Validation of Technology Acceptance Model in Educational Laptop Settings

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Abstract: *This article focuses on the psychometric stability of the technology acceptance model (TAM) by Davis [8] when applied to laptop usage in the educational settings. Using a survey of 297 users, this research provides evidence that the TAM provides a model for a valid and reliable measure to use among students in assessing their perceptions of laptop usage. Given this evidence, those involved with implementation and training in laptop environment can confidently apply the instrument.*
Keywords: *technology acceptance model; laptop; Validation*

1. Introduction

In an effort to keep abreast with the current trend in higher education, and to meet the needs of students and employers who are actively looking for technologically agile students, a laptop initiative was launched in a college of business at a Midwestern university. The laptop Initiative allows students to access technology and the Internet anywhere on campus. The portability of a laptop also enables more convenient computer access for both students and faculty, and when coupled with classroom set-up for connectivity, enhance onsite learning and classroom experiences. The benefits, drawbacks, and prerequisites of a laptop initiative have been well documented [3, 7, 22, 23 and 25]. The benefits mentioned would only be experienced with acceptance and use of the laptop by the students. The motivation for the study is to better understand the usage perception of laptop in the academic settings.

This paper presents the results of a study conducted as part of an investigation into student satisfaction of laptop usage. The report expands the investigation of the significance of perceptions within the area of educational technology and training by focusing on the analysis of a widely used model in MIS literature, the Technology Acceptance Model (TAM), from the perspective of student computer usage. This type of study will add to the broader applicability of the TAM model for the examination of users' psychological reactions to systems and extends its use into the field of educational technology. *Perceived usefulness* and *perceived ease of use* constructs developed by Davis [8] are used as independent variables in the study. A laptop usage construct is the dependent variable. These items have been worded to test the relationship between student perceptions of the constructs within a generalized concept of laptop.

2. Technology Acceptance Model (TAM)

There has been a considerable amount of studies testing the Technology Acceptance Model in MIS literature. The model attempts to predict and explain system use by positing that *perceived usefulness* and *perceived ease of use* are of primary relevance in computer acceptance behavior [8, 9]. In its original form, the model defined the constructs of *perceived usefulness* as "the degree to which a person believes that using a particular system would enhance his or her job performance, and *perceived ease of use* as "the degree to which a person believes that using a particular system would be free of effort" [8]. These are essentially the same as the "relative advantage" and "complexity" definitions posited by Rogers [24] as two of the attributes of innovation that influence adoption decisions.

A large number of replications and other studies have also validated the TAM using a variety of specific systems [1, 5, 14, 15, 16, 27 and 30]. Based upon these studies a general model for the TAM can be developed including Davis' constructs for perception.

Davis, *et al.* [8] suggest that the "goal of TAM is to provide an explanation of the determinants of computer usage that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations." To that end, several studies have explored the applicability of *perceived usefulness* and *perceived ease of use* constructs to broader system concepts. Taylor and Todd [28,29] studied the applicability of the TAM in the use of a computing resource center (CRC). A sample item from the *perceived usefulness* scale states "Using the CRC will improve my grades," and a sample *perceived ease of use* item states "It will be easy to operate the equipment in the CRC." Igbaria has also investigated the broader applicability of the TAM in his studies on the relationship between *perceived usefulness*, *perceived ease of use*, and microcomputer usage [18, 19]. A sample item from the *perceived usefulness* scale states "Using microcomputers improves my job performance," and a *perceived ease of use* scale item states "I would find microcomputers easy to use."

3. Methodology

3.1 Subjects and Procedure

A survey instrument was administered to several sections of an Information Systems Management class at a Midwestern university. The class is required for all undergraduates majoring in business and includes students from all departments within the business school. Each student was asked to complete the survey at the beginning of a regularly scheduled class meeting. A total of 297 surveys were received, of which 278 were usable. Results of the survey were analyzed using the structural equation modeling program LISREL 8.5.

3.2 Measures

Computer Usage is based on a construct developed by Igbaria [17] [20]. It is measured by two indicators: (1) actual daily use, which asks the respondent to indicate the amount of time spent on a laptop per day using a six-point scale ranging from "almost never" to "more than 3 hours a day," and (2) frequency of use, which is measured on a six-point scale ranging from "less than once a month" to "several times a day." *Perceived Usefulness* is measured by items used in studies by Davis, Bagozzi and Warshaw [9, 10]. Each indicator in the construct is measured on a five-point scale ranging from "strongly agree" to "strongly disagree" as used by Igbaria, *et al.* [17] [20]. The construct's four indicators are: (1) using laptop improves my effectiveness, (2) using laptop improves my performance, (3) using laptop increases

my productivity, and (4) I find laptop useful. *Perceived Ease of Use* is also measured by items used in studies by Davis, Bagozzi and Warshaw [9, 10] on five-point

scales ranging from "strongly agree" to "strongly disagree" as used by Igbaria, *et a*l. [17] [20]. The construct's four indicators are: (1) learning to use laptop is easy for me, (2) I find it easy to get laptop to do what I want, (3) it would be easy for me to become skillful at using laptop, and (4) I find laptop easy to use.

3.3 Analysis

Unidimensionality is a necessary condition for construct reliability and validity. Unidimensionality is demonstrated when the indicators of a construct have an acceptable fit on a single factor model. The evaluation of fit in any one-dimensional measurement model requires a model with some positive degrees of freedom. In a one-dimensional model, a construct must have more than three indicators to achieve positive degrees of freedom. A construct with less than three degrees of freedom is under-identified, has negative degrees of freedom, and cannot be evaluated for fit. One measure commonly used to evaluate fit is the goodness-of-fit index (GFI). The GFI ranges in value from 0.00 to 1.00, with higher values indicating better fit. The GFI's are .90 for *perceived usefulness* and .96 for *perceived ease of us*e, indicating that both constructs demonstrate acceptable reliability. The *computer usage* construct contains only two indicators and cannot be evaluated for fit in a one-dimensional model.

Reliability refers to the relative level of consistency, dependability, predictability, and accuracy of a construct [21]. It is a necessary but not sufficient condition for validity [21]. A construct is considered reliable if its indicators explain the majority of the construct's variation [2]. Three methods which are often used to separately assess construct reliability include coefficient alpha, the composite construct reliability index, and the variance extracted [6, 11, 12 and 13]. Coefficient alpha is a general formula for scale reliability based on internal consistency. It provides a lower bound for the proportion of test variance among construct indicators that may be attributed to a single common factor. A construct is considered reliable if it has a coefficient alpha that is .70 or higher, a construct reliability index of .70 or higher, and a variance extracted of .50 or higher.

Construct	**coefficient alpha**	**construct reliability**	**variance extracted**
Perceived Usefulness	.91	.95	.90
Perceived Ease of Use	.90	.92	.84
Computer Usage	.84	.80	.83

Table 1. Analysis of Construct Reliability

Table 1 shows acceptable reliability of all three constructs. The discriminant validity implies that one construct can be empirically differentiated from other constructs that may be similar [21]. Discriminability may be demonstrated with a chi-square difference test among all possible pairs of constructs. In this test, analyses are performed on two models of a selected pair of constructs. The first model allows

for free correlation between the constructs, and the second model fixes the construct correlation to one. The constructs are discriminable if the difference in chi-squares between the models exceeds the chi-square critical value for one degree of freedom [2]. The chi-square critical value is 7.88 at the .005 significance level. All differences for the three constructs were significant at the .005 level, demonstrating that the constructs exhibit discriminant validity.

LISREL 8.5 was used to test the fit of the hypothesized model against the collected data. Table 2 presents the goodness of fit indexes. The absolute indexes (GFI=.93, AGFI=.89, and RMSR=.042) compare favorably with the values accepted as a good model-data fit [4, 12, 21 and 26]. The Chi-square statistic divided by the degrees of freedom also indicates a reasonable fit at 3.84 [31].

	Recommended	Current Study
Chi-square	< 5	3.84
GFI	> .90	.93
AGFI	> .80	.89
NFI	> .90	.95
NNFI	> .90	.95
CFI	> .90	.96
RMSR	< .20	.042

Table 2. Goodness of fit indexes

4. Discussion

The study developed a LISREL model to examine the validity of the TAM model and Davis' perception constructs when applied to a laptop as opposed to the specific systems used in earlier studies. This relationship was tested to determine if a conclusion could be reached regarding the generality of the TAM model. Demonstrating this generality lends support to the idea that perceptions by the end-users of computing systems are critical to system success (when usage is considered a surrogate for success).

The findings in this study show a strong relationship between the student perceptions their reported usage of laptop in general. This provides support for the use of the TAM model. This analysis provides insight into how much of a system's "success" (when usage is used as a surrogate for success) may be attributed to student *perceptions* of the system being used. Likewise, these results have a strong implication in implementation of information technology in educational settings to provide support and training as well as positive information to students and teachers in an attempt to establish a strong positive perception of these types of systems. Such support and training will provide the foundation for improved and increased use of

computer technologies within education and training settings by providing users with experiences that change their perceptions.

Thus, this paper provides a general assessment of the TAM model and documents its suitability as a valid and reliable measure of technology acceptance in educational setting. The study provides a starting point for researchers interested in using the TAM model to investigate user behavior in these educational settings, as well as establishing a baseline for further research regarding the impact of attitudes and perceptions on the use and adoption of new technological innovations in that settings.

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