A Survey of University Faculty Innovation Concerns and Perceptions that Influence the Adoption and Diffusion of a Course Management System

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Survey research was conducted to describe university faculty innovation concerns and perceptions that influence the adoption and diffusion of a course management system (CMS). Significant differences were found between adopters and nonadopters on their perceptions of the CMS attributes, on their Stages of Concern, and on their communication channels. Nonadopters' perceptions and concerns differed significantly across their intent to use the CMS. Implications for theory, practice, and research are discussed.

Keywords: Diffusion of Innovations, Stages of Concern, Course Management System

The need to integrate technology into the teaching and learning process has become a focus in higher education (Groves & Zemel, 2000). Course management systems are being promoted as one tool to improve education by providing flexible learning and more online learning through the use of features that allow the retrieval of educational content, asynchronous and synchronous discussion, administrative functions such as grading and attendance, and tools for assessment and feedback (Ansorge, 1998).

However, after great investments in instructional technology by higher education, including course management systems, with a high usage of computers by faculty and students for research and communication, a growing number of examples of innovative and successful applications, and all the improvements educational technologies were meant to affect, we are still far from realizing technology's full potential (Geoghegan, 1994; Kolbo & Turnage, 2002). The biggest obstacle to the application of technology in teaching has been the faculties' reluctance to use it (Bennett & Bennett, 2003). The support model at the two campus colleges in this study needed to be changed to address the next group of faculty adopters by focusing on their needs and concerns (Buckley, 2002; Donovan & Macklin, 1998).

Therefore, the purpose of this research study was to determine faculty's innovation concerns about a course management system (CMS), faculty's perceptions of CMS attributes, faculty's communication channels, and how all of these factors influence faculty's likelihood of adoption of a CMS. The results of this investigation would inform the development of an action plan and a faculty support model for the continuing adoption and integration of the participating university's CMS, called ANGEL.

Theoretical Framework

Adoption theory presents two major perspectives: micro-level theories that focus on the individual adopter, and macro-level theories that focus on the institution and systemic changes and/or focus on the innovation with a broad range of technologies and practices (Carr, 1999). Both approaches were considered. A micro-level approach would take into account how the innovation affected each individual faculty member. A macro-level approach was warranted for the innovation of the CMS because of the changes it can bring into the higher education system which could affect the traditional methods of teaching and learning.

There are two empirically tested models which can be applied to the study of these theories and their focus on change: the Concerns-Based Adoption Model (CBAM) and the Diffusion of Innovations (DoI). These two models have been used in conjunction with each other to assist support personnel in the development of strategies to positively affect innovation adoption rates and to design appropriate professional development programs (Jennings & Dirksen, 1997; Signer, Hall, & Upton, 2000; Surry, 2002).

Although the CBAM offers three different diagnostic procedures for evaluating individuals' concerns about an innovation and evaluating their uses of it, the Stages of Concern Questionnaire (SoCQ) was chosen as the logical starting point for this research study because the data it generates could be used to design interventions to continue the movement of ANGEL adoption forward. Gaining the knowledge of the faculty's concerns about the CMS would

help to identify the kind of faculty support needed at any given time. The SoCQ has been used extensively in concerns research involving a variety of innovation adoption situations (Khan, 1997).

In taking a macro-approach to understanding the adoption of an innovation, the Diffusion of Innovations (DoI) is a model which can assist in building a potential blueprint for change (Khan, 1997). Everett Rogers defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 2003). Thus, the main elements are the innovation, communication channels, time, and the social system.

The characteristics of innovations, as perceived by individuals, can help to explain their different rates of adoption. Rogers identified these characteristics as relative advantage, compatibility, complexity, trialability, and observability. If an innovation, such as a CMS, is perceived as having greater relative advantage, compatibility, trialability, and observability and less complexity than other innovations, it will be adopted more rapidly. Past research studies have shown these five innovation characteristics, and especially relative advantage and compatibility, to be the most important characteristics of innovations in explaining and predicting the rate of adoption (Rogers, 2003). Rogers recommends that new scale measures of the five perceived attributes of the innovation should be developed in each diffusion study because of the differences in the ways these attributes are expressed in different innovations.

The interpersonal channels used in communicating an innovation from one individual to another provide a subjective evaluation of an innovation among peers (Rogers, 2003). Understanding this social process, identifying the channels used, and promoting this communication can provide a change agent with another means of affecting the adoption process.

Time is reflected in the innovation-decision process as an individual becomes aware of an innovation and moves through towards its adoption or rejection. Time is also involved in the innovativeness of the individual based on their earliness or lateness to adopt compared to the other members of their social system. An innovation's rate of adoption is another function of time and is usually measured as the number of individuals who have adopted it over a period of time.

The final element of DoI is the social system. Separate campuses of a university create large subsystems. The schools and departments within a university create additional smaller subsystems. With a university faculty population, there is a formal structure created by the contract type they are employed under and by their academic rank. In addition, the individuals in a social system do not all adopt an innovation at the same time. Some individuals adopt earlier, others adopt later, and a few may never adopt. Based on when an individual first begins using an innovation, they can be classified in an adopter category as innovators, early adopters, early majority, late majority, or laggards, which becomes a convenient means of description. Combining the time element and the adopter categories allows us to draw a diffusion curve showing the cumulative number of adopters plotted over time on a frequency basis. It usually follows a normal S-shaped curve with a slow initial distribution accelerating to a maximum until half of the individuals in the social system have adopted. Then the increase slows as fewer and fewer individuals continue to adopt.

Research Questions

The purpose of this research study was three-fold:

1. To distinguish the adopters from the nonadopters based on four sets of constructs: individual's characteristics; individual's concerns about the CMS; individual's perceptions of the CMS attributes; and individual's communication channels,
2. To develop a reliable instrument to measure the perceived attributes of a course management system and their influence on its rate of adoption; and,
3. To use the study's findings to develop a new support model for CMS adoption and integration at the university.

The study addressed five research questions:

Q1: Is there a significant difference between the concerns, attribute perceptions, and communication channels of faculty who have adopted the CMS and faculty who have not adopted the CMS?

Q2: Do non-adopter attribute perceptions of the course management system differ across their intent to use it?

Q3: Do non-adopter concerns about the course management system differ across their intent to use it?

Q4: Do the characteristics of faculty differ for those who are using the course management system compared to those faculty who are not?

Q5: Into which adopter category has the CMS adoption progressed to date: innovators, early adopters, early majority, late majority, or laggards?

Methods

In this section, the population and sample, research design, outcome measures, and data analysis procedures are discussed.

Population and Sample

The target population for this research study was higher education faculty. The study was conducted with all full-time and part-time teaching faculty employed for the fall 2004 semester at two campus locations of a large mid-Atlantic research university. A total of 355 surveys were mailed with 161 useable surveys completed and returned for a response rate of 45%.

Data were collected on 20 demographic variables: campus, school, contract type, ANGEL adopter or nonadopter, primary role, academic rank, number of years at the university, age, gender, year last degree was conferred, total years of teaching experience, number of colleges/universities in which full time appointments were held, semester and year ANGEL use began, stimulus that motivated them to use ANGEL, past experience with a different CMS, level of ANGEL use, intent to use ANGEL, receipt of formal ANGEL training, from whom they obtained information that influenced their decision to use or not use ANGEL, and from whom they have sought or might seek information or advice about ANGEL. The last two variables were included to describe the faculty communication channels, a main element of the DoI model.

The sample closely reflected the population in gender, contract type, campus, and school. The largest difference between the population and the sample was in the ANGEL use category with the sample reflecting a much higher percentage of ANGEL adopters to nonadopters than the population. However, this sampling did represent a majority of ANGEL adopters over nonadopters which is also present in the population.

Research Design

The survey consisted of three assessments, the perceived attributes survey from the Diffusion of Innovations, the Stages of Concern Questionnaire from the Concerns-Based Adoption Model, and a demographic instrument.

First, the DoI model focuses on five constructs which define an innovation's perceived attributes: relative advantage, compatibility, complexity, trialability, and observability. While the DoI provides the five innovation attribute constructs, it is the researcher's responsibility to define those constructs within the context of the innovation being studied.

Definitions for the perceived attributes instrument's constructs were studied and items were generated from the researcher's knowledge of ANGEL and from a review of the literature. Empirical studies using perceived innovation attributes were identified and items similar to those identified by Rogers were collected. Items suggested from these studies that matched the attributes of a course management system were included in the new survey instrument. Feedback was received from students familiar with ANGEL in a graduate Program Evaluation course. A modified Delphi process was utilized through the use of two assessment experts in higher education and five ANGEL support specialists to eliminate and modify items. The items were judged on how well they supported the constructs' operationalized definitions, how well they fit the context in which they were being used, how well they reflected actual or potential use by faculty, and the understandability of the wording. Forty items were grouped by construct and a five-point Likert scale was added. Each construct grouping included one reverse-scaled item.

The attributes survey was field tested by seven faculty known to the researcher as early adopters and experienced users of ANGEL. Each of the university's five schools was represented by at least one faculty member. Their comments resulted in the deletion of some items to eliminate duplication, and changes to other items to improve their clarity and to reflect their perceptions of ANGEL's attributes. Minor formatting changes were made to contain the instrument's final 37 items on two pages.

Second, the SoCQ describes the feelings and perceptions of the individuals adopting an innovation within seven intensity levels. These intensities are quantitatively measured within the seven SoC dimensions through the SoCQ. The SoCQ is a quick scoring, 35-item, pencil-and-paper instrument used to assess faculty perceptions, feelings, and motivations relative to the innovation. By recognizing and accommodating concerns through appropriate interventions, the adoption and integration of the CMS should continue successfully.

Third, the SOCQ included an additional page of demographics to gather information about the respondents for sample descriptions, correlation purposes, and description of their communication channels.

Outcome Measures

An instrument to measure faculty's perceptions of a CMS's attributes was conceptualized, designed, and implemented. The Cronbach's alpha test was used to assess the internal reliability of each attribute scale in the perceived attributes survey instrument. Inter-item correlations were run for each construct. Alpha coefficients for the constructs ranged from .708 to .940 indicating strong inter-item reliability (relative advantage = .917, compatibility = .940, complexity = .922, trialability = .708, observability = .815).

Data Analysis Procedures

Quantitative data analysis methods were performed on the SoCQ data including SoC profile comparison, Peak Stage Score, and Second High Stage Score analyses. The means were calculated for the total sample, adopters of ANGEL, and nonadopters of ANGEL. These mean scores were reported in a table for each group and for the total sample, and then graphically displayed on bar graphs. Trends were identified and compared to the Perceived Attributes data and the demographic variables for each individual.

The mean and standard deviation scores for ANGEL adopters and nonadopters were calculated for each perceived attribute construct to describe whether faculty who have not adopted ANGEL perceive ANGEL's attributes differently than the earlier adopters or later adopters. An ANOVA was used to test for statistically significant differences between the groups' perceptions of ANGEL's attributes. Descriptive statistics were used to examine the respondents' distribution across all of the demographic variables. The frequency and percent for each variable were reported in table form.

Limitations

Four important limitations of this study, comparable to limitations in similar studies, should be noted. The study was based entirely within the single context of ANGEL with which the adoption process at the participating university had already been underway for three years. Testing the research questions under different CMSs in different stages of adoption, may increase the study's generalizability to other CMSs and settings. Since this study was not longitudinal, it provided insights into the concerns and perceptions of the respondents at a single point-in-time. A third limitation was that the setting was two campus colleges of a public research university that emphasize both teaching and research. The reality is that research, and its resulting publications, plays a larger role in promotion and tenure decisions in many research universities than does faculty's demonstration of teaching excellence (Anderson, Varnhagen, & Campbell, 1998; Carr, 1999; Hall & Elliott, 2003; Signer et al., 2000). A college, university, or a community college with less emphasis on research and greater emphasis on teaching in promotion and tenure decisions may yield different results in faculty concerns about and perceptions of their CMS. The last limitation, the small size of these two campus colleges and the small sample size, may be limitations to the study's generalizability. Further studies should be conducted with larger numbers of respondents, a larger sample size, and at different types of colleges and universities.

Results

Research was conducted to develop a reliable instrument to measure the perceived attributes of the university's CMS, ANGEL. This instrument, in addition to the Stages of Concern Questionnaire and a demographic instrument, were used to investigate five research questions to distinguish the CMS adopters from the nonadopters based on four sets of constructs: individual's characteristics; individual's concerns about the CMS; individual's perceptions of the CMS attributes; and individual's communication channels. An alpha level of .05 was established a-priori for the statistical tests.

Research Question 1: Is there a significant difference between the concerns, attribute perceptions, and communication channels of faculty who have adopted the CMS and faculty who have not adopted the CMS?

A 2 (adopters/nonadopters) x 7 (Stages of Concern) factorial ANOVA confirmed that the level of concern differs significantly ($F(6, 954) = 16.26$, $p = .000$) between adopters and nonadopters in every stage of concern except Stage 2-Personal and Stage 3-Management. In addition, the means of the CMS adopters and nonadopters are changing differently. The higher the stage scores, the more intense are the concerns at that stage. The adopters' mean percentile scores are lower than the nonadopters' mean scores in Stage 0-Awareness and Stage 1-Informational which can be interpreted as lower concern intensity for those stages. The mean percentile scores for adopters and nonadopters are similar in Stage 2 and Stage 3 which can be interpreted as similar concern intensity. Finally, the adopters' mean percentile scores are higher than the nonadopters' mean scores in Stage 4-Consequence, 5-Collaboration, and 6-Refocusing which can be interpreted as higher concern intensity for those stages. In addition, the nonadopters' mean percentile scores show a greater range in intensity of concerns from Stage 0 to Stage 6 than the adopters' mean percentile scores. The Stage of Concern scores were also significantly different by faculty, as a whole, across the stages.

The peak stage scores and second high stage scores for the CMS adopters and nonadopters were also compared. This comparison showed that the adopters have less intense peak stage scores in Stage 0, 1, and 2, comparable intensity in Stage 3, and more intensity in Stage 4, 5, and 6 compared to nonadopters. This tells us that the adopters are aware of the CMS, have adequate information about the CMS, and have lower personal concerns around the CMS than do the nonadopters. The adopters and nonadopters have comparable intensity of concerns about their use of time and management of the CMS. Although the adopters' concerns about consequence, collaboration, and

refocusing are low in Stage 4, 5, and 6, they are higher than those of the nonadopters. The nonadopters exhibited a typical profile for a nonadopter with their peak stage scores predominantly Stage 0-Awareness and more intense than that of the CMS adopters. Out of the 45 nonadopters, 30 had their peak stage score in Stage 0. The nonadopters mean score for Stage 0 was 84 showing an awareness of the CMS and a relatively intense concern about the CMS.

A 2 (adopters/nonadopters) x 5 (attributes) factorial ANOVA confirmed a significant interaction ($F(4, 636) = 8.76$, $p < .05$). The mean scores of the adopters were always higher than the mean scores of the nonadopters. The users main effect confirmed that significant mean differences existed between the user groups, and the attributes main effect confirmed that significant mean differences also existed across the attribute perceptions for all subjects. Simple effects tests showed a significant difference exists between the means of the five attributes. Faculty adopters of a course management system perceive the five attributes more positively than faculty nonadopters.

Two questions on the demographic instruments dealt with communication channels. Adopters identified more individuals whom they had contacted or whom they could contact for information or advice about ANGEL than did the nonadopters. A majority of the nonadopters identified "no one" or gave no response to these questions. For both groups, the ANGEL support specialist employed by the university was mentioned most often, and the colleagues identified in the question responses had a close proximity or school affiliation with the survey respondents.

Research Question 2: Do non-adopter attribute perceptions of the course management system differ across their intent to use it?

To determine whether the nonadopter perceptions of ANGEL were significantly different by their intent to use the CMS, a 3(intent to use) x 5 (attributes) factorial ANOVA was run yielding an $F(2, 42) = 4.06$, $p < .05$. A significant difference in attribute perceptions by intent to use was found in relative advantage, compatibility, and observability. A post hoc comparison Tukey HSD was run to determine specific significant differences within intent to use categories. Significant differences were found within the relative advantage, compatibility, and observability constructs determining that these constructs are perceived differently by those who intend to adopt sooner than by those who intend to adopt later or who do not intend to adopt at all.

Research Question 3: Do non-adopter concerns about the course management system differ across their intent to use it?

To determine whether the nonadopters' perceptions of ANGEL were significantly different by their intent to use, a 3(intent to adopt) x 7 (Stages of Concern) factorial ANOVA was calculated, producing an $F(2, 42) = 2.10$, $p = .136$. The only stage in which the groups were found to be significantly different was in Stage 0-Awareness. A post hoc comparison was run using Tukey HSD to determine where the significant difference occurred within Stage 0. The only significant difference ($p=.022$) occurred between those who intended to use ANGEL next semester and those who do not intend to use it. Therefore, faculty who intend to adopt ANGEL have relatively less intense concerns about using ANGEL than faculty who do not intend to adopt it.

Research Question 4: Do the characteristics of faculty differ for those who are using the course management system compared to faculty who are not?

The Pearson chi square test showed that the adopters and nonadopters were not significantly different by campus location, contract type, highest degree earned, the year their degree was conferred, or by their primary role. However, significant differences were found by gender, academic rank, previous use of another CMS, school, and whether they had received training in the use of the CMS. Finally, an independent-samples t-test confirmed that the means of adopters and nonadopters did not differ significantly for years at Capital College, age, years of teaching experience, or the number of full-time appointments.

Research Question 5: Into which adopter category has the CMS adoption progressed to date: innovators, early adopters, early majority, late majority, or laggards?

Everett Rogers developed the dominant method of adopter categorization using the criterion of innovativeness, which is the degree to which an individual is relatively earlier in adoption than the other members of the same system (Rogers, 2003). Using the S-shaped adopter distribution, it was determined that CMS adoption at these participating university campuses had progressed into the late majority category based on an adoption rate of 53.8%.

Discussion

Analysis of the SoC data found that the level of concern differs significantly between adopters and nonadopters in every stage except Stage 2-Personal and Stage 3-Management. The analysis of the DoI data found significant differences between adopters and nonadopters in their perceptions of ANGEL's attributes. A significant difference in attribute perceptions for nonadopters by intent to use was found. In addition, adopters and nonadopters differed significantly when compared by gender, academic rank, and school.

Stage 2 concerns involve an uncertainty about the demands of the innovation, the faculty's inadequacy to meet those demands, and their role with the innovation, including their relation to the reward structure of the organization. Stage 3 concerns focus on the process and tasks of using the innovation with issues related to efficiency, organizing, managing, scheduling, and time demands (Hall, George, & Rutherford, 1998). Therefore, one possible explanation for no difference between adopters and nonadopters in these two stages could be that all faculty experience continual demands on their time. Another possible explanation could involve the lack of a reward structure for integrating technology, such as a CMS, into their teaching.

It was surprising to find that the adopters' concerns had not progressed past Stages 2 and 3. It has been suggested that personal concerns may be higher than other Stages of Concern because using a CMS can challenge the instructor's role and control that are characteristic of the traditional lecture class. A possible explanation for the adopters' low intensity of concerns in these later stages could be in their use of ANGEL. Analysis of the demographic data indicates that very few users identify themselves as advanced users of the CMS.

A significant difference was found between attribute perceptions for the ANGEL adopters and nonadopters. The difference showed that the adopters' perceptions of ANGEL reflect higher levels of a relative advantage over the way they used to do things, a compatibility with their teaching, an ease to learn and use ANGEL, an ability to try it before they decided to use it, and an ability to see it demonstrated. In communications with the researcher, the nonadopters have expressed no need to use ANGEL; therefore, they do not perceive a relative advantage. Although these nonadopters use technology for their research and publication activities, most do not currently use technology in their teaching. Therefore, technology integration into their teaching is problematic, and they might not perceive ANGEL to be compatible with the way they currently teach. These faculty may also feel that their use of ANGEL would take away from their face-to-face interactions with their students which would not be compatible with their philosophy of teaching. In addition, most nonadopters have not had an opportunity to try ANGEL and have not observed ANGEL in use.

A significant difference in attribute perceptions for nonadopters by intent to use was found in relative advantage, compatibility, and observability, making these three attributes most important in the nonadopters' decision to try ANGEL. Past research studies have shown relative advantage and compatibility to be the most important characteristics of innovations in explaining and predicting the rate of adoption (Rogers, 2003). Those nonadopters who intended to adopt ANGEL perceived this course management system as having a higher level of relative advantage, compatibility, and observability than did those who did not intend to adopt ANGEL

This study also found that adopters and nonadopters were significantly different when compared by their gender, academic rank, and school. The analysis found a similar number of female (48.3%) and male (51.7%) faculty as adopters, but much fewer female faculty (24.4%) compared to the number of male faculty (75.6%) as nonadopters. This is also true of the study's population. One explanation for this may be that the school with the lowest percentage of adoption, the School of Science, Engineering and Technology, also has the highest percentage of male faculty (85%). However, when comparing the total population in each school by gender and adoption rate, the female faculty have adopted at a higher percentage rate than the male faculty. Two possible explanations for the higher adoption rate by female faculty might be a gender bias on the part of the eLearning Support Specialist responsible for ANGEL adoption and training, or a higher level of confidence in female faculty in their use of technology than other studies have reported. More research in this area is recommended.

More adopters were represented in the academic ranks of assistant, associate, and full professor, and instructor. More nonadopters were represented in the rank of lecturer, which represents part-time faculty. There are several explanations that could account for this difference. One reason could be the lack of a formal communication structure to link faculty support with part-time faculty. Another reason could be that part-time faculty have full-time day jobs that prevent them from participating in professional development opportunities to learn how to use ANGEL. They also have fewer encounters with the full-time faculty.

The adopters outnumbered the nonadopters in each school. This significant difference by school may be explained simply by the lower number of nonadopters responding to the survey. Distributing forty-five nonadopters across six schools diminished their effect in the statistical analysis.

Implications for Theory of CMS Adoption Study

An increased awareness of diffusion's importance and an expanded use of diffusion theories are of potentially great benefit to instructional technology (Surry, 1997). The majority of faculty typically do not seek out campus teaching, learning, and technology centers (Donovan, 1999). However, faculty development personnel must understand the needs and expectations of faculty (Donovan, 1999; Donovan & Macklin, 1998). Therefore, a goal to better understand faculty needs and to learn more about their teaching challenges and work habits can be accomplished through the use of the survey instruments used in this study.

Implications for Practitioners and Researchers of CMS Adoption Efforts

The results of this study showed that CMS adoption at the participating university campuses has progressed into the late majority category based on an adoption rate of 53.8%. This is an important factor to consider in the recommendations resulting from this study. The late majority, also referred to as second-wave and wary adopters, comprise 34% of the adopter population (Rogers, 2003). Their adoption of the innovation represents the first significant turn toward the institutionalization of the innovation. The late majority are more risk aversive than the early adopters, and require a higher level of support (Rogers, 2003). A different support infrastructure is needed for faculty comprising the late majority category than that which sufficed for early adopters (Anderson et al., 1998; Jacobsen, 1998; Parker & Conway, 2000).

Applying these implications to practice, a five-step process proposed by Rogers (2003) can be utilized to support the late majority as these potential adopters pass from first knowledge of ANGEL to its full use. This model has been widely adopted and is fairly typical of the way diffusion scholars presently view the innovation-decision process (Burkman, 1987). During the first step, the knowledge step, faculty are exposed to ANGEL and become aware of it. They will require a clear and positive image of ANGEL that stresses its relative advantage and compatibility. In this study, these are the two attribute constructs where the most significant differences were found between those planning to use ANGEL in the next semester or next year, and those not considering its use. This message should be brief and easy to understand but, at the same time, motivate them to seek more information to alleviate the Stage 0 and Stage 1innovation concerns.

After new faculty become aware of ANGEL and seek more information, the second step of Rogers proposed model known as the persuasion step, opportunities should be made available for them to learn more to continue to alleviate concerns common in Stage 1 and Stage 2. These opportunities would also serve to better inform their perceptions of ANGEL's relative advantage and compatibility.

In the third step of the five-step model proposed by Rogers, the decision step, faculty contemplate their use of ANGEL. Information should be provided which will enable them to envision ANGEL's use within their own context (Hall & Elliot, 2003). This mental trial could be accomplished by providing live demonstrations in each school. No risk/low risk applications of ANGEL through its use in committee and departmental work would provide an avenue for experimentation before faculty decide to use it with their courses.

After faculty decide to use ANGEL, the implementation step, they should be encouraged to begin their use on a small scale. Training and support should continue to be available with faculty development personnel providing personal contact.

In the last step of the proposed model, the confirmation step, the faculty use of ANGEL would be more routine. Faculty support personnel should ask what skills are still needed and learn of faculty's concerns and needs that ANGEL might address. Practice sessions should be provided accompanied by reminders in newsletters and brief follow-up questionnaires. ANGEL use, including its level of use, should be tracked so that teaching and learning advances can be communicated through regular newsletters making faculty aware of the ongoing research in this field, providing examples and evidence for change (Anderson et al., 1998).

Implications for Future Research in the Study of CMS Adoption

Four limitations identified in this research study suggest future research needed in the study of CMS adoption. First, this study should be repeated using different course management systems in different stages of adoption to increase the findings' generalizability. Second, this study should be repeated at the participating university campuses in this current study to gain a longitudinal perspective rather than a single point-in-time snapshot. Repeated administration of the surveys could track the progression of faculty concerns and diffusion of ANGEL. Tracking the attribute perceptions of those faculty who have adopted the CMS could inform researchers if the attributes of relative advantage, compatibility, and observability continue to be the factors that lead them to continue to use a CMS, or if the factors eventually change to something more pedagogically-based. A longitudinal study could also inform faculty support personnel of the impact of the intervening faculty development efforts. Finally, this study should be conducted at different types and sizes of colleges and universities to increase its generalizability to other campus settings and population sizes.

Contributions to New Knowledge in HRD

This research study established an instrument to measure a course management system's perceived attributes to predict its rate of adoption. Better measures for predicting and explaining the adoption of a CMS have great value to faculty development personnel within higher education, as well as CMS vendors. A clearer understanding of which factors actually lead to adoption will help universities create an environment to foster that adoption process. A goal to better understand faculty needs and to learn more about their teaching challenges and work habits can be

accomplished through the use of the survey instruments used in this study. It is hoped that other colleges and universities will be able to utilize the results of this study to assess their CMS adoption efforts.

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