Predictors of the Adoption of Educational Technologies by Faculty in the University of Guadalajara Center for Biology, Agronomic and Animal Sciences

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Abstract

The primary purpose of this study was to determine whether personal and institutional characteristics of professors at the University Center for Biology, Agronomic and Animal Sciences (CUCBA) in the University of Guadalajara, Mexico could be used to predict their adoption of computers and the Internet for traditional classroom instruction and their potential adoption of distance education for learning and for teaching. Four variables explained 18% of the variance in professors' adoption of computers and the Internet for classroom instruction. Potential adopters of distance education for learning were more likely to choose distance education for learning via the Internet, report that their highest level of education was a bachelor's degree, report their subject matter discipline as veterinary science, have been teaching longer and were less likely to be self-taught computer users than those who were not potential adopters.

Predictors of the adoption of distance education for teaching were consistent with those identified for the adoption of distance education for learning.

Introduction

The University of Guadalajara is the only public university in the state of Jalisco, Mexico. It has about 50,000 students enrolled in higher education, and 96,300 students attending high school (Universidad de Guadalajara, 1998b). The university’s system of operation is referred to as Red Universitaria or University Net. The net is a system that connects several university centers throughout the state of Jalisco. The university’s mission embraces teaching, research, and extension as a means to promote economic development and scientific advancement similar to the mission of a typical land-grant university in the United States. Most land-grant universities in the United States have a college of agriculture. Likewise, the University of Guadalajara has a University Center for Biology, Agronomic and Animal Sciences (CUCBA).

Only a small proportion of the 10,259 academicians employed by the University of Guadalajara hold graduate degrees. This is a concern of the university as it tries to reinforce the academic culture of the institution (Universidad de Guadalajara, 1998c). What options are available to enhance the educational level of faculty in the University of Guadalajara? Carr (1999) indicates that Mexican national universities with graduate programs, universities in other countries, and distance learning are options.

Providing equal access to education and access to information sources are two additional challenges faced by the University of Guadalajara (Universidad de Guadalajara, 1998b). Computers, the Internet, and distance education may be useful tools in addressing challenges faced by the university. Educators in Mexico have found that the advantages of modern technologies help them to cope with both old and new challenges at the higher education level (Alvarez-Manilla, 1996). As with any new technology, even those with obvious advantages, securing adoption by a majority of the population is not an easy task. Adoption takes time, the amount of which is influenced by individual decision-making processes, the individual’s level of innovativeness, and the rate of adoption in the system (Rogers, 1995). Are faculty in the CUCBA ready to adopt these technologies? Faculty readiness is an important consideration because resistance by faculty can be a major barrier to technology implementation (Dillon and Walsh, 1992). Researchers (Faseyitan & Hirschbuhl, 1992; Masiclat, 1992; Wu, 1996; Yarbrough, 1986) have examined factors that influence educators’ adoption of instructional
technologies. The question that still remains, however, is what factors might influence CUCBA professors’ adoption of educational technologies for traditional classroom instruction, for distance learning, and for distance teaching?

**Purpose and Objectives**

The primary purpose of this study was to determine whether personal and institutional characteristics of professors at the University Center for Biology, Agronomic and Animal Sciences (CUCBA) in the University of Guadalajara, Mexico, could be used to predict their adoption of computers and the Internet for traditional classroom instruction and their potential adoption of distance education for learning and for teaching. The objectives of the study were as follows:

1. Describe selected demographic characteristics of CUCBA professors.
2. Describe CUCBA professors’ interest in computers and their interest in distance education for learning and for teaching.
3. Describe how CUCBA professors were using computers for traditional classroom instruction.
4. Identify predictors of CUCBA professors’ adoption of computers and the Internet for traditional classroom instruction.
5. Identify predictors of CUCBA professors’ potential adoption of distance education for learning and for teaching.

**Procedures**

The target population (N=234) included all full-time and selected part-time professors who taught at least one course in any of the majors offered by CUCBA. A list of all technical and academic personnel (N=341) was provided by the CUCBA administration. The list of technical and academic personnel was reviewed by department heads and secretaries to eliminate names of persons not involved in teaching. All members of the target population were surveyed.

The questionnaire was developed by the researchers. It contained 100 questions and was organized into six sections. A variety of question types were used including Likert-type items, closed-ended questions, partially closed-ended questions, and open-ended questions. Included in the questionnaire was a computer and Internet self-efficacy instrument. This instrument was developed after reviewing similar instruments developed by Murphy, Coover, and Owen (1988), Delcourt and Kinzie (1993), and Faseyitan and Hirschbuhl (1992). The computer and Internet self-efficacy instrument contained 17 Likert-type items with response options ranging from 1 (not confident) to 5 (most confident).

Content and face validity for the questionnaire were established by a panel of experts from CUCBA and Iowa State University. To enhance design and clarity, the questionnaire was field-tested with a group of 10 Spanish-speaking graduate students at Iowa State University. These graduate students had previously been employed as professors of agriculture at universities in Mexico and other Latin-American universities. Five of the graduate students completed the questionnaire a second time four weeks later. The coefficient of stability for this test-retest procedure was .81. The computer and Internet self-efficacy instrument was not included in the test-retest procedure. Instead, Cronbach’s alpha was calculated on data received from the actual survey and resulted in a coefficient of .95.

Data were collected in the spring of 1998. The questionnaire along with a cover letter and an ink pen were distributed to all persons in the target population. The ink pen was intended to be an incentive for participation in the survey. Cultivando el Futuro, CUCBA, Universidad de Guadalajara (Cultivating the future, CUCBA, University of Guadalajara), was printed on the pen. Most professors received their materials when they went to the treasurer’s office to collect their paycheck. Materials were delivered to the offices of the remaining professors. Approximately two weeks after initially distributing the questionnaires, nonrespondents were sent a written reminder and a replacement questionnaire. A total of 159 useable questionnaires was returned for a response rate of 68%. Nonresponse error was addressed by comparing early and late respondents (Miller & Smith, 1983). Early respondents (n=124) were those who returned their questionnaire within
two weeks. The remaining 35 respondents were considered late. Comparisons were made on professors’ adoption of computers and the Internet for traditional classroom instruction, professors’ potential adoption of distance education for learning and for teaching, and professors’ computer and Internet self-efficacy. No significant differences were found and the results were deemed generalizable to the population.

Analysis of Data

All data were analyzed with the SPSS for Windows, version 7.0, personal computer program. Davis’ (1971) descriptors were used to interpret the magnitude of all measures of association. Because of the exploratory nature of the study, the alpha level was set \( \alpha = .10 \). In preparation for the stepwise regression analysis and discriminant analysis procedures that were used, variables at the nominal level were coded into a set of dummy variables (Norusis, 1990). Measures of association between the predictor variables and the dependent variables and among the predictor variables included Pearson correlations, point biserial correlations, biserial correlations, and phi coefficients.

Findings

Objective 1. Describe selected demographic characteristics of CUCBA professors.

Most (89%, \( n = 135 \)) of the professors held full-time positions in the CUCBA. A majority (57.6%, \( n = 91 \)) of professors held master’s degrees as their highest level of educational attainment, 27.2% (\( n = 43 \)) held the bachelor’s degree and 15.2% (\( n = 24 \)) held the Ph.D. degree. The professors were, on the average, 38.7 years of age with a standard deviation of 7.3 and had completed 9.9 years of service to the CUCBA with a standard deviation of 7.4. The most frequently cited area of expertise reported by the professors was biological sciences (43%, \( n = 68 \)) followed by agronomical sciences (30%, \( n = 48 \)), veterinary sciences (17%, \( n = 26 \)), social sciences (6%, \( n = 9 \)), and mathematic and exact sciences (4%, \( n = 7 \)). Almost three fourths (74.2%, \( n = 118 \)) of the professors were male.

Objective 2. Describe CUCBA professors’ interest in computers and their interest in distance education for learning and for teaching.

Most (90%, \( n = 141 \)) of the professors at CUCBA were very interested in learning more about computers and 99% (\( n = 151 \)) were interested in improving their skills in using some software. More than three fourths of the professors (82%, \( n = 120 \)) were planning to restructure their courses to use computers more extensively.

A majority (60%, \( n = 92 \)) of the CUCBA professors considered distance education as an option for their own education. These professors noted such advantages as time management, practicality, availability when local attendance is not an option, ability to maintain family and career responsibilities, and a reduction in the need to travel. Slightly more than one fourth of the professors (26.2%, \( n = 40 \)) did not consider distance education as an option for their own education. They noted concerns about the lack of interaction, a preference for on-campus study, and concerns about quality. Approximately half (49%, \( n = 75 \)) of the professors at CUCBA were interested in teaching courses at a distance.

Objective 3. Describe how CUCBA professors were using computers for traditional classroom instruction.

A majority (67%, \( n = 102 \)) of CUCBA professors frequently or very frequently used computers to prepare for classes, 54% (\( n = 82 \)) required students to use computers in completing homework, 31% (\( n = 47 \)) taught with computers, and 5% (\( n = 7 \)) used electronic mail to deliver class materials and to communicate with students.

Objective 4. Identify predictors of CUCBA professors’ adoption of computers and the Internet for classroom instruction.

Professors’ adoption of computers and the Internet for traditional classroom instruction was measured with a 5-point Likert-type scale consisting of five statements. Response options ranged from 1 (never) to 5 (very frequently). Professors provided a mean score of 2.5 with a standard deviation of .8 on the scale.
Twenty-nine independent variables were considered for inclusion in a stepwise multiple linear regression analysis. Eleven of these were significantly correlated with adoption of computers and the Internet for traditional classroom instruction and were used in the analysis. Associations ranged in magnitude from low to moderate. It was determined that four variables explained a statistically significant unique proportion of the variation. These were (1) computer and Internet self-efficacy, (2) sharing experiences and knowledge about computers with other people, (3) professors’ use of an Internet account, and (4) whether professors were planning to restructure courses to increase their use of computers in the classroom. The four variables explained 18% of the variance in professors’ adoption of computers and the Internet for classroom instruction (Table 1).

Table 1
Stepwise multiple regression of adoption of computers and the Internet for traditional classroom instruction on the significant independent variables.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>R²</th>
<th>R² Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer software and Internet self-efficacy</td>
<td>.11</td>
<td>.11</td>
</tr>
<tr>
<td>Sharing experiences and knowledge about computers</td>
<td>.15</td>
<td>.04</td>
</tr>
<tr>
<td>Plan to restructure courses for more computer use</td>
<td>.17</td>
<td>.02</td>
</tr>
<tr>
<td>Use of an Internet account</td>
<td>.18</td>
<td>.01</td>
</tr>
</tbody>
</table>

Objective 5. Identify predictors of CUCBA professors’ potential adoption of distance education for learning and for teaching.

Professors’ potential adoption of distance education for learning was measured by the professors’ response to the question “Do you consider distance education as an option for your own education?” A majority (60%, n = 92) of professors responded affirmatively whereas 26% (n = 40) responded negatively. Data from professors (14%, n = 21) who indicated that they were uncertain about the meaning of distance education were not included in the analysis.

Thirty-six independent variables were examined for possible relationships with professors’ potential adoption of distance education for learning. Of these thirty-six variables, sixteen were significantly related to the dependent variable with magnitudes ranging from low to moderate.

Stepwise Discriminant analysis was used to determine if a linear combination of the sixteen significantly correlated variables could be used to predict adoption of distance education for learning. Out of 159 cases, only 109 were used in the discriminant analysis, due to missing data on the discriminating variables. Of these, 35 belonged to the non-potential adopters group and 74 to the potential adopters group. For the classification of all professors, a mean substitution was used for missing data. The mean discriminant score (centroid) for potential adopters (.46) was significantly different from the mean discriminant score for non-potential adopters (-.98) (Wilks’ Lambda = .68, Chi-square (5df) = 39.78, p<.10) The analysis resulted in an eigenvalue of .46 and a canonical correlation of .56. The most distinguishing characteristics of potential adopters of distance education for learning, when compared with non-potential adopters, can be determined by examining the standardized discriminant function coefficients (Table 2).

Potential adopters were more likely to choose distance education for learning via the Internet, report that their highest level of education was a bachelor’s degree, report their subject matter discipline as veterinary science, have been teaching longer, and were less likely to be self-taught computer users than those who were not potential adopters of distance education for learning.

The discriminant function resulted in an overall correct classification rate of 77%. Potential adopters of distance education for learning were correctly classified 79% of the time whereas non-potential adopters were correctly classified 70% of the time. Random assignment of professors to adoption groups would result in correct classification 50% of the time. Classification of professors using the five
Table 2

Summary of data from the discriminant analysis procedure, predicting potential adoption of distance education for learning

<table>
<thead>
<tr>
<th>Variables</th>
<th>b</th>
<th>s</th>
<th>Group</th>
<th>Centroids</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Would use distance education for learning via Internet</td>
<td>.50</td>
<td>.37</td>
<td>Potential adopters</td>
<td>.46</td>
</tr>
<tr>
<td>2. Highest degree was bachelor’s</td>
<td>.46</td>
<td>.49</td>
<td>Non-potential adopters</td>
<td>-.98</td>
</tr>
<tr>
<td>3. Subject matter discipline: veterinary science</td>
<td>.45</td>
<td>.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Self-taught computer user</td>
<td>-.42</td>
<td>-.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Years teaching</td>
<td>.35</td>
<td>.44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Eigenvalue</th>
<th>R&lt;sub&gt;c&lt;/sub&gt;</th>
<th>Wilks’ Lambda</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.46</td>
<td>.56</td>
<td>.68</td>
<td>&lt;.10</td>
</tr>
</tbody>
</table>

b = standardized canonical discriminant function coefficient.  
s = within-groups structure coefficient.  
R<sub>c</sub> = canonical correlation coefficient.

discriminating variables resulted in 53% fewer errors than would be expected from random classification (tau = .53). Professors’ potential adoption of teaching at a distance was measured by their response to the question, “Do you think you are interested in teaching courses at a distance?” Almost half (49%, n = 74) of the professors answered yes and 24% (n = 36) answered no. Data from professors (28%, n = 42) who indicated that they were uncertain about the meaning of distance education were not included in the analysis.

Thirty-seven variables were examined for possible relationship with the dependent variable. Of these thirty-seven variables, ten had significant associations with the dependent variable ranging in magnitude from low to moderate.

Stepwise discriminant analysis was used to determine the linear combination of these ten significantly correlated variables that most accurately predicted the professors’ potential adoption of teaching at a distance. Due to missing data on the discriminating variables, only 92 of the 159 cases were used in the discriminant analysis. Of these, 30 belonged to the non-potential adopters group, and 62 belonged to the potential adopters group. For the classification of all professors, a mean substitution was used for missing data.

The procedure resulted in the selection of seven discriminating variables from the ten included in the analysis. The mean discriminant score (centroid) for the potential adopters (.57) was significantly different from the mean discriminant score for non-potential adopters (-1.19) (Wilks’ Lambda = .59, Chi-square (7 df) = 45.6, p <.10. The eigenvalue was .69 and the canonical correlation was .64. The most distinguishing characteristics of potential adopters, when compared with non-potential adopters, can be determined by examining the standardized discriminant function coefficients (Table 3).

When compared with non-potential adopters, potential adopters of teaching at a distance were more likely to share experiences and knowledge about computers with other people, to consider restructuring their courses to incorporate more use of computers, to consider distance education as an option for their own learning, and to choose distance education for learning via the Internet and satellite. Potential adopters were less likely to be self-taught computer users and have expertise in sociology.
Table 3

Summary of data from the discriminant analysis procedure, predicting potential adoption of teaching at a distance.

<table>
<thead>
<tr>
<th>Variables</th>
<th>b</th>
<th>s</th>
<th>Group</th>
<th>Centroids</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Self-taught computer user</td>
<td>-.44</td>
<td>-.43</td>
<td>Potential adopters</td>
<td>.57</td>
</tr>
<tr>
<td>2. Sharing experiences and knowledge about</td>
<td>.41</td>
<td>.25</td>
<td>Non-potential adopters</td>
<td>-1.19</td>
</tr>
<tr>
<td>computers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Plan to restructure courses for more</td>
<td>.39</td>
<td>.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>computer use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Subject matter discipline: sociology</td>
<td>-.36</td>
<td>-.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Consider distance education an option for</td>
<td>.35</td>
<td>.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>own education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Would choose distance education for learning via Internet</td>
<td>.34</td>
<td>.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Would choose distance education for learning via satellite</td>
<td>.28</td>
<td>.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$R_c$</th>
<th>Wilks’ Lambda</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>.69</td>
<td>.64</td>
<td>.59</td>
<td>&lt;.10</td>
</tr>
</tbody>
</table>

Note: $b$ = standardized canonical discriminant function coefficient; $s$ = within-groups structure coefficient; $R_c$ = canonical correlation coefficient.

The discriminant function resulted in an overall correct classification rate of 81%. Potential adopters of teaching at a distance were correctly classified 84% of the time whereas professors who are non-potential adopters were correctly classified 75% of the time. Random assignment of professors to adoption groups would result in correct classification 50% of the time. Classification of professors using the five discriminating variables resulted in 62% fewer errors than would be expected from random classification (tau = .62).

Conclusions and Recommendations

CUCBA professors were using computers to prepare for classes and were using computers on a much more limited basis to teach, disseminate materials, and communicate with students. Faculty in previous studies (Nordheim & Connors, 1997; Adam & Wilson, 1996) also were using computers for planning but using them less often as a teaching tool. To promote the adoption of computers and the Internet for traditional classroom teaching at CUCBA, programs are needed to enhance faculty confidence in their ability to use computers and the Internet. Based on Bandura’s (1986) theory, it is recommended that faculty be provided with authentic experiences with computers, be provided access to a network of colleagues with whom to discuss their experiences and knowledge about computers, and be provided with positive reinforcement to recognize their efforts.

Because the University of Guadalajara places a priority on hiring and rewarding faculty with the Ph.D. degree (Universidad de Guadalajara, 1998c), a significant proportion of the CUCBA faculty could benefit from advanced formal education. Distance education may provide a viable option for enhancing the educational level of CUCBA faculty. Faculty expressed interest in distance education for their own education and were very interested in learning more about computers and selected software programs. In planning for potential distance-learning programs, CUCBA administrators should target faculty whose highest level of education is the
bachelor’s degree, have relatively more teaching experience, have expertise in the area of veterinary sciences, and have participated previously in computer training. Administrators should also promote programs delivered via the Internet. In order to appeal to faculty who do not currently consider distance education as an option for their own education, administrators and faculty must address issues of interaction and concerns about quality.

A significant number of CUCBA professors were interested in teaching courses via distance education technologies. The most distinguishing characteristics of this group of faculty were similar to those of faculty who were potential adopters of distance education for learning. In fact, one of the most distinguishing characteristic of faculty interested in teaching at a distance was that they considered distance education to be an option for their own education. It is recommended that CUCBA administrators seek to involve the same faculty at the same time in distance education programs to enhance their educational level and to offer courses to CUCBA clientele. If faculty experience distance education as learners at the same time that they are responsible for teaching at a distance, they may be better prepared to design more effective instructional programs.

References


http://www.udg.mx/docs/realyfutu/SistemaEMS.html

http://wwudg.mx/udg/docs/realyfutu/UDGsActual.html
