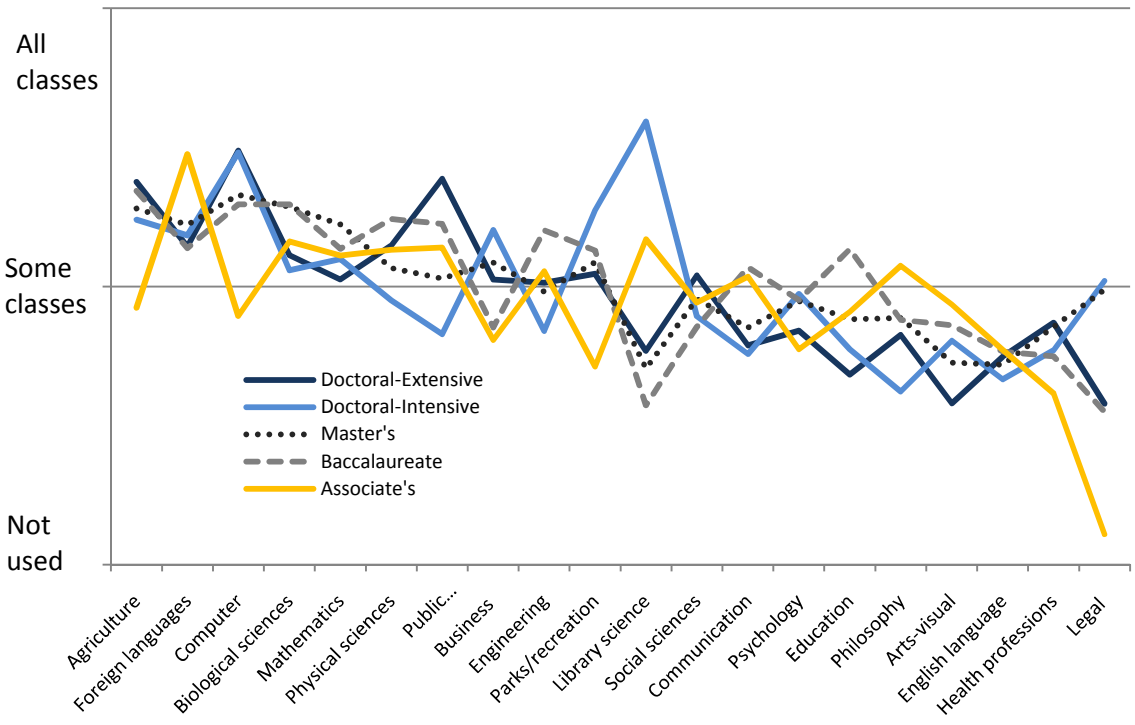

Figure A-23. In How Many Undergrad Classes Are Short Answer Midterm/Final Exams Used: Mean by Carnegie Type and Disciplinary Field

Table A-24. In How Many Undergrad Classes Are Term/Research Papers Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	2.45	2.45	2.17	2.20	2.27	2.36
Arts-visual and performing	2.02	1.95	1.90	2.23	1.96	2.00
Biological and biomedical sciences	1.99	2.17	2.17	2.55	2.04	2.12
Business/management/marketing/related	2.42	2.47	2.43	2.39	2.04	2.33
Communication/journalism/comm. tech	2.81	2.56	2.43	2.39	2.31	2.49
Computer/info sciences/support tech	1.94	2.22	2.08	2.01	1.88	1.98
Education	2.62	2.59	2.58	2.47	2.37	2.53
Engineering technologies/technicians	2.02	1.96	2.06	1.89	1.68	1.94
English language and literature/letters	2.74	2.83	2.77	2.69	2.58	2.70
Foreign languages/literature/linguistics	2.47	2.09	2.38	2.21	2.13	2.34
Health professions/clinical sciences	2.24	1.98	2.39	2.58	2.19	2.24
Legal professions and studies	2.21	2.49	2.40	1.94	1.90	2.23
Library science	1.75	2.59	2.57	2.82	2.28	2.39
Mathematics and statistics	1.42	1.74	1.75	1.91	1.58	1.63
Parks/recreation/leisure/fitness studies	2.47	2.21	2.35	2.30	1.81	2.19
Philosophy, religion & theology	2.43	2.47	2.39	2.67	2.42	2.47
Physical sciences	1.80	1.92	1.91	2.03	1.82	1.88
Psychology	2.50	2.50	2.44	2.50	2.39	2.46
Public administration/social services	3.00	2.76	2.59	2.75	2.93	2.73
Social sciences (except psych) & history	2.41	2.50	2.49	2.50	2.46	2.46
Total	2.23	2.27	2.31	2.37	2.12	2.24

SOURCE: National Center for Education Statistics, NSOPF:04.

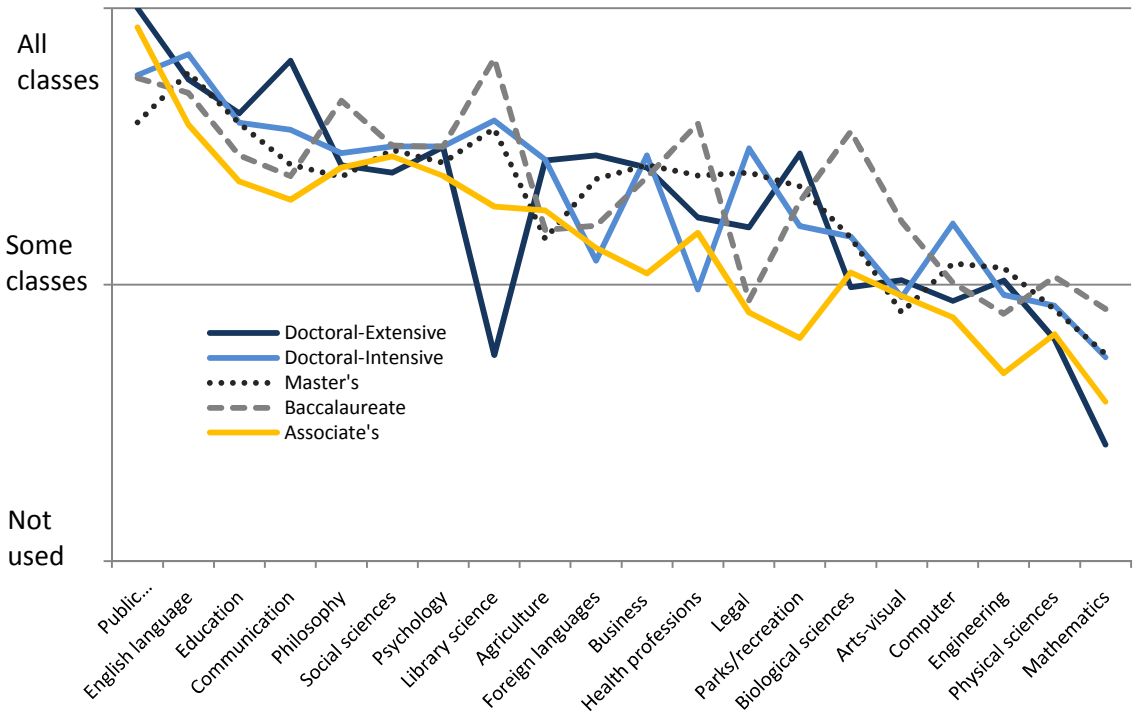

Figure A-24. In How Many Undergrad Classes Are Term/Research Papers Used: Mean by Carnegie Type and Disciplinary Field

Table A-25. In How Many Undergrad Classes Are Multiple Drafts of Written Work Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.55	1.89	1.59	1.40	1.50	1.57
Arts-visual and performing	1.46	1.44	1.40	1.67	1.37	1.46
Biological and biomedical sciences	1.36	1.35	1.51	1.98	1.42	1.47
Business/management/marketing/related	1.57	1.65	1.72	1.60	1.40	1.59
Communication/journalism/comm. tech	1.89	1.85	1.72	1.86	1.83	1.81
Computer/info sciences/support tech	1.35	1.60	1.43	1.43	1.35	1.39
Education	2.09	2.00	2.07	1.98	1.82	2.00
Engineering technologies/technicians	1.43	1.41	1.52	1.23	1.35	1.41
English language and literature/letters	2.37	2.24	2.41	2.39	2.49	2.41
Foreign languages/literature/linguistics	2.00	1.75	2.00	1.93	1.69	1.93
Health professions/clinical sciences	1.48	1.54	1.51	1.60	1.32	1.43
Legal professions and studies	1.34	1.65	1.62	1.69	1.83	1.60
Library science	1.56	2.29	1.36	2.25	1.86	1.74
Mathematics and statistics	1.29	1.37	1.28	1.39	1.21	1.28
Parks/recreation/leisure/fitness studies	1.62	1.50	1.61	1.52	1.25	1.48
Philosophy, religion & theology	1.46	1.80	1.49	1.71	1.62	1.57
Physical sciences	1.29	1.35	1.44	1.50	1.22	1.36
Psychology	1.76	1.73	1.71	2.01	1.56	1.73
Public administration/social services	2.43	2.23	1.81	1.88	1.92	1.97
Social sciences (except psych) & history	1.66	1.60	1.75	1.88	1.58	1.69
Total	1.61	1.63	1.69	1.79	1.54	1.64

SOURCE: National Center for Education Statistics, NSOPF:04.

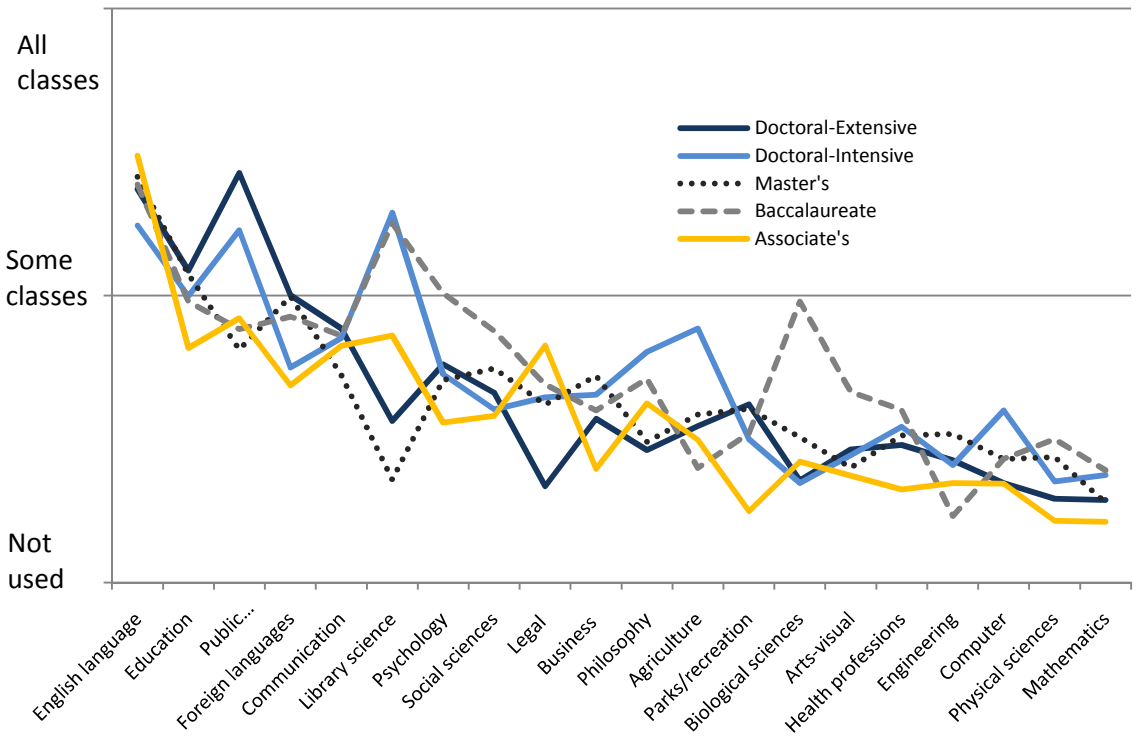

Figure A-25. In How Many Undergrad Classes Are Multiple Drafts of Written Work Used: Mean by Carnegie Type and Disciplinary Field

Table A-26. In How Many Undergrad Classes Are Oral Presentations Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.89	2.21	2.01	2.09	1.93	1.96
Arts-visual and performing	2.10	2.06	2.01	2.13	2.02	2.06
Biological and biomedical sciences	1.73	1.78	1.81	2.22	1.65	1.78
Business/management/marketing/related	2.04	2.01	2.21	2.28	1.81	2.06
Communication/journalism/comm. tech	2.07	2.36	2.47	2.54	2.38	2.37
Computer/info sciences/support tech	1.63	1.96	1.96	1.77	1.75	1.79
Education	2.33	2.40	2.49	2.53	2.18	2.39
Engineering technologies/technicians	1.74	1.85	1.87	1.70	1.71	1.77
English language and literature/letters	2.20	2.12	2.09	2.29	1.88	2.07
Foreign languages/literature/linguistics	2.35	2.31	2.32	2.30	2.61	2.36
Health professions/clinical sciences	1.91	2.05	2.03	2.17	2.04	2.02
Legal professions and studies	1.86	2.40	1.99	2.02	1.49	1.94
Library science	1.71	1.95	1.71	1.82	2.12	1.91
Mathematics and statistics	1.39	1.48	1.39	1.54	1.29	1.38
Parks/recreation/leisure/fitness studies	2.04	1.81	2.22	2.07	1.82	2.02
Philosophy, religion & theology	1.57	1.79	1.94	1.82	1.70	1.77
Physical sciences	1.57	1.55	1.55	1.61	1.37	1.54
Psychology	1.68	2.02	1.84	2.08	1.90	1.87
Public administration/social services	2.51	2.64	2.53	2.55	2.29	2.51
Social sciences (except psych) & history	1.74	1.85	1.88	2.03	1.76	1.83
Total	1.87	1.96	2.01	2.09	1.84	1.93

SOURCE: National Center for Education Statistics, NSOPF:04.

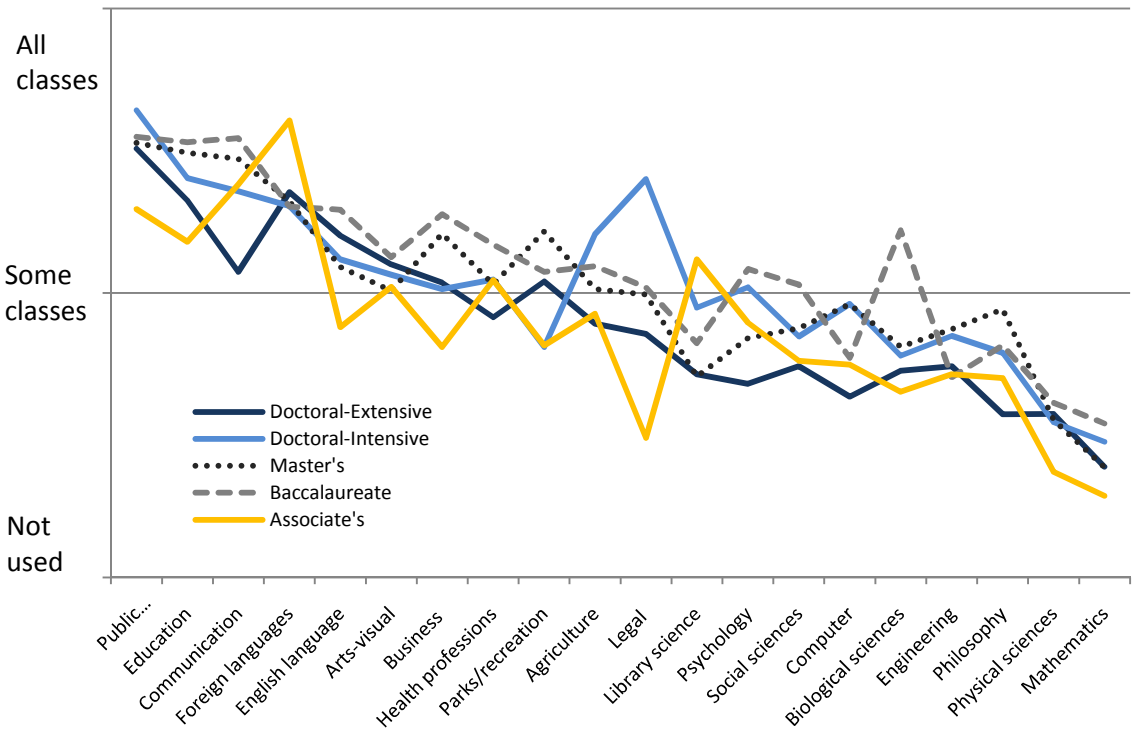

Figure A-26. In How Many Undergrad Classes Are Oral Presentations Used: Mean by Carnegie Type and Disciplinary Field

Table A-27. In How Many Undergrad Classes Are Oral Presentations Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.95	2.39	1.96	2.04	2.00	2.02
Arts-visual and performing	1.79	1.68	1.77	1.78	1.80	1.77
Biological and biomedical sciences	1.62	1.67	1.71	2.29	1.69	1.73
Business/management/marketing/related	2.22	2.08	2.25	2.04	1.90	2.12
Communication/journalism/comm. tech	2.14	2.15	2.02	2.33	2.19	2.14
Computer/info sciences/support tech	1.97	2.13	1.93	2.00	1.90	1.95
Education	2.26	2.25	2.43	2.39	2.03	2.29
Engineering technologies/technicians	2.03	1.96	1.94	1.83	1.97	1.99
English language and literature/letters	1.92	1.75	1.81	1.99	1.86	1.86
Foreign languages/literature/linguistics	1.60	1.93	1.93	1.81	2.02	1.78
Health professions/clinical sciences	1.83	1.82	1.95	2.22	1.88	1.90
Legal professions and studies	1.94	1.92	1.36	1.20	1.47	1.65
Library science	1.77	1.00	1.71	1.98	1.24	1.47
Mathematics and statistics	1.42	1.61	1.48	1.89	1.58	1.55
Parks/recreation/leisure/fitness studies	2.01	1.93	1.88	1.79	1.98	1.92
Philosophy, religion & theology	1.37	1.54	1.62	1.56	1.98	1.57
Physical sciences	1.64	1.57	1.66	1.83	1.57	1.65
Psychology	1.63	2.17	1.70	1.97	1.81	1.79
Public administration/social services	2.28	2.20	2.21	2.22	2.37	2.24
Social sciences (except psych) & history	1.52	1.64	1.57	1.65	1.80	1.61
Total	1.78	1.85	1.87	1.93	1.84	1.84

SOURCE: National Center for Education Statistics, NSOPF:04.

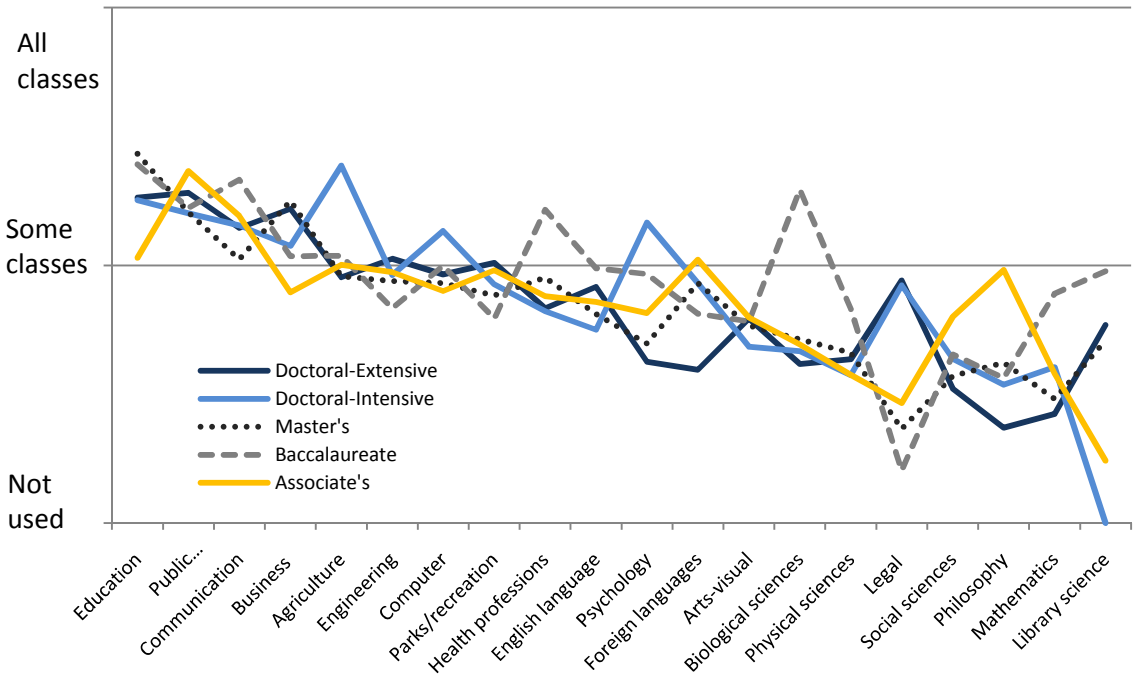

Figure A-27. In How Many Undergrad Classes Are Oral Presentations Used: Mean by Carnegie Type and Disciplinary Field

Table A-28. In How Many Undergrad Classes Are Student Evaluations of Each Others' Work Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.44	1.48	1.50	1.65	1.21	1.41
Arts-visual and performing	1.79	1.77	1.87	1.82	1.87	1.83
Biological and biomedical sciences	1.42	1.32	1.38	1.69	1.25	1.39
Business/management/marketing/related	1.77	1.69	1.81	1.69	1.45	1.69
Communication/journalism/comm. tech	1.74	1.97	1.91	2.01	2.25	1.97
Computer/info sciences/support tech	1.42	1.55	1.53	1.55	1.50	1.50
Education	1.80	1.96	1.92	2.07	1.69	1.88
Engineering technologies/technicians	1.36	1.58	1.42	1.23	1.37	1.40
English language and literature/letters	2.02	1.92	2.09	2.15	2.01	2.04
Foreign languages/literature/linguistics	1.40	1.21	1.65	1.52	1.57	1.48
Health professions/clinical sciences	1.43	1.46	1.51	1.45	1.47	1.47
Legal professions and studies	1.18	1.51	1.50	1.00	1.26	1.33
Library science	1.00	1.30	1.24	1.48	1.42	1.32
Mathematics and statistics	1.17	1.15	1.17	1.24	1.23	1.19
Parks/recreation/leisure/fitness studies	1.49	1.70	1.59	1.47	1.59	1.57
Philosophy, religion & theology	1.20	1.35	1.38	1.36	1.70	1.36
Physical sciences	1.22	1.16	1.24	1.29	1.29	1.24
Psychology	1.42	1.43	1.43	1.53	1.31	1.41
Public administration/social services	1.56	1.30	1.71	1.81	1.75	1.64
Social sciences (except psych) & history	1.33	1.34	1.33	1.50	1.42	1.37
Total	1.48	1.53	1.60	1.64	1.54	1.55

SOURCE: National Center for Education Statistics, NSOPF:04.

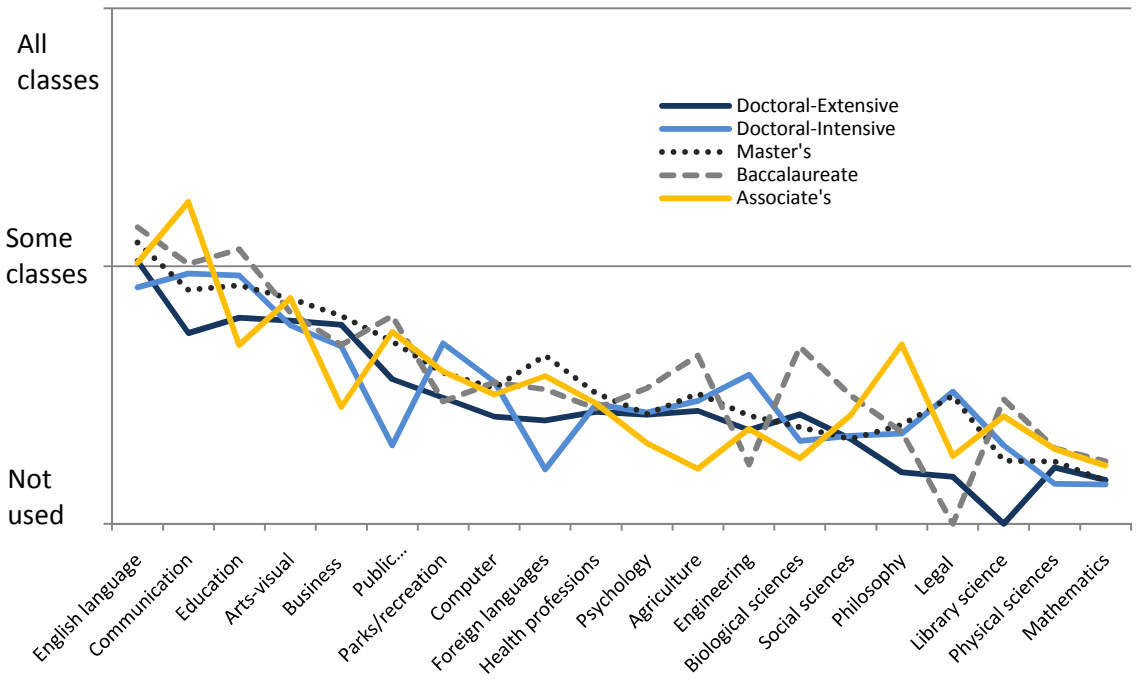

Figure A-28. In How Many Undergrad Classes Are Student Evaluations of Each Others' Work Used: Mean by Carnegie Type and Disciplinary Field

Table A-29. In How Many Undergrad Classes Are Laboratory/Shop/Studio Assignments Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.94	2.50	1.94	2.41	2.38	2.13
Arts-visual and performing	2.21	2.16	2.30	1.98	2.29	2.21
Biological and biomedical sciences	1.78	1.92	2.37	2.50	2.39	2.15
Business/management/marketing/related	1.46	1.36	1.35	1.57	1.74	1.49
Communication/journalism/comm. tech	1.55	1.62	1.63	1.51	1.68	1.61
Computer/info sciences/support tech	2.17	2.32	2.31	2.40	2.47	2.36
Education	1.88	1.78	1.76	1.83	1.69	1.78
Engineering technologies/technicians	2.01	1.87	1.90	1.99	2.48	2.06
English language and literature/letters	1.39	1.13	1.21	1.25	1.38	1.30
Foreign languages/literature/linguistics	1.36	1.70	1.76	1.71	1.84	1.59
Health professions/clinical sciences	1.76	1.99	1.90	1.91	2.14	1.99
Legal professions and studies	1.00	1.40	1.24	1.00	1.55	1.26
Library science	2.05	1.30	1.73	1.59	2.02	1.83
Mathematics and statistics	1.33	1.34	1.41	1.47	1.40	1.39
Parks/recreation/leisure/fitness studies	2.09	1.82	1.65	1.74	1.74	1.75
Philosophy, religion & theology	1.10	1.02	1.14	1.13	1.14	1.12
Physical sciences	1.95	2.09	2.09	2.26	2.39	2.12
Psychology	1.67	1.48	1.52	1.58	1.32	1.51
Public administration/social services	1.26	1.24	1.29	1.75	1.46	1.35
Social sciences (except psych) & history	1.29	1.18	1.23	1.16	1.20	1.23
Total	1.67	1.66	1.68	1.69	1.86	1.72

SOURCE: National Center for Education Statistics, NSOPF:04.

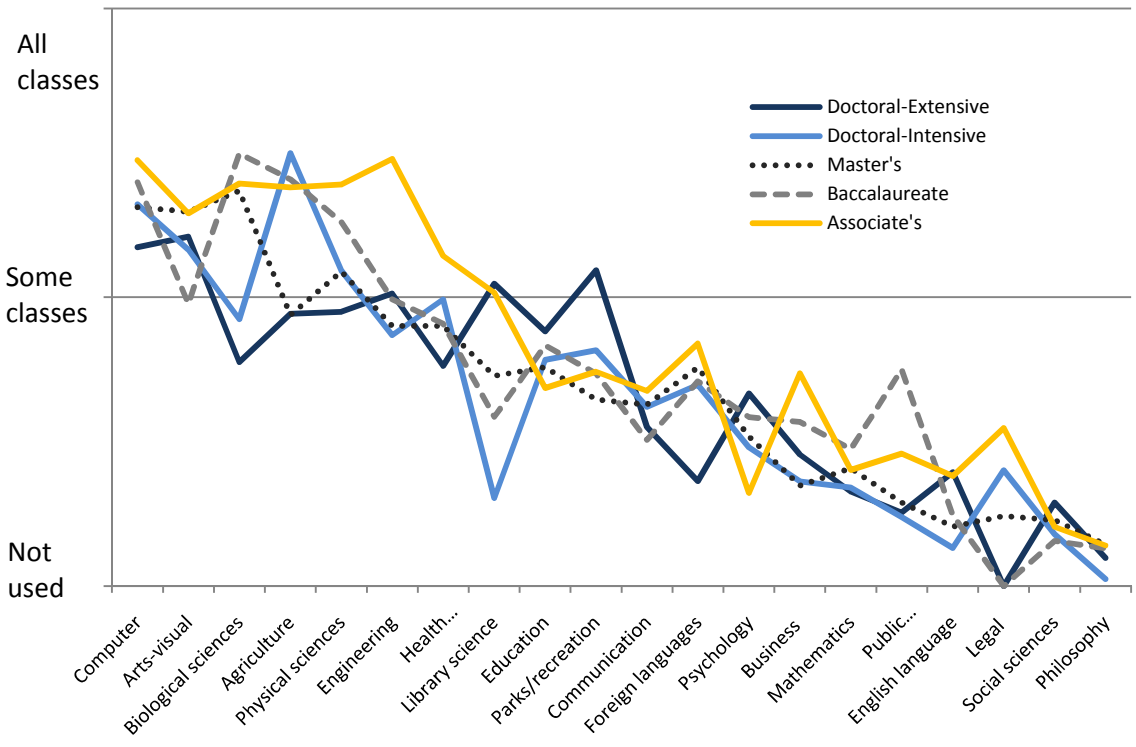

Figure A-29. In How Many Undergrad Classes Are Laboratory/Shop/Studio Assignments Used: Mean by Carnegie Type and Disciplinary Field

Table A-30. In How Many Undergrad Classes Are Service Learn/Co-Op Interactions with Business Used: Mean by Carnegie Type and Disciplinary Field (Likert Scale: 1=Not used, 2=Some classes, 3=All classes)

	Doctoral-Extensive	Doctoral-Intensive	Master's	Baccalaureate	Associate's	Total
Agriculture/natural resources/related	1.49	1.42	1.62	1.59	1.58	1.52
Arts-visual and performing	1.34	1.32	1.32	1.40	1.37	1.35
Biological and biomedical sciences	1.14	1.17	1.15	1.18	1.16	1.15
Business/management/marketing/related	1.50	1.45	1.43	1.55	1.46	1.46
Communication/journalism/comm. tech	1.60	1.62	1.61	1.80	1.48	1.60
Computer/info sciences/support tech	1.21	1.40	1.21	1.39	1.41	1.33
Education	1.89	1.85	1.98	1.87	1.78	1.89
Engineering technologies/technicians	1.18	1.24	1.23	1.36	1.55	1.28
English language and literature/letters	1.23	1.22	1.19	1.31	1.20	1.22
Foreign languages/literature/linguistics	1.10	1.23	1.41	1.20	1.34	1.22
Health professions/clinical sciences	1.60	1.54	1.81	1.77	1.97	1.81
Legal professions and studies	1.13	1.05	1.24	1.20	1.68	1.26
Library science	1.00	2.29	1.38	1.49	1.33	1.42
Mathematics and statistics	1.09	1.10	1.10	1.20	1.09	1.11
Parks/recreation/leisure/fitness studies	1.75	1.46	1.72	1.60	1.38	1.58
Philosophy, religion & theology	1.04	1.35	1.26	1.19	1.20	1.19
Physical sciences	1.08	1.06	1.10	1.16	1.12	1.10
Psychology	1.20	1.47	1.30	1.42	1.40	1.34
Public administration/social services	2.24	1.98	1.89	1.58	2.14	1.95
Social sciences (except psych) & history	1.17	1.18	1.29	1.27	1.41	1.26
Total	1.28	1.34	1.40	1.39	1.44	1.37

SOURCE: National Center for Education Statistics, NSOPF:04.

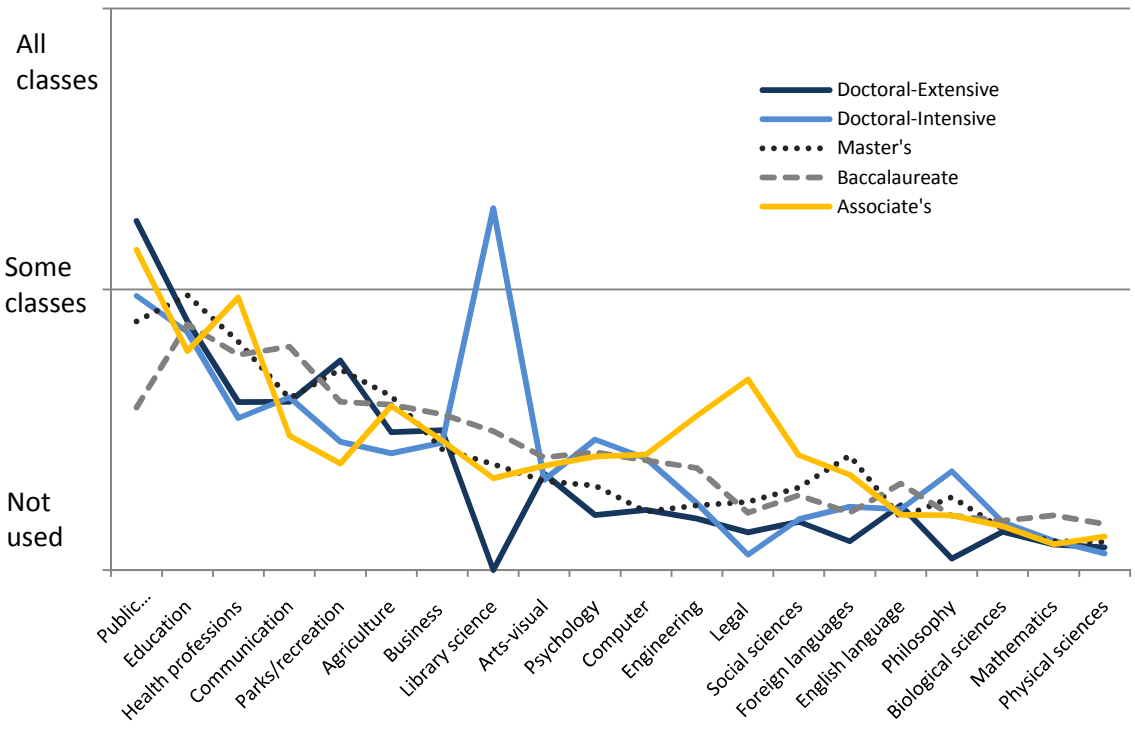

Figure A-30. In How Many Undergrad Classes Are Service Learn/Co-Op Interactions with Business Used: Mean by Carnegie Type and Disciplinary Field

Appendix B

HLM6 Program Code for Model A-7

```
LEVEL1:FS_PUB=INTRCPT1+FD_1,1+FD_4,1+FD_5,1+FD_6,1+FD_7,1+FD_8,1+FD_10,1+
FD_11,1+FD_12,1+FD_14,1+FD_16,1+FD_17,1+FD_18,1+FD_21,1+FD_24,1+FD_25,1+FD_2
6,1+FD_27,1+FD_30,1+FD_33,1+RANDOM

LEVEL2:INTRCPT1=INTRCPT2+X00_1+X00_2+X00_3+X00_5+X00_6+RANDOM/

LEVEL2:FD_1=INTRCPT2/
LEVEL2:FD_4=INTRCPT2/
LEVEL2:FD_5=INTRCPT2/
LEVEL2:FD_6=INTRCPT2/
LEVEL2:FD_7=INTRCPT2/
LEVEL2:FD_8=INTRCPT2/
LEVEL2:FD_10=INTRCPT2/
LEVEL2:FD_11=INTRCPT2/
LEVEL2:FD_12=INTRCPT2/
LEVEL2:FD_14=INTRCPT2/
LEVEL2:FD_16=INTRCPT2/
LEVEL2:FD_17=INTRCPT2/
LEVEL2:FD_18=INTRCPT2/
LEVEL2:FD_21=INTRCPT2/
LEVEL2:FD_24=INTRCPT2/
LEVEL2:FD_25=INTRCPT2/
LEVEL2:FD_26=INTRCPT2/
LEVEL2:FD_27=INTRCPT2/
LEVEL2:FD_30=INTRCPT2/
LEVEL2:FD_33=INTRCPT2/

LEVEL1WEIGHT:WTA00
LEVEL2WEIGHT:WTB00
VARIANCEKNOWN:NONE
RESFIL1:N
RESFIL2:N
HETEROL1VAR:n
ACCEL:5
LVR:N
LEV1OLS:10
MLF:n
HYPOTH:n
FIXTAU:3
CONSTRAIN:N
```