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ABSTRACT

This paper reports results of a longitudinal study of faculty (n=85) at three undergraduate institutions in North Dakota that adopted notebook computers for their faculty and students--Valley City State University, Mayville State University, and Jamestown College. Questions examined included the variables that might predict computer use by faculty and differences among institutions and over time related to level of computer use among faculty, faculty computer anxiety, and types of concerns. Faculty completed a questionnaire that included measures of levels of computer use, subjective norms, innovativeness, computer anxiety, and stages of concerns, as well as demographic and computer-related questions; participants received the same questionnaire one year later. In the first phase of the study, the criterion variable, level of computer use, was determined; the predictor variables--age, academic rank, subjective norms, and innovativeness--were compared to the level of computer use. The second phase of the study dealt with technology teaching changes; indicators of change included computer anxiety, faculty and student use of technology, frequency of software use by faculty, and level of computer use. Four tables present data on predictors of computer use, differences among campuses and between pre and post scores, use level, and differences in subjective norms. Contains 19 references. (DLS)

Prediction of and Differences in Computer Use when Universally Available

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Problem

Expectations for faculty members to integrate educational computing into undergraduate teaching are high. Levels of integration among faculty are often low. The universal availability of computers through the adoption of notebook computer for faculty by the University may be one answer. The researcher studied this problem through a survey of faculty at three undergraduate institutions which adopted notebook computers for their faculty and students.

Participants

Longitudinal Study

1. Undergraduate faculty from three small campuses (n = 85).
   - Valley City State University (VCSU) (n = 36)
   - Mayville State University (MaSU) (n = 28)
   - Jamestown College (JC) (n = 21)
2. Respondents answered two questionnaires one year apart
3. Age, Academic Rank, Innovativeness Scale, and Subjective Norms Index determined prior to adoption of notebook computers on any of the campuses.
4. The second questionnaire was used to determine level of computer use.
5. Faculty had had notebooks between six months and one year at the time of the second questionnaire. The three campuses had differing infrastructures and expectations
6. The matched responses from the two surveys were used to determine changes on the three campuses.

Variables

	Dependent	Independent	Demographics
Phase I	Levels of Computer Use	Subjective Norms Innovativeness	Age Academic Rank
Phase II	University	Level of Computer Use Faculty Stages of Concern Student Technology use Faculty Technology Use Computer Anxiety Frequency of Software Use by Faculty	

Questions

1. What variables might predict computer use by faculty?
2. •Are there differences in the following variables because of the differences in the institution and are there differences over time?

    1. What is the level of computer use among faculty at the three institutions?

    2. What happens to the use of computer technology when notebook computers are available to faculty and or students?

    3. Does the faculty's computer anxiety become lower after faculty have had access to the notebooks for a period of time?

    4. Does the faculty and student access to the notebook computers change the types of concerns expressed in the Stages of Concerns Questionnaire (SoCQ)?

Instruments

- Levels of Computer Use scale (LCU) (Marcinkiewicz & Welliver)
- Subjective Norms Scale (Marcinkiewicz & Regstad)
- Innovativeness Scale (IS) (Hurt, Joseph, & Cook)
- Computer Anxiety Index (CAIN) (Simonson, Maurer, Montag-Torardi & Whitaker)
- Stages of Concerns Questionnaire (Hall, George & Rutherford)

Procedures

Participants completed a *Computer Technology in Teaching* questionnaire composed of the above measures as well as demographic and computer related questions. Faculty received the questionnaire prior to the adoption of notebook computers on three undergraduate campuses. The faculty received the same questionnaire one year later. During the interim between the questionnaires, the three campuses adopted notebook computers for all faculty at varying times. One of the campuses also adopted notebooks for all students.

In the first phase of the study the dependent variable, level of computer use, was determined using responses to the second questionnaire. The independent variables; age, academic rank, innovativeness and subjective norms were drawn from responses to the first questionnaire.

The second phase of the study dealt with technology teaching changes on the three campuses. Indicators of this change included: computer anxiety, faculty and student use of technology, frequency of software use by faculty and level of computer use. Data from the first questionnaire was compared to data from the second questionnaire using a linear model with matched pairs. Only data from faculty who responded to both questionnaires were used.

Analysis

In the first phase of the study the LCU scale determined the criterion variable, level of computer use. The predictor variables, age, academic rank, subjective norms and innovativeness, were compared to the level of computer use. The researcher applied a linear regression to the data. Another linear model was then utilized to determine the effect of university on the level of computer use.

In the second phase of the study, a linear model was also used to compare each of variables. An F test indicated differences in the variables among the campuses and differences over time. T-tests were done between the campuses to determine which of the campuses was responsible for the difference.

Results

In the first phase of the study, the data indicated that one variable-- Subjective Norms Index-- was a significant predictor of the faculty's levels of computer use. Two of the remaining variables, Age and Innovativeness Scale, while were somewhat predictive. The last variable, Academic Rank did not add to the predictive value beyond that indicated by Subjective Norms Index, Innovativeness Scale and Age. The researcher applied a fixed effect for university to the data and the predictive value of Subjective Norms Index was no longer significant. The institution at which the faculty was employed had more of an effect on computer use than did the criterion variables.

Table I Predictors of Computer Use

Variable	t-test statistic	Sig. WO/Effects	Sig. W/Effects
Age	-.567	.057	.093
Innovativeness	1.952	.055	.135
Academic Rank	-.131	.896	.541
Subjective Norms	2.555	.013 *	.295
	*p< .05		

In the second phase of the study, the matched data indicated significant differences in the campuses over time for several variables including; number of different technology uses by faculty and students and the frequency of software use by faculty. Only one variable, number of student required uses of technology, indicated a difference among the campuses as a whole. The data showed significant increases in level of computer use, number of faculty and student technology uses and amount of software use occurred with the VCSU faculty compared to the rest of the respondents. VCSU was also the only campus which had adopted computers for students during the period of the study. See Table II.

Table II. - Differences Among Campuses and Between Pre and Post Scores

			Differences			
	Among all campuses (F test)	In campuses over time (F test)	In VCSU over time (t-test)	Between MaSU & JC (t-test)	Between VCSU & MaSU (t-test)	Between VCSU & JC (t-test)
Variable						
Computer Anxiety	.822	.188	.617	.106	.119	.771
Level of Use	.430	.092	.048 *	.324	.818	.205
# of Faculty Tech. Uses	.804	.000 ***	.000 ***	.743	.511	.791
# of Student Tech. Uses	.018 *	.000 ***	.000 ***	.571	.008 **	.063
Amount of Faculty Software use	.161	.001 **	.022 *	.058	253	.315
		*p < .05	**p < .01	***p <.001		

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Stages of Concerns

The following interpretation is one part of the research completed on a problem studied through a survey of faculty employed at three undergraduate institutions which adopted notebook computers for their faculty.

Interpretation - Questionnaire I

Interpreting the Stages of Concerns Questionnaire (SoCQ) involved determining the mean of each of the seven concerns and comparing the changes in those means from 1996-1997 for each of the concerns. Charts detailing levels of each concern are available at this web site http://www.vcsu.nodak.edu/offices/titleiii/Links.htm. The following narrative was written using profile interpretations from the *Measuring Stages of Concern about the Innovation Manual*, Hall, George and Rutherford.

When the SoCQ was recorded in 1996, prior to the adoption of the notebook computers, faculty from both VCSU and JC had very similar patterns of concern about computer technology. Both groups indicated they knew quiet a lot about computers and were not threatened by them. They also had minimal to no concerns about managing their use but some concern about the consequences of use for students.

MaSU faculty indicated significantly different concerns including: wanting more information about the computers, intense personal concern about computers and their consequences for them, no concerns about the relationship of students to use and they were more likely to be negative toward the innovation.

Interpretation - Questionnaire II

At the time of the second questionnaire in 1997 the patterns had changed, some significantly. JC's pattern remained nearly the same as the previous year. MaSU had moved into a pattern nearly identical to that of VCSU's and JC's from the previous year. MaSU's greatest concerns were about looking for ideas from others, reflecting more a desire to learn from what others know and are doing, rather than concern for collaboration. VCSU, in the second questionnaire, showed significantly different concerns including, a fairly intense involvement with computers and concerns about a collaborative effort in relation to the other high stage concerns Also some individuals indicated that they already know all about computers and have plenty of ideas.

Discussion

The results of the concerns may be explained by the difference in the culture on the three campuses. Information from the questionnaire indicated several differences on the campuses. First, at the time of the first questionnaire in the Spring of 1996 faculty on the VCSU and JC campuses had significantly more experience with computers than did faculty on the MaSU campus. One year later the difference was no longer significant, probably due to the disappearance of the non-user on the MaSU campus. See Table I.

Table III. - Use Level on Campuses

Institution	# 1996	Mean of Computer Use 1996	# 1997	Mean of Computer Use 1997
MaSU	23	2.91	25	3.56
JC	19	3.79	20	3.85
VCSU	35	3.80	33	3.79
Total	77	3.53	78	3.72

Computer Use in Years 0= non-use 1= < 1 year 2= 1-2 years 3= 3-4 years 4= >5 years

Second, the results of the Subjective Norms Survey indicated that VCSU faculty scored significantly higher than the other two campuses. This indicates the faculty on the VCSU campus perceive the expectations of students, peers, and administration are more important than did other faculty in the study. See Table II

Table IV. - Differences in Subjective Norms Score at the Three Institutions

Institution	Subjective Norms Mean	# of Faculty	MaSU Significance	JC Significance	VCSU Significance
MaSU	50.027	26	--	--	--
JC	50.472	21	.004	--	--
VCSU	56.075	37	.001	.004	--
Mean/ Total	52.802	84			

Third, during the period of the study only VCSU adopted notebooks for their students. Also, the infrastructure of the campus included many rooms capable of multimedia (computer) projection and Internet connections by students. The MaSU campus had plans, the year following the study, to adopt notebooks for their students with the same infrastructure changes as VCSU however, JC had no multimedia capable rooms and had no plans for student adoption.

Length of computer use, perceived importance of student, peer and administration expectations of use and student adoption are thought to be responsible for the cultural differences on the campuses. The differing cultures are thought to have influenced the responses to the SoCQ over the one year period of the study.

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