

# Organizational models of veterinary colleges in the Americas

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Universities currently offer many more opportunities for education, research, and use of technological innovations than ever before. Tools to investigate and deliver services have been increased greatly by virtue of several new closely related phenomena. More scientific information is generated now than was generated a few decades ago, as reflected by increases in the number of publications per year. Information is rapidly disseminated as a result of the use of remote computer-based access to libraries and other sources of information. New technologies and scientific information facilitate lifelong learning and long-distance education. Worldwide electronic universities now are feasible, allowing worldwide access to study programs, research projects, and services.

These changes offer new possibilities and challenges for veterinary education. It is questioned whether veterinary academic institutions are prepared in terms of organization and function to respond to these changing environments. These questions have not been assessed on an international basis. To respond to these questions, it was necessary to establish

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Supported in part by the Department of Education, College of Agriculture and Life Sciences, Cornell University.

The authors thank Dr. Evelyn Weber Polack for assistance with the survey.

an evaluative paradigm that would be methodologically reliable and valid, yet would allow researchers to generate theories and hypotheses.

Because of the lack of theoretical models that provide standards for comparison, evaluations may be implemented without a previously defined standard by the use of descriptive, multisite studies. Reciprocal comparisons can be used to infer implicit organizational models. The greater the diversity of the units in the study, the greater the chance of detecting differences and of identifying implicit models. Thus, international comparative exploratory studies are meant to generate questions that have their basis in theory or in empirical findings.<sup>1,2</sup> Although comparative studies cannot prove or disprove theories, they may facilitate the development of implicit models that can lead to confirmatory studies. Theory generation, then, is a necessary initial step leading to the evaluation of programs and policy analysis of veterinary organizations that deal with higher education. Theory generation is a critical focus in research-based development of academic and professional practices and is an objective that may be facilitated by formative evaluation theory. Formative evaluation approaches are based on the assumption that it is more informative to measure factors affecting inputs and outputs (eg, processes) than to measure inputs and outputs themselves (ie, summative evaluation).<sup>3</sup>

In the study reported here, we attempted to determine the current organizational structures of veterinary colleges. Descriptions of the implicit organizational model of educational institutions from a research perspective may improve evaluation processes and policy planning. Determination of the current status of academic organizations and, particularly, identification of processes associated with performance may facilitate accountability and enhance the ability of institutions to attract public and private funding. Thus, the study attempted to explore whether a process-based evaluation of veterinary colleges could be used to generate a theory regarding organizational status. Although each factor selected to be measured was specifically narrow to describe an educational organization, it was hoped that, as a whole, assessment of all factors could be used to facilitate generation of inferences.

## Materials and Methods

Qualitative and quantitative research methods were used to address whether indicators of academic inputs, values, and processes were related to indicators of academic

performance.<sup>4</sup> Qualitative methods were used to assess policies for academic promotion, as indicated in faculty handbooks. Quantitative methods were used to obtain additional data by means of a survey. The survey contained items related to academic missions, inputs, values, processes, and outputs. We defined veterinary colleges as systems that attempt to conduct certain missions and that receive inputs and conduct processes that result in selected outputs (Fig 1).

Inputs are variables associated with policy (eg, human and economic resources). Motivations for faculty members to conduct their work (personal values) might be regarded as intermediate products closely associated with each college's reward system (academic values). Processes included communication among faculty members, learning styles promoted by each college, and evaluative procedures to assess performance. Outcomes included number of research publications and number of graduate students trained.

Academic missions were assessed by means of a survey question that asked whether teaching, conducting research, providing services, a combination of these missions, or other various missions were the primary goals of the institution. Academic inputs were defined as potential economic resources (as reflected by the per capita gross national product<sup>5</sup>) and human resources (expressed as percentage of faculty members with postgraduate education). Values promoted by the college's reward system (academic values) were elicited from questions addressing perceptions on current criteria for selection and promotion of academic personnel. Values measured were subjectivity (nonacademic factors that influenced academic promotion, such as gender, ethnicity, age, or religion), seniority (years of service), postgraduate education achieved by an academician, extent of research grants proposed, and record of publications. An identical list of values ideally expected by academicians to be considered by promotion boards (personal values) also was measured. Differences between personal and academic values provided an indicator to summarize the extent of discrepancy (high difference) or concordance (low difference). This indicator was identified as academic cognitive dissonance.<sup>6</sup>

Academic process variables included perceived satisfaction in relation to interfaculty communication (within and outside each college), evaluation frequency, and profile of learning styles (eg, emphasis on rote memorization, critical thinking, or self-directed learning). These categories were referred to as communication, evaluation, and education, respectively.

Values and process variables were measured (scale, 1 to 5; 1, lack of emphasis or satisfaction; 5, full emphasis or satisfaction). Mean values of specific process variables were used to create a composite index of process variables.

Academic outputs were classified into 2 categories: mean number of peer-reviewed publications per academician during the 2 years preceding the survey (representing performance of research implementation) and mean number of graduate students advised per academician during the academician's career (representing graduate student training performance).

The survey was submitted to 980 faculty members of veterinary colleges that differed in institutional mission, number of faculty body, and language-related cultural background. Of the 10 veterinary colleges selected, 3 were located in the United States (Cornell University, Ithaca, NY; North Carolina State University, Raleigh; and Washington State University, Pullman) and 1 each in Canada (Ontario Veterinary College, Guelph), Mexico (National Autonomous University of México, Mexico), Costa Rica (National University, Heredia), Venezuela (Central University, Maracay), Brazil (Federal University of Paraná, Curitiba), Argentina (National University, La Plata), and Uruguay (University of the Republic,

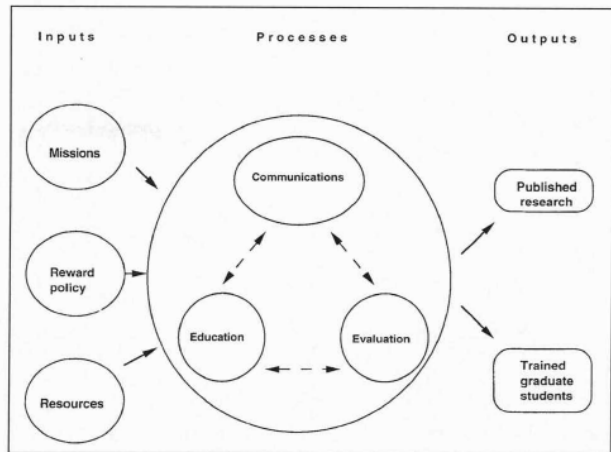


Figure 1—Diagram of a model for educational institutions. Colleges of veterinary medicine are regarded as organizations in which outputs depend on inputs and academic processes.

lic, Montevideo). During the second half of 1993, questionnaires were sent to all active faculty members of colleges that had  $\leq 100$  members (except Ontario Veterinary College) and to at least three fifths of the faculty members (chosen at random) of those colleges with  $\geq 100$  faculty members (including Ontario Veterinary College). Confidentiality was ensured by making the questionnaire anonymous.<sup>7</sup> The survey was developed, validated, and pilot tested<sup>7</sup> by use of an interactive process that involved faculty members from Cornell University (5), North Carolina State University (4), the Federal University of Paraná (1), and the University of the Republic (1). This purposive sample of academicians included 5 tenured and 6 nontenured faculty members (4 women, 7 men). The final questionnaire contained 200 items including closed and open-ended questions.<sup>8</sup> Questionnaires were printed in the official language of each country (English, Portuguese, or Spanish). Because the purpose of the study was to assess an evaluative instrument, not to assess performance of veterinary colleges, results did not identify each specific college.

Survey reliability was assessed by use of Cronbach's alpha test.<sup>8</sup> Correlation analysis and regression methods were used to determine associations among variables. Mean scores for value and process variables were analyzed by use of Student's *t*-tests. Data were analyzed, using statistical software packages.<sup>b,c</sup>

## Results

Four hundred five of 980 questionnaires were returned (mean response rate per college, 45%). Not all of the returned questionnaires were completed. Results reported here were on the basis of responses for 375 completed questionnaires. Analysis indicated a Cronbach's alpha value of 0.86. Alpha values<sup>8</sup> of  $\geq 0.80$  are indicative of a reliable survey.

Perceptions regarding the emphasized academic missions indicated that 5 of 6 Latin American colleges emphasized professional teaching. One hundred seventy of 250 (68%) of the respondents from these 5 colleges chose this option (minimum per college, 25/47, 53%; maximum per college, 75/87, 86%), whereas of the 4 colleges in the United States and Canada, most of the respondents chose teaching, research, and serv-

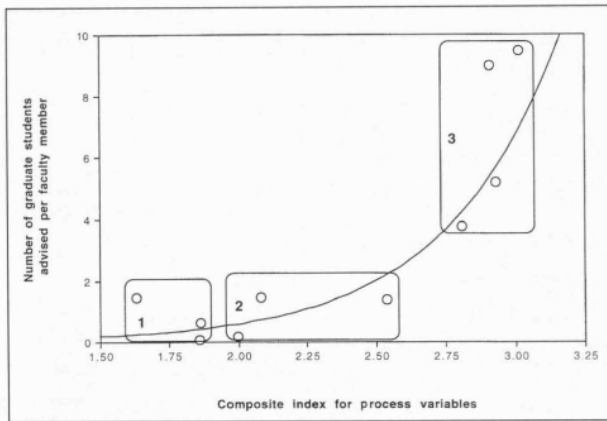


Figure 2—Relationship between academic processes and performance, as measured on the basis of the number of graduate students trained at 10 colleges of veterinary medicine. Composite index of processes was calculated as the mean of all process variables (education, communication, evaluation) for 375 respondents. A scale (1 to 5) was used to indicate degree of satisfaction (1, lack of satisfaction; 5, full satisfaction). Values reported are the mean number of students trained during an academician's career. Analysis of data suggested that 3 clusters were evident.

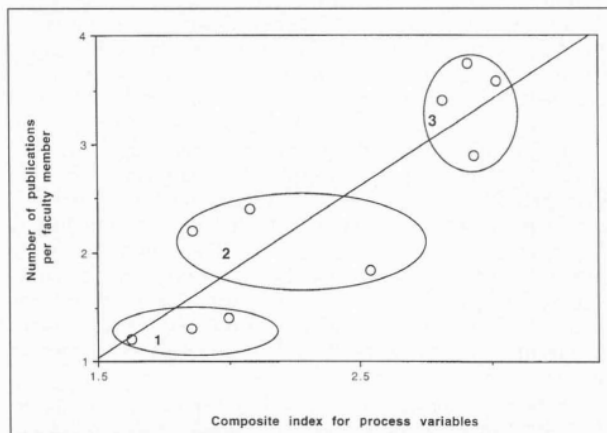


Figure 3—Relationship between academic processes and performance, as determined on the basis of the number of research publications at 10 colleges of veterinary medicine. Number of peer-reviewed publications was the mean number of publications per academician published in the official national language for that institution during a 2-year period. Analysis of data suggested that 3 clusters were evident.

ices (103/131, 79% [minimum per college, 28/47, 60%; maximum per college, 27/30, 90%]).

The composite index of process variables correlated positively with outputs (correlation coefficient for graduate student training and research publications, 0.86 and 0.73, respectively).

Analysis of the data was suggestive of 3 organizational models in the investigated colleges. One model (traditional; cluster 1) consisted of institutions whose faculty members had reported an emphasis on teaching professional students, had a low percentage of full-time faculty members or a low percentage of faculty members with degrees other than DVM (ie,

PhD), had a promotion system based on subjective, academic reward values (eg, seniority), and had a low performance in graduate student teaching and research. The second model (transitional; cluster 2) consisted of institutions whose faculty members had a predominant focus on teaching, an additional research emphasis, and an intermediate level of faculty professionalization (ie, full-time faculty members and faculty members with degrees other than DVM), with faculty promotion determined on the basis of postgraduate training and continuing education in conjunction with subjective values, and had an intermediate research and graduate teaching performance. The third model (diversified; cluster 3) consisted of institutions whose faculty members had diverse missions and a high degree of faculty professionalization, promoted faculty on the basis of future-oriented, performance-based, academic rewards (eg, securing research grants), had low emphasis on collaborative work, and had high research and graduate teaching productivity. Analysis of documented university procedures for selection and promotion of faculty members that were reported in faculty handbooks supported survey findings (data not shown).

Analysis of the data indicated 3 clusters of colleges. Respondents in cluster 1 indicated the lowest composite-process indices and the lowest scores for academic performance, respondents in cluster 2 had intermediate values, and respondents in cluster 3 had the highest values (Fig 2 and 3).

Analysis of respondents' perceptions on current values indicated that subjectivity and seniority were negatively correlated with outcomes (eg, number of publications), whereas postgraduate education, emphasis on preparation of grant proposals, and emphasis on publications were positively correlated with number of publications. Academic cognitive dissonance scores correlated negatively with actual performance (number of publications). Further analysis of reported academic values measured the emphasis toward collaborative versus individual work. For cluster 3 respondents, mean scores of perceptions for current rewards that promoted collaborative behaviors were significantly ( $P < 0.008$ ) lower than scores for rewards that promoted individual work.

Analysis of results of mean scores provided evidence that the model composed of variables including academic processes and values was a reliable indicator for predicted performance. In contrast, potential economic resources expressed as per capita gross national product (GNP; an academic input) did not account for differences among clusters as much as did the level of faculty postgraduate training. Mean per capita GNP for countries with institutions in the traditional model was slightly higher than that of countries with institutions in the transitional model, whereas performance of research training and implementation was much lower in traditional institutions than in transitional institutions (Fig 4). In contrast, another input (faculty expertise) explained performance better than per capita GNP. For instance, the percentage of PhD-trained faculty was 1.65 times higher and research performance was 1.67 times higher for institutions in the transi-

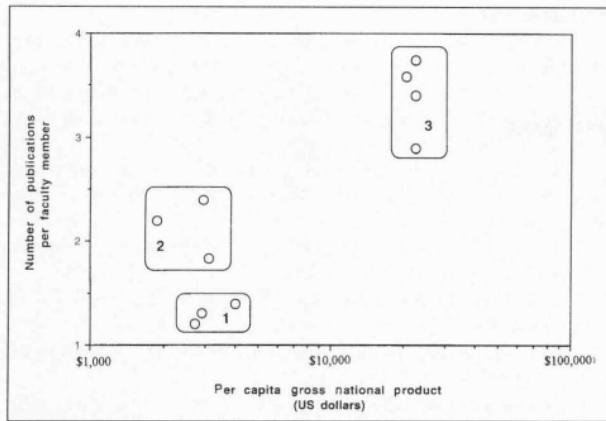


Figure 4—Relationship between per capita gross national product and research performance. Number of publications was the mean number of publications during a 2-year period. Analysis of data indicated that 3 clusters of colleges were evident.

tional model than for institutions in the traditional model.

Although economic resource and faculty expertise inputs were highly correlated with outputs, they were insufficient to explain mechanisms affecting outputs. Performance was better explained by values for academic processes than by values for inputs. For instance, a multiple regression analysis of performance (research) on process variables was highly significant ( $P < 0.0001$ ) and explained almost half of the variation of performance ( $R^2, 0.46$ ).

## Discussion

**Assumptions and limitations**—In the study reported here, we did not test hypotheses regarding organization of veterinary colleges. Given the limited number of performance indicators considered (ie, number of peer-reviewed publications and number of graduate students mentored), the limited number of inputs, processes, and values, the nature of the research instrument (ie, assessment of perceptions), and the potential for various biases inherent to survey-based research, the data should be considered with caution. However, the data provided by this study may be used to generate theories that will require further testing.

**Methodologic considerations**—Analysis of the results of our study suggested that a formative (process-based) evaluation provided a reliable, valid, and explanatory instrument to assess some aspects of academic organizations. Although this study was exploratory and could not test hypotheses, the data obtained was used to generate theories (ie, 3 implicit institutional models), which may help to guide professional development, policy, and educational goals and may aid in the standardization of credentials for domestic and international institutions.

**Educational and communication processes**—Regarding learning styles, it might be expected that graduates educated in institutions in which critical learning was emphasized may have a greater chance of professional success than graduates with a similar grade

point average who were educated in institutions in which critical learning was not emphasized.<sup>9</sup> Similarly, it might be expected that faculty members working in institutions with satisfactory interpersonal communication, especially among faculty members of various disciplines, may have a greater chance of receiving, interpreting, and adopting new scientific information generated outside their own specialty than equally qualified faculty members working in institutions with unsatisfactory interfaculty communication.

**Reward system**—Analysis of our results coincided with a report<sup>10</sup> of undergraduate-level instruction that, in some institutions, revealed a tacit reversal of rewards for teaching and research performance between the time faculty members were hired and the time they were promoted. A dichotomy in rewards given to faculty members between those engaged in collaborative work, compared with those faculty members working individually, suggested a possible underutilization or fragmentation of available knowledge, even in institutions with the highest performance. In some colleges, perceptions of rewards given for individual work suggested that there was a negative reward for collaborative work. This study provided a valid and reliable survey instrument to assess product-oriented rewards (eg, promotions influenced by first-author status in peer-reviewed publications) and intermediate-process rewards (eg, rewards for collaborative work).

**Evaluative processes**—Analysis of the data would suggest that when other things were equal between 2 institutions (eg, economic resources, faculty professional expertise), there may have been differences in the levels of performance according to their evaluative practices. Because evaluation of results feeds the planning process, various factors involving evaluation (frequency, scope, theoretical foundations, audiences targeted, methodologies applied) may be critical for planning. Analysis of these findings would suggest that monitoring processes and evaluative tools may be based on measurements of dissonance (difference between expected vs actual emphasis of a given activity).<sup>6</sup> Reports of investigations in other fields, such as evaluations of job satisfaction among agriculture extension workers,<sup>4</sup> have indicated that high dissonance is associated with job dissatisfaction and poor performance. Altogether, organizational factors seemed to influence academic performance (research, productivity in training graduate students). Thus, the performance of specific faculty members and, collectively, that of the institution were influenced, positively or negatively, by organizational factors. These hypotheses, examined in a quantitative empirical study, could facilitate improvement of the quality of teaching, research, and services.

By focusing on methodologic aspects (eg, assessing the reliability of a process-based evaluative approach), our findings provided a theoretic foundation and provided information useful for developing an organizational policy of colleges. Analysis of our results indicated that when other things were equal, processes may explain outputs. Moreover, when other things

were not equal (when some factors even were unfavorable), processes, when adequate, may be able to compensate and result in a favorable outcome. This was particularly relevant for institutions with scarce resources, because research-based policy that is oriented toward better understanding of the effects of processes on performance may be used to expand the impact of limited resources. However, these findings also were relevant for institutions with more resources, because lack of holistic assessments may have resulted in underutilization of some resources. A policy that places emphasis on monitoring and evaluating academic processes with a focus on integration of organizational factors may lead to improved academic and professional performance.

<sup>a</sup>A copy of the survey and details on methods used are available from the senior author upon request.

<sup>b</sup>SPSS/PC+, version 4.0.1, SPSS Inc, Chicago.

<sup>c</sup>Minitab computer system, version 5.1.1, Duxbury Press, Boston.

<sup>d</sup>Erickson DM. *An examination of the effects of inequity perceptions on the turnover of New York state cooperative extension agents*. MS thesis, Department of Education, Cornell University, Ithaca, NY 1987.

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