# Empirical Investigation on Interface Usage of Citation Database

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**Abstract.** This study seeks to report an investigation into the ways in which end-users perceived citation database interfaces (CDI). The investigation uses the Technology Acceptance Model (TAM) constructs of usefulness and ease of use to assess acceptance of citation database interfaces by university graduate students. A structural equation model was used to fit and validate the Citation Database Interface Acceptance Model (CDIAM) and the results indicate good fit to the data. The causal relationships between the constructs considered by the CDIAM are well supported, accounting for 95% of the total variance in the citation database interface acceptance and usage. This study concluded that usefulness and ease of use for citation database interface are proved to be key determinants of the acceptance and usage of citation database. This study may help explain human-computer interaction using MIS-proven TAM instead of traditional system usability approach.

## 1 Introduction

The interface design of citation databases has been dominated by the use of menus systems, with the majority of citation database interfaces relying on user interaction with menus as the main dialogue structure. Prior research in designing menu interfaces indicates that different ways of menu item organization affect user performance in terms of time, accuracy and user satisfaction, and also reveals that interface usability affects thesaurus browsing/navigation and other information-searching behaviors. Web sites are an increasingly important part of a library's service. As such, it is crucial that they are easy to navigate and deliver the required information in a clear and consistent manner. Human-computer interaction (HCI) with the design, evaluation and implementation of interactive computing systems for human use, is proved to be useful for improving the usability of traditional interactive applications [3]. Determining the psychometric properties of key constructs such as usefulness and ease of use is

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of paramount importance in establishing the quality of user interactions with database interfaces.

This study adopts the Technology Acceptance Model (TAM) and integrates it with theoretical and empirical finding from prior usability research for information system to model the usability of database interfaces. The TAM developed by Davis, et al. [1] has received little attention among HCI practitioners and system designers. However, TAM appears to offer HCI professionals a theoretically grounded approach to software acceptability, which can be directly coupled to usability evaluation [2]. This study asked subjects recruited at National Sun Yat Sen University (NSYSU) and National Kaohsiung First University of Science and Technology (NKFUST) in Taiwan to query two popular citation databases, ABI/INFORM and Science Direct OnSite (SDOS), at university libraries. The primary research questions to be addressed in this study are as follows:

- Would perceived ease of use or perceived usefulness of citation database interface affect on its usage?
- Whether interface language would interfere the strength of perceived usefulness of citation database interface would affect its usage?
- Whether user characteristics such as gender, university would interfere the strength of perceived usefulness of citation database interface would affect its usage?

## 2 Research Method

Three constructs were used as acceptance indicators: ease of use, usefulness, and usage. The usefulness of the citation database interface is defined as "the students' beliefs that using a citation database interface will enhance their searching performance, efficiency, and effectiveness". Ease of use refers to "the extent to which the user expects the use of the citation database interface to be free of effort". The usage of the citation database interface is the intent to use the citation database interface. Students are likely to choose the citation database interface as a research support technology if they perceive that this technology would help them to improve their searching effectiveness and efficiency. Therefore, a useful citation database needs a suitable interface. CDIAM is TAM applied to the citation database interface, therefore the basic TAM hypotheses are to be verified. The first hypothesis tests the relationship between citation database interface ease of use and usefulness. The ease of use is postulated to affect the usefulness of the citation database interface. Accordingly, the following hypothesis is proposed.

**H1.** The ease of use of a citation database interface significantly affects its usefulness.

A citation database interface that is easy to use is likely to be well accepted and used. The second hypothesis tests the relationship between ease of use and the acceptance and usage of the citation database interfaces. The ease of use is postulated to affect the usage and acceptance of the citation database interfaces. Accordingly, the second hypothesis is proposed.

**H2.** The ease of use of a citation database interface significantly affects its usage and acceptance.

If students perceive the interface of a citation database as useful, then they are likely to find it acceptable for future usage. Accordingly, the following hypothesis is proposed:

**H3.** Usefulness is important in predicting the citation database usage. The usefulness of citation database interface usefulness positively affects its usage.

This study hypothesizes that a user's perceptions of usefulness to his usage and acceptance of citation database interface does not vary according to the interface language, gender and university.

**H4.** Perceptions of usefulness of a citation database interface influence usage and acceptance by both Chinese and English interfaces equally.

**H5.** Perceptions of usefulness of a citation database interface influence usage and acceptance by both male and female students equally.

**H6.** Perceptions of usefulness of a citation database interface influence usage and acceptance by graduate students at NSYSU and NKFUST equally.

## 3 Hypothesis Testing

The Structural Equation Modeling was utilized to examine the full CDIAM and evaluate its goodness of fit. The modification indices recommended by AMOS 5.0 were adopted, and the standardized residuals were verified. The path coefficients for three measurement subsystems were all above 0.7. The $\chi^2$ value indicates that the CDIAM fitted the collected data ($\chi^2$= 11.179, p-value = 0.083>0.05, and $\chi^2$/degree-of-freedom=1.863). The GFI and AGFI values were 0.973 and 0.906 also indicating a good fit. Furthermore, the RMR value of 0.049 was within the acceptable levels. The explained variance of citation database interface usefulness was 33%. The CDIAM as a whole explains 95% of the variance in the acceptance of citation databases interfaces.

The direct path {CDI ease of use → usefulness} is significant since the regression coefficient is 0.501 with $p$<0.0001. Therefore, the hypothesis **H1** is supported, which implies that the ease of use of a citation database interface significantly affects its usefulness. Although the path {CDI ease of use → usage} has insignificant direct effect on the usage and acceptance, it has significant indirect and total effects on the usage and acceptance via usefulness. The bootstrap approximation obtained by constructing two-sided bias correlation confidence intervals demonstrated that the unstandardized indirect effect and total effect of CDI ease of use were significantly different from zero at the 0.01 level ($p$=0.001, two-sided). Therefore, the hypothesis **H2** is supported, which indicates that the ease of use of the citation data-base interfaces significantly affects its usage and acceptance. The unstandardized total effect of the ease of use of the citation database interface on the usage and acceptance of citation database interface was 57%. The third hypothesis **H3** is accepted because the direct path {CDI usefulness → usage} is significant, having a regression parameter of 1.09 with $p$<0.0001. The results indicated that CDI usefulness had the strongest direct

impact on CDI usage and acceptance, and that CDI ease of use had a significant direct impact on CDI usefulness, whereas the CDI ease of use had a smaller direct effect on CDI usage and acceptance.

This study then applied the "Manage Models" and "Manage Groups" dialog built into AMOS 5.0 to test hypotheses 4, 5 and 6. The hypothesis **H4** is supported, which means that a user's perceptions of usefulness of a citation database interface influences his usage and acceptance of both Chinese and English interfaces equally. The hypothesis **H5** is supported, which means that a user's perceptions of usefulness of the citation database interface influences usage and acceptance equally among both male and female users. However, the hypothesis **H6** is not supported, which means a user's perceptions of usefulness of the citation database interface influences her or his usage and acceptance more strongly for graduate students at NSYSU than at NKFUST. This result is possibly due to the different focus of the two universities. NSYSU is much more research orientated than NKFUST.

## 4 Conclusions

The purpose of this study was to investigate the acceptance of citation database interfaces as research tools in higher education institutions as perceived by university first-year graduate students. The causal relationships among the constructs were well supported. The CDIAM analysis indicates that the perceived usefulness of citation database interfaces has a significant direct impact on the usage and acceptance of citation database interface. Ease of use significantly affects the students' perceived usefulness directly and the acceptance indirectly through the usefulness of mediating construct in citation database interface.

This study shows how first-year graduate students who are unfamiliar with the ABI/INFORM and SDOS citation databases rated their perceptions of interface usage after conducting several queries. TAM provides a theoretically sound and parsimonious method for evaluating the citation database interface. By gathering user perceptions of a citation database interface's usefulness and ease of use, developers can accurately assess whether systems will ultimately be accepted by users and design a user-centered interface. Future study should incorporate the design of the user interface to increase the usability of citation database system.

## References

1. Davis, F. D., Bagozzi, R. P. and Warshaw, P. R.: User acceptance of computer technol-ogy: a comparison of two theoretical models, Management Science, Vol. 35(8), 982-1003 (1989)
2. Morris, M. G., Dillon, A.: How user perceptions influence software use?, IEEE Software, Vol. 14(4), 58-65 (1997)
3. Schmidt, C. T.: The systemics of dialogism: on the prevalence of the self in HCI design, Journal of the American Society for Information Science, Vol. 48(11), 1073-1081 (1997)