Faculty Motivation to do Research: Across Disciplines in Research-Extensive Universities

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Abstract: *This study investigated personal, contextual, and motivational factors that influence faculty research productivity across disciplines. Participants were 781 faculty members in four different academic divisions of 28 U.S. research-extensive universities, in 17 states across the continental U.S. Data were collected as self-reported via online questionnaires, and were analyzed with path analysis using LISREL 8.72 to test a model of factors contributing to faculty members' research productivity. The model fit the data well, supporting the theorized contributions to faculty productivity. Three variables accounted for the largest*

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amounts of unique variance in research productivity: research valuing and research effort (positively) and teaching load (negatively). This analysis further confirmed the fit of the general model for faculty motivation from our previous research, on a larger and more diverse sample. Qualitative data were coded to identify themes related to the research hypotheses. Implications for faculty work, institutional administration, and future research are discussed.

As educational expenditures rise, including the costs of research, and institutions of higher education compete for high-quality faculty and for external funding, issues surrounding faculty productivity have been undergoing extensive debate. One part of this debate is over the relative values of teaching and research, first as faculty tasks and as elements of the institutional mission, and second in their relationship to one another in terms of individual and institutional productivity and value to society (Fairweather, 2002; Hattie & Marsh, 1996). Another part of this debate is over the consideration of accumulative advantage; that is, of research as valued activity attracting both faculty and funding that, in turn, reciprocally promote more productivity, both for the institution and for individual faculty members (Goodwin & Sauer, 1995; Hu & Gill, 2000).

There exists a robust research literature on faculty productivity, largely featuring external, organizational characteristics as predictors (Goodwin & Sauer, 1995), but few theory-driven studies focus on faculty motivation for research. Some exceptions exist in the international literature such as in Taiwan (Tien, 2000) and Australia (Bailey, 1999). However, cultural and policy differences challenge generalizability across national boundaries (Teodorescu, 2000). Those theory-driven studies done in the U.S. have generally concentrated in a small subset of academic disciplines, notably business (Chen, Gupta & Hoshower, 2006; Levitan & Ray, 1992; Schultz, Meade & Khurana, 1989). In order to control for a maximum number of variables, many studies have focused narrowly, such as on a single institution, college or department (Wood, 1990; Buchheit, Collins & Collins, 2001), but this type of design offers little generalizability. A few previous studies of factors influencing research productivity have integrated effects of personal and institutional characteristics (Levitan & Ray, 1992). Other productivity research has taken a life cycle development approach to investigating motivation (Baldwin & Blackburn, 1981; Goodwin & Sauer, 1995; Hu & Gill, 2000).

A number of institutional and contextual factors theoretically and empirically present implications for faculty motivation with regard to research. The organizational and local factors (e.g., institutional goals and mission, supervisor and departmental support) can be better examined by focusing data collection on a specific stratum of institution, the research-extensive university. Our previous study addressed faculty motivation for research in departments of psychology and educational psychology only (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007). The present study investigated research-related motivational characteristics of faculty members in four different academic divisions in Carnegie I, research-extensive, doctoral-granting universities across the continental U.S., to see if the same predictive relationships generalize across a broader set of faculty and local contexts, in institutions with similar global organizational characteristics.

Background

Most faculty members in research-extensive universities are expected to be productive in research, teaching, and service (Blackburn & Lawrence, 1995; Fairweather, 2002). A greater emphasis is placed on scholarly research that results in conference presentations and publications such as refereed journal articles, books, and book chapters (Bentley & Blackburn, 1991; Hearn, 1999). This emphasis exists because such productivity contributes to the scientific and professional literature and brings credibility and acclaim both to the individual scholar and to the institution (Plucker, 1988; Tien & Blackburn, 1996). It is important for research to consider how the nature and priorities of tasks in the professoriate are differentiated by type of institution and by discipline (Fairweather, 1999; Levin & Stephan, 1992).

Faculty Productivity

One measure of faculty productivity is teaching, generally quantified as courses taught and class size (Boyer, 1990). In the research university, however, faculty productivity is often assessed as scholarly publications and presentations, sometimes including grants (Braskamp & Ory, 1994; Wong & Tierney, 2001). A national movement has begun to broaden the definition of *scholarship* (Boyer, 1990) and to more comprehensively evaluate faculty members' contributions in the academy (Colbeck, 2002; Middaugh, 2001). However, in the research university, scholarly publications defined as peer-reviewed articles in recognized professional

journals often function as the primary productivity measure in the granting of promotion and tenure (Braskamp & Ory, 1994; Lazear, 1998; Pellino et al., 1981; Wong & Tierney, 2001).

Extensive research in the relationship between research and teaching has produced mixed findings, based on the variables of interest and how they are measured (Ovington, Diamantes, Roby, & Ryan, 2003). Little relationship has been found between teaching *evaluations* and research productivity (Bailey, 1999; Colbeck, 1997; Feldman, 1987), but faculty research and teaching *load* are negatively related (Buchheit, Collins & Collins, 2001; Chen, Gupta & Hoshower, 2006; Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007; Hattie & Marsh, 1996). Overlap exists between research and teaching in seminars and mentoring (or research advising) more than in traditional classroom teaching (Altbach & Lewis, 1997; Colbeck, 1997). Faculty members sometimes identify a conflict between the existing reward and evaluation systems and faculty members' individual values and efforts (Colbeck, 1994; Plucker, 1988; Serow, 2000). Faculty value for research is predicted by departmental support as well as individual interest, and value for research, in turn, predicts research productivity (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007; Serow & Demry; 1999). There may be a selectivity issue of match in research universities, with those who value the research mission more seeking employment where that mission is embedded in the priority and evaluation system of the institution (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007; Meyer & Allen, 1991). Beyond valuing, time as a resource limitation may create a tension between research and teaching, so that faculty members with higher teaching loads tend to be less productive in research (Buchheit, Collins & Collins, 2001; Chow & Harrison, 1998; Colbeck, 1994). At the same time, this tension is contingent on the degree to which faculty members see the three key elements of their work (research, teaching and service) as integrated (vs. discrete), such that resources (such as time, energy and effort) are shared rather than having various task demands competing for limited resources (Colbeck, 1998, 2002; Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007).

Stress influences productivity in all areas of life, and one study found five areas of stress among faculty members: reward and recognition, time constraints, departmental influence, professional identity, and student interactions (Gmelch, Wilke & Lovrich, 1986). Of these major stressors,

two (reward and recognition and professional identity) are closely related to research activities, and another (student interactions) is directly linked to the teaching role. It may be argued that the other two (time constraints and departmental influence) are linked to both research and teaching, as well as to the service role of faculty. Time is linked to research and teaching because these responsibilities consume much of a professor's time and effort, and they are linked to departmental influence and service because institutional values systems are embedded in both recognition models and the way faculty identities are defined and esteemed.

Several global theories of faculty work link productivity to career stages, with different assertions about their relationships. One strand of the research literature argues for an accrued advantage of faculty experience and connections, and thus asserts that faculty rank should predict productivity in a relatively linear fashion, so that faculty in higher ranks should demonstrate higher productivity than those in lower ranks (Baldwin & Blackburn, 1981; Tien & Blackburn, 1996). Another strand of the faculty research literature presents a "lifecycle" theory of faculty work, arguing that the salience of extrinsic rewards causes faculty to exert greatest effort when promotion and tenure decisions are imminent and less after promotion, predicting fluctuations in productivity over time and eventually a downturn in productivity later in the academic career, after promotion to full professor and as faculty members near retirement (Goodwin & Sauer, 1995; Hu & Gill, 2000). Neither of these theories strands takes into account the importance of institutional context or individual differences in a complex model of motivational characteristics.

According to the more complex psychological model of motivational characteristics, both early and late in faculty careers, the consistency with which institutions and departments communicate their standards and expectations shapes faculty members' values and motivations with regard to research and teaching as job priorities (Alpert, 1985; Baldwin & Blackburn, 1981; Boice, 1992). Faculty members develop as researchers by analyzing and reflecting on their work (Schön, 1983), processes that are supported by clear, consistent competence feedback (Braskamp & Ory, 1994). However, many universities fail to give faculty members effective feedback on their work, and faculty may be timid about discussing their work because they feel vulnerable to criticism or judgment (Braskamp & Ory, 1994). In this more complex motivational

framework, beliefs and expectations of success continue to exert important influences on faculty success, even after tenure is achieved (Chen, Gupta & Hoshower, 2006; O'Meara, 2003), and throughout the career.

Individual and situational differences, such as life and career stages, individual motivation and incentives, and external funding opportunities, also influence faculty research productivity (Blackburn & Lawrence, 1995; Jackson, 2004; Lee & Rhoads, 2004; Levin & Stephan, 1989). Mixed findings indicate that gender and family commitments exert differential effects on research productivity (Sax, Hagedorn, Arredondo, & Dicrisi, 2002). Some studies have found extrinsic rewards to be the strongest correlate with research productivity (Diamond, 1993; Fairweather & Rhoads, 1995), while others found a strong positive relationship of intrinsic factors (e.g., motivation and self-efficacy) and research productivity (Bailey, 1999). Still others have identified differential relationships between intrinsic and extrinsic motivations relative to other factors such as tenure status (Chen, Gupta & Hoshower, 2006). Massy and Widgren (1995) found faculty members' self-perceptions closely related to research, but on a narrow sample with limited generalizability. Several studies have found that dissertation involvement and effort in research (Blackburn and Lawrence, 1995), or advising students in research (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007), predicted faculty research productivity. These behaviors are linked to faculty self-knowledge (e.g., interest, commitment, efficacy, satisfaction, morale) and social knowledge (e.g., social support, institutional values and rewards, institutional support) (Miller, Beesley, Pace, Maxwell, & Xie, 2007). Yet little is known about theoretically-anchored models of the expectations and motivations of faculty (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007), or how they might vary by types of institutions or by discipline (Fairweather, 1996, 2002).

In addition to the predictive power of particular individual and organizational characteristics is the question of match (concordance vs. discordance) between them. This question is important because it has potential to influence the investment of intangible personal resources such as energy, time and effort (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007). It is an issue of both general fit (Colbeck, 1998) and of socialization of faculty (Fairweather, 2002; Levitan & Ray, 1992).

The Role of Motivation

Much of the previous work on faculty productivity has tended to focus on external factors such as organizational and job characteristics, based on the argument that these are actionable and malleable by institutions and departments (Buchheit, Collins & Collins, 2001). However, internal and individual difference variables are influenced by external factors in the work context and social environments, through perceptions (Boice, 1992; Deci & Ryan, 1987; Diamond, 1993). Therefore, it is essential to engage in research that models motivation and personal investment as taking into account both contextual and individual differences (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007). Motivation theory can shed additional light on the personal and social dynamics that may promote or inhibit faculty members' research productivity (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007). The present study utilized three strands of motivation theory: intrinsic versus extrinsic motivation, self-determination and social support, and self-efficacy.

Intrinsic and extrinsic motivation are two different types of reasons for acting that predict valued outcomes across life stages and work contexts (Deci, 1995; Pintrich & Schunk, 1996; Sansone & Harackiewicz, 2000). Intrinsic motivation is when an individual engages in an activity because of interest and enjoyment of the activity itself, while extrinsic motivation leads the individual to engage in the activity because of incentives or external pressures (Reeve, 1995; Sansone & Harackiewicz, 2000). In both learning environments and work-based studies, intrinsic motivation predicts effort, engagement, enjoyment and achievement, while extrinsic motivation predicts minimal effort, lack of enjoyment and minimal performance often with a hesitancy to take risks or innovate (Deci & Ryan, 1987; Pintrich & Schunk, 1996; Reeve, 1995). Consistent with this theoretical perspective, Colbeck (1992) found that merit pay was relatively unimportant and that incentives perceived as external pressures did not productively motivate faculty members.

Motivation is affected by how those in positions of leadership and influence communicate values and contingencies (Bland, Center, Finstad, Risbey, & Staples, 2006; Ryan & Deci, 2000), as well as by the explicit or implicit social norms of the group (Deci & Ryan, 2002; Lazear, 1998). According to self-determination theory (Deci & Ryan, 1987), individuals' perceptions of themselves as autonomous (given choice and freedom in their work) predict their well-being, work effort and

performance (Deci & Ryan, 2002). Similarly, individuals' perceptions of themselves as competent (capable) in their work cause them to put forth effort and engage fully in work-related tasks (Ryan & Deci, 2000). A third element of self-determination, relatedness, refers to the degree to which individuals feel interpersonally supported by supervisors and others, and relatedness also predicts job performance and satisfaction (Deci & Ryan, 2002).

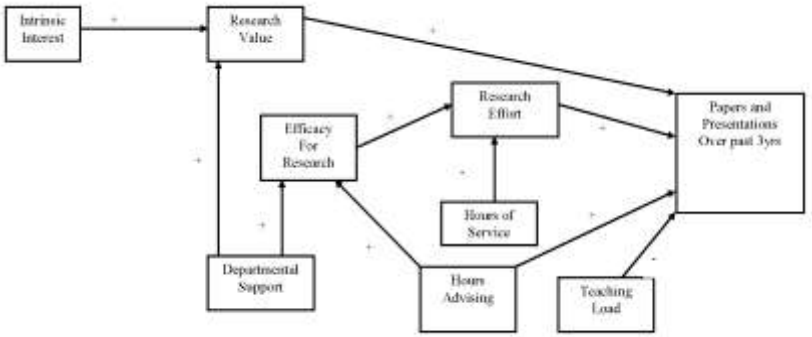
Task-specific self-efficacy predicts positive motivational and achievement outcomes across contexts, including persistence and performance (Bandura, 1997). Self-efficacy is the individual's perception of ability to take on and complete tasks and accomplish goals, even in the face of challenges (Bandura, 1997; Reeve, 1995). Among higher education faculty across institutional types, self-efficacy accounted for a significant amount of variance in research productivity (Blackburn, Bieber, Lawrence, & Trautvetter, 1991). Among research university faculty specifically, efficacy for research predicted effort invested in research, which, in turn, predicted research publications and presentations (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007). Further, supportive culture predicted faculty motivation for teaching (Feldman & Paulsen, 1999), and general well-being is associated with overall faculty success (Walker, 2002).

Intrinsic motivation, self-determination, and self-efficacy are critical motivational characteristics that have been demonstrated to lead to workplace success across many contexts. Yet there is little research applying these variables to studies of faculty motivation, except an occasional study focused on a specific discipline or subset of related disciplines (Chen, Gupta & Hoshower, 2006; Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007) and just a handful of studies sampling across institutions and disciplines (Bailey, 1999; Blackburn et al., 1991). The present study addressed these gaps by sampling across a range of academic disciplines, but holding constant the institutional type to research-extensive universities. The traditional differences in how faculty work is valued, accounted for, and rewarded tend to complicate comparisons across colleges and disciplines. However, the burden of university policy and administration to fairly compare faculty for internal grants, awards and promotion decisions requires that researchers take on these challenges. Within this context we examined which among several subsets of factors best predicted faculty research productivity: a)

personal motivational factors (intrinsic interest, self-efficacy, valuing of research, effort invested in research); and b) contextual factors (e.g., departmental support; and teaching, advising and service loads). Our principal outcome indicator for faculty productivity was the number of papers published and presentations given over the past three years, a time frame equally relevant to pre-tenure and post-tenure faculty.

Based on our previous model test across research universities, but in a narrower range of disciplines (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007), we used structural equation modeling to test the generalizability of the relationships we found previously across a broader range of faculty in a regionally different subset of research universities (see Figure 1).

Figure 1
Hypothesized Model for Research Productivity



We hypothesized that the same model would fit this data well, and also used the correlational relationships in these data to indicate what additional paths might emerge as significant in this sample that perhaps had not been significant in the previous sample, and thus indicate different elements of a well-fitting model.

Methods

Participants

Participants were 781 faculty members in four academic divisions of 28 research-extensive universities in 17 states across the continental U.S.

Academic divisions represented were as follows: Languages & Literatures 111 (14%); Humanities 158 (20%); Social Sciences 192 (25%); and Math & Science 238 (30%). There were 448 (57%) males and 284 (37%) females (6% did not report). As to race/ethnicity, 654 (84%) self-reported as Caucasian; 27 (4%) Black; 10 (1%) Latino; 19 (3%) Asian, 1 (.1%) Native American; and 34 (4%) other (5% did not report). There were 308 (40%) full professors, 224 (29%) associate professors, and 192 (25%) assistant professors; 526 (67%) were tenured and 204 (26%) were untenured (7% did not report). As to family commitment, 640 (82%) reported having a spouse or domestic partner, and 499 (64%) reported having children in the home. An online search of the participating schools' faculties indicated that the gender and ethnic mix in these departments is very similar to our sample, so we judged the sample as representative on these variables.

Procedures

Participants were recruited via e-mail at their institutional addresses and invited to complete the anonymous online questionnaires. The secure online data collection site was available for a period of three months. The voluntary response rate was 781 out of 1208 (65%), a very high return for anonymous online surveys (Hardré, Crowson, Ly, & Xie, 2007; Leece et al., 2004).

Measures

Demographics. Demographic characteristics included age, gender, ethnicity, family commitment, rank (full professor, associate professor or assistant professor), and academic division (language & literatures, humanities, social sciences, and math & sciences).

Personal value. Faculty members indicated their personal value for research, teaching and service, each on a separate Likert-type 10-point scale. They responded to the following question: "To what extent do you personally value each of these three professional activities?" Each of the three activities was then presented to the left of a 1-10 numeric scale (1=low, 10=high), without additional descriptive anchors.

Percentage of effort. Participants indicated the amount of effort invested in research, teaching and service as part of their professional activities. They responded to the following question: "Based on your

own personal standard, how much effort do you invest in each of the following professional activities?". Each of the three activities was then presented to the left of a 1-10 numeric scale (1=low, 10=high), without additional descriptive anchors.

Expected investment of intangible resources. Participants indicated the relative percentage of intangible resources that their department expected to be invested in research, teaching and service. The prompt was as follows: "Based on the functionally defined reward structure in your department, what percentage of your non-financial personal resources (such as time, energy and effort) are you expected to invest in each of the following professional activities?" The participants provided a percentage to indicate level of expected involvement in research, teaching and service, as percent-response fields constrained to total 100%.

Ideal investment of intangible resources. Participants indicated the percentage of intangible resources that they personally felt should be invested in research, teaching and service. The prompt was as follows: "Based on your own professional standards, what do you believe would be the ideal reward structure; that is, what percentage of your non-financial personal resources (such as time, energy and effort) should you be expected to invest in each of the following professional activities?" Again, participants provided a percentage to indicate level of expected involvement in research, teaching and service, as percent-response fields constrained to total 100%.

Motivation for research. The individual's intrinsic and extrinsic motivation for research was assessed using a 12-item instrument (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007). Sample items: intrinsic ("I do research because I like to do it"); and extrinsic ("I do research because I have to, to keep my job"). Responses were on a 1-5 Likert-type numeric scale, anchored as follows: 1="Not at all true"; 3= "Somewhat true"; 5="Very much true" (*alpha*=.85).

Self-efficacy for research. Task-specific self-efficacy was assessed using a 7-item self-efficacy for research scale (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007). Sample items: "I feel capable of identifying worthwhile research questions" and "I can write and publish research studies." Participants responded on a 1-5 Likert-type scale

(anchored as follows: 1 = "Not at all true", "3 = "Somewhat true" and 5 = "Very much true" (*alpha* = .88).

Teaching load. Faculty members indicated their current annual teaching load in terms of courses per year on average. The question was as follows: "How many courses per academic year do you teach on average?" Participants indicated the number of courses, with no additional guides or constraints. In order to create comparable numbers, the course loads reported by those in institutions on the quarter system were multiplied by 2/3 to produce numbers analogous to the semester system.

Service load. Faculty members indicated their current annual service load in terms of hours per week on average. Two questions addressed different levels of service. The first question was: "About how many hours a week, on average, do you spend on internal service commitments (service to department/program, college and institution)? (fill in hours)". The second question was: "About how many hours a week, on average, do you spend on external service commitments (service to professional organizations outside your institution)? (fill in hours)". Participants provided the number of hours, with no additional guides or constraints. The combined number of service hours reported constituted the individual's service load for our analysis.

Perceived departmental support for research. Participants indicated what they perceived as the degree of departmental and interpersonal support for research. We used an 8-item instrument based on self-determination theory and contextualized from the Work Climate Questionnaire (Baard, Deci, & Ryan, 2004). Sample items: "My department is socially supportive of research, encouraging me to collaborate with other faculty members", "My research is valued by my department and my college", and "My department provides me with choices in the research questions and issues that I investigate." Responses were on a 1-5 Likert-type numeric scale, anchored as follows: 1="Not at all true"; 3="Somewhat true"; 5="Very much true" (*alpha*= .75).

Productivity outcomes. Because of its prevalence as the primary indicator of research productivity among research-extensive universities like those from which our sample was drawn, we used

research disseminated as peer-reviewed publications and national/international conference presentations to assess productivity outcomes. As a time period that could be equally applicable to those across faculty ranks, we asked faculty members to report those publications and presentations for over the past three years. The questions were as follows: "How many peer-reviewed research publications did you count as author or co-author on in the past three calendar years?" and "How many national or international professional research conference presentations did you count as author or co-author on in the past three calendar years?". The combined total of publications and presentations constituted our measure of research productivity.

Open-ended Response Items. We also included at the end of each section of the questionnaires a text box with the label "Comments or elaborations". Its purpose was to invite participants to supply additional detail to illuminate their responses and to inform our understanding of their unique situations and contexts. These were embedded (and thus contextualized) fields for voluntary elaboration, based on participants' perceptions, rather than items designed to systematically elicit specific responses from all participants.

Results

Reliabilities

All scales demonstrated good reliabilities, with Cronbach's *alphas* from .80 to .88.

Correlates of Productivity, Effort and Efficacy

Correlational analyses of the variables (at $p<.01$) supported the relationships found in previous studies to a large degree. Table 1 shows the relationships among the study variables.

Table 1
Correlation Matrix for Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Research productivity	-															
2. Academic rank	17**	-														
3. Research hrs/wk	44**	04	-													
4. Research effort	38**	09*	43**	-												
5. Research value	27**	10*	26**	55**	-											
6. Research advising	30**	09*	30**	20**	14**	-										
7. Intrinsic motivation	20**	14**	19**	34**	64**	12**	-									
8. Extrinsic motivation	- 01	- 16**	- 01	- 08*	- 12**	- 18**	- 15**	-								
9. Self-efficacy	27**	28**	24**	42**	47**	15**	41**	- 09*	-							
10. Research support	23**	11**	16**	19**	23**	10*	19**	04	26**	-						
11. Total courses	- 37**	- 19**	- 29**	- 20**	- 21**	- 26**	- 19**	13**	- 11**	- 27**	-					
12. Teaching hrs/wk	- 28**	- 11**	- 23**	- 13**	- 14**	- 12**	- 07	07	- 10**	- 22**	48**	-				
13. Teaching effort	- 02	05	- 04	27**	12**	03	13**	- 09*	16**	02	12**	22**	-			
14. Teaching value	- 06	06	- 12**	05	16**	- 06	07	- 01	07	17**	13**	15**	52**	-		
15. Service effort	01	15**	- 10*	050	08*	- 06	15**	02	15**	15**	- 06	- 05	32**	26**	-	
16. Service value	02	07	- 10*	03	07	- 06	15**	13**	07	24**	- 09*	- 06	11**	38**	58**	-

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

As indicated in the matrix, intrinsic motivation was most strongly correlated with value for research, research effort, and self-efficacy. Effort invested was also positively related to intrinsic motivation across the three faculty tasks, as were hours invested in service and research-related advising. However, number of courses taught was negatively related to intrinsic motivation for research. The relationships were nearly the same for self-efficacy for research, except that there was a negative correlation with teaching hours per week, and no relationship with service hours or value.

Thus, factors that correlated most strongly with research productivity were: rank; research time, effort, and value; research-related advising; departmental support; self-efficacy for research; and intrinsic motivation for research (and teaching demands negatively). Variables that correlated most strongly with research effort invested were productivity, time invested, research value, effort invested in teaching, intrinsic motivation for research, research-related advising, departmental support, and efficacy for research. Variables that correlated most strongly with research efficacy were hours advising, research productivity, value for research, effort invested in research, and departmental support; the

relationships were similar for intrinsic motivation for research. Thus, a strong web of relationships exists between valuing research and feeling efficacious in doing it, putting forth effort and being productive in scholarly contributions.

Working hard at research was associated with working hard at teaching, but not at service. The same pattern appeared in valuing; valuing research was associated with valuing teaching but not service. These faculty members may, therefore, feel a conflict in valuing among the three faculty tasks of research, teaching, and service.

High concordance between institutional expectations and faculty priorities indicate that these faculty members agreed with the priorities of their institutions with regard to the prioritization of faculty tasks. Correlations among institutional expectations and faculty priorities were strong and positive. Faculty members were asked what percentage of intangible resources (e.g., time, energy, effort) they were *expected* to devote to the three areas (research, teaching, and service) and, in a separate section, what percentage they ideally *should* be expected to devote. Outcomes were not only identical in rank order (research, then teaching, then service) but also very similar in actual numeric percentages. However, the mean *ideal* percentage of service (14.66%) was lower than the *expected* percentage of service (16.50%). A paired-samples *t* test revealed this difference to be significant, $t(598)=4.32$, $p<.001$. This result is congruent with the correlational finding that there is no relationship between value and effort in research and value and effort in service, and indicates that faculty believe that they are expected to do more service than they ideally believe that they should.

ANOVA for Faculty Rank

Although faculty rank was significantly correlated with three-year productivity, we did not include it in the path analysis because we believe the relationship to be an artifact of the tenure and promotion process. Senior, tenured faculty have achieved tenure at research institutions because they were productive researchers, whereas new, untenured assistant professors may or may not demonstrate a sufficiently high level of research productivity. However, given the diverse findings and assertions regarding faculty rank from previous studies, we conducted a separate ANOVA to investigate the apparent relationship of

rank to productivity. Table 2 shows the sample size, means and standard deviations for faculty productivity by rank.

Table 2
Means and standard deviations for research productivity by faculty rank

Rank	n	M	SD
Assistant Professor	164	15.10	6.87
Associate Professor	205	14.97	8.26
Full Professor	272	18.18	8.58

A one-way analysis of variance was conducted to evaluate the relationship between rank (assistant, associate, and full professor) and research productivity. The relationship between rank and productivity was not linear, because although full professors reported the highest productivity, assistant professors reported the next-highest and associate professors the lowest. The ANOVA was significant, $F(2, 638) = 11.97$, $p < .001$. However, the strength of the relationship between rank and research productivity, as assessed by partial η^2, was small, as only 3.6% of the variance in research productivity was accounted for by rank. A post-hoc Tukey HSD showed pairwise significant differences between full and assistant professor and between full and associate professor, but not between assistant and associate.

Path Analysis

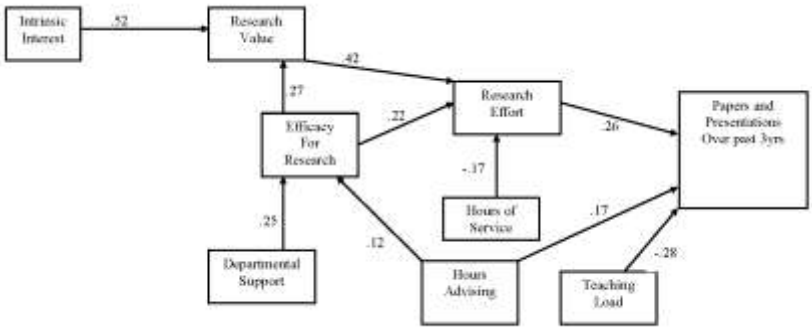
Guided by previous research and theory in motivation and the strength of our previous model test, we used LISREL 8.72 (Jöreskog & Sörbom, 2005) to test our previous model and assess its fit for this larger and more diverse sample of faculty (see Figure 1). Based on Self-Determination Theory (Ryan & Deci, 2000) we depicted intrinsic interest in research to influence participants' valuing of research. Based on Self-Efficacy Theory (Bandura, 1997) we depicted variations in participants' self-efficacy for research to influence the perceived value and effort they devoted to research, and viewed departmental support to be a contextual variable that would positively influence self-efficacy for research. Another contextual variable, hours of service, was anticipated to have a

negative influence on the effort devoted to research. Based on previous research we depicted valuing of research influencing research effort, and research effort positively influencing research productivity.

When we tested the proposed causal model using path analysis, the path estimates showed the relationships to be in the expected directions, and the *t* values indicated that all paths were significant. However, the fit indices were less than satisfactory. Although the Goodness of Fit Index (GFI) was good at .91, the Adjusted GFI (adjusted for model complexity) was .74, the Normed Fit Index was .73, and the Comparative Fit Index was .74, all well below the standard of .90 and above. Also, the Standardized Root Mean Square Residual (the summary of average covariance residuals) was .12, where <.10 is optimal. Because all of the paths were significant, removing paths would likely not have improved the model fit. Instead, it seemed probable that the model required more paths, to explain variance not yet accounted for.

Using the results of this initial test of fit and the correlations among variables in our current study data, we reexamined the data. Based on the correlational relationships in the current data, we identified two additional relationships that were significant, research value with research effort, and efficacy for research with research value. Given the magnitude and significance of these relationships, we added two new paths to the model and retested it for fit with the data (see Figure 2).

Figure 2
Path Coefficients for Research Productivity



Overall, the fit of the model was much better, and the path from value to effort had the second largest coefficient, overall, explaining why the fit indices were less satisfactory without this path. While most of the relationships in the original model remain significant, a few relationships changed in important ways. For example, in the new model, research value does not exert a significant direct effect on research productivity, but is mediated through research effort. The degree of significance of several other variables also shifted.

The chi-square value was significant, but this value is affected by the large sample size. The Normed Fit Index (NFI) and Comparative Fit Index (CFI) are both stable at different sample sizes (Tanguma, 2001), and are therefore preferred fit indices. In well-fitting models the NFI and CFI should be greater than 0.90 and ideally close to 1.0; in this analysis the NFI was 0.90 and the CFI was 0.91, which are both in the acceptable range. Although the Root Mean Square Error of Approximation (RMSEA) should generally be under about .08, it was close, at .12. The Standardized Root Mean Square Residual (SRMR) should be less than 0.10, and it was appropriately low at .09 (Kline, 1998). *T* values for all paths were significant.

Next, to assess the generalizability of the whole-sample model to the disciplinary divisions, we divided the sample along disciplinary lines and retested the hypothetical model for the separate subgroups. The sample was divided into two subgroups, Group 1 representing languages, literature, and humanities (n = 267, see Figure 3) and Group 2 representing social sciences, laboratory sciences, and mathematics (n = 361, see Figure 4). The model was run with each subgroup. For both, the structure of the model remained the same; all paths remained significant and all the coefficients retained their signs, positive or negative. The fit indices were similar to those for the whole sample (for Group 1, CFI = .89, NFI = .86, RMSEA = .12, SRMR = .10; for Group 2, CFI = .90, NFI = .89, RMSEA = .12, SRMR = .092). Regardless of the faculty members' field of study, the structure of their motivation for research remained essentially the same.

Figure 3
Path coefficients for Group 1, Languages, Literature, and Humanities
(n = 267)

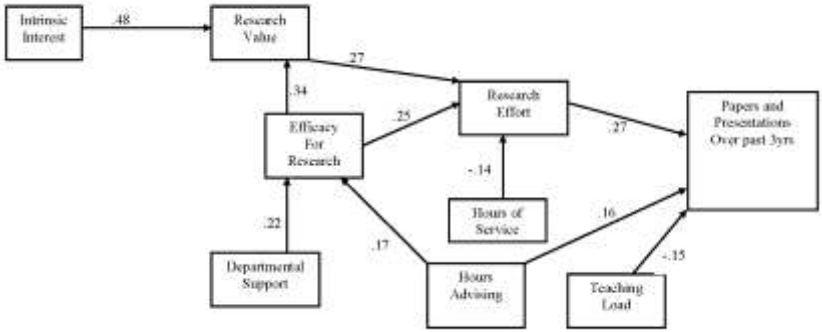
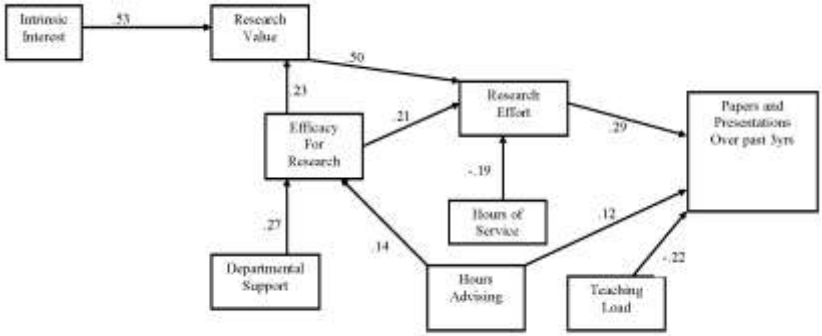


Figure 4
Path Coefficients for Group 2, Social Sciences, Laboratory Sciences, and Mathematics
(n = 361)



Qualitative Data

There were a total of 420 responses to the open-ended field opportunities from 360 different participants (out of 781). Two of the researchers independently analyzed the participants' voluntary responses, using open coding and axial coding. The goal was to identify patterns and themes that could help illuminate the quantitative results and inform our understanding of the nature of these faculty members' motivations to do research. We consider below the themes that were prevalent in that they were mentioned by at least 10% of those who provided comments. The

themes that emerged from these analyses focused on the nature and influences of four clusters of factors on their activity and motivation: research time, productivity measures, teaching load, and advising and mentoring.

Research time. Faculty members invest hugely different amounts of time on research seasonally based on the other demands on their time, and they are clear on the influential nature of lack of time. One faculty member reported time for research as "5 hours/week on research during the semester if I'm lucky. 40 hrs/week during the summer when I'm technically unemployed." Others reported similarly, "50 hours a week when the semester is not in session" and "40-60 hours in summer." Still another underscoring the contrast with some frustration wrote, "very rough averaging out hours over the year. It's more like 50 hours a week in vacations and 4 desperate hours per week during the semester." What was very clear is that when faculty members do have time they work overtime on research, for all kinds of personal reasons. It was also clear that faculty members on 9 or 10-month contracts devote their off-contract time to research, despite the lack of pay for those time periods. However, they are frustrated by the lack of time for research when they are also fulfilling their teaching, service and administrative responsibilities.

Productivity measures. Different institutions and disciplines count different types of products (e.g., textbooks, peer-reviewed vs. theoretical or conceptual articles, peer-juried vs. invited presentations, editorial work, and so on), and these differences confound both measurement and comparison across disciplines. Faculty members made it clear that they organized their research projects and types of publication targets based on what is valued in their current institutions and roles. For example, one professor said, "At my institution, we do not even count co-authored articles, so I stopped keeping track of them." Peer-reviewed articles are the most generalizable measure of research productivity across natural and social sciences, but they present unique problems among sciences with clinical components. In history, the arts, literature and the humanities, the best-fit productivity measures are often books and works of creative art, including poetry, drama and fiction. For faculty members in some fields (e.g., history, philosophy, creative writing), a book is the *sine qua non* without which tenure or promotion is impossible, and in other areas (e.g., psychology, math, education) early

career researchers are told to wait on books or editorial roles until after tenure and promotion. Some institutions count faculty members' articles in press while others do not, and some institutions count only sole-author or first-author articles, while others count all peer-reviewed publications regardless of author order. The open-ended responses confirmed strongly that however the institution counts and rewards productivity is how the faculty members focus their energies. The influence of institutional valuing may, in turn, exert an influence on research-related issues of design and practice, such as collaborations. One faculty member in a university that counted only sole-authored publications wrote, "I never discuss my research with anyone except in passing," In contrast, a faculty member in an institution that values and counts publications at all levels of collaboration said, "I have a difficult time distinguishing between running my lab, mentoring students, and my own research."

Teaching load. Some faculty members lamented the burden of time consumed by "extra and unacknowledged" or "overload" courses (e.g., research supervision, independent studies, directed readings, individualized instruction). These constitute a very high number of additional teaching hours for some faculty, and they indicated that they did not always feel free to say no to such requests. In this data it was clear that the majority of these faculty members saw teaching and research as primarily discrete activities and perceived that teaching load demands vie with research for limited, intangible resources such as time and energy, with time identified most frequently.

Advising and mentoring. Advising loads vary hugely by institution and department, as some institutions have recently moved to hired academic advisors whose primary role is to assist students with course selection and career decisions. In these institutions the faculty feel more able to give informal mentoring and support as needed, and also have more time to devote to research. Two faculty members expressed the importance of this new development: 1) "We have designated academic advisors to help with course selection and such issues, so I technically only advise and mentor students whose theses and dissertations I direct. I end up spending some time advising other students informally", and 2) "The fact that I don't advise undergraduates any more gives me more time for my research and for . . .my grad students."

Faculty mentoring varies a great deal among official and unofficial, formal and informal, graduate and undergraduate roles. Examples ranged from the very formal and official, "I mentor doc students from Comprehensive Exams through dissertation," to very informal and unofficial, "Potentially any conversation with a grad student could count as 'mentoring.'" The variety of communication contexts and access, and the varied nature of interactions between students and faculty, such as "emailing back and forth all of the time regarding projects and papers in progress," makes it difficult for faculty members to estimate how much time they actually spend at advising and mentoring.

Family and life commitments. There were vast differences in the types of family commitments that faculty members found limiting their time and flexibility for research. We asked about children under 18 still living at home at least half of the time. This commitment was characterized by a range of different assertions about how family should or can interfere with faculty work. On one hand was the perception that family stage and commitments are unavoidably an influence on the job and should be acknowledged: 1) "children demand more time for schoolwork and after school activities. This limited my research time to a great extent", and 2) "My family is a VERY significant factor in limiting the time I have available for research and writing." On the other hand was the perception that job and family were separate, characterized by this example: "This is irrelevant to the performance of the job. Family is a decision, as is accepting a faculty position. If you have a 40-hour work week, family is not part of that time." This difference of perspectives seems to hinge on whether the faculty member expects the research program to fit into a traditional work model, a "40-hour work week."

However two other types of family care commitments that we had not anticipated were the care of children with disabilities or special needs, regardless of age, and the care of elderly parents. In the first group were a number of faculty members who expressed something like the following example, "I have a child with significant medical needs, a situation that affects my scholarly activity." In the second group were faculty members who said something like the following, "I also have an aged, mildly senile parent living with me, in effect another child," or "Caretaking of elderly parents, very time-consuming at this age." These two types of special family care commitments were reported by 35 individuals, or about 10% of those who provided qualitative comments.

Limitations

Admittedly, the present study data is self-reported and this may be seen by some as a limitation. However, it draws on not just affective and perceptual variables but uses actual productivity as the principal outcome indicator. There was a ceiling effect on our productivity measure, that is, 30 participants (or about 4%) indicated that they had more publications than the pull-down option allowed (capped at 30 in 3 years). This degree of productivity was more typical of faculty on large research teams and affiliated with research centers. Even so, we acknowledge it as a limitation of our measure.

Discussion

This study adds to the existing literature a view of faculty motivation informed by motivation theory. Its design samples across a range of institutional and disciplinary boundaries within a single stratum of institutional type. Unlike much of the previous work, we included both individual and organizational variables in a single model. Also unlike many previous studies, which were largely descriptive and correlational, this study takes a more rigorous quantitative approach to the analysis, using multivariate statistics to examine the dependencies among those relationships more closely. In contrast to the developmental research and some previous studies of influential factors, we sampled across faculty rank but excluded rank as a predictive variable, because of the arguably dependent relationship between rank and productivity in the research university.

The model demonstrated consistency with the previous model (Hardré, Miller, Beesley, Pace, Maxwell, & Xie, 2007), thus confirming a large degree of generalizability of the relationships across the samples in the two studies, despite their differences. Most of the paths from the previous study were significant as before, with only two paths added in this study that did not appear in the previous one. Most of the paths remained fairly consistent, though the magnitude of the relationships shifted, in ways that present interesting potential insights.

In building on Hardré, Miller, Beesley, Pace, Maxwell, & Xie (2007), the present study adds some different dimensions to our understanding of the internal factors that influence faculty research productivity. In the present study the magnitude of the relationship of intrinsic motivation on valuing

is higher, and that of departmental support directly on valuing is lower. The path from efficacy to valuing is significant and strong, as is a path from valuing to effort invested in research, although these paths were not significant in the previous study. The most striking changes in magnitude were the decrease in the relationship of teaching load on productivity, and that of value directly on productivity. This second change may be explained by the emergence of the significant paths that suggest a mediated relationship of efficacy and valuing on productivity through effort invested. From one perspective we might expect this shift of value less correlated with productivity to shift outside the research university, but these are inside, just across a range of disciplines, so it may indeed indicate differences between these groups of faculty.

The two strongest predictors of productivity are research effort (positively) and teaching load (negatively). This finding is consistent with the model of competition for limited resources, which was also expressed by many faculty in their qualitative comments. Similar to Sax et al. (2002), we found no significant relationship between family commitment and research productivity. The shift in the influential roles of teaching and service raise questions of whether these elements of faculty work are less consistent with research and teaching in these other disciplines. Is there more tension between the three hats that these faculty members wear? Departmental support lost significance in its relationship on research valuing. However it retained its effect on efficacy for research. This difference may be explained, in part, by the nature of valuing as a more stable personal characteristic and efficacy as more closely linked to action expectations and thus more sensitive to contextual characteristics that could enable or constrain task follow-through. Overall the model test confirmed much of our previous findings as generalizable to this broader sample, but also added a contribution to new knowledge and insights.

Theories of faculty work promoting accrued advantage assert that faculty rank should predict productivity in a relatively linear fashion (Baldwin & Blackburn, 1981; Levitan & Ray, 1992). In contrast, the lifecycle theories argue that the salience of extrinsic rewards causes faculty to exert greatest effort when promotion and tenure decisions are imminent and less after promotion, predicting a downturn in productivity later in the academic career (Goodwin & Sauer, 1995; Hu & Gill, 2000). The tenured faculty in our study overall were significantly more productive

than untenured faculty, and our ANOVA revealed a non-linear relationship of rank to productivity. Together these findings suggest that the relationship of faculty productivity is more complex than can be explained by either of these global theories alone, perhaps more individualized and sensitive to both individual differences and to contextual variables.

Conclusions and Implications

The present study offers a different perspective on faculty work, from a theory-driven motivational framework, than is apparent in most of the previous literature. Yet it includes the variables found in previous research and integrates those into the model of faculty members' motivation for research. These findings present important implications for faculty work, for organizational and institutional policy, and for future research.

Implications for Faculty Work

Effort most significantly predicted productivity, so high effort should be encouraged, and faculty members rewarded for effort invested, not just for immediate (or short-term) measures of productivity. For example, institutions might consider creating evaluation models that acknowledge and reward papers and grants submitted, instead of only those published or funded. This is particularly important as the highest-quality and most enduring contributions to intellectual activity often come from the long-term investment rather than the quick or short-term project that produces immediate and quantifiable productivity evidence.

Similarly, there is evidence in this study of a relationship between how institutions value publications (what counts) and how the faculty members position themselves in their work. If this is a causal relationship, suggested by the qualitative comments, then institutions should be certain that their rewards systems (e.g., for tenure and promotion) send a message consistent with the organizational mission and values rather than one which may undermine them. For example, if the institution values and wants to promote collaboration, then it should reward collaborative products, and if it seeks to encourage solo projects and single-author work, then it should put in place a system that celebrates and rewards these.

Consistent with the findings of Bailey (1999) among university faculty in Australia, we found that efficacy is an important factor relevant to faculty productivity. Because institutions gain from productive faculty, it follows that institutions will benefit from investing resources to give faculty the tools they need to be efficacious in doing research. This includes training and professional development, particularly as the technology tools and methods for doing research are changing rapidly rather than remaining stable.

Departmental support was consistently and strongly predictive of efficacy for research (and through efficacy, arguably, of value, effort and subsequently productivity). Thus, faculty members clearly respond to competence and autonomy support from their supervisors and departments. This finding is consistent with the findings of Deci and Ryan (1987, 2002) that autonomy supportive leadership predicts high quality performance across work contexts. It is also consistent with the findings of Wood (1990) in Australian research universities, that academic faculty believe in and value academic autonomy as "freedom of inquiry" in choice of research topics and scholarly pursuits. The implication of these findings is that administration and policy should provide for and support academic autonomy and choice for faculty. Departmental support was also an important factor in predicting efficacy, which further underscores the implication that faculty members need to see their departments and institutions as supportive of their efforts and development of research skills and tools.

Implications for Organization and Administration

The negative quantitative relationship of teaching load with research productivity was strong, and the qualitative commentary also strongly voiced the tension between teaching and advising responsibilities and time for research. Thus, a policy keeping teaching load to a minimum when research productivity is expected would promote faculty productivity. Perceived departmental support remains an important influence on efficacy and on effort that faculty members invest in research, underscoring the critical nature of communicating departmental support to faculty through policy and rewards or values systems. Communication is particularly important here, because where there are differences between actual and perceived support, it is the *perception* that will most powerfully drive human motivation and predict individual actions.

Implications for Further Research

As to further research in this area, a continued focus on motivational model testing in research universities, both by discipline and across disciplines, can further extend and elaborate an understanding of this complex issue. Based on the developmental assertion that faculty perceptions and motivation shift with career trajectory (Baldwin & Blackburn, 1981; Levitan & Ray, 1992), additional large-scale studies testing models of this type with subgroups by rank and career trajectory may add information from the developmental perspective, as would model testing studies tracking faculty productivity for the same individuals over time. Expanding the study of motivation for research to other strata of institutions from comprehensive universities to community colleges will further inform the field. Related to the study of differences by institutional stratum is the need to review the actual evaluation criteria for promotion, tenure and merit that institutions and departments use to communicate their expectations. The research literature lacks systematic tests of 1) the degree educational institutions and disciplines share similarities in the ways that they measure faculty productivity, and 2) how they communicate expectations and criteria, both explicitly and implicitly. A next step is also to introduce other motivational variables and see how they may influence the factors in this model (e.g., whether they seem to mediate, explain additional variance, or improve the fit). It is important that the research attend to internal perceptual and affective influences, not only to external and contextual factors, as the present study illustrates the potential for important information to be gained from studies of their interactive and integrative influences. Admittedly these are more difficult to measure, but with reliable questionnaire instruments for motivation from educational psychology, they are demonstrably possible to measure with a good degree of confidence.

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