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Utilization of Technical Support by Instructors in Computer-Supported Learning

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Abstract
The role of instructional technologies in educational settings considerably increased in the last decade improving the efficiency of teaching and learning; however, some factors still limit the capabilities of instructional technologies. Among the various limitations, technical support is identified as one of the most significant issues. Therefore, the effectiveness of technical support plays a central role in implementing instructional technologies in academic environments. This research is designed to determine how factors, such as instructors' attitudes toward technology, their academic background, the training they received, and their previous experience are related to their needs for technical support. A paper-based questionnaire was sent out and collected from faculty members from a mid-sized university. The data was analyzed by running a factorial analysis to reveal the possible factors and characteristics of instructors influencing the usage of technical support. Suggestions were made regarding improving the effectiveness of technical support.

Introduction
The effectiveness of technical support in higher education has become an important issue following the growing trend of using instructional technologies for teaching and learning. According to the opinion of educators and students, instructional technologies have dramatically improved teaching and learning in the last decade by assisting teachers in designing, developing, utilizing, managing and evaluating processes and resources for learning. Some limitations of instructional technologies are related to technical support (Li, 2007; Weaver, 2006; Baker 2003). The technical problems teachers encounter in classes could waste time and make the effectiveness of expensive instructional technology questionable (Biscontini, 2008). Therefore, it is critical to improve the effectiveness of educational technologies by reducing the time spent on resolving technical problems experienced by instructors and students in higher education. In most situations, the technical support provided by technicians is the best solution to common technical problems (Sandholtz, 2004). To improve the quality of instruction and users' satisfaction, additional resources, including more technical personnel and training are needed. Budget increases implementing wise technology solutions are effective if they meet common needs of students and teachers (Hurwitz, 2008).

In general, implementation of instructional technologies requires technical support services to be more proactive in network administration, hardware and software troubleshooting, server maintenance, infrastructure monitoring, virus protection and hardware repair. Past studies (Chen, 1997) indicated that ad hoc support, which is conducted when end-users encountered problems, are not effective, but training creates a desired comfort level leading to end-user satisfaction. The latest research argues that the integration of instruction, pedagogy and technology in problem-

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based learning in higher education provides a natural ground for training and technical support (Roisin, 2010). Teachers' readiness to use computerized instruction and their self-actualization in subjects of instructional technology elevates overall satisfaction and the effectiveness of all participants of on-line educational experiences (Oomen-Early, 2009). The real-time technical support is difficult to implement in education; one of the possible solutions is flow chart support systems (Caudill, 2007), providing users with economical on-line help and problem resolution.

Problem Description

The attitude of instructors toward understanding and applicability of educational technologies seems to be a major factor influencing the needs and usage of technical support in higher education. This study focuses on finding factors that may influence the efficiency of technical support in a mid-sized university, such as instructors' attitudes toward technology, their academic background, the training they received and their previous experience. This research investigates how characteristics of instructors, such as negative or positive attitudes toward technology and technical support, influence instructors' usage of technical support at a mid-sized university. By better understanding the factors influencing the usage of technical support, this study intends to make suggestions about how to reduce the time instructors spend on solving common technical problems.

Method

The number of times technical support was used by university faculty in the past three years was obtained from the work log kept by the university help desk. Thirty-two instructors who frequently use technical support were selected for this study. The paper-based questionnaire was used to collect additional quantitative data on participants' equipment training, attitude toward implementation of instructional technology and opinion of technical support.

The collected data was entered into an Excel spreadsheet and encoded to a zero-one matrix where rows of this matrix correspond to participants; columns describe answers/options from the original survey. In the next step, a Matrix Fox external Excel package (Volpi, 2007) was used for the correlation and factorial analysis of encoded data, following the algorithm (Zaidel, 2007) presented below.

Let's compute matrix $R[r_{ij}]$ where r_{ij} is the correlation coefficient between data column "i" and column "j;" i,j = 1, 2, … ,n. For this matrix the eigenvalue-eigenvector equation can be written as:

$$(R - \lambda I)\, x = 0, \quad x \neq 0 \qquad (1)$$

This implies that $(R - \lambda I)$ is singular and hence that

$$\det(R - \lambda I) = 0 \qquad (2)$$

Eigenvalues are roots of the above polynomial equation. Let $\lambda_1, \lambda_2, \ldots, \lambda_n$ be eigenvalues of matrix R and let $X_1, X_2, \ldots\ldots, X_n$ be a set of corresponding eigenvectors:

$$X_j = [\, x_{1j}, x_{2j}, \ldots\ldots, x_{nj} \,] \quad \text{for } j = 1, 2, \ldots\ldots, k;\ k \leq n \qquad (3)$$

In the above model each eigenvector $[X_j]$ explains variability among correlation coefficients in terms of a smaller number of unobservable conglomerate variables called factors. Individual eigenvalues are proportional to the amount of variation explained by the corresponding

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eigenvector in the total variability of the data; the eigenvalue is not the percent of variance explained but rather a measure of the amount of variance in relation to the total variance. Loadings x_{ij} are correlation coefficients between "n" original variables (survey options) and computed factors. Coefficients with the highest absolute values are used to analyze the meaning of each factor.

Data Analysis

Due to the small population of participants, the data collected in this study does not describe all common technical support circumstances, but it attempted to provide a framework and methodology to generalize results in broader situations.

The level of 0.38 was used to determine statistical significance of data correlation matrix. Table 1 contains characteristics of instructors that are highly correlated with the level of technical support used. For example instructors from the School of Education have a low usage of technical support; instructors who strongly agree that technologies are essential to teach have a high level usage of technical support; and instructors who agree that the use of technology helps students to learn have a moderate or high usage of technical support.

Characteristics of instructors are not only correlated to the usage of technical support but correlated to each other as well; the factorial analysis explains complex relations between data. The level of 0.19 was used to determine the statistical significance of eigenvector loadings to select characteristics of each cluster. For each cluster, variables with loadings larger than 0.19 were recognized as the characteristics of the cluster. The eigenvalue of the cluster describes variability of the given eigenvector to the total variability measurements of all conglomerate factors within the subjects surveyed.

We identified seven clusters (and corresponding characteristics) describing approximately 59% variability of the data using conglomerate measurements describing the surveyed faculty:

Cluster 1 explains 13.1% variability of the data.
Variables:

- Use of technology is not essential in teaching my courses.
- Instructional technologies do not make teaching easier in my courses.
- It is not proven that computer-supported learning helps students to learn in my area.
- Instructional technologies do not enhance teaching in my area.

Cluster 2 explains 10.4% variability of the data.
Variables:

- Instructional technologies cannot effectively support all content in my courses.
- Use of instructional technologies makes teaching easier in my courses.
- I use TS in class because technicians can fix technology problems faster than I.

Cluster 3 explains 8.4% variability of the data.

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Variables:

- My area of expertise is in the School of Education.
- The se of instructional technology is essential in my courses.
- The se of instructional technology enhances teaching in my class.
- I call TS because technicians are better qualified than I.
- One of most common problems I have is computer crash.
- Characteristics divided between two options: a) I would rather not fix a problem in class even if I would know how to do it; b) I would definitely fix a problem in class if I would know how to do it.

Cluster 4 explains 7.6% variability of the data.

Variables:

- Technical problems definitely happen too often in my classes.
- I have no opinion on time spent on resolving problems with instructional technology.
- I do not like to attend TS training.
- I will definitely try to solve technical problem in class if there is a guide to follow.
- Most of my technical expertise was gained from my educational background or university training.

Cluster 5 explains 7.3% variability of the data.

Variables:

- Most of the technology problems in the classroom should be handled by technicians.
- I have attended technology training twice in the last two years.
- I call TS because technicians are reliable in their work.
- I will not try to solve technology problems in my class even if there is a guide to follow.
- In the last year I used TS less often than before because I became more familiar with instructional technologies.

Cluster 6 explains 6.6% variability of the data.

Variables:

- Instructional technologies can effectively support classes I teach.
- Using instructional technologies definitely helps students to learn.
- Instructional technologies are not essential to teach courses in my area.
- Technical problems happen very seldom in my class.
- Most of my technical knowledge does not originate from my education.

Cluster 7 explains 5.5% variability of the data.

Variables(8, 30, 63, 80):

- My area of expertise is in Health and Fitness.
- Instructional technologies are not essential to teach my classes.
- I am not consistent in designing computer-supported instruction for my classes
- Most likely I would ask for TS if a problem happens on my computer.

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Table 1.
The characteristics of instructors with the highest correlation coefficients to the level of technical support used (in bold font).

Characteristics of Instructor	Low	Average	High
Teaching area: Education	**0.40**	-0.19	0.17
Teaching area: Fine Arts	0.2	0.24	**-0.42**
Disagree that using technology is essential in my courses	-0.19	**0.41**	-0.24
Agree that using technology is essential in my courses	**0.58**	-0.20	-0.31
Strongly agree that using technology is essential …	**-0.47**	-0.04	**0.47**
Disagree that using technology makes teaching easier	-0.19	**0.41**	-0.24
Not sure that using technology makes teaching easier	**0.40**	-0.06	0.31
Not sure that using technology helps students to learn	**0.38**	-0.09	-0.25
Agree that using technology helps students to learn	**-0.38**	0.13	0.219
Strongly agree that technologies are essential to teach	-0.29	**-0.41**	**0.68**
Disagree that technology enhances teaching in my classes	-0.19	**0.41**	-0.24
Agree that technology enhances teaching in my classes	**0.47**	-0.17	-0.26
Strongly agree that technology enhances teaching …	**-0.38**	-0.09	**0.43**
Strongly disagree that fixing tech problems takes too long	0	**-0.41**	**0.42**
Strongly agree that technicians should handle problems	**0.40**	-0.19	-0.17
Typical problem: no connection to Internet	0.17	0.29	**-0.45**
Typical problem: computer system crash	**0.58**	-0.27	-0.24
Typical problem: common software does not work well	0.29	**-0.41**	**0.68**
The most about technology I learned from technicians	-0.24	**-0.46**	**0.68**

Results

The factorial analysis showed how the opinion about technical support and instructional technology differs among university faculty. Some instructors represent opinions that the technology is not always beneficial for learning, and these instructors are very skeptical about the benefits of instructional technology. They do not have any clear opinion towards technical support, and they are not interested in exploring any related issues. Another group of instructors considers technology as a helpful tool for classes, and they want technical support to be efficient. The main reason they use technical support is that they believe technicians can resolve problems faster. Other instructors are not satisfied with technical support. They think technical problems happened too often in their classes, and they are willing to solve technical problems by themselves if there is a guide to follow.

Training is also a critical part of improving the effectiveness of technical support. Instructors who participated in technical training in the last two years used less technical support than others. Another important finding related to the training is that instructors (mostly from the education department) who believe technology is essential in teaching are willing to solve

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technical problems on their own if they know how to do it. Since training can help instructors solve technical problems on their own, technicians will have more time to focus on complicated problems, and, therefore, be more efficient.

Details of conglomerate cluster characteristics are presented below.

Cluster 1 describes characteristics of the technical support process involving instructors who have a very skeptical approach to instructional technologies and have no prevailing opinion about technical support. These instructors represent opinions that technology is not essential in classes, using technology does not make teaching easier, using computer-supported instructional technologies does not necessarily help students to learn, and using instructional technology does not enhance teaching in classes. This outcome is consistent with the results of previous studies that some instructors are questioning the helpfulness of technology in education. Whether it is because technology is simply not developed enough, or technology does not fit the subjects they teach, or technical support does not meet their requirements is not quite clear.

Cluster 2 describes characteristics of technical support processes involving instructors who are enthusiastic about instructional technology. They believe technology is essential for teaching; they also want technical problems to be fixed as soon as they happen. They strongly agree that the use of technology is significantly helpful in classes, and they will call technicians for help mainly because they believe technicians can solve the problem faster. The possible explanation for this is that instructors who value technology in education tend to use it in their teaching activities. The fact that students are very easily distracted if instruction is interrupted by technical problems seems to be a concern of instructors, and instructors want technical problems to be resolved as soon as possible to keep students focused.

Cluster 3 describes characteristics of the technical support processes involving instructors who believe technology is essential and helpful for teaching. They agree that the use of technology is essential and could enhance teaching in classes. The instructors, mostly from the education department, are definitely willing to try to solve technical problems if they know how to do it or they rather not touch it. This indicates that if instructors have positive attitudes toward technology, they are also active in learning technology.

Cluster 4 describes characteristics of technical support processes involving instructors who are generally not satisfied with technical support and gained their technological knowledge from their own education and training. They think technical problems happen too often in their class and they would try to solve them by themselves if there is a guide to follow. This result shows that instructors' technological knowledge gained from their formal education background is generally not useful. It also suggests that technicians may take different approaches, such as adding on-site-guides, to improve the instructors' ability to use technology and improve their satisfaction with technical support.

Cluster 5 describes characteristics of technical support processes involving instructors who believe technicians will do their job reliably; these instructors attended technical training in the

past. They believe that most technical problems that happen during class should be handled by technicians. They participated in technical training twice in the last two years, and they used less technical support because they became more familiar with the technology they were using. The survey data shows that training is very helpful in making instructors familiar with the technology they use. For this, group training is a very important element in improving instructors' ability to use instructional technology,

Cluster 6 describes characteristics of technical support processes involving instructors who believe that technology plays an important role in education; these instructors require low level technical support. They strongly agree that instructional technology can effectively support courses and can help students to learn. The work log from the help desk also shows that these instructors use less technical support than other instructors. This suggests that instructors' attitudes toward technology can affect their usage of technical support. The positive attitudes toward technology may make instructors more active in learning it. One of the possible conclusions for this group might be that higher technical expertise leads to lower usage of technical support.

Cluster 7 describes a group of characteristics of technical support processes involving instructors who don't believe technology is essential in education; these instructors have marginal experience in designing computer-supported instructions and do not design computer-supported instructions regularly. They are more likely to use technical support for their personal computers. They tend to use technical support mostly for their office and personal computers, which means their knowledge of instructional technology is rather marginal.

Summary

The results of this study demonstrated that providing technical support in real-time is the main concern for instructors because they want technical problems to be solved as soon as possible. The study also found that some instructors are questioning the helpfulness of technology in some courses. Instructors also showed interest in solving technical problems by themselves, which can be a solution for improving the efficiency of technical support. The study indicated that training and on-site-guides could be a practical approach to help instructors solve technical problems by themselves. The study also found that instructors' attitudes toward technology could affect their usage of technical support and the pattern of using it. The results showed that instructors who have positive attitudes toward technology are better trained and used less technical support.

Despite the interesting results this study provided, the sample used in this study was quite small. Consequently, limited numbers of factors affecting the usage of technical support were found. Due to the small sample size, the study also lacked diversity, which made it very susceptible to sampling bias. Thus, generalization of outcomes is limited. However, this study provided a framework for finding factors affecting the usage of technical support.

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