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The Relation Between Research Productivity and Teaching Effectiveness

Complementary, Antagonistic, or Independent Constructs?

The major responsibilities of academics in the modern university are teaching and research as well as, to lesser extents, administration and community service. Indeed, some (Crittenden, 1997) consider that one of the defining characteristics of a university is that all academics are expected to be active researchers and active teachers (while noting the rationale for teachers who are not expected to pursue research in non-University tertiary institutions). Senior academics often contend that this mutually reinforcing, symbiotic relation between teaching and research is what distinguished universities from other research and educational institutions (Neumann, 1992). Conventional wisdom—typically not based on empirical research—is that teaching and research are mutually supporting if not inseparable (Webster, 1986). Ideally, teaching effectiveness and research productivity are complementary. Much of the rationale for the existence of research universities is that these two activities are so mutually reinforcing that they must coexist in the same institutions. Marsh (1987), Hattie and Marsh (1996), Braxton (1996), and others, however, argue that plausible arguments can be made as to why teaching and research activities should be complementary, conflicting, or unrelated to each other.

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There is a strong rationale reinforcing the claims that research should contribute to teaching. Research forms the basis of the content of teaching. Teachers who are active researchers are more likely to be on the cutting edge of their discipline and aware of international perspectives in their field. Because textbooks may not be current in many rapidly developing areas, lectures may be the first point of contact with the latest developments. Teachers who are involved in research are more likely to be at the forefront of their discipline. Results from one's research can be used to clarify, update, and amend the teaching of a topic. Research enhances teaching through the introduction of new topics and methodologies. Teachers discussing their own research provide a sense of excitement about the results and how they fit into a larger picture. Active researchers are more effective at instilling an actively critical approach to understanding complex research findings rather a passive acceptance of facts. Students appreciate teachers who present research that the teachers have actually conducted. This provides an authenticity to the presented material that differs from presentations by teachers who are only discussing the work of others in which they have no active involvement.

Similarly, teaching should contribute to research. The process of teaching the subject matter of a discipline forces academics to clarify the big picture into which their specific research specialization fits. Preparation of teaching materials can elucidate gaps in the academic's knowledge base. Sharing the results of one's research with students in a teaching context helps researchers clarify their research. Students' suggestions, comments, questions, and criticisms can elucidate new research directions. Sharing the results of one's research efforts with an appreciative audience provides reinforcement for having done the research and pursuing further research.

In presenting the case for why teaching and research should be complementary activities, Braxton (1996) argued that the roles of teaching and research are similar, that they involve common values (e.g., rationality) and that they should be mutually reinforcing. Sullivan (1996) emphasized that academic staff, even those who are the most productive researchers, support normative structures that place a high value on teaching effectiveness.

Ramsden and Moses (1992) proposed what they referred to as a weak version of the teaching-research hypothesis (of a positive relation between the two activities) based on data aggregated at the departmental level. Thus, it is not necessary for every academic to be an active researcher for the department to be a strong research department. According

to this weaker version, it is only necessary for academics to be in a strong research department in order to facilitate their teaching effectiveness.

It can also be argued, however, that teaching and research activities are antagonistic, leading to a negative teaching-research relation. Blackburn (1974) noted, for example, that unsatisfactory classroom performance might result from academics neglecting their teaching responsibilities in order to pursue research and publications. The time and energy required to pursue research is limited by the time demands of teaching, and vice-versa (Marsh, 1987). Marsh also suggested that the motivation and reward structures that support the two activities might be antagonistic as well. Barnett (1992) claimed that teaching and research are inescapably incompatible. He argued that universities have already begun the process of dividing the university structure into components devoted to undergraduate education taught by nontenure-track teachers and graduate students and to full-time research. Although unsettling to many academics, Barnett suggests that this would have the healthy effect of bringing decisions about the expenditure of resources for teaching and research into open competition. Sample (1972) argued that there is an inherent conflict between teaching and research, because effective researchers must be highly specialized, whereas effective teachers must be very broad. Those arguing against the inseparability of teaching and research point out that high quality research is performed in research institutes where there is no undergraduate teaching, and high quality teaching does occur in tertiary institutions where staff pursue little research (Ramsden & Moses, 1992). Another claim is that the two activities require different preparation, are different tasks, involve different personality characteristics, and are funded separately by governments. Hence, the relation is, or should be, zero.

The rationale of modern research universities dictates that there should be a positive relation between teaching and research. Without this positive relation, the claim that teaching and research are mutually supporting activities is weakened, and one basis for funding universities to pursue research as well as providing teaching is undermined. Reflecting this ideal or, perhaps, these pragmatics, many academics and university administrators want to believe that the relation is positive. Thus creating a more positive relation—to whatever extent it currently exists—should be an important goal of universities. In this sense, the purpose of the present study is to examine the effects of potential mediators and moderators—variables that might explain why the relation is not more positive—and to examine different settings to determine specific academic units where the relation is more positive.

The Relation Between Teaching and Research

We (Hattie & Marsh, 1996) reported a meta-analysis of the relation between teaching and research among University academics. Based on 58 articles contributing 498 correlations, the overall correlation was 0.06 (see also Feldman, 1987). We searched for mediators and moderators to this overall correlation, with little success. The overall conclusion of a zero relation was found across: disciplines, various measures of research output (e.g., quality, productivity, citations), various measures of teaching quality (student evaluation, peer ratings), and different categories of university (liberal, research). Based on this review we concluded that the common belief that research and teaching are inextricably entwined is an enduring myth. At best, research and teaching are very loosely coupled. There were, however, several suggestions from this literature and by other authors about further research that was needed to better understand this relation and to discover situations or characteristics that reinforce a positive teaching-research relation.

Marsh (1984; 1987; Marsh & Overall, 1979; also see subsequent discussion of Figure 2 based on this model) posited a model identifying the major potential factors and how the various factors were related. In this model, a positive relation between the ability to be a good teacher and the ability to be a good researcher is mediated, in part, by a negative relation between the amount of time devoted to teaching and research. Via the model, the abilities to be effective at teaching and research are positively correlated; time on research and time spent on teaching are negatively correlated and may in turn be influenced by a motivation structure that systematically favors one over the other. Hence, the near-zero relation between teaching and research outcomes is a function of the counterbalancing positive relation between teaching and research abilities and the negative relation between time required to be effective at teaching and research and, perhaps, the motivation to be a good researcher and a good teacher. Although this theoretical model provided an organizing tool for our (Hattie & Marsh, 1996) meta-analysis, there was not sufficient information available from previous studies to adequately test the model. Hence, one goal of this study is to provide a more a defensible test of this model.

Departmental ethos and other characteristics of the department may influence teaching, research, and their relation. Thus, for example, the near-zero relation between teaching and research may represent an amalgamation of positive relations in some departments and negative relations in others. The claim is that colleagues who are particularly committed to research and/or teaching are more likely to seek and/or to gain

intrinsic rewards and recognition from colleagues for excellence in that activity. If there is systematic variation in the teaching-research relation from department to department, then it may be possible to find departmental characteristics that are associated with a positive teaching-research relation (Volkwein & Carbone, 1991; 1994; Ramsden & Moses, 1992). Consistent with this perspective, Braxton and Hargens (1996) provided a historical overview of the ways in which academic disciplines have been classified in higher education research, suggesting that "consensus" (i.e., discipline differences that vary along dimensions such as soft-hard, low-high paradigm development, low-high consensus, and low-high codification (see Braxton & Hargens, 1996, for more discussion) may be particularly important. They noted, for example, that researchers typically attribute high levels of consensus to the physical sciences, lower levels of consensus to the social sciences, and even lower levels of consensus to the humanities. Of particular relevance to the present investigation, Braxton and Hargens suggested that Feldman's (1987) meta-analysis provided evidence that the teaching-research relation was moderate in low-consensus disciplines (0.21) and smaller in high-consensus departments (0.05). Although Feldman did not actually consider consensus per se, he did report that the average correlation between teaching and research (based on very few studies) was 0.22 for humanities, 0.20 for social sciences, and 0.05 for natural sciences. Feldman, however, emphasized that these apparent differences were based on a small number of studies, that even these small differences were "extremely tentative," and that the information from even one or two additional studies "might well change the overall results and conclusions drawn" (Feldman, 1987, p. 273). Hattie and Marsh's (1996) subsequent meta-analysis (that included all studies from the Feldman review as well as many more recent studies) provided a more comprehensive analysis of this issue. They reported that the average correlation between teaching and research was 0.07 for humanities, 0.10 for social sciences, 0.00 for natural sciences. These more comprehensive results seem to offer little support for extrapolations based on the Feldman data offered by Braxton and Hargens. Nevertheless, we agree with Braxton (1996; Braxton & Hargens, 1996) that it is important to pursue the question of whether different departments vary in terms of the teaching-research relation.

We (Hattie & Marsh, 1996) also noted that most research in this area is limited to the evaluation of simple correlations and has not taken advantage of important new advances in statistical methodology. Testing theoretical models like that posited by Marsh (1987; Hattie & Marsh, 1996) and investigating more defensible mediators of the teaching-re-

search relation are facilitated by the use of structural equation modeling. Data in this literature typically have a multilevel structure in which teachers are clustered within academic units (departments, faculties, schools), and perhaps academic units are clustered within universities. If there is systematic variation in the higher-order levels (e.g., systematic differences between departments), then the typical single-level analyses that ignore this clustering effect may be invalid. Furthermore, systematic evaluation of the multilevel structure of the data allows researchers to pursue new questions about how these constructs vary from department to department and about the characteristics of departments associated with this variation. Even though Ethington's (1997; also see Marsh, Rowe, & Martin, 2002) handbook chapter clearly establishes the relevance of this multilevel approach in higher education research, there are few examples of substantive studies in higher education that have used it. Whereas we know of no systematic attempt to conduct multilevel analyses of the teaching-research relation, we introduce the application of multilevel modeling techniques that are particularly appropriate for this issue.

Potential Mediating and Moderating Variables

A major aim of this study is to revise, select, and construct a potentially useful set of variables that will assist in articulating the relation between research and teaching. A number of mediator and moderator variables are chosen based on theory (e.g., Marsh, 1987; Ramsden & Moses, 1992) and on our meta-analysis (Feldman, 1987; Hattie & Marsh, 1996). Specifically, we focus on variables posited as affecting the correlation between teaching and research and grouped them into two categories: background variables and resources.

Background Variables

There are many possible background variables that can affect the relation between teaching and research. Those chosen for this study appeared to be most likely to relate to the relation, given prior studies and the model proposed by Marsh (1987).

Research and teaching ability. Marsh (1987) posited that the ability to be an effective teacher and a productive researcher are positively related. Academics who believe that they are highly able teachers are likely to be more motivated to be good teachers, to spend more resources on teaching, and, consequently, to be better teachers. Similarly, those who believe that they have high ability as a researcher will be more motivated to do research, will spend more resources at research, and consequently be better researchers. Such self-efficacy has been shown to be a critical

determinant for success in a number of areas, and Bandura (1997) has demonstrated its importance in accounting for why individuals invest more effort, commitment, and diligence to the task.

Teaching and research satisfaction. A sense of satisfaction is an important basis of motivation. The degree of satisfaction with a task may influence the amount of discretionary resources (time, energy) that a person invests in a task. Thus, the more satisfaction an academic derives from teaching, the higher the expected teaching quality; similarly for research, and also for those who are committed to both teaching and research. Furthermore, the relation between satisfaction derived from research and from teaching may be one determinant of the relation between teaching and research outcomes (Marsh, 1987).

Personal goals. Further indicators of motivation are the personal goals of an academic (e.g., research, teaching, community service, administration, and collegiality). Feldman (1987) found that the majority (72%) of academics claimed that their primary goals related to teaching, and only 28% had primary goals related to research (see also Astin, 1993; Miller, 1996; Mooney, 1991). Mooney (1991) reported a study using 35,478 faculty from 392 universities who responded to a question asking about the essential or very important goals, and these were: research (58%), teaching (98%), community service (43%), administration, (29%) and collegiality (80%).

Extrinsic rewards for teaching and research. Marsh (1987) argued that extrinsic rewards for teaching and research may influence relations between teaching and research. The rewards may be public recognition (e.g., teaching awards), promotion, or salary.

Constraints to teaching and research. Marsh (1987) suggested that there might be constraints perceived by academics as to why they cannot involve themselves more in teaching or research. The constant cavil is that research interferes with teaching capabilities and productivity or, similarly, time teaching is a major constraint to improving research productivity. For example, Boyer (1990) reported that academics at US research universities believe that the pressure to conduct research reduced the quality of university teaching (also see Ramsden, 1998).

Beliefs about the nexus between teaching and research. In an analysis of senior academic administrators, Neumann (1992) found strong beliefs in a teaching-research nexus, a symbiotic relation in which the two roles of academic as teacher and academic as researcher are mutually reinforcing. Respondents indicated that this nexus occurred at a tangible level (transmission of cutting-edge research), an intangible level (stimulation and attitudes towards knowledge), and a global level (for departments as well as individuals). Recognizing that these responses may

represent ideal beliefs or values rather than actual reality, Neumann suggested that "these perceptions may be a more powerful influence on behaviors than 'reality'" (p. 169).

Neumann (1994; also see Jenkins, Blackman, Lindsay & Paton-Saltzberg, 1998) extended her research on the teaching-research nexus to include the views of students. Students reported benefits of the research involvement by their teachers, including keeping course content current, demonstrating interest and enthusiasm in the course content, having credibility as academics, and providing insights to students about what researchers do. Students were also critical, however, of academics who allowed their research activities to detract from their teaching responsibilities, were unavailable to students, and who emphasized their own research area to the detriment of the intended course curriculum. The essential issue for these researchers is how to promote the teaching-learning nexus.

We (Hattie & Marsh, 1996) found diametrically opposed beliefs about the direction of the teaching-research relation. There is one group of academics who believe that teaching and research are complementary activities, whereas another group believes that they are antagonistic activities; it was rare to find any who saw them as unrelated. Although these two groups obviously disagree, it is possible that both are correct. In particular, the teaching-research relation may be positive for those who believe that it is a positive nexus (because, for example, they pursue these activities in ways that are mutually reinforcing), whereas it may be negative for those who believe that the nexus is negative. Indeed, the near-zero teaching-research relation actually observed may be compatible with this speculation. Although we know of no research specifically pursuing this question, Ramsden and Moses (1992) presented a reliable measure of the teaching-research nexus. Unfortunately, they did not, however, use the results from this scale in their subsequent analyses. Moreover, it is probably useful to develop separate scales to assess beliefs that teaching facilitates research and that research facilities teaching.

Departmental ethos for teaching and research. It is probable that the ethos and other characteristics of a department influence teaching effectiveness, research productivity, and the relation between the two. Senior academic administrators in Neumann's (1992) study indicated that the teaching-research nexus operated at the departmental level as well as at the level of the individual academic. Department characteristics may also influence the motivation to pursue teaching and research activities. A departmental ethos, for example, could lead academics in the department to place greater emphasis on research, on teaching, or on the combination of the two activities. If colleagues are particularly committed to

research and/or teaching then it is more likely that there would be intrinsic rewards and recognition from colleagues for excellence in that activity. Ramsden and Moses (1992) suggested that "highly productive departments are populated by staff who are on average less effective teachers — and vice versa" (p. 287; but see Volkwein & Carbone, 1991; 1994). Although apparently not pursued previously, new advances in multilevel modeling provide an appropriate analytic framework for separating the effects of departments from those of individuals within the departments. This provides a methodologically appropriate test to Ramsden and Moses' conjecture about the teaching-research relation at the departmental level. Of particular interest is the question of whether there are some academic departments where teaching effectiveness and research productivity are positively related and, if this is the case, what some of the key characteristics of these departments are that distinguish them from other departments.

Resources

Time on teaching and research. The time that it takes to be a good teacher and the time to be a good researcher were central variables in Marsh's (1987) model of the teaching-research relation. He posited that the relation is negative and explains, in part, why teaching and research outcomes are not more positively related. Consistent with this model, we (Hattie & Marsh, 1996) found that time on research is negatively related to time on teaching. Similarly, Olsen and Simmons (1996) reported a negative (-0.56) relation between reported time spent on teaching and research, even though research productivity was significantly related to time spent on research but not time spent on teaching. Thus, it is worth continuing the debate about the role that time plays in the teaching-research relation. We also noted, however, that time on research was more critical than time on teaching, and there was not a direct one-hour for research to one-hour for teaching relation. It may be that productive researchers are more organized and thus time is not the critical variable, or it may be that more can be accomplished for less input in time with respect to teaching than to research. The effects of increased teaching load for non-researchers may need to be considered in future studies, as well as the converse: "Superior faculty may well do research and teach better than inferior faculty, but they might teach even better if they did no or less research (Black, 1972, p. 349).

Perhaps the most common claim to explain the zero relations between teaching and research is time and other resources associated with time: "Given the scarcity of time and energy, the probability of role conflict for the multiple joiner is somewhat more than abstract and hypothetical"

(Moore, 1963, p. 108). Fox (1992) concluded that there was a strain between research and teaching in that academics trade off one set of investments against another. Thus, teaching and research "do not represent aspects of a single dimension of interests, commitments, and orientations, but are different dimensions that are at odds with each other" (p. 301). The conflicts are represented, she claimed, via the focus of graduate versus undergraduate programs, requirements of the curricula versus the scholarly interests of the departments, the disciplinary versus the institutional identification of faculty, and the publicly declared versus the actual operating functions of colleges and universities. Jencks and Riesman (1968) claimed that academics "have only a limited amount of time and energy, and they know that in terms of professional standing and personal advancement it makes more sense to throw this into research than teaching" (p. 532). This is particularly the case, argued Trice (1992), because both teaching and high research productivity are labor intensive, and thus it is nearly impossible for individuals to excel in both domains. Linsky and Straus (1975) claimed that "only so much time and energy is available to any one person and commitment to either (role) prevents the development of excellence in the other role."

In our meta-analysis (Hattie & Marsh, 1996) we found evidence that time on teaching and time on research are negatively correlated. We located 14 correlations between time on teaching and time on research, and the mean correlation was –0.17, with values ranging from –0.46 to 0.19. Only two correlations were positive, and the average of the negative values was –0.25. It does appear that there is a tension between the time devoted to the two activities, but this tension may not be translated into differential outcomes.

We (Hattie & Marsh, 1996) located 23 correlations relating time to teaching and research productivity. Time on research was related to articles published (0.46, McCullagh & Roy, 1975; 0.19, Harry & Goldner, 1972; 0.40 for books and papers, 0.18 for refereed papers, 0.24 for doctoral thesis supervised, 0.21 for citations, and 0.46 for total publication performance, Jauch, 1976). Time on teaching, however, was not related to quality of teaching (0.00, Bausell & Magoon, 1972; –0.18, Harry & Goldner, 1972; –0.25 Clark, 1974; 0.08 Delaney, 1976; –0.12 Hoffman, 1984; 0.04 McDaniel & Feldhusen, 1970; 0.04, Wood, 1978). Time on research was not related to quality of teaching (–0.11 Bausell & Magoon, 1972; –0.04, Harry & Goldner, 1972; –0.05 McCullagh & Roy, 1975). Despite her conclusions to the contrary, Fox (1992) reported only 1 of the 28 standardized coefficients relating time on teaching to teaching evaluations greater than 0.06. Feldman (1987) reported that whereas research productivity was positively correlated with time or effort devoted to re-

search, there was no support that teaching effectiveness was related at all to time or effort devoted to either research or teaching. Time on teaching, however, tended to be negatively related to publication outputs (–0.37, Fox, 1992; –0.10, Harry & Goldner, 1972; 0.04 Volkwein & Carbone, 1991; Jauch, 1976; –0.14 for papers in referred journals, –0.03 for doctoral theses supervised, –0.07 for citations, –0.38 for books and papers, and –0.27 for total publication performance). The overall message appears to be that time on research is related to research productivity but not teaching effectiveness, whereas time on teaching is not related to teaching effectiveness but may be negatively related to research productivity.

Harry and Goldner (1972) reported that "increments in time for scholarly activity appear to reduce teaching time only slightly; these time increments have no independent relation to student evaluations" (p. 53). Moreover, they demonstrated that increments in time spent in scholarly activity are more likely to be taken from leisure or family time (also see Hattie & Marsh, 1996). Furthermore, Light (1974) found that respondents reported a conflict between teaching and research time, but that they expressed a desire to reduce time devoted to undergraduate teaching, to increase time devoted to graduate teaching, and to reduce administrative duties by one-half.

In summary, those who spend more time on research do have higher research outcomes, but those who spend more time on teaching do not seem to be more effective teachers. There seems to be a non-reciprocal pattern of relations in that time on research is more critical to outcomes than time on teaching. Following Feldman, we would agree that time on research probably comes from non-teaching times, and that there is, at best, not a one to one trade-off between time on teaching and research. Also, academics vary in the total amount of time that they give to their work per week. Thus, the proportion of total time devoted to teaching and research can also be used.

Activity in teaching and research. A common index of teaching or research activity is the amount of time invested on these activities. Time on teaching or research, by itself, may not be the best indicator of resources expended; rather, the critical variables are the actual activities that academics undertake in pursuit of teaching and research outcomes. Along these lines, Ramsden & Moses (1992) devised a research activity measure that asked academics whether they were involved in different academic research tasks (e.g., grants, supervision of postgraduate students, joint projects, editorial duties, review of grant proposals, refereed articles, conference delivery) and a teaching activity index about teaching activities. They did not, however, report the correlation between this research activity measure and their research productivity index.

Method

Participants

The present investigation was conducted at a large urban university in Australia that has both teaching and research orientations. The initial sample of 182 academics was drawn from those with completed student evaluations of teaching using the University's then Teaching Evaluation standard form (see Scriven, 1980, 1981, 1988, 1994). Based on responses to 12,567 rating instruments, 271 sets of ratings were collected for the 182 teachers (when more than one set of ratings were available for the same teacher, they were averaged together). The 182 teachers were from 20 academic departments (Business/Econ [34], Agriculture [13], Anatomy [4], Anthropology [10], Botany/Biology [3], Chemistry [3], Engineering [13], Maths/Comp Science [15], Languages [8], Medicine [9], Education [23], Phil/History [4], Human Movement [7], Law [5], Psychology [7], Social Work [4], Zoology [9], English [4], Dental [2], Geology [5]). Academic staff in the present investigation indicated that they spent almost half of their typical 48.3 hour working week on teaching activities (21.9 hours, 46%), a quarter on research (13.5 hours, 28%) and a quarter on administration and other work (12.9 hours, 27%). This is not that dissimilar to the distribution in the United Kingdom, where 38% of the total time was assigned to teaching, 28% to research, and 34% for committee and other work (Halsey, 1992). McInnis (1992), in Australia, reported that the academic working week was 44.6 hours.

Measures

Teaching effectiveness. Teaching effectiveness was assessed with students' evaluations of teaching effectiveness based on the standard university form (Scriven, 1980, 1981, 1988, 1994). The evaluation form included overall ratings of the teacher and the value of the course. In addition, there were dichotomous (absent or present) ratings of 120 "cues" representing positive or negative aspects of course materials and teacher presentations. The cues were intended to be of diagnostic value that would lead to improved teaching effectiveness. The materials and presentations variables were the sum of the positive features minus the sum of the negative features, computed separately for each aspect. For purposes of the present investigation, we focus on the overall teacher rating that is intended to be the primary summative evaluation from this instrument, but we also consider ratings of the overall course value, course materials, and teacher presentations.

Research outcomes. The research attainment of each academic in the university was available through submissions completed by each depart-

ment. Every three years, a substantial amount of discretionary research funds is allocated on the basis of the research attainment of each department (see Hattie, Tognolini, Adams, & Curtis, 1990 for more details). Hence, the stakes for providing accurate information about research publications are very high. An independent panel assesses all outputs and applies a similar set of rules for all departments as to what is allowed to count as research productivity. This evaluation was accumulated over a three-year period. The average number of publications was 3.73 (*SD* = 5.74) per staff member, primarily consisting of journal articles (2.32), conference papers (0.65), chapters in books (0.60), edited books (0.04), and authored books (0.10). Relations with teaching effectiveness were similar for the simple sum of publications and a weighted average (authored books = 10, edited books = 5, book chapters = 3, journal articles = 2, conference papers = 1). Thus, a simple unweighted sum of the total number of publications is used in most analyses, although results for the different components and the weighted average are also considered.

Potential mediating and moderating variables. Based on Marsh's (1987) model of the teaching-research relation, results of our meta-analysis (Hattie & Marsh, 1996; also see Feldman, 1987), and other research (e.g., Ramsden & Moses, 1992), we constructed a teaching and research survey. Included in the survey were items related to teaching and research activities, time spent in a typical week, potential sources of motivation (personal goals, perceived university goals, sources of satisfaction), and self-ratings of ability as a teacher and researcher (see earlier review of relevant literature). Scales derived from items (and the response scales upon which they are based) and their psychometric properties are summarized in the Appendix.

Statistical Analyses

Teaching-research relations. The focus of this study is on the relation between teaching and research outcomes. In the initial analyses we simply correlate various teaching outcomes (students' evaluations of teaching effectiveness) with various research outcomes (number of publications). Because we have multiple indicators of teaching (different components of the students' evaluations) and research (different kinds of publications), we conducted a confirmatory factor analysis. In this analysis all the teaching outcomes were posited to be indicators of a global teaching construct and all the research outcomes were posited to be indicators of a global research construct. All these analyses were based on data for 182 academics.

Multilevel analysis. A critical direction of the present investigation is

to evaluate the extent to which the teaching-research relation varies as a function of academic department using appropriate statistical techniques. These analyses are based on recent advances in multilevel modeling conducted with the commercially available MLwiN (Goldstein et al., 1998) statistical package. A detailed presentation of the conduct of multilevel modeling (also referred to as hierarchical linear modeling) is available elsewhere (e.g., Bryk & Raudenbush, 1992; Goldstein, 1995; Goldstein et al., 1998). In the present investigation, individual academics (level 1) are clustered within academic departments (level 2). This clustering poses special problems related to appropriate levels of analysis, aggregation bias, and associated problems of model misspecification due to lack of independence between measurements at different levels. Thus, it is inappropriate to pool responses by individual academics without regard to academic department unless it can be shown that departments do not differ significantly from each other in terms of teaching, research, and their relation. Moreover, results at one level might not bear any straightforward connection to relations observed at another level (e.g., a relation can be positive at one level and negative at another level). In the present investigation, multilevel analyses allow us to simultaneously consider results based on individual academics and academic departments within the same analytic framework. In the variance component models, estimates of the variance and covariance (and tests of statistical significance) at each level (e.g., individual academic and department) are determined. Of particular relevance in the present investigation is a test of the extent to which the teaching-research relation varies significantly across the 20 academic departments represented in these data. If there is significant department-to-department variation in the results, then addition predictor variables (e.g., departmental characteristics based on alternative classifications such as those discussed by Braxton (1996; Braxton & Hargens, 1996) can be added to determine their effects and their ability to explain differences between the 20 academic departments (for further discussion of this approach, see Marsh et al., 2002). All these analyses were based on data for 182 academics.

Mediating variables. The initial analysis with the mediating variables was to evaluate a structural equation model designed to test Marsh's (1987) theoretical model of relations between teaching and research variables. Because the sample size (n = 80 academics who completed the teaching-research survey) is so small, only those variables most directly relevant to the original theoretical model were considered (although correlations with the other variables are considered). Because of the potential of multicollinearity and the small sample size, a more parsimonious model was constructed in which nonsignificant parameter

estimates were eliminated one at a time. This was done starting with the estimate that had the highest *p*-value (i.e., was "least statistically significant") until all retained parameter estimates were statistically significant at the $p < 0.1$ level (i.e., retaining only parameter estimates that were at least marginally significant).

Moderating variables. Moderating variables are variables that interact with the variable in question (see Kenny, 1996, for a discussion of the distinction between moderating and mediating variables). For purposes of these analyses, we conducted the traditional multiple regression approach to analysis of variance in which each potential moderating variable was related to teaching effectiveness, research publications, and the teaching-by-research interaction. In order to facilitate interpretations, all variables were initially standardized, and then the interaction term was the crossproduct of the standardized measures of teaching and research (see Aiken & West, 1991; Cohen & Cohen, 1975; Pedhazur & Schmelkin, 1991). For purposes of these analyses, the main interest is the relation between the teaching-by-research interaction with each potential moderating variable—whether academics who have systematically high or low scores for both teaching and research differ on any of the potential moderating variables. Thus, for example, a positive interaction effect would imply that academics who were high on the potential moderating variable showed greater agreement in their teaching and research. Although based in part on suggestions from the Hattie and Marsh (1996) meta-analysis and our review of the literature, these analyses are largely exploratory. It is, however, reasonable to hypothesize, for example, that there should be significant interactions for the nexus variables (beliefs that teaching facilitates research or that research facilitates teaching), that the teaching-research relation should be stronger for academics who have positive nexus beliefs.

Results

Teaching-Research Relations

Bivariate teaching-research relations. The relation between the overall teacher rating and total number of publications is close to zero (0.03, Table 1 and Figure 1) and clearly not statistically significant ($p = 0.69$). The teaching-research relation (0.04) is nearly the same when the teaching is represented as the mean z-score for the four components of teaching effectiveness (overall teacher rating, course value, materials, presentations) and research is represented by the mean z-score of the five publication components (journal articles, conference papers, book chapters, edited books, and authored books). Neither the overall teacher

rating nor the mean z-score was significantly related to any of the five individual components of the total publications (*r*s vary from -0.03 to 0.09, mean $r = 0.03$). Similarly, neither the total publications nor the mean z-score publication score was significantly related to any of the four individual components of the teacher ratings (*r*s vary from 0.01 to 0.07, mean $r = 0.03$). It can be seen (Figure 1) that many staff (41%) published nothing over the three-year evaluation period, which is not atypical across Australian universities (Hattie, Print, & Krakowski, 1994) or in the United States (Miller, 1996). A further 25% published between 1 and 3 publications, and the other 34% had more than 3 publications. When the staff who published nothing are omitted, the relation is still not statistically significant (-0.06). When quadratic, cubic, or both components were added to the prediction equation, the relation was still nonsignificant. When various transformations were applied to the data (e.g., log, rank order, normalizing), the teaching-research relation was still not significantly different from zero. Consistent with previous research (see the Hattie & Marsh, 1996, meta-analysis), our results based on this study clearly demonstrate that the teaching-research relation is close to zero.

TABLE 1

Correlations Between Various Indicators of Teaching Effectiveness and Research Productivity ($N = 182$ Teachers)

	Teaching		Research	
Variables	Overall Teacher	Mean Z-score	Total Pubs	Mean Z-score
Teaching (Student Ratings)				
Overall teacher (a)	1.00	0.95**	0.03	0.06
Mean z-score	0.95**	1.00	0.02	0.04
Presentations (a)	0.91**	0.94**	0.01	0.03
Materials (a)	0.74**	0.86**	0.04	0.07
Course value (a)	0.78**	0.85**	0.01	0.01
Research (Publications)				
Total publications	0.03	0.02	1.00	0.93**
Mean z-score	0.06	0.04	0.93**	1.00
Journal articles (b)	0.01	0.01	0.90**	0.77**
Conference papers (b)	–0.03	–0.03	0.72**	0.69**
Book chapters (b)	0.06	0.05	0.59**	0.60**
Books authored (b)	0.09	0.05	0.51**	0.63**
Books edited (b)	0.05	0.06	0.28**	0.55**
Weighted pubs	0.06	0.04	0.97**	0.95**

NOTE: Teaching is represented by the overall teacher rating and the mean z-score of all teacher ratings (those marked with a). All teaching measures are based on students' evaluations of teaching effectiveness. Research productivity is represented by the total number of publications (unweighted) and the mean z-score of all the publications (those marked with b).
*$p < 0.05$. **$p < 0.01$.

TABLE 2

Confirmatory Factor Analysis of Teaching and Research Relation

Variables	Factor Loadings		Uniqueness
	Teacher	Publish	
Teacher (Student Ratings)			
Overall teacher	0.97	0	0.06
Presentations	0.94	0	0.12
Materials	0.79	0	0.38
Course value	0.78	0	0.40
Research (Publications)			
Journal articles	0	0.93	0.13
Conference papers	0	0.56	0.69
Book chapters	0	0.30	0.91
Books (authored)	0	0.56	0.69
Books (edited)	0	0.20	0.96
Factor Correlations			
Teaching	1.00		
Publications	0.02	1.00	

NOTE: All parameter estimates presented in completely standardized format. The goodness of the fit of the solution was good (Tucker-Lewis Index = 0.93).

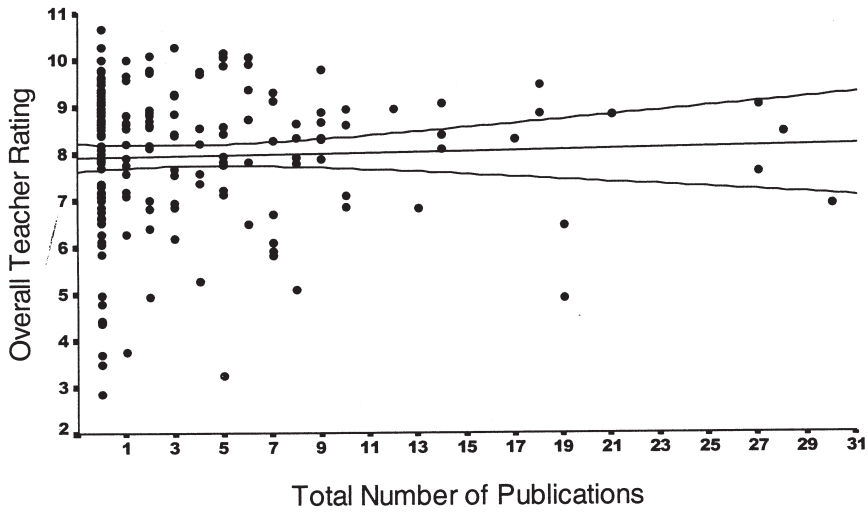

FIG. 1. Teaching-Research Relation. Scatter Plot Showing the Size of the Relation ($r = 0.03$), the Best Fit Regression Line, and the 95% Confidence Interval.

Confirmatory factor analysis. We conducted a confirmatory factor analysis in which a global teaching factor was represented by the four indicators of teaching, and a global publication factor was presented by the five indicators of publications (see Table 2). The model was well defined and provided a reasonable fit to the data (Tucker-Lewis Index = 0.93). Again, however, the correlation between the global teaching and global publication factor is $r = 0.02$) is nearly zero and not statistically significant (Table 2).

Multilevel relations. For purposes of these multilevel analyses, level 1 was defined as the 182 individual academics, and level 2 was defined as the 20 academic departments to which they belong (Table 3). In the initial variance components model, the variance in teaching effectiveness (overall teacher rating), research publications (total publications), and the teaching-research relation was divided into variance due to differences between departments (level 2, departmental level) and variance due to individual academics (i.e., differences within departments). The variance components at the individual academic level (level 1) are substantial and highly significant, indicating that there is considerable variance at the level of individual academics. However, the covariance term (representing the teaching-research relation) is still close to zero and clearly not statistically significant. These results are similar to those based on the single-level analyses (e.g., correlations in Table 2) that ignore the potential multilevel structure of the data.

The important new contribution of this analysis is the variance components at the department level. These results demonstrate, however, that variance at the department level is not statistically significant for teaching effectiveness, for research publications, or for the teaching-research relation. Hence, the near-zero relation between teaching and research publications is very consistent across the 20 academic departments considered here.

The nonsignificant variance and covariance components at the departmental level have several important implications. Methodologically, these results imply single-level analyses, which are the basis of most of this study, are valid even though the data have a multilevel structure that could have invalidated these analyses. Furthermore, because there are no significant differences between departments, it makes little sense to pursue departmental characteristics to explain the (nonsignificant) differences between departments. Substantively, the nonsignificant variance components at the departmental level have important implications. In contrast to suggestions by Hattie and Marsh (1996) and others (e.g., Braxton, 1996; Ramsden & Moses, 1992), these data differences in departmental ethos (or any other departmental characteristic) apparently have little or no impact on the teaching-research relation.

TABLE 3

Multilevel Analysis of Relation Between Teaching Effectiveness and Research Productivity as a Function of Department: Variance and Covariance Components (Standard Errors in parentheses)

	Research		Teaching	
Teacher Level				
Research	31.144	(3.415)		
Teaching	0.132	(0.657)	2.317	(0.252)
Department Level				
Research	1.806	(1.706)		
Teaching	0.129	(0.273)	0.041	(0.085)

NOTE: Variance components (for overall teacher rating and total publications) and the corresponding covariance term (relation between teaching and research). Parameter estimates at the individual teacher level refer to variance and covariance in scores for 182 teachers (based on the objective measures of teaching research for which there was no missing data; see Table 2). Parameter estimates at the department level indicate the extent to which there is variation in the 20 different departments. Parameter estimates less than two standard errors from zero are not statistically significant ($p < 0.05$).

If there had been significant department-to-department variation in the size of the near-zero relation between teaching and research, it would have been reasonable to incorporate additional variables representing departmental characteristics based on alternative classifications, such as alternative classification schemes discussed by Braxton (1996; Braxton & Hargens, 1996), to determine how much of the variation in department could be explained by such characteristics. However, because there was no significant variation between departments to be explained, we did not pursue these further analyses. Nevertheless, the multilevel approach to this issue—including the evaluation of department characteristics if there is significant department-to-department variation—is a potentially important contribution that should be pursued in the future.

Teaching-Research Relations: Mediating Variables

Tests of Marsh's (1987) model. One intent of the present investigation is to evaluate the theoretical model proposed by Marsh (1987). According to this model (see Figure 2), teaching and research outcomes are a function of ability, motivation, and time. The near-zero relation between teaching effectiveness and research publications is posited to represent a combination of: (a) a positive relation between the ability to be a good teacher and the ability to be a good researcher and (b) a negative relation between the time devoted to teaching and research and, perhaps, the motivation to be a good teacher and a good researcher. For purposes of the present investigation, teaching and research ability are measured by

academic self-ratings, motivation is inferred from the satisfaction one gets from teaching and research and one's personal goals to be a good teacher or to engage in research, and time is represented by the proportion of time each person typically devotes to teaching and research. All these variables are based on self-ratings (see Appendix). Teaching and research publication outcomes are inferred from the four components of students' evaluations and the five components of total publications.

In the structural equation model, all nonsignificant paths were eliminated in order to achieve a more parsimonious model, to avoid potential

TABLE 4

Structural Equation Model of Relations Between Measures of Teaching (Tch) and Research (Res)

	Ability		Motivation		Time		Outcomes	
Variables	Tch	Res	Tch	Res	Tch	Res	Tch	Res
Factor Loadings								
Tch ability	0.95	0	0	0	0	0	0	0
Res ability	0	0.95	0	0	0	0	0	0
Tch personal goal	0	0	0.77	0	0	0	0	0
Tch satisfaction	0	0	0.50	0	0	0	0	0
Res personal goal	0	0	0	0.87	0	0	0	0
Res satisfaction	0	0	0	0.84	0	0	0	0
Tch proportion time	0	0	0	0	0.95	0	0	0
Res proportion time	0	0	0	0	0	0.95	0	0
Overall teacher	0	0	0	0	0	0	0.96	0
Presentations	0	0	0	0	0	0	0.94	0
Material	0	0	0	0	0	0	0.79	0
Course value	0	0	0	0	0	0	0.77	0
Journal articles	0	0	0	0	0	0	0	0.89
Conference papers	0	0	0	0	0	0	0	0.59
Book chapters	0	0	0	0	0	0	0	0.33
Books authored	0	0	0	0	0	0	0	0.55
Books edited	0	0	0	0	0	0	0	0.23
Path Coefficients								
Tch ability	0	0	0	0	0	0	0	0
Res ability	0	0	0	0	0	0	0	0
Tch motivation	0.43	–0.36	0	0	0	0	0	0
Res motivation	–0.20	0.66	0	0	0	0	0	0
Tch time	0	–0.48	0	0	0	0	0	0
Res time	0	0.43	0	0	0	0	0	0
Teaching effectiveness	0.28	0	0	0	0	0	0	0
Publications	0	0.53	0	0	0	0	0	0
Residuals								
Factor variances	1.00	1.00	0.68	0.53	0.77	0.81	0.92	0.72
Factor convariances	0	0	0	0	-0.33[a]	0	0	0

NOTE: All parameter estimates are presented in completely standardized format. A backward elimination procedure was used so that all non-significant parameter estimates were fixed to zero.

[a]The only residual covariance in the final solution was the negative relation between the proportion of time spent on teaching and research (see Fig.2).

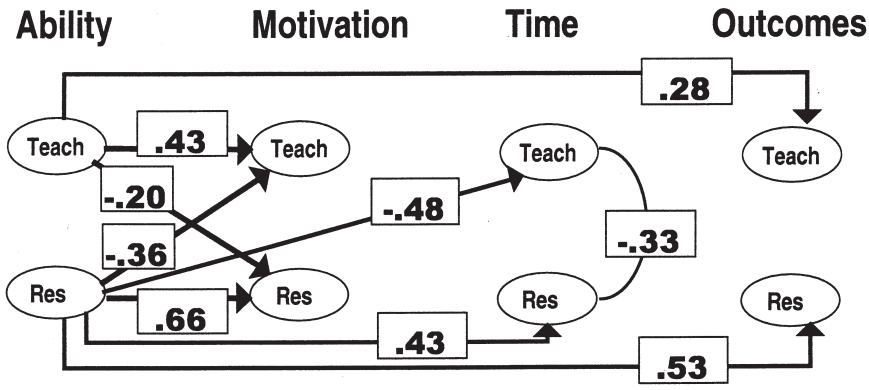

FIG. 2. Structural Equation Model of Relations Between Measures of Teaching and Research based on the Marsh (1987) Theoretical Model (also see Table 4).

problems of multicollinearity, and to facilitate interpretations. The results of this final model (Figure 2 and Table 4) provide only limited support for theoretical predictions. As predicted, there is a substantial negative relation between time spent on teaching and time spent on research (–0.33) and no significant relation between teaching and research outcomes. There are, however, no significant relations between teaching and research ability or between teaching and research motivation. Also consistent with predictions, self-ratings of teaching ability have a moderate effect on students' evaluations of teaching (0.28) and self-ratings of research ability have a substantial effect on research publications (0.53). The corresponding motivation and time variables, however, have no significant effect on the teaching and research outcome variables (beyond what can be explained in terms of the ability self-ratings). Self-rated research ability has many effects in addition to its effect on research outcomes; positive effects on research motivation and time spent on research and negative effects on teaching motivation and time spent on teaching. Self-rated teaching ability has no significant effect on teaching motivation or time spent on teaching, but it has a negative effect on research motivation.

The results provide strong support for the "independent constructs" relation of research and teaching constructs. Although there is no support at all for the complementary nature of teaching and research constructs, there is some support for their antagonistic nature in relation to time spent on the two activities. This apparent antagonism, however, does not explain why the relation between teaching and research

outcomes is not more positive. In particular, whereas time spent on teaching and research are negatively correlated, these time variables have no effect on teaching and research outcomes beyond what can be explained by the self-ratings of ability. These ability self-ratings are the only variables to affect the teaching and research outcomes, and these self-ratings of ability are not significantly correlated.

In summary, the fundamental assumption underlying the Marsh (1987) model is that the ability to be a good teacher and the ability to be a good researcher are positively related. The results of the present investigation do not support this assumption. Indeed, because self-ratings are likely to be positively biased by potential biases (e.g., halo effects), it is quite surprising that these self-rating variables are not positively correlated. Hence, in contrast to implications of the theoretical model, the nonsignificant relation between self-ratings of teaching ability and research ability provide strong support for the construct validity of interpretations of the near-zero relation between teaching effectiveness and research productivity.

Other potential mediating variables. Correlations involving a wider variety of potential mediating variables—including those presented in the structural equation model—are evaluated (Table 5) in order to explore further potential mediators of the negative teaching-research relation. Consistent with results based on the structural equation model, self-rating of teaching ability is the only teaching variable that is significantly related to teaching effectiveness. Also consistent with the structural equation model, research goals and research satisfaction—the two variables comprising motivation in the structural equation model—are negatively related to teaching outcomes. The pattern of results is somewhat different for self-ratings of teaching ability that is significantly related to teaching goals and external rewards for teaching (the claim that teaching effectiveness would be enhanced if teaching were externally rewarded).

Research publications are more consistently correlated with other research variables including self-ratings of ability, personal goals, proportion of time spent on research, and research nexus (the belief that research facilitates teaching effectiveness). These results demonstrate that the nonsignificant paths between many of these research variables and research publications are not because these variables are uncorrelated, but rather that these relations are not significant once the substantial relation between self-ratings and research publications is controlled. Self-ratings of research ability are even more highly correlated with these research variables (Table 5), but they are also negatively correlated with some of the teaching variables (personal goals and proportion of time).

TABLE 5
Potential Mediating Variables: Correlations with Measures of Teaching (T) and Research (R)

Variables		Mean	*SD*	Mediating Correlations: Objective Measures *T*	Objective Measures *R*	Self-Ratings *T*	Self-Ratings *R*	Matching *T & R* Variables
Teaching and Research								
Objective Measures	T	7.97	1.53	1.00**	0.03	0.29**	–0.00	0.03
	R	3.73	5.74	0.03	1.00**	0.10	0.45**	
Potential Mediators								
Self-ratings	T	4.25	0.61	0.29**	0.10	1.00**	0.10	0.10
	R	3.70	0.83	–0.00	0.45**	0.10	1.00**	
Satisfaction	T	3.88	1.00	0.03	–0.03	0.20	–0.14	–0.15
	R	4.39	0.88	–0.24*	0.19	–0.12	0.50**	
Personal goals	T	4.41	0.65	0.08	–0.00	0.28*	–0.24*	–0.20
	R	4.15	0.89	–0.26*	0.31**	–0.07	0.52**	
University goals	T	3.13	1.02	0.02	0.04	–0.17	0.19	–0.10
	R	4.26	0.79	–0.07	–0.11	–0.01	–0.17	
External reward	T	3.01	1.22	–0.02	0.05	0.24*	–0.01	0.80**
	R	2.91	1.12	–0.19	0.14	–0.00	0.07	
Constraints	T	2.80	0.92	–0.01	0.04	0.12	–0.01	0.48**
	R	3.79	0.92	–0.13	–0.18	0.01	–0.10	
Time spent	T	21.88	8.97	–0.04	–0.20	–0.06	–0.14	–0.24*
	R	13.54	8.81	–0.04	0.20	0.05	0.38**	
Proportion time	T	0.46	0.17	–0.06	–0.27*	–0.13	–0.41**	–0.49**
	R	0.28	0.17	0.02	0.23*	0.04	0.37**	
Activities	T	3.70	0.66	–0.10	–0.11	0.14	–0.22	–0.14
	R	1.75	0.24	0.04	0.34**	0.12	0.48**	
Nexus	T	3.18	0.84	–0.06	0.03	0.15	–0.09	0.47**
	R	3.89	0.72	–0.13	0.25*	0.08	0.35**	

NOTE: All measures (see Appendix) are paired, one referring to teaching (T) and one referring to research (R). For each measure, correlations are presented between it and objective measures of teaching and research (overall teacher rating and total publication measures considered earlier), teacher self-ratings of their ability as a teacher and a researcher, and the matching measure (e.g., the research goals measure is correlated with the teaching goals measure)
*$p < 0.05$. **$p < 0.01$.

Also presented in Table 5 are correlations between matching teaching and research variables. The majority of these relations are nonsignificant—including relations between objective outcomes (0.03) and self-ratings of teaching and research abilities (0.10). Three of the relations are significantly positive: external rewards (0.80, the claim that teaching or research would improve if there were greater external rewards), constraints (0.48, the belief that teaching or research are limited by external constraints); nexus (0.47, the belief that research contributes to teaching or that teaching contributes to research). The only significantly negative relations are for the time variables (-0.24 for actual time and -0.48 for proportion of time), although the negative relation between teaching and research goals (-0.20, $p = 0.08$) approaches statistical significance.

Potentially important new relations not included in the path model involve the activities and nexus variables. In each case, the relations are specific to research variables. Research activities are significantly related to research publications and self-ratings of research, but not teaching effectiveness and self-ratings of teaching. In contrast, teaching activities are not significantly related to either teaching effectiveness or self-ratings of teaching (or to either of the corresponding research variables). Similarly, the belief that research contributes to teaching is positively related to research publications and self-ratings of research, but not the corresponding measures of teaching. In contrast, the belief that teaching contributes to research is not significantly related to self-ratings or outcomes for either teaching or research.

Teaching-Research Relation: Moderating Variables

To the extent that a positive teaching-research relation should be a goal of higher education, it is useful to test moderating variables that can distinguish between subgroups where the relation is relatively more positive from subgroups where the relation is relatively more negative. Of particular relevance, for example, are the nexus variables. We posited that the teaching-research relation is likely to be more positive for academics who believe that teaching contributes to research and that research contributes to teaching. In order to pursue this question, we related each of a set of potential moderating variables (the same set that we considered as potential mediating variable) to teaching, research, and the teaching-by-research interaction, applying the typical multiple regression approach of analysis of variance (e.g., Cohen & Cohen, 1975; Aiken & West, 1991; Pedhazur & Schmelkin, 1991). For present purposes, the primary interest is in the teaching-by-research interaction term. This interaction, however, is not statistically significant for analyses based on any of the set of 20 potential moderating variables (see Table 6).

Because our search for moderating variables is exploratory, it is useful to examine the pattern of some of the moderating variables, although they are not significantly related to the teaching-research cross-products. Of particular interest are the nexus variables (beliefs that teaching and research are complementary activities) that were posited a priori to contribute positively to the teaching-research relation. Not only is the teaching-by-research interaction not significantly related to either of the nexus variables, but the direction of the nonsignificant interaction is negative rather than positive (betas = -0.17 & -0.10; see Table 6). The teaching-research relation is actually more negative for those who have the most positive beliefs that good teaching contributes to good

research. The teaching-by-research interaction is nearly significant for proportion of time spent on teaching (beta = 0.20, $p = 0.07$). The interaction effect is positive (i.e., the teaching-research relation is more positive for academics who spend a greater proportion of their time teaching), suggesting that academics who spend a high proportion of their time devoted to teaching may be able to devise strategies whereby their teaching efforts contribute to their research productivity.

In summary, a wide variety of potential moderating variables were found to be not significantly related to the teaching-research relation. Because there were no statistically significant teaching-by-research interactions for any of the 20 tests that were conducted, the results support earlier conclusions that the near-zero correlation between teaching and research is very robust in our study. Because of the exploratory nature of these analyses based on a single institution, we suggest that further research is needed to evaluate the generalizability of our results.

TABLE 6

Potential Moderating Variables: Relations with Teaching (T) and Research (R) and their Interaction

Variables		Beta Weights			Mult *R*
		Tch	Res	Tch x Res	
Potential Mediators					
Self-ratings	T	0.29**	0.09	–0.09	0.33*
	R	0.04	0.43**	–0.06	0.45*
Satisfaction	T	0.02	–0.09	–0.14	0.13
	R	–0.22*	0.20	0.07	0.30*
Personal goals	T	0.07	–0.06	–0.17	0.18
	R	–0.23*	0.33**	0.10	0.40*
University goals	T	0.02	0.03	–0.02	0.05
	R	–0.08	–0.12	–0.01	0.14
External reward	T	–0.01	0.06	0.03	0.06
	R	–0.17	0.19	0.17	0.28
Constraints	T	–0.02	–0.03	–0.17	0.16
	R	–0.15	–0.15	0.10	0.25
Time spent	T	–0.05	–0.15	0.14	0.25
	R	–0.02	0.18	–0.04	0.21
Proportion time	T	–0.07	–0.20	0.21	0.34*
	R	0.05	0.27*	0.09	0.25
Activities	T	–0.11	–0.12	–0.01	0.15
	R	0.06	0.30**	–0.12	0.37*
Nexus	T	–0.07	–0.05	–0.17	0.17
	R	–0.11	0.20	–0.10	0.28

NOTE: All potential moderating variables (see Appendix) are paired, one referring to teaching (T) and one referring to research (R). A separate multiple regression was conducted for each potential moderating variable, relating it to teaching, research, and the teaching-by-research interaction.

*$p < 0.05$. **$p < 0.01$.

Summary and Implications

Academics believe, many with passion, that there is a nexus between research and teaching. For many, the teaching-research relation is obvious and enriching. The claim is that this combination of teaching and research in the one person is the underlying reason for universities. The self-estimates of the relation are extremely high (Neumann, 1992; Jensen, 1988) although most report that the link is from their research to their teaching. In a US national survey of the relative importance of research and undergraduate teaching, Gray, Diamond, and Adam (1996) reported that most respondents made the case that their teaching and research could not be separated but also claimed that institutions could emphasize both vital activities by drawing on the differential strengths of faculty. Hence, the typical claim is that for me research and teaching are inseparable, but others may wish to emphasize (typically) the teaching tasks.

In contrast to the apparent academic myth that research productivity and teaching effectiveness are complementary constructs, results of the present investigation—coupled with the findings of the Hattie and Marsh (1996) meta-analysis—provide strong support for the typical finding that the teaching-research relation is close to zero. Hence, even though it is always appropriate to question the generalizability of the results from one study based on data from a single institution, the results from the present investigation are very consistent with results based on a comprehensive meta-analysis of previous research in the area. The near-zero relation found in the present investigation, although consistent with previous research, is more robust than the results typically reported in many ways. Because our measures of research publications were based on performances over three years, were externally audited, and were the basis of research allocations, they are likely to be more accurate than self-report data used in many studies. Although we had multiple indicators of research publications and multiple indicators of teaching effectiveness, the nonsignificant teaching-research relation was consistent across all possible combinations of the two sets of measures. Indeed, when the two sets of multiple indicators were combined in a structural equation model, the correlation between the global teaching and global research factors (0.02) was still close to zero.

It is, of course, possible to argue about the appropriateness of our measures of research productivity and teaching effectiveness. Thus, for example, our measures of research focused on the quantity of research publications and did not incorporate other variables that might better reflect the quality of the research. Similarly, our multiple indicators of

teaching effectiveness were all based on students' evaluations of teaching effectiveness, and these continue to be controversial measures of teaching effectiveness for many academics (see Marsh & Roche, 1997). It is, however, important to emphasize that we also considered two quite different measures of teaching and research; academics' self-ratings of their abilities as teachers and researchers. Although we would certainly not defend these measures as being more valid than our more objective measures, they are fundamentally different constructs. Because of the well-known self-report biases (e.g., halo effects) that are likely to positively bias relations between these self-rating variables, we would expect that these self-rating variables would be modestly or even substantially (positively) related. Furthermore, the Marsh (1987) theoretical model that was a primary basis of the present investigation predicted that the underlying ability to be a good researcher should be positively correlated with the ability to be a good teacher. In contrast to these likely positive biases and our theoretical predictions, not even the self-ratings of research and teaching abilities were significantly correlated. Hence, these results based on self-ratings provide strong support for the near-zero relation between measures of teaching effectiveness and research publications.

We hypothesized that the teaching-research relation would differ systematically from department to department. In order to test this hypothesis we introduced new state-of-the-art statistical procedures that are more appropriate for addressing this question than procedures used previously in this area of research. Our plan was to initially demonstrate that there were substantial differences between departments in the size and direction of the teaching-research relation and then to pursue explanatory variables that would allow us to explain this departmental variation and identify departmental characteristics that are associated with a positive teaching-research relation. In marked contrast to our expectations, our initial multilevel analyses indicated that the near-zero teaching-research relation did not differ from department to department. Because there was no variation in the teaching-research relation, it made no sense to examine explanatory variables to explain the nonexistent variation that we hoped to find. Furthermore, because our study was based on a single institution, it would not have been possible to unconfound the effects of the individual members within a department from the discipline that they represented. Particularly in respect to looking for discipline differences (as well as discipline-related differences such as the consensus dimension emphasized by Braxton and Hargens, 1996), reliance on data from a single institution is an important limitation. Nevertheless, the consistency of the teaching-research relation is consistent

with results from the Hattie and Marsh (1996) meta-analysis. In summary, the multilevel analyses demonstrated that the near-zero correlation between teaching and research was remarkably robust across 20 academic departments in the one institution considered in our research.

We also explored a wide variety of potential moderators of the teaching-research relation to determine if there were some subgroups for which the relation was positive. Although the small sample size and exploratory nature of these analyses dictate cautious interpretation, the results were not encouraging; the critical tests were nonsignificant for all 20 potential moderating variables that we considered. Particularly disappointing were the teaching and research nexus variables designed to assess beliefs that good teaching facilitated research and that good research facilitated teaching. Responses to these items indicated that many staff do believe in this nexus. Thus the items "having to teach something helps me clarify my ideas in my research work on it" and "having to research something helps me clarify my ideas in my teaching of similar topics" both received mean responses of about 4 = very much on a 1 to 5 response scale. Also, the two scales were moderately correlated (0.47), indicating that academics who believed that research facilitated teaching also believed that teaching facilitated research. Importantly, we posited that the teaching-research relation would be stronger for academics who had stronger beliefs that the two activities were complementary. Although both nexus scales had reasonable reliability and showed good variation, these nexus variables were not significantly related to the teaching-research relation. Furthermore, the direction of the nonsignificant relation was negative such that the teaching-research relation was stronger for academics expressing the most negative beliefs about a teaching-research nexus. Although not supporting our a priori hypotheses, the results provide further support for the robustness of the near-zero relation between teaching and research in our study.

Marsh (1979; 1987; Marsh & Overall, 1979) posited a theoretical model that explained the near-zero relation between teaching and research. According to their model the near-zero correlation represented the juxtaposition between the positive relation between abilities to be a good researcher and a good teacher and the negative relation between the time and, perhaps, the motivation required to be a good teacher and a good researcher. Because the model had not previously been fully tested with appropriate data and statistical techniques, a potentially important contribution of the present investigation was an appropriate test of the model. Although apparently appropriate variables and statistical procedures were used and the results (Figure 2) were interesting, it was inevitable that the main predictions of the model would not be supported.

In particular, the fundamental premise of the model was that the ability to be a good teacher and the ability to be a good researcher were positively related, but the self-rating variables used to represent these variables were not significantly correlated. Despite the problems associated with the model, however, there was some support for a potential antagonism between teaching and research constructs. In the structural equation model, self-ratings of research were negatively related to teaching motivation and time devoted to teaching, whereas self-ratings of teaching were negatively related to research motivation. The most clearly evident antagonism between teaching and research was for the time variables in that research time and teaching time were negatively correlated (Table 5) for both the proportion (–0.49) and absolute (–0.24) estimates of time. Although the negative correlation between personal goals to pursue research and teaching (–0.20) was not quite statistically significant, it is also suggestive. Furthermore, research publications and self-ratings of research ability were both negatively correlated with time devoted to teaching, and the self-rated ability was negatively related to the goal of being a good teacher. Finally, objective measures of teaching effectiveness were negatively related to satisfaction derived from being a good researcher and the personal goal to be a good researcher. In summary, although the test of the theoretical model did not provide support for the most important prediction, there was support for the antagonism between some teaching and research constructs that were posited in the model.

It is important not to perpetuate the myth that there is a positive and reciprocal relation between teaching and research. There is no doubt that many would like such a positive relation to be true, and there is a strong conviction that research and teaching are closely linked. "The two academic 'products' were funded as if, like wool and mutton, they were delivered in harmonious joint supply" (Halsey, 1992, p. 176). Perhaps the most common defense is the reliance on the single case: The "quintessential academician is a Nobel Prize winner who can enthrall an undergraduate class" (Baker, 1986). The evidence suggests that these exceptions are far from the norm. Furthermore, a near-zero correlation between teaching and research is consistent with the observation that some academics are gifted teachers and researchers, but that others are substantially better at one than the other, and some are weak as both teachers and researchers. We would disagree, however, with Webster (1985, p. 62) who claimed, "It may be that we continue to believe that research enhances teaching, in the face of enormous evidence that it does *not*, so that we can continue to justify the time we spend doing it to people who would rather see us use the time teaching". Instead, it is im-

portant to recognize that teaching effectiveness and research productivity are not naturally complementary and to continue to search for strategies to achieve this ideal.

Most of the current debate relates to possible mediators and moderators that may account for the zero relation, with little effect. There has also been a recent flurry of articles claiming that there truly is a relation but not discoverable by other than qualitative designs (Brew & Boud, 1995; Colbeck, 1998) or by other than considering nontraditional conceptions of research and teaching. Brew (1999), for example, argued that the relation between teaching and research differs depending on how knowledge is viewed, and Smelby (1998) claimed that the view of knowledge involved is different at the undergraduate and graduate levels. Brew claimed that if knowledge is viewed as objective and involves the creation or discovery of knowledge, "it would seem consistent to think that it requires transmission and absorption through a separately conceptualized teaching process" (1999, p. 296). But, if knowledge is viewed as a product of communication and negotiation, then "the relation between teaching and learning becomes an intimate one." She suggested that research and teaching are not so distinct in academics' minds as we find in most of the studies. The evidence from our present and previous studies, which are based on the products of these various kinds of teaching and research, provide no support for this view. We devised measures to tease out different conceptions of learning and teaching, with little gain. Teaching, in this and previous studies, is not narrowly conceived as lecturing, or research as publications, as Brew claims. Instead, the process and products of research have been investigated from a variety of perspectives with little evidence of relations between the two.

Although we encourage research into different conceptions of teaching and research, we are less optimistic that this will lead to finding the Holy Grail of a high and positive relation. This search appears to assume that the relation between research and teaching is high and positive and that we have been looking for the Grail under a lamplight that is broken and defective. The results of the present study, which are consistent with the preponderance of research on this topic, support the conclusion that there just is no such relation. So, instead of looking for even more mediators and moderators, instead of arguing about the nature of knowledge and how the process of constructing knowledge may have close parallels in teaching and research, we maybe should accept the conclusion that teaching and research (however conceived) are unrelated and move on to ask how we should enhance this relation (of course, assuming that we wish to do so).

A further theme emerging in recent literature is to more closely examine the actual tasks undertaken by academics and argue that there are tasks in common to teaching and research. Colbeck (1998) observed 12 academics in two universities and claimed that the mean proportion of time engaged in activities that integrated teaching and research time was 19%. She found that this proportion was less influenced by the levels of students (undergraduate or graduate) but more by the purpose of teaching (classroom or training students to conduct research). Academics who use a master-apprentice model rather than a counselor model to teach students how to conduct research were more likely to integrate research into teaching. The integration occurred more in universities that had broader conceptions of what counts for research and where there was more flexibility by academics to choose their teaching responsibilities and courses. Colbeck suggested that we and others have not found a relation because we are looking at outputs of activities whereas we should be looking at the nature of the activities. Such investigations may assist in developing strategies to enhance the relations, but at minimum, it is not defensible to claim that these outputs of teaching activities (typically assessed by student evaluations of teaching) and research (typically assessed by research activities) are related. We must not assume that there is a relation, but it is reasonable to claim that we should enhance the relation. There are numerous strategies that can be used to enhance the relation. Woodhouse (1998) and Jenkins et al. (1998) outline many such actions from a student perspective, and Hattie and Marsh (1996) from a staff perspective.

Many have called for teaching to become more research-like (Barnett, 1997; Jenkins et al., 1998; Rowland, 1996; Shore, Pinker, & Bates, 1990). Neumann (1992) found that students could see the nexus between research and teaching by perceiving that their courses were up-to-date and that staff demonstrated interest in what they were studying, although "up-to-date knowledge and interest in the subject were not seen as substitutes for good teaching practice" (p. 327). Lindsay (1999) found that students were positive about teachers who do research, because involvement makes the teachers enthusiastic and creates confidence of relevance, but students are negative when teachers are inexplicably absent or unavailable and when the staff research is not passed on to them. Jenkins et al. (1998) found that undergraduate students do perceive that there is a teaching-research nexus that mainly leads to positive benefits, such as perceptions of enthusiasm, knowledge of the discipline, credibility as teachers, and a research reputation that assists in helping future career plans.

The origins of universities came from the transmission of knowledge,

culture, and values (i.e., from a teaching role), and it was only much later that this transmission was enhanced by the pursuit of research (e.g., Leinster-Mackay, 1978). It would be difficult to imagine today's university teachers not being aware of recent research, although whether they also have to generate this research to be excellent teachers is questioned by the results of this and other studies demonstrating that the relation between teaching and research is close to zero. Perhaps the major implication of this study is that it may be of most value to ask institutions how they could re-weight research and teaching *within* institutions and departments. A major aim would be to increase the relations between teaching and research and devise strategies to achieve this mission. Institutions need to reward creativity, commitment, investigativeness, and critical analysis in both teaching and research and particularly value these attributes when they occur in both teaching and research. The time taken to partake in either or both activities needs to be recognized, although merely providing more time does not make a good teacher (but can improve research productivity). Only when these attributes are recognized is it likely that the relation between teaching and research will be increased in both students and staff. This is a desirable aim of a university.

A perplexing pattern of results (Table 5) is that teaching effectiveness and even self-ratings teaching ability are mostly not significantly related to other teaching constructs (e.g., satisfaction, personal goals, time expenditures, and activities). In contrast, research productivity and self-ratings of research ability are positively related to most of the corresponding research constructs. Why should there be this asymmetry in the pattern of results? Academics receive considerable training in how to be productive researchers and are constantly exposed—through professional reading, conferences, and collaboration—to role models who are productive researchers. Because academics know how to be productive researchers, it follows that greater motivation, time, effort, and appropriate activities should result in increased research productivity. In contrast, most academics receive little or no training in how to be effective teachers and are rarely exposed to role models who demonstrate effective teaching. In their research on the use of students' evaluations of teaching effectiveness to improve research productivity, Marsh and Roche (1993) found that even teachers who were motivated to improve their teaching and had systematic feedback from their students identifying their strengths and weaknesses did not know how to improve their teaching effectiveness. In contrast, randomly assigned groups of teachers who met with external consultants to discuss specific strategies to

improve their teaching effectiveness in areas selected by the teachers did significantly improve their teaching effectiveness (in relation to pretests and to a randomly assigned control group). If teachers do not know how to improve their teaching effectiveness, it follows, perhaps, that devoting more time and effort to teaching may not improve teaching effectiveness. If universities want their academic staff to be better teachers, then they need to invest in teaching improvement interventions like those proposed by Marsh and Roche.

The results of the present investigation—coupled with the comprehensive Hattie and Marsh (1996) meta-analysis—clearly indicate that teaching effectiveness and research productivity are nearly uncorrelated, thus supporting the hypothesis that they are independent constructs. These results have some obvious implications. Good researchers are neither more nor less likely to be effective teachers than are poor researchers. Good teachers are neither more nor less likely to be productive researchers than are good teachers. There are roughly equal numbers of academics who—relative to other academics—are: (a) good at both teaching and research, (b) poor at both teaching and research; (c) good at teaching but poor at research; and (d) poor at teaching but good at research. These results clearly demonstrate that personnel selection and promotion decisions must be based on separate measures of teaching and research and on how academics provide evidence that their research and teaching are mutually supporting. Research performance does not provide a surrogate measure of teaching effectiveness, nor do measures of teaching effectiveness provide an indication of research productivity. Similarly, if students want to be taught by outstanding teachers, they need to focus on measures of teaching effectiveness rather than reputations based on research performances. If universities want to improve their teaching effectiveness, they need to select, retain, promote, and support academics who are good teachers. If universities want to improve their research productivity, they need to select, retain, promote, and support academics who are good researchers. If universities want to improve both teaching and research, then they need to select, retain, promote, and support academics who are good at both teaching and research. If universities want to improve either their teaching or research, they need to not select, retain, promote, or reward academics who are poor at both teaching and research.

APPENDIX

Description of Items, Scale, Estimates of Reliability, Means, Standard Deviations

	Mean	*SD*	Factor Loadings
Teaching Ability[a]			
1. Under ideal conditions (i.e., no limits on time, resources etc.) compared with others in your discipline, how would rate your ability as a teacher	4.23	0.61	
Research Ability[a]			
1. Under ideal conditions (i.e., no limits on time, resources etc.) compared with others in your discipline, how would rate your ability as a researcher	3.65	0.83	
Teaching Satisfaction[a]			
1. Teaching undergraduates students is an activity that gives me a great deal of satisfaction	3.89	0.98	
Research Satisfaction (alpha = 0.96)[a]			
1. Being involved in research gives me a great deal of satisfaction	4.34	0.94	0.98
2. Conducting research is an activity that gives me a great deal of satisfaction	4.35	0.93	0.98
Personal Teaching Goal[a]			
1. My personal goal primarily is to be a good teacher	4.44	0.65	
Personal Research Goal[a]			
1. My personal goal primarily is to engage in research	4.10	0.91	
University Teaching Goal[a]			
1. Perceived university goal is primarily to be a good teacher	3.13	1.02	
University Research Goal[a]			
1. Perceived university goal is primarily to engage in research	4.26	0.79	
Extrinsic Rewards for Teaching (alpha = 0.85)[a]			
1. Having more public recognition to quality teaching would inspire me to become a better teacher	3.06	1.24	0.93
2. Having a salary increase related to my teaching performance would inspire me to become a better teacher	3.08	1.37	0.93
Extrinsic Rewards for Research (alpha = 0.72)[a]			
1. Having more public recognition to quality research would inspire me to become a better researcher	2.99	1.20	0.89
2. Having a salary increase related to my research performance would inspire me to become a better researcher	2.95	1.35	0.89
Constraints of Research on Teaching (alpha = 0.64)[a]			
1. Research interferes with my teaching capabilities and productivity	2.15	1.21	0.63
2. Time is a major constraint to improving my teaching productivity	3.68	1.31	0.65
3. Does your time and commitment to research interfere with your teaching capabilities	2.57	1.12	0.67
Constraints of Teaching on Research (alpha = 0.74)[a]			
1. Teaching interferes with my research capabilities and productivity	3.29	1.27	0.77
2. Time is a major constraint to improving my research productivity	4.33	0.93	0.53
3. Does your time and commitment to teaching interfere with your research capabilities	3.78	1.22	0.81
Time Spent on Teaching (reliability = 0.70)[b]			
1. How many hours during a typical week do you spend on preparation for teaching	8.69	5.11	0.80
2. How many hours during a typical week do you spend on teaching	7.59	2.89	0.34
3. How many hours during a typical week do you spend on follow-up from teaching (e.g., marking, talking to students)	5.60	4.12	0.50
Time Spent on Research[b]			
1. How many hours during a typical week do you spend on research	13.54	8.81	

APPENDIX (*Continued*)

	Mean	*SD*	Factor Loadings
Research Activity (alpha = 0.65)[c]			
1. Had informal discussions with departmental colleagues about common research interests	1.91	0.28	0.23
2. Participated in one or more joint research projects with colleagues	1.78	0.42	0.56
3. Maintained professional contact with colleagues oversees	1.85	0.36	0.64
4. Reviewed one or more proposals for a funding agency	1.53	0.50	0.60
Teaching Activity (alpha = 0.79)[a]			
1. I make use of assessment material to diagnose what my students understand and do not understand	3.59	1.13	0.71
2. I use the results of examinations and student assignments to amend my subsequent teaching of a topic	4.00	1.03	0.56
3. When I revise a course, I always examine teaching and assessment methods to see if they are appropriate	3.85	1.11	0.70
4. I go out of my way to help students with their study problems	3.87	0.87	0.75
5. I regularly consult books and articles on teaching methods	2.42	1.27	0.58
6. I try hard to understand the difficulties students may be experiencing with their work	3.99	0.84	0.80
7. I make time to discuss my students' progress with them regularly	3.81	0.92	0.63
8. When I revise a course, I do library research to make the content up to date	4.08	0.97	0.24
Nexus of Teaching on Research (alpha = 0.79)[a]			
1. Becoming a good teacher enhances an academic's research	3.10	1.16	0.61
2. Having to teach something helps me clarify my ideas in my research work on it	4.00	1.10	0.66
3. I feel I have something to learn from my undergraduate students in my subject area	3.02	1.08	0.63
4. My research is enhanced by my undergraduate teaching	2.89	1.10	0.67
5. Students' questions can help me elucidate issues in my research	2.73	1.10	0.71
Nexus of Research on Teaching (alpha = 0.70)[a]			
1. Conducting good research enhances an academic's teaching	4.17	0.89	0.61
2. Having to research something helps me clarify my ideas in my teaching of similar topics	4.13	1.00	0.81
3. I share ideas from my research with my undergraduate classes	3.74	0.99	0.53
4. I use the results of my research to amend my subsequent teaching of a topic	3.52	1.17	0.67

Note: For all scales based on multiple items, a coefficient alpha estimate of reliability is presented along with the factor loadings from a one-factor congeneric model relating each of the indicators to a single latent construct (also see Table 3 for a factor analysis of the teaching and research outcome variables).[a] based on a five-point response scale; [b]based on actual number of hours reported; [c]based on dichotomous response scale.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Astin, A. W. (1993). *What matters in College? Four critical years revisited.* San Francisco: Jossey-Bass.

Baker, P. J. (1986). The helter-skelter relationship between teaching and research: A cluster of problems and small wins. *Teaching Sociology, 14,* 50–66.

Bandura, A. (1997). *Self-efficacy: The exercise in control.* New York: Freeman.

Barnett, B. (1992, June 3). Teaching and research are inescapably incompatible. *Chronicle of Higher Education,* p. A40.

Barnett, R. (1997). *Higher education: A critical business.* Buckingham: Society for Research into Higher Education and Open University Press.

Bausell, R. B., & Magoon, J. (1972). *The validation of student ratings of instruction: An institutional research model.* Newark, DE: College of Education, University of Delaware.

Black, S. (1972). Interactions between teaching and research. *Universities Quarterly, 26,* 348–352.

Blackburn, R. T. (1974) The meaning of work in academia. In J. I. Doi (Ed.), *Assessing faculty effort. New Directions for Institutional Research* (Vol. 2, pp. 75–99). San Francisco: Jossey-Bass.

Boyer, E. L. (1990). *Scholarship revisited: Priorities in the professoriate.* Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Braxton, J. M. (1996). Contrasting perspectives on the relationship between teaching and research. *New Directions for Institutional Research* (Vol. 90, pp. 5–14). San Francisco: Jossey-Bass.

Braxton, J. M., & Hargens, L. L. (1996). Variation among academic disciplines: Analytic frameworks and research. In J. C. Smart (Ed.), *Higher education: A handbook of theory and research* (Vol. 11, pp. 1–46). New York: Agathon.

Brew, A. (1999). Research and teaching: Changing relationships in a changing context. *Studies in Higher Education, 24,* 291–301.

Brew, A., & Boud, D. (1995). Teaching and research: Establishing the vital link with learning. *Higher Education, 29,* 261–273.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods.* Newbury Park, CA: Sage.

Clark, M. J. (1974). *Organizational stress and professional performance among faculty members at a small college.* Unpublished doctoral dissertation, University of Michigan. (Doctoral dissertation, University of Michigan, 1973). *Dissertation Abstracts International, 35,* A209.

Cohen, J., & Cohen, P. (1975). *Applied multiple regression/correlation analysis for the behavioral sciences.* Hillsdale, NJ: Erlbaum.

Colbeck, C. C. (1998). Merging in a seamless blend: How faculty integrate teaching and research. *Journal of Higher Education, 69,* 647–671.

Crittenden, B. (1997). *Minding their business: The proper role of universities and some suggested reforms.* Academy of the Social Sciences: Canberra, ACT, Australia.

Delaney, E. L. (1976). *The relationships of student ratings of instruction to student, instructor and course characteristics.* Paper presented at the annual meeting of the American Educational Research Association. (ERIC Document Reproduction Service No. ED 126 140)

Ethington, C. A. (1997). A hierarchical linear modeling approach to studying college effects. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 12). New York: Agathon.

Feldman, K. (1987). Research productivity and scholarly accomplishment of college teachers as related to their instructional effectiveness: A review and exploration. *Research in Higher Education, 26,* 227–298.

Fox, M. F. (1992). Research, teaching, and publication productivity: Mutuality versus competition in academia. *Sociology of Education, 65,* 293–305.

Goldstein, H. (1995). *Multilevel statistical models* (2nd ed.). London: Arnold.

Goldstein, H., Rasbash, J., Plewis, I., Draper, D., Browne, W., Yang, M., Woodhouse, G., & Healy, M. (1998). *A user's guide to MLwiN.* London: Institute of Education, University of London.

Gray, P. J., Diamond, R. M., & Adam, B. E. (1996). *A national study on the relative importance of research and undergraduate teaching at colleges and universities.* Center for Instructional Development, Syracuse University.

Halsey, A. H. (1992). *Decline of donnish dominion: The British academic profession in the twentieth century.* Oxford: Clarendon.

Harry, J., & Goldner, N. S. (1972). The null relationship between teaching and research. *Sociology of Education, 45,* 47–60.

Hattie, J, & Marsh, H. W. (1996). The relationship between research and teaching—a meta-analysis. *Review of Educational Research, 66,* 507–542.

Hattie, J. A., Print, M., & Krakowski, K. (1994). Productivity of academics. *Australian Journal of Education, 38,* 201–218.

Hattie, J. A., Tognolini, J., Adams, K., & Curtis, P. (1990). *An evaluation of a model for allocating research funds across departments within a university using selected indicators of performance.* Canberra, Australia: Department of Employment, Education, and Training.

Hoffman, R. A. (1984). An assessment of the teaching, research, and service function of a college faculty. *Journal of Research and Development in Education, 17,* 51–54.

Jauch, L. R. (1976). Relationships of research and teaching: Implications for faculty evaluation. *Research in Higher Education, 5,* 1–13.

Jencks, C., & Riesman D. (1968). *The academic revolution.* Garden City, NY: Doubleday.

Jenkins, A., Blackman, T., Lindsay, R., & Paton-Saltzberg, R. (1998). Teaching and research: Student perspectives and policy implications. *Studies in Higher Education, 23,* 127–141.

Jensen, J. (1988). Research and teaching in the universities of Denmark: Does such an interplay really exist? *Higher Education, 17,* 17–26.

Kenny, D. A. (1996). The design and analysis of social-interaction research *Annual Review of Psychology, 47,* 59–86.

Leinster-Mackay, D. P. (1978). The idea of a university: A historical perspective on some precepts and practices. *Vestes, 20*(4), 28–33.

Light, D. (1974). Introduction: The structure of the academic professions. *Sociology of Education, 47,* 2–28.

Lindsay, R. (1999). *Teaching and research-the missing link*? Oxford Brookes University website: www.brookes.ac.uk/services/ocsd/linkl/research/rtlindsay.html

Linsky, A. S., & Straus, M. A. (1975). Student evaluations, research productivity, and eminence of college faculty. *Journal of Higher Education, 46,* 89–102.

Marsh, H. W. (1984). Students' evaluations of teaching: Dimensionality, reliability, validity, potential biases, and utility. *Journal of Educational Psychology, 76,* 707–754.

Marsh, H. W. (1987). Students' evaluations of university teaching: Research findings, methodological issues, and directions for further research. *International Journal of Educational Research, 11,* 253–388.

Marsh, H. W., & Overall, J. W. (1979). *Validity of students' evaluations of teaching: A comparison with instructor self-evaluations by teaching assistants, undergraduate faculty, and graduate faculty.* Paper presented at the annual meeting of the American Educational Research Association. (ERIC Document Reproduction Service, No. ED 177 205)

Marsh, H. W., & Roche, L. (1993). The use of students' evaluations and an individually structured intervention to enhance university teaching effectiveness. *American Educational Research Journal, 30,* 217–251.

Marsh, H. W., & Roche, L. A. (1997). Making students' evaluations of teaching effectiveness effective. *American Psychologist, 52,* 1187–1197.

Marsh, H. W., & Rowe, K. J., & Martin, A. (2002). PhD students' evaluations of research supervision: Issues, complexities and challenges in a nationwide Australian experiment in benchmarking universities. *Journal of Higher Education, 73,* 313–348.

McCullagh, R. D., & Roy, M. R. (1975). The contribution of noninstructional activities to college classroom teacher effectiveness. *Journal of Experimental Education, 44,* 61–70.

McDaniel, E. D., & Feldhusen, J. F. (1970). Relationships between faculty ratings and indices of service and scholarship. *Proceedings of the 78th Annual Convention of the American Psychological Association,5,* 619–620.

McInnis, C. (1992). Changes in the nature of academic work. *Australian Universities' Review, 35,* 9–12.

Miller, M. M. (1996, April). *Role conflict among university faculty*. Paper presented at the annual meeting of the American Educational Research Association, New York City.

Mooney, C. J. (1991, May 8). Professors feel conflict between roles in teaching and research. Say students are badly prepared. *Chronicle of Higher Education,* pp. 15–17.

Moore W. E. (1963). *Man, time, and society*. New York: Wiley.

Neumann, B. (1992) Perceptions of the teaching-research nexus: A framework for analysis, *Higher Education, 23,* 159–171.

Neumann, R. (1994). The teaching-research nexus: Applying a framework to university students' learning experiences. *European Journal of Education, 29,* 323–339.

Olson, D., & Simmons, A. J. M. (1996). The research versus teaching debate: Untangling the relationships. *New Directions for institutional Research, 90,* 31–39.

Pedhazur, E. J., & Schmelkin, L. P. (1991). *Measurement, design, and analysis: An integrated approach.* Hillsdale, NJ: Erlbaum.

Ramsden, P. (1998). Managing the effective university. *Higher Education Research and Development, 17,* 347–370.

Ramsden, P., & Moses, I. (1992). Association between research and teaching in Australian higher education. *Higher Education, 23,* 273–295.

Rowland, S. (1996). Relationships between teaching and research. *Teaching in Higher Education, 1,* 7–20.

Sample, S. B. (1972). Inherent conflict between research and education. *Educational Record, 53,* 17–22.

Scriven, M. (1980). The Evaluation of College Teaching. Professional Development. Occasional Paper Number 3. (ERIC Document Reproduction Service No. ED203729)

Scriven, M. (1981). Summative teacher evaluation. In J. Millman (Ed.), *Handbook of teacher evaluation* (pp. 244–271). Beverley Hills, CA: Sage.

Scriven, M. (1988, March 13). Evaluating teachers as professionals. (ERIC Document Reproduction Service No. ED300882)

Scriven, M. (1994) Using student ratings in teacher evaluation: Evaluation perspectives. *Newsletter of The Center for Research on Educational Accountability and Teacher Evaluation, 4,* 1–4.

Shore, B., Pinker, S., & Bates, M. (1990). Research as a model for university teaching. *Higher Education, 19,* 21–38.

Smelby, J. C. (1998).Knowledge production and knowledge transmission: The interaction between research and teaching at universities. *Teaching in Higher Education, 3,* 5–20.

Sullivan, A. V. S. (1996). Teaching norms and publication productivity. *New Directions for Institutional Research, 90,* 15–21.

Trice, A. J. (1992, June 17) The tensions between teaching and scholarship. *Chronicle of Higher Education,* p. B4.

Volkwein, J. F., & Carbone, D. (1991, November). *A study of research and teaching orientations in twenty-seven academic departments: The impact on undergraduates.* Paper presented at the annual meeting of the Association for the Study of Higher Education, Boston, MA. (ERIC Document Reproduction Service No. ED 339 332)

Volkwein, J. F., & Carbone, D. A. (1994). The impact of departmental research and teaching climates on undergraduate growth and satisfaction. *Journal of Higher Education. 65,* 147–167.

Webster, D. (1985). Does research productivity enhance teaching? *Educational Record, 66,* 60–62.

Webster, D. (1986). Research productivity and classroom teaching effectiveness. *Instructional Evaluation, 9,* 14–20.

Wood, P. (1978, March). *Student and peer ratings of college teaching and peer ratings of research and service: Four years of departmental evaluation.* Paper presented at the annual Meeting of the American Educational Research Association, Toronto, Canada. (ERIC Document Reproduction Service No. ED007 347)

Woodhouse, D. (1998). Auditing research and the research/teaching nexus. *New Zealand Journal of Educational Studies, 33,* 39–53.