Identifying Factors that Influence Instructional Alternatives

in the Undergraduate Classroom

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The traditional undergraduate classroom is being revised and reconstructed to include a variety of instructional methods. For the past two decades, a movement in undergraduate education increasingly questioned traditional and passive styles of teaching. Pressures from various constituents (e.g., policy makers, administrators, parents, students) encouraged institutions and professors to use new methods that increase student participation and promote student learning beyond short-term memorization (Paulsen & Feldman, 1995). These innovations, typically defined as student-centered, concentrate on the needs of the learner and their active involvement in the learning process.

Instructional research across all disciplines encourages faculty to use methods in the classroom that incorporate active learning principles, and many constituents believe promoting active and student-centered learning practices in the classroom enhance undergraduate education. However, faculty members overwhelmingly rely on lectures (Chen, 2002). Research is limited in the area of faculty role behavior and influences on the use of student-centered teaching, but several initial studies suggested personal attributes of instructors, academic discipline, and the organizational/work environment significantly influenced the use of active teaching methods and teaching motivation (Blackburn & Lawrence, 1995; Colbeck et al., 2002; Einarson, 2001; Fairweather & Rhoads, 1995; Singer, 1996).

The purpose of this study was to explore the characteristics of faculty, institutions, and academic disciplines that are related to innovation in undergraduate instruction and instructional
motivation. This study asked the following research question: What academic attributes influence the use of instructional alternatives and teaching motivation in the undergraduate classroom? The study specifically evaluated how the use of student-centered learning differed based on the instructor's perceptions of their institution's instructional climate, perceptions of the undergraduate students, scholarly productivity, gender, race, graduate student experience, years of employment, tenure status, salary, total hours taught, and the institutional enrollment.

Further, this study investigated how student-centered learning differed across disciplines by using Holland Personality Types—Social, Artistic, Enterprising, and Investigative—to differentiate faculty disciplinary groups for analysis. The Holland Personality types identify academic environments by focusing on the environmental settings and personality types of the individuals who create them. Specifically, Holland's Social environments emphasize social interactions and community; the Artistic environments emphasize literature and the arts; the Investigative environments emphasize analytical, scientific, and mathematical competencies; and the Enterprising environments emphasize attainment of organizational goals, leadership development, and economic gain.

This study was guided by the following three research questions.

What academic attributes influence the use of student-centered learning in the undergraduate classroom?

Within each disciplinary type, does the use of student-centered teaching methods and teaching motivation differ depending on the instructor's scholarly productivity?

Do individual and institutional characteristics influence student-centered learning differently by discipline using Holland's Personality types?

To answer these research questions, I used responses to the 1999 National Survey of Postsecondary Faculty (NSOPF-99) as my database and analyzed data to identify the academic
influences on student-centered learning. In addition, I used a nested model comparison method to highlight the differences across the disciplines.

College Instruction

In undergraduate courses, a conventional approach to teaching centers on the common college lecture. The professor transfers knowledge to the student and achievement is assessed based on retention of facts. This model is contrasted with one of engaged learning. Many researchers concluded that typical methods of instruction have not maximized student learning and failed to recognize differences in learning needs and styles (Astin, 1963; Pascarella & Terenzini, 1991; Stage, Muller, Kinzie, & Simmons, 1998).

National organizations, higher education institutions, and faculty understand that traditional methods do not serve current students and exclude many students from the complete benefits of the undergraduate experience (Barr & Tagg, 1995; Caprio & Micikas, 2002). New teaching methods focus on measuring long-term student learning (outputs) instead of the transfer of knowledge (inputs). Innovations in college instruction concentrate on engaging learning instead of producing lectures. Instruction strengthens learning by encouraging active instead of passive learning. In the literature, there are several names for these methods (e.g., constructivist, experiential learning, problem based learning). For this study, the term active learning describes all methods that involve students in the instructional process and encourage student empowerment in the learning process.

Even though instructional theorists and others promote the use of student-centered teaching methods, clear evidence exists that faculty still heavily rely on the lecture format. In reporting the teaching practices of faculty, Chen (2002) used the 1999 National Study of
Postsecondary Faculty (NSOPF-99) – a nationally representative survey of U.S. faculty members conducted by the National Center for Educational Statistics every six years since 1988. Chen (2002) noted that a majority of faculty (over 80%) used lecture as the primary format in at least one of their undergraduate classes. However, Chen found that faculty used various other active instructional methods. For instance, labs and clinics were used in addition to lecture in their undergraduate classes. To assess student learning, 40-60% of faculty used a variety of methods: multiple-choice exams, student evaluation of work from their peers, revised drafts of student work, and assignment of term/research papers in the classroom. Chen (2002) distinguished several differences across disciplines. Not surprisingly, the fine arts and health sciences exhibited higher use of labs in college instruction compared to other disciplines. The health sciences also used fieldwork more than other disciplines. Chen provided a starting point in understanding the differences in college instruction. This study uses causal modeling which provides a more complete picture of the use of instructional alternatives in the undergraduate classroom. The updated NSOPF-99 also includes new information on faculty that was not included in Chen's study. These new opinions and perceptions can further our understanding of instructional practices.

Across all disciplines, research on undergraduate instructional methods overwhelmingly supports the use of student-centered learning techniques (Cusick, 2002; McKeachie et al., 1986; Treisman, 1992; Wisker et al., 2001). Faculty use a variety of methods to implement student-centered learning innovations in the classroom. Among those learning methods described in recent literature include constructivist techniques, problem based learning, student assisted teaching, collaborative learning, and experiential learning (Cantor, 1995; Gardner & Baron, 1999; Kedrick, 1996; Leonard, 2002; Miller, Groccia, & Miller, 2001; Pezdek, 2002).
Environmental and Individual Characteristics Influencing College Instruction

Students, employers, administrators, and national organizations increasingly advocate that faculty members incorporate active learning in the undergraduate classroom (Association of American Colleges, 1985; Boyer, 1987; Centra, 1993; Curriculum Research and Evaluation, 1999; Paulsen & Feldman, 1995; Taylor, 1999). Typical research in this area focuses on how instructional innovations maximized student learning (Bonwell & Eison, 1991; Boyer, 1987; Cusick, 2002) or how faculty motivation promoted teaching excellence (Blackburn & Lawrence, 1995; Fairweather & Rhoads, 1995; McKeachie, 1990). Little is known about the environmental conditions that encourage multiplicity of instructional activities. In their call for future research, Blackburn and Lawrence (1995) noted that the National Study of Postsecondary Faculty (NSOPF) may provide further insight into the environmental conditions that impact teaching. Several researchers also noted that work is needed to understand how characteristics of the individual and the environment combined influence faculty work (Blackburn & Lawrence, 1995; Colbeck, Cabrera, & Terenzini, 2001; Einarson, 2001). Limitations in the literature present several problems for scholars trying to explain the characteristics and influences on faculty teaching behavior and workload. Furthermore, administrators may find such a study helps their understanding of how individual and environmental characteristics enhance or hinder the scholarship of teaching (Boyer, 1987).

Research in this area serves several purposes. A causal model of college innovations in undergraduate instruction might assist in identifying how administrative actions (e.g., workload, assignments, tenure, compensation, statements of purpose, or campus initiatives) affect instructional techniques in the classroom. As researchers assess the impacts of innovations on
student learning, a model that distinguishes the individual and environmental influences on active learning may 1.) increase research on student learning and learning outcomes assessment in the undergraduate classroom; 2.) help researchers identify what hinders student-centered approaches; 3.) highlight the differences in teaching methods in faculty and institutional characteristics; and 4.) consequently drive policy.

Conceptual Framework

Research in college teaching encourages faculty to use innovations in the classroom that incorporate active learning principles (French & Russell, 2002; Garvin & Snyder, 2001; Henderson & Buising, 2002; Keys, Horner-Johnson, & Weslock, 1999; Krockover et al., 2002). However, faculty members continue to rely on lectures (Chen, 2002). Research is limited in the area of faculty role behavior and teaching methods, but several initial studies suggested personal attributes of instructors, academic discipline, and the organizational/work environment significantly influence the use of active teaching methods.

To develop the conceptual model for this study, empirical studies of faculty work behavior were used to identify variables that impact faculty teaching roles. For instance, Fairweather and Rhoads (1995) structured factors based on several policy perspectives in the literature. Einarson’s (2001) study of influences on undergraduate teaching methods, also identified socialization variables that impact teaching behavior. However, she divided variables based on personal, disciplinary, and organizational influences. Other than socialization, researchers have used self-motivation to identify instructional and research behaviors (Blackburn & Lawrence, 1995; Colbeck, Cabrera, & Marine, 2002). Research used to develop the conceptual framework includes the following:
Factors from Policy Perspectives. Fairweather and Rhoads (1995) structured factors based on several policy perspectives in the literature: graduate school interventions, an individual’s fit with the institutional mission and work environment, scholarly productivity, and institutional rewards.

Personal, Disciplinary, and Organizational Factors. Einarson’s (2001) study of influences on undergraduate teaching methods, also identified socialization variables that impact teaching behavior. Since Einarson (2001) developed a path model to analyze her study, her model was influential in developing the final conceptual model—See Figure One. The variables used in the model were categorized as personal (P), disciplinary (D), and organizational (O).

Perception of the Instructional Climate and Undergraduate Student. Institutional policies that reward teaching, encourage professional development, and allocate resources toward instruction are often noted as factors that develop a strong teaching climate (Blackburn & Lawrence, 1995; Boyer, 1987; Fairweather & Rhoads, 1995).

Scholarly Productivity. Social role and conflict theories predict that an increased research workload will decrease time spent on college instruction. However, several studies determined that there is little relationship between scholarly productivity and teaching excellence (Paulsen & Feldman, 1995). Colbeck’s (1998) qualitative study analyzing how faculty integrate teaching and research, concluded that many faculty use expansion—fulfilling two roles at once—where teaching and research roles conflict.

Methods

Structural Equation Modeling was used to analyze a secondary data source—The 1999 National Study of Postsecondary Faculty. LISREL was the primary statistical method to test the
Figure One – Model of Teaching Alternatives and Motivation (adapted from Einarson, 2001)

Socializing Influences:
P=Personal
D=Disciplinary
O=Organizational

Criterion of Analysis: Discipline Affiliation. Separate models will be run based on five Holland Personality Types: Artistic, Investigative, Realistic, Enterprising, and Social

Institutional Characteristics (O)

Teaching Assignment (O)

Perception of Institution (O)

Perceived Teaching Climate (O)

Perceived Quality of Undergrad Student (O)

Teaching Motivation

Teaching Importance

% of Time Prefer Teaching

Use of Tech

Primary Teaching Method

Undergrad Ind. Study

Outputs

Graduate Experience (D)

Employment Status (P)

Scholarly Productivity (D)
validity of the hypothesized model and illustrate the interrelationship between variables. Two models were simultaneously analyzed—the measurement model and relationship model.

Data File & Selecting the Sample Population. The 1999 National Survey of Post Secondary Faculty (NSOPF-99) data set provided information for over 18,000 faculty members at 960 postsecondary institutions (83% response rate). It contained information on academic backgrounds, salaries/benefits, future plans, perceptions of institution, and teaching methods. I included full-time faculty from four year institutions who taught an undergraduate credit-bearing course during the Fall Term of 1998. The final sample size for this study was 7,347. Table One outlines the criterion used to select the data, and the number of selected cases left after applying each criterion.

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # of faculty members in NSOPF-99</td>
<td>18,043</td>
</tr>
<tr>
<td>Four year institution</td>
<td>12,297</td>
</tr>
<tr>
<td>Indicated instructional duties</td>
<td>11,656</td>
</tr>
<tr>
<td>Principal activity teaching or research</td>
<td>9,517</td>
</tr>
<tr>
<td>Indicated with faculty status</td>
<td>9,010</td>
</tr>
<tr>
<td>Taught undergraduate course</td>
<td>7,347</td>
</tr>
</tbody>
</table>

Identifying Disciplinary Affiliations. Disciplinary affiliation was used as the criterion for comparative analyses in this study. I grouped disciplines using Holland's personality types as recommended by Smart, Feldman, & Ethington (2000). Using The College Major Finder (Rosen et al., 1989), I divided disciplines into five of the six Holland personality types (Realistic,
Investigative, Artistic, Social, and Enterprising). The Conventional group (N=255) and Realistic group (N=372) were omitted because few college majors relate to this personality type. Table Two provides the final sample size for each Holland personality group.

Table Two: Sample Size for Each Holland Personality Classification

<table>
<thead>
<tr>
<th>Holland Personality Classification</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigative (e.g., biology, chemistry, physics, economics)</td>
<td>2,218</td>
</tr>
<tr>
<td>Artistic (e.g., art, language, music, and theater)</td>
<td>1,599</td>
</tr>
<tr>
<td>Social (e.g., history, political science, education, social work, and philosophy)</td>
<td>2,131</td>
</tr>
<tr>
<td>Enterprising (e.g., journalism, marketing, management, and computer science)</td>
<td>772</td>
</tr>
<tr>
<td>Total</td>
<td>6,720</td>
</tr>
</tbody>
</table>

Comparing Differences across Disciplines. In SEM, researchers use nested models to compare models or to compare differences across groups of models. When models are nested, it means that one (or more) of the paths are programmed to remain equal in all or some of the models while other paths are allowed to be free—not forced to equal a specified value. The resulting chi-square is compared to that of the previous model to evaluate whether the chi-square difference is significant, for the change in degrees of freedom. If the difference is significant, the null hypothesis is rejected. If the difference is not significant, the null hypothesis is confirmed.

The LISREL output included the four models by Holland disciplinary groups for comparison: Social, Enterprising, Artistic, and Investigative. A difference in chi-square was tested each time a selected path was constrained. When no significant difference occurred, the paths were set to remain equal to each other across the four models. When constraining the paths produced significant difference, the path in each model was compared with the other models. For instance, the Social model was separately compared with Enterprising, next compared with
Artistic, and then compared with Investigative to determine where the significance lay.

Subsequently, the Enterprising model was compared with Artistic and then Investigative.

Finally, the Artistic model was compared to the Investigative model. The final outcome of these tests indicated which paths could remain equal to each other and which ones should remain free.

**Dependent Variables**

Two variables were created to adhere to the instructional attitudinal and behavioral scales created by Singer (1996) using the theoretical framework from Menges & Rando (1989): Instructional Alternatives and Teaching Motivation

*Instructional Alternatives.* Four variables calculated from NSOPF-99 measured the instructional alternative dependent variable: 1.) principal instructional method; 2.) student contact with instructor through email and the internet, 3.) contact hours with undergraduate independent study; and 4.) variety of outputs (i.e., assignments, exams, papers) in the classroom (Centra, 1993). These four variables were used as a multiple measures to create a latent construct – Instructional Alternatives.

*Teaching Motivation.* Teaching motivation variable was included as a dependent variable as well. This variable used two items from NSOPF-99: preference to teaching in their career and preference in percentage of time devoted toward teaching (Singer, 1996). These two variables were used as multiple measures to develop the latent construct – Teaching Motivation.

**Independent Variables**

Seventeen items from NSOPF-99 were used as independent variables, and they were grouped in constructs that coincide with major areas of the conceptual framework (See Table Three). Independent variables for this study were derived from Einarson’s (2001) study on alternative teaching methods and explained in the following table.
Table Three: Independent Variables and NSOPF-99 Item

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>NSOPF:99 Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional Characteristics</td>
<td>Institutional control (public or private); institutional size;</td>
</tr>
<tr>
<td>Sociodemographic Characteristics</td>
<td>Gender; Race</td>
</tr>
<tr>
<td>Graduate Experience</td>
<td>Highest degree; type of institution awarding the degree;</td>
</tr>
<tr>
<td>Employment Status</td>
<td>Years employed; tenure; salary</td>
</tr>
<tr>
<td>Teaching Assignment</td>
<td>Number of classes taught; number of students taught per week; number of hours teaching per week. These variables were used to create a multiple indicator of Teaching Assignment.</td>
</tr>
<tr>
<td>Perceived Quality of Undergraduate Students</td>
<td>Perceived quality of undergraduates; perceived quality of undergraduate education</td>
</tr>
<tr>
<td>Perceived Teaching Climate</td>
<td>Agreement that teaching is rewarded; agreement that teaching effectiveness should be primary criterion for promotion.</td>
</tr>
<tr>
<td>Scholarly Productivity</td>
<td>Total number of articles in refereed journals, book reviews and chapters in edited books, textbooks, and presentations at conferences</td>
</tr>
</tbody>
</table>

Results

When creating and finalizing the Structural Equation Model used for this study, the measurement model was the first component analyzed. The measurement model depicts the configuration between the directly measured variables and the latent constructs—employment status, graduate experience, teaching motivation, and instructional alternatives and resembles a confirmatory factor analysis. Table Four shows the factor loads and error variances (in parenthesis) for all of the latent constructs. The factor loadings for each Holland personality are
presented in the columns of the table, and the direct variables used to measure the latent construct are presented in the table rows. For each latent construct a measure is selected for a starting value of one – the other measures are calculated in relation to it. The first three measures listed in Table Four had little variation. However, the factor loadings for the Instructional Alternatives varied between Holland types. For the Artistic and Enterprising personality types, the use of technology measure had a negative factor loading. This may indicate that the use of technology does not vary widely within these two groups.

Table Four – Measurement Model

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Years Employed</td>
<td>.51 (.83)</td>
<td>.50 (.81)</td>
<td>.46 (.83)</td>
<td>.26 (.99)</td>
</tr>
<tr>
<td>Tenure Status</td>
<td>1.00 (.3)</td>
<td>1.00 (.26)</td>
<td>1.00 (.26)</td>
<td>1.00 (.32)</td>
</tr>
<tr>
<td>Base Salary</td>
<td>.85 (.48)</td>
<td>.91 (.42)</td>
<td>.81 (.48)</td>
<td>.88 (.46)</td>
</tr>
<tr>
<td>Graduate Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td>1.00 (.64)</td>
<td>1.00 (.61)</td>
<td>1.00 (.35)</td>
<td>1.00 (.35)</td>
</tr>
<tr>
<td>Research Graduate</td>
<td>.62 (.75)</td>
<td>.64 (.75)</td>
<td>.53 (.82)</td>
<td>.60 (.77)</td>
</tr>
<tr>
<td>Teaching Motivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Importance</td>
<td>.87 (.82)</td>
<td>.94 (.82)</td>
<td>.71 (.82)</td>
<td>.88 (.83)</td>
</tr>
<tr>
<td>% of Time Prefer Teach</td>
<td>1.00 (.75)</td>
<td>1.00 (.83)</td>
<td>1.00 (.61)</td>
<td>1.00 (.78)</td>
</tr>
<tr>
<td>Instructional Alternatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Use</td>
<td>1.14 (5.08)</td>
<td>-.94 (5.31)</td>
<td>0.42 (4.99)</td>
<td>-.18 (6.68)</td>
</tr>
<tr>
<td>Independent Study</td>
<td>1.00 (.88)</td>
<td>1.00 (.88)</td>
<td>1.00 (.83)</td>
<td>1.00 (.87)</td>
</tr>
<tr>
<td>Teaching Method</td>
<td>1.17 (.96)</td>
<td>.81 (1.03)</td>
<td>.72 (.82)</td>
<td>.66 (.72)</td>
</tr>
<tr>
<td>Outputs</td>
<td>.82 (.80)</td>
<td>.27 (.94)</td>
<td>1.42 (.84)</td>
<td>.81 (1.09)</td>
</tr>
</tbody>
</table>

**The Model**

To achieve model convergence for all four Holland Personality groups, I adapted the original model. This modified model included all of the main variables from the conceptual model; however it included fewer direct measures and fewer paths to latent, independent variables. I originally included the Carnegie Classification as a measure of institutional
classification; however inclusion of the variable continually resulted in unstable models in the LISREL analysis. Therefore, it was dropped from the model. Other institutional characteristics were included, however. The inclusion of institutional control and undergraduate enrollment as independent variables were included and resulted in stable models for comparison.

The model—which is called the base model for comparison purposes—was created by following the Theoretically reasonable modification indices provided in the initial LISREL analysis. Several path changes and error covariance relationships between measures were made to improve model fit.

Fit indices from the output indicated that the global fit of all four individual base models was good. The global chi-square for the model was 1296.86, and the degrees of freedom measure was 552. Chi-Square/Degrees of Freedom Ratio was 2.35 which is less than the suggested maximum of 2.5. In addition, the Root Mean Square Error of Approximation (RMSEA) was .029 which is below the suggested .06 (Schreiber, Nora, Stage, Barlow, & King, 2006). The analysis resulted in a Normed Fit Index of .95, also indicating a good fit. Other indices signified a good fit as well. The Incremental Fit Index was .97, and the Comparative Fit Index was also .97. Both of these measures are higher than the .95 minimum suggested by Schreiber et al. (2006).

Overall, the LISREL analysis for the base model produced data and fit indices indicating a good fit for the base model. The initial model was slightly adapted by changing paths to endogenous variables and including several error covariance relationships to improve the overall fit of the model. These changes and adaptations followed the research and theory of instructional practices and teaching motivation in the undergraduate classroom.
The Structural Aspect of the Model by Holland Personality Type

Next, I present results from the LISREL maximum likelihood estimates that specify the relationships between and among the independent and dependent variables. Table Five presents the estimates for paths between variables, one column for each of the independent variables. The final row provides the explained variance ($R^2$) for each equation. A blank indicates that the model had no direct path from the independent variable to the dependent variable. The following sections further explain the model goodness of fit and the significant relationships for each Holland Personality Type.

Social

Figure Two illustrates the path model for the Social group. The goodness of fit measures for this model indicated a good fit. The Root Mean Square Residual was .037—which is below the suggested .06 maximum. In addition, the Goodness of Fit Index for the Social group was .99 which is higher than the recommended .95 minimum score.

The estimates between the independent variables and the teaching motivation dependent construct indicated that seven variables significantly influenced teaching motivation. Enrollment ($\beta=.1; p<.01$), Non-White ($\beta=-.05; p<.01$), graduate student experience ($\beta=-.28; p<.01$), and scholarly productivity ($\beta=-.08; p<.01$) negatively influenced teaching motivation. The Social group also had three variables that positively influenced teaching motivation: Hours spent teaching ($\beta=.05; p<.01$), perception of undergraduate students ($\beta=.05; p<.01$), and perception of
Table Five – LISREL Maximum Likelihood Estimates for Base Model

<table>
<thead>
<tr>
<th>Ind. Variables</th>
<th>Social</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Investigative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teach</td>
<td>Instrect</td>
<td>Teach</td>
<td>Instrect</td>
<td>Teach</td>
<td>Instrect</td>
<td>Teach</td>
</tr>
<tr>
<td></td>
<td>Motivation</td>
<td>Alternatives</td>
<td>Motivation</td>
<td>Alternatives</td>
<td>Motivation</td>
<td>Alternatives</td>
<td>Motivation</td>
</tr>
<tr>
<td>Private/Public</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.06*</td>
<td>0.0</td>
<td>0.02</td>
</tr>
<tr>
<td>Enroll</td>
<td>-.1**</td>
<td>-.02</td>
<td>-.06**</td>
<td>-.05*</td>
<td>-.05</td>
<td>.01</td>
<td>-.12**</td>
</tr>
<tr>
<td>Gender</td>
<td>-.01</td>
<td>.1**</td>
<td>-.03</td>
<td>-.01</td>
<td>0.0</td>
<td>.04</td>
<td>-.02</td>
</tr>
<tr>
<td>Race</td>
<td>-.05**</td>
<td>-.06*</td>
<td>-.07*</td>
<td>-.09**</td>
<td>-.3**</td>
<td>-.11</td>
<td>-.31**</td>
</tr>
<tr>
<td>Grad. Exp.</td>
<td>-.28**</td>
<td>-.16**</td>
<td>-.14**</td>
<td>-.47**</td>
<td>-.3**</td>
<td>-.11</td>
<td>-.31**</td>
</tr>
<tr>
<td>Employ</td>
<td>-.05</td>
<td>.15**</td>
<td>-.17*</td>
<td>.36**</td>
<td>-.06</td>
<td>.13*</td>
<td>-.02</td>
</tr>
<tr>
<td># of Students</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
<td>.07*</td>
<td>.03</td>
<td>.08*</td>
<td>.10**</td>
</tr>
<tr>
<td># Hrs. Teach</td>
<td>.05**</td>
<td>.08**</td>
<td>.06**</td>
<td>.12**</td>
<td>.03</td>
<td>.08*</td>
<td>.10**</td>
</tr>
<tr>
<td>Percep.</td>
<td>.05**</td>
<td>.02</td>
<td>.01</td>
<td>.01</td>
<td>.04</td>
<td>.04**</td>
<td>.01</td>
</tr>
<tr>
<td>Teach</td>
<td>.10**</td>
<td>.02</td>
<td>.11**</td>
<td>.04</td>
<td>.09**</td>
<td>.03</td>
<td>.17**</td>
</tr>
<tr>
<td>Scholar</td>
<td>-.08**</td>
<td>0.0</td>
<td>-.04*</td>
<td>.01</td>
<td>-.02</td>
<td>.01</td>
<td>-.13**</td>
</tr>
<tr>
<td>R²</td>
<td>.61</td>
<td>.35</td>
<td>.53</td>
<td>.67</td>
<td>.57</td>
<td>.34</td>
<td>.71</td>
</tr>
</tbody>
</table>
Figure Two – Path Model of Social Group

[Diagram showing relationships between public/private, enrollment, gender, race/ethnicity, degree, research grad, yrs. employed, tenure, salary, # of students, # hrs. teaching, view undergrads, teach climate, scholarly product, teaching motivation, % prefer teach, and instructional alternatives.]

Teaching Motivation $R^2 = .61$

Instructional Alternatives $R^2 = .35$

$\rightarrow = P < .01$  
$\longrightarrow = P < .05$
the teaching climate ($\beta = .10; p < .01$). The explained variance ($R^2$) for the teaching motivation was .61.

The maximum likelihood estimates for the instructional alternatives dependent variable had four significant relationships. Women ($\beta = .10; p < .01$), advanced employment status ($\beta = .15; p < .01$), and hours spent teaching positively influenced the use of instructional alternatives ($\beta = .08; p < .01$). The graduate experience of doctoral research graduates negatively influenced the use of instructional alternatives ($\beta = -.16; p < .01$). The $R^2$ was .35 for this group.

Artistic

The path structure for the Artistic group is specified in Figure Three. Like the Social Model, the LISREL output showed that the Artistic group had a good fit. The Goodness of Fit Index was .98; the Root Mean Square Residual was .044—which is below the suggested .06 maximum.

For the teaching motivation dependent variable, the explained variance was high ($R^2 = .53$). The results indicated that five variables negatively influenced teaching motivation: High enrollment ($\beta = -.06; p < .05$); non-white ($\beta = -.06; p < .01$); doctoral research graduate ($\beta = -.14; p < .01$); scholarly productivity ($\beta = -.04; p < .05$); and advanced employment status ($\beta = -.17; p < .05$). Two variables were positively related to teaching motivation. These included number of hours spent teaching ($\beta = .06; p < .01$) and perceived climate for teaching ($\beta = .11; p < .01$).

The Instructional Alternative dependent variable had four significant relationships. Enrollment negatively influenced the use of instructional alternatives ($\beta = -.05; p < .01$). Doctoral research graduates also negatively influenced instructional alternatives ($\beta = -.47; p < .01$). Two variables had a positive relationship with instructional alternatives: Number of years teaching ($\beta = .36; p < .01$) and hours spent teaching ($\beta = .12; p < .01$). This variable also had a high explained
Figure Three – Path Model of Artistic

Teaching Motivation $R^2 = .53$
Instructional Alternatives $R^2 = .67$

$\rightarrow$ = $P<.01$  
$\rightarrow \rightarrow$ = $P<.05$
variance ($R^2=.67$). Four significant paths between the independent variables and the Instructional Alternative dependent variable were the fewest number paths of all four models.

*Enterprising*

The Enterprising Group is presented in Figure Four. The Enterprising group’s Root Mean Square Residual was the highest of all four groups (RMSR = .053). However, it is still lower than the recommended .06 maximum. The Goodness of fit score of .98 indicated a good fit.

This group had fewer significant relationships between the independent variables and the dependent variable. Non-white instructors ($\beta=\-.07; p<.05$) and doctoral graduates from research institutions ($\beta=\-.3; p<.01$) had a negative relationship with teaching motivation. The perceived teaching climate ($\beta=\.09; p<.01$) was positively related to teaching motivation. The explained variance was .57.

Four independent variables were positively related to the use of instructional alternatives for the Enterprising group. Whether the institution was public ($\beta=\.06; p<.05$) significantly influenced the use of instructional alternatives. In addition, advanced employment status ($\beta=\.13; p<.05$); number of students taught ($\beta=\.07; p<.05$); and hours spent teaching ($\beta=\.08; p<.05$) positively influenced the use instructional alternatives ($\beta=\.13; p<.05$). The explained variance for this group was .34. None of these four paths between the independent variables and the instructional alternatives dependent variable had a significance level below .01. However, all four were less than .05. The paths between instructional alternatives and gender, enrollment, perception of undergraduates, graduate experience, and scholarly productivity were not significant.
Figure Four – Path Model of Enterprising

Teaching Motivation

-88

% Prefer Teach

Instructional Alternatives

Tech

Input

Study

Prim.

Method

Outputs

Grad Experience

Teach Climate

Scholarly Prod.

Teaching Motivation $R^2 = .57$

Instructional Alternatives $R^2 = .34$

Public/Private

Enrollment

Gender

Race/Ethnicity

Degree

Research Grad

Yrs. Employed

Tenure

Salary

# of Students

# Hrs. Teaching

View Undergrds

Teach Climate

Scholarly Prod.

-0.07

0.3

0.06

0.07

0.13

0.07

0.08

0.81

0.88

1.0

1.0

0.07

0.88

= P<.01

= P<.05
Investigative

The Investigative group is represented in Figure Five. Like the other models, this group also had good fit indicator scores. The Goodness of Fit Index was .98. The Root Mean Square Residual (RMSR) was .041.

The estimates for the Investigative group indicated that six variables had significant relationships with teaching motivation. Like the previous models, enrollment ($\beta=-.12; p<.01$), non-white ($\beta=-.09; p<.01$), doctoral research graduate ($\beta=-.31; p<.01$), and scholarly productivity ($\beta=-.13; p<.01$) were negatively related to motivation. In addition, hours spent teaching ($\beta=.10; p<.01$) and positive perception of the teaching climate ($\beta=.17; p<.01$) influenced teaching motivation. The explained variance for this model was .71. The highest of all four groups

The use of instructional alternatives for the Investigative group also had several significant relationships. High enrollment negatively influenced instructional alternatives ($\beta=-.05; p<.01$). Five variables, however, had a positive influence on instructional alternatives: Women ($\beta=.04; p<.01$); number of students taught ($\beta=.03; p<.05$); hours spent teaching ($\beta=.08; p<.01$); positive perception of the undergraduate student ($\beta=.04; p<.01$); and positive perception of the instructional climate ($\beta=.04; p<.01$). The explained variance for this group on this variable was the lowest of all four groups ($R^2=.27$).
Figure Five – Path Model of Investigative

Teaching Motivation

Teach Importance

% Prefer Teach

Instructional Alternatives

Tech

Indpndnt Stud

Prim Method

Outputs

Teaching Motivation $R^2 = .71$
Instructional Alternatives $R^2 = .37$

Public/Private

Enrollment

Gender

Race/Ethnicity

Degree

Research Grad

Yrs. Employed

Tenure

Salary

# of Students

# Hrs. Teaching

View Undergrads

Teach Climate

Scholarly Product

Grad Experience

Employment Status

-.09

-.31

-.12

-.10

-.17

-.13

-.05

-.04

.04

.04

.08

.03

-.04

-.49

+.62

1.0

.85

1.0

1.14

1.0

1.34

.74

-> = P<.01

----- = P<.05
Comparison of Holland Personality Groups

After finalizing the base model, the next step was to compare the differences between all four groups (Social, Enterprising, Artistic, and Investigative) and determine which comparisons are significant. I used the nested model method to compare groups. This approach starts with a less restricted model (the base model) and finalizes a more restricted model with a better fit. In this comparison, I restricted the paths between independent variables of interest and the two dependent variables.

Using null hypothesis statements as a guide, I tested 13 paths. If restricting the path to equal values for all four groups produced insignificant change in the chi-square values, the paths remained restricted and the conclusion was that the relationship between variables did not significantly differ across the groups. However, if restricting the path resulted in significant results (p<.05 or p<.01), I conducted further tests to determine specifically which groups were significantly different for that restricted sets of paths. These tests used the following order:

1.) Equalizing the paths for the Social and Enterprising groups.
2.) Equalizing the paths for the Social and Artistic groups.
3.) Equalizing the paths for the Social and Investigative groups.
4.) Equalizing the paths for the Enterprising and Artistic groups.
5.) Equalizing the paths for the Enterprising and Investigative groups.
6.) Equalizing the paths for the Artistic and Investigative groups.

The comparison of results from these tests determined which paths should remain free and which paths remain restricted. After following the process outlined above, the results were implemented and tested to determine if the null hypothesis should be rejected.
The estimates for each path between variables are presented in Table Six. The headers for the columns indicate the Holland Personality group and the two dependent variables. The rows of the table present the independent variables. The final row of the table shows the explained variance, $R^2$ for each equation. Blanks in the table indicates that the model had not direct path from the independent to the dependent variable.

The final LISREL output for this model indicated a good fit for all four models. The chi-square increased from the previous base model ($\chi^2 = 1348.76$), however the Degrees of Freedom also increased to 585. Resulting in a chi-square/degrees of freedom ratio of 2.31. This ratio indicated that the nested model improved the overall fit. The Normed Fit Index remained at .95, and the Root Mean Square Residual slightly decreased to .028. These Goodness of Fit measures indicated a good fit.

Summary of Results

Results from this analysis indicated that several variables affected teaching motivation and the use of instructional alternatives. The variables that significantly influenced teaching motivation included: Institutional enrollment, race, perception of the instructional climate, and scholarly productivity. Employment characteristics—tenure status, salary, and years of employment—also significantly influenced the use of instructional alternatives for three out of the four groups. The nested model comparison of Holland Personality Types also produced significant results. Four variables exhibited significant differences across disciplinary groups: perception of the instructional climate, gender, scholarly productivity, and employment status.
Table Six – LISREL Maximum Likelihood Estimates for Nested Model

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Discussion

Analysis of the models created for this study produced interesting results. Several institutional and individual attributes of faculty influenced the use of instructional alternatives in the undergraduate classroom. For instance, high enrollments negatively influenced teaching motivation and use of instructional alternatives in the undergraduate classroom. In addition, the number of years employed as a faculty member negatively influenced teaching motivation. Both of these outcomes were not unexpected. To further discuss the results of this study, the three original research questions are reviewed and answered in the following paragraphs.

What academic attributes influence the use of student-centered learning in the undergraduate classroom? The attributes that significantly influenced the use of student-centered learning varied depending on the Holland Personality Type. Overall, several factors demonstrated significant influence across all or most of the four groups. The number of hours devoted to teaching was significantly and positively related to the use of instructional alternatives as well as teaching motivation for all four groups. Previous research demonstrated that instructors devote larger amounts of time to instruction typically use a variety of methods to instruct their course and they have greater motivation to teach (Fairweather & Rhoads, 1995; McKeachie, 1990; Paulsen & Feldman, 1995). Spending more time on classroom instruction was also positively related to student-centered instruction. The relationship between teaching motivation and use of instructional alternatives followed the Motivation Systems Theory used by Colbeck’s et al. (2002) study on alternative teaching methods. The significance of this variable confirmed that instructors who devote more time to teaching exhibit higher levels of motivation and strengthen their teaching with a variety of methods.
The graduate experience of the individual faculty member also had significant influence on student-centered teaching. Faculty who came from non-research institutions and who did not hold advanced degrees were more likely to use student-centered instructional techniques but had lower measures of teaching motivation. Other studies also found that academic background of the instructor significantly affected teaching attitudes and behaviors (Einarson, 2000; Fairweather & Rhoads, 1995). Fairweather and Rhoads (1995) discussed the importance of graduate school socialization in influencing the teaching behavior and attitudes of faculty. Through socialization, graduate students learn about the values, attitudes, norms, and skills needed to be an effective member of the faculty. At Research institutions, the socialization of graduate students and faculty tends to favor research over instruction. The significance of the graduate experience variable in this study demonstrated that the effect of socialization of faculty members in graduate school may be an important factor influencing student-centered instruction in the undergraduate classroom.

Gender was another variable that significantly influenced instructional alternatives. For all four groups, women were more likely to use instructional alternatives. There was no significant relationship between women and teaching motivation—the other dependent measure in the model. Across disciplines, gender significantly differed between groups. For the Social group (e.g., philosophy, nursing, psychology), women were significantly more likely to use instructional alternatives ($\beta=.1, p<.01$) than were women in the other three groups ($\beta=.03$). This variable was also significantly related to student-centered learning in Einarson's (2001) and Singer's (1996) studies. Referring to the work of Gilligan (1982) and others (Belenky, Clinchy, Goldberger, & Tarule, 1986), Einarson explained such disparity by attributing different processes of communication, reasoning, and knowledge acquisition for women. In addition, Singer noted
that Feminist scholars suggest that often women approach pedagogy differently by encouraging and facilitating cooperative learning environments and learner-centered activities. The results of this study substantiated the Feminist Pedagogy perspective. Women in the undergraduate classroom appeared to use student-centered attributes that encouraged faculty-student interaction, valued a variety of learning styles, and encouraged active participation in the learning process.

The instructor's perception of the teaching climate at the institution significantly influenced the use of instructional alternatives and teaching motivation. Professors who believed that teaching was rewarded at their institution were more likely to use instructional alternatives and to be more motivated to teach. Additionally, the variable's influence on teaching motivation was significantly higher for the Investigative group (e.g., biology, chemistry, mathematics).

Blackburn and Lawrence (1995) found that perception of instructional climate was an important factor influencing time spent on teaching. If faculty believe that instruction is not rewarded, they will be less motivated to teach and to use student-centered instructional methods. In her study on active learning methods, Einarson (2001) found that that perception of the instructional climate had no significant influence on teaching. On the contrary, results from this study indicated that perception of the instructional climate had a stronger influence on teaching motivation than on instructional methods, possibly meaning that the instructor's perception of the instructional climate influences teaching motivation and sequentially enhances the use of instructional alternatives. This data indicated that institutional context and instructional rewards are important to keep faculty motivated because it improves their perception of the institution's instructional mission and encourages the use of instructional alternatives.

*Within each disciplinary type, does the use of student-centered teaching methods and teaching motivation differ depending on the instructor's scholarly productivity?* Scholarly
productivity significantly and negatively influenced teaching motivation for all four groups. However, scholarly productivity had very little influence on the use of instructional alternatives. Results from this study also found that the influence of scholarly productivity on student-centered teaching significantly differed by academic discipline. Like perception of the teaching climate, the Investigative group (e.g., math and science) significantly differed from the other three. Scholarly productivity also had a stronger, more negative influence on teaching motivation for the Investigative group.

The effect of scholarly productivity on teaching effectiveness is often debated in the literature. Studies on faculty workload indicated that faculty spend less time on teaching when they spend more time on research (Jordan, 1994; Yuker, 1984). This is often the view of social role and role conflict theorists. Role expectations typically predict individual behavior. If faculty believe their role as researchers is more important than as teachers, they will spend more time on research activities than on teaching. However, a meta-analysis conducted by Feldman (1987) found that scholarly productivity has a small positive effect on teaching effectiveness. In addition, Colbeck (1998) found that scholarly productivity’s influence on teaching depended on the context and conditions of the institution and the academic discipline.

Results from this study indicated that scholarly productivity does not affect teaching methods, however it does influence the professor’s instructional attitudes and motivation. Like Colbeck’s conclusion, this study validated the idea that the influence of research on teaching depends on the context of the institution and the context of the academic disciplines. As noted by Clark (1975), faculty have role expectations from the organizational culture of their institutions and expectations from their disciplines. Often, faculty must balance the context of the discipline and the institution. The significant relationship of the two independent variables—
scholarly productivity and perception of the instructional climate—indicated that faculty must balance their research expectations and their role as teachers.

The significantly larger negative influence of scholarly productivity on teaching motivation for faculty from the Investigative group demonstrated that faculty from this cluster typically have high expectations of research that negatively affect the individual's teaching motivation. This corroborates Colbeck's (1998) conclusion that the context of the academic discipline may influence how scholarly productivity influences student-centered teaching. This also follows Holland's Personality types. The Investigative academic environments have strong orientation toward intellectual pursuits, scholarly work, and academic rigor (Smart et al., 2000).

*Do individual and institutional characteristics influence student-centered learning differently by discipline using Holland's Personality types?* Yes. The Holland's Personality Types proved to be very useful in distinguishing significant differences by academic discipline. Using the Holland Personality Types as the principal criterion for analysis, this study found differences in how characteristics (i.e., scholarly productivity, perception of the instructional climate, gender, and years of employment/salary) affect student-centered learning. The usefulness of Holland's theory was also demonstrated by several studies conducted by Smart (1976; 1982), Smart et al. (2000), Richards, Seligman, and Jones (1970), and Peters (1974).

For instance, the analysis found several significant differences between Investigative disciplines and the other groups. For disciplines in the Investigative group (e.g., chemistry, engineering, economics), the instructor's perception of the instructional climate had a significantly higher influence on teaching motivation than for the other three groups. Using Holland (1966), Smart, Feldman, & Ethington (2000) characterized the Investigative academic environments as valuing intellectual and academic goals. This may explain why instructors from
this group significantly differ from the other groups. If faculty from Investigative disciplines believe that the institution places high value on instruction, they will be more motivated to spend time on instruction to advance the academic goals of the institution. If institutions value teaching, the Investigative faculty are more likely to also enhance their teaching to advance the academic and intellectual goals of the institution.

Limitations

Some limitations to this study exist. Using NSOPF-99 provided access to comprehensive information regarding faculty. However, it did not provide specific information on instructional methods used in the classroom. From the data set, this study could only provide a general view of faculty instructional practices. The data set also collected information on faculty instructional practices from the Fall of 1998. It does not reflect some of the innovations that have occurred in college instruction since 1999. The quantitative nature of the study also presents several limitations. This study provides a framework for future studies, but it does not offer a model that predicts the use of instructional alternatives. In addition, the variables used in this study do not cover all the factors that may influence the use of instructional alternatives (e.g., personal views of college instruction, personal psychological traits, undergraduate experience). Finally, the study does not employ qualitative research techniques that could provide a deeper understanding of faculty motivation to use student-centered learning and relationships between institutional, individual, and disciplinary characteristics.

Implications

Results from this study offer several suggestions for administrators and researchers interested in college instruction. First, the outcomes indicated that significant differences existed between disciplines. Administrators and policy makers involved in improving the effectiveness
of undergraduate instruction should have an understanding of these differences when targeting specific disciplines to improve instructional practices in the undergraduate classroom. This study confirmed previous research from Smart et al. (2000) that academic environments differ according to Holland’s Personality Types. Understanding disciplinary differences will help administrators to adapt discipline specific initiatives that will enhance undergraduate instruction.

This study serves several purposes. The causal model developed through this study identifies how administrative actions (e.g., workload, assignments, how tenure decisions are made, and salary increases) affect instructional techniques in the classroom. It distinguishes the individual and environmental influences on student-centered learning, and will hopefully promote further research on student learning and learning outcomes assessment. Furthermore, this study helps researchers and administrators recognize disciplinary characteristics that enhance and hinder student-centered approaches. This study provides further evidence that institutional and individual characteristics exist, and these characteristics vary based on disciplinary differences.

Understanding and improving undergraduate instruction has been a focus of many administrators, policy makers, and faculty members through the past twenty-five years. This study adds to our knowledge of disciplinary differences in approaching undergraduate instruction and the academic characteristics that influence the use of student-centered teaching. By gaining further understanding of the influences on college instruction and teaching motivation, we can help institutions and individual faculty members expand their instructional practices and enhance their teaching methods.
Conclusion

This study confirmed that several individual and institutional characteristics influenced student-centered instruction in the undergraduate classroom. Some of the significant variables include: gender, graduate experience, perception of the instructional climate, and scholarly productivity. The study also found that these variables and dependent measures differed based on academic discipline—when using the Holland Personality Types as the classification system. The use of the NSOPF-99 data set and development of the model produced several conclusions for this study.

Based on several theoretical concepts from the literature, the model for this study produced results that clarify the influences on student-centered instruction and teaching motivation. The model's explained variances ($R^2$) were high for several Holland Personality types, and the model's fit produced excellent statistical values. As to be expected, the model could be improved. However, it provides many variables that demonstrated significant influences on the focus of this study.

Understanding and improving undergraduate instruction has been a focus of many administrators, policy makers, and faculty members through the past twenty-five years. This study adds to our knowledge of the disciplinary differences in approaching undergraduate instruction and the academic characteristics that influence the use of student-centered teaching. By gaining further understanding of the influences on college instruction and teaching motivation, we can help institutions and individual faculty members expand their instructional practices and enhance their teaching methods.
References


