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AN EMPIRICAL INVESTIGATION OF THE EQUITY IMPLEMENTATION MODEL: AN ALTERNATIVE LENS FOR UNDERSTANDING TECHNOLOGY ADOPTION

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Abstract

Many studies of technology adoption have noted that new technology can have far-reaching effects, dramatically changing the environment (e.g., work, home, school) in which we use the technology. The current research operationalizes the equity implementation model (EIM) to provide an equity/fairness perspective on technology adoption in the context of online discussion tools. The EIM applies equity theory to assess user outcomes and inputs related to adopting a new technology in comparison to the outcomes and inputs of other technology stakeholders. Equity theory provides an alternative lens for understanding technology adoption that may capture broader issues related to the changes resulting from new technology. A survey instrument measuring these equity constructs is developed, and a longitudinal, empirical study of the EIM (and other determinants of technology adoption) is conducted. The results indicate that the instrument and model exhibit good measurement properties, and the model provides explanatory power comparable to most models of technology adoption.

Keywords: Equity theory, Equity implementation model (EIM), Technology adoption, Technology acceptance, Discussion tool

Introduction

Equity theory was developed to explain how individuals assess the fairness of a relationship or exchange and how they behave when the relationship/exchange is perceived to be unfair (Adams 1963; 1965). The use of equity theory, and other justice theories, in psychology, sociology, organizational behavior, and consumer behavior research speaks to the ability of the theory to address a wide-range of interpersonal and organizational challenges in explaining individual behavior (Ambrose et al. 1999; Oliver et al. 1989b). In the area of information systems, equity theory has been applied to explain user satisfaction with the information systems (IS) function (Joshi 1990) and to propose an equity model for understanding adoption of new technology (Joshi 1991).

Joshi proposed the conceptual equity implementation model (EIM) to explain why users may adopt (or resist) a new technology based on perceptions that use of the new technology is favorable (or unfavorable) to them. The EIM suggests that users make equity evaluations of new technology at three comparative levels: 1) their individual net benefits (outcomes and inputs), 2) their net benefits as compared to the net benefits of some authority or organization, and 3) their net benefits as compared to other users (Joshi 1991). While several exploratory, qualitative investigations of EIM have been conducted, to

our knowledge, the results of an empirical study with an operationalized version of the EIM have not been reported in the literature.

The EIM provides an alternative lens for understanding technology adoption from the perspective of equity through comparative assessments of user net benefits in relation to other technology stakeholders. Given the significant impact that technology can have on our daily lives at work, home, and in educational endeavors, it makes sense to consider a broader evaluation of net benefits in using new technology and to capture the comparative processes that occur as users consider how they fare as a result of using the technology. As evidenced by the numerous applications of equity theory, equity/fairness issues exist in many interpersonal and organizational contexts. From an IS perspective, equity issues could be expected in technology adoption scenarios where different categories of users exist and net benefits from technology use could accrue to multiple technology stakeholders.

Online discussion forums (ODF) are applications that facilitate knowledge sharing and are commonly used to support both distance and face-to-face learning environments. These collaborative tools enable students and instructors to share course-related knowledge in an ubiquitous manner and have the potential to enhance learning performance (Leidner et al. 1995; Piccoli et al. 2001). While instructors make this technology available to enhance learning in their classes, actual use of the technology has not materialized at the expected levels (Yang et al. 2005). An equity perspective on ODF intentions and usage could provide insight through an assessment of the perceived fairness of adopting the new technology and the comparative perceptions of how an individual benefits from the use of ODF as compared to other students and the instructor.

This paper describes an empirical study of EIM, usage intentions, and actual usage of a voluntary ODF used to support a large undergraduate business course. Scales were developed to measure the three comparative levels of equity assessment, and these scales along with measures of common technology adoption constructs were included in a survey provided to 345 subjects after a training session on the voluntary ODF. Actual usage of the ODF was measured at the conclusion of the course.

The paper is organized as follows. First, equity theory and the hypotheses are discussed. The research methodology is then presented, followed by the data analysis. Lastly, a discussion of the results is provided along with the study limitations and directions for future research.

Theoretical foundations and hypotheses

Equity theory was initially proposed by Adams (1963; 1965), and was developed to address an individual's desire for equity or fairness in social exchange by integrating insights from reinforcement theory, cognitive consistency theory, psychoanalytic theory, and exchange theory (Walster et al. 1978). The theory addresses how individuals assess exchanges or relationships, and how they will behave when an exchange/relationship is perceived to be unfair. Propositions of the theory include: (1) individuals will evaluate an exchange/relationship by assessing their own outcomes and inputs (net impact/benefits) in comparison to the net benefits of other referents, (2) individuals will be distressed if exchanges/relationships are perceived as inequitable, and (3) when distressed, individuals will take action to restore equity (Adams 1963; Adams 1965).

Researchers in sociology and psychology have applied equity theory to various forms of interpersonal relationships, while researchers in management, marketing, and IS have applied the theory to explain attitude and behavior in organizational contexts. In the management literature, the theory has been used to explain various impacts on job satisfaction and performance resulting from fairness beliefs (Janssen 2001; O'Neill et al. 1998). Greenberg (1988) examined the influence of workers' equity perceptions on their job performance and employee theft (Greenberg 1990). Marketing researchers have examined the influence of equity in customer–merchant relationships (Huppertz et al. 1978) and on merchant and product satisfaction (Oliver et al. 1989a; Oliver et al. 1989b). In the area of information systems, equity theory has been applied to explain satisfaction with the information systems function (Joshi 1990) and to propose a conceptual model (EIM), for understanding user adoption of technology (Joshi 1991).

The equity-implementation model (EIM)

The EIM provides a theory-based understanding of users' response to the change brought about by new technology (Joshi 1991). The conceptual model, shown in Table 1, draws upon the core propositions of equity theory to explain how users evaluate the technology as favorable or unfavorable, and based on this evaluation decide to adopt or resist it. EIM proposes that users make equity evaluations of new technology through three levels of comparative analysis, 1) their individual net benefits (outcomes and inputs), 2) their net benefits as compared to the net benefits of some authority or organization, and 3)

their net benefits as compared to other users (Joshi 1991). These three levels of comparative evaluation form an overall perception of equity which leads to adoption or resistance behavior.

Table 1. Equity implementation model – adapted from (Joshi 1991)

Level of Evaluation	Focus	Criterion
1	Self	Change in equity status of self
2	Self and Authority /Organization	Asymmetry in equity status between self and authority
3	Self and Other Users	Asymmetry in equity status between self and other users

The equity perspective offered through the EIM can provide new insight into technology adoption. As an example, consider how equity issues could influence adoption of a knowledge sharing application. One group of workers may end up providing most of the content for a knowledge database while another group may be the primary users of this knowledge. In addition, the organization as a whole may benefit from this sharing of knowledge while the workers that provide the bulk of the knowledge content have increased work load with no additional compensation or improved outcomes. If the organizational benefits are not passed on in some manner to the workers contributing to the database, and their quality of work-life actually decreases, these workers may resist the new application. The EIM could explain why one group of users may resist the knowledge sharing application while a different group of users and organizational management views the application favorably.

Several qualitative case studies have applied the EIM to explain user adoption (resistance) of a new information system in the contexts of computer-based manufacturing process planning system (Joshi et al. 1999), computer-aided design (Joshi et al. 1998), and purchasing process transformation (Parikh et al. 2005). While these studies demonstrate that the model can provide insight in the adoption of diverse technologies and systems, the model has not been empirically tested.

Research model and hypotheses

The research model shown in Figure 1 was operationalized using the description of the EIM provided by Joshi (1991) for the specific context of an ODF. The overall equity assessment construct was modeled as a second-order construct based on the notion that users would form some overall assessment of equity through their own comparative analyses. Three levels of equity evaluations were represented as three first-order constructs using the technology stakeholders present in ODF: 1) Equity-Self, 2) Equity-Instructor representing the net benefit comparison with the authority figure (the instructor), and 3) Equity-Other Students representing the net benefit comparison with other students.

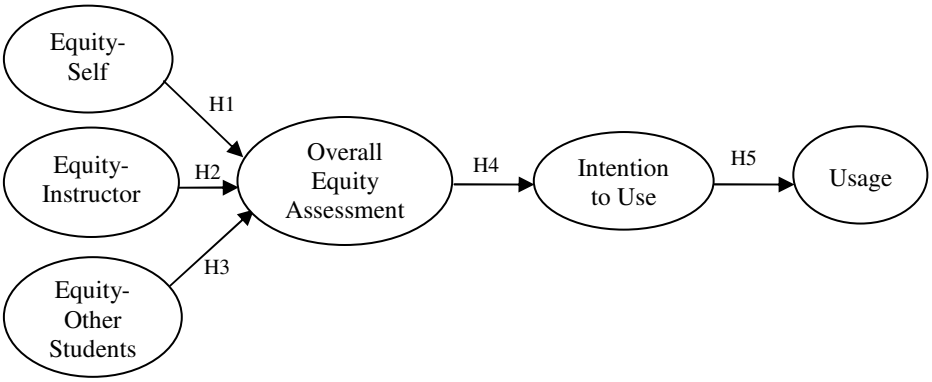


Figure 1. Research model

The second-order construct was modeled as formative rather than reflective based on the assumption that the three equity comparisons would impact overall equity (rather than being caused by overall equity), and that the three first-order equity constructs would not necessarily be highly correlated or possess internal consistency reliability (Jarvis et al. 2003; Straub et al. 2004). For example, in one technology scenario a user could report that a new technology was favorable to them at level one but unfavorable to them at level 2 because the instructor had greater net benefits than the user. With a different

technology, the user could report that the new technology was unfavorable to them at level 1 and also unfavorable to them at level 2. All first-order constructs were modeled as having reflective indicators.

Given that individuals assess the equity/fairness of new technology based on an evaluation of their own outcomes and inputs in using the technology, we hypothesize that:

> *H1: The perceived net benefits from using the discussion tool will have a positive effect on an overall equity assessment of the discussion tool.*

After assessing their own net benefits from using the discussion tool, individuals will compare their net benefits to the net benefits of the authority figure or organization employing the technology. In the context of an ODF, an individual whose net benefits exceed or are comparable to the instructor's net benefits will assess the ODF favorably. If the instructor is benefiting from the ODF but the individual is not, then the individual will not assess the ODF favorably. Given this comparative assessment, we hypothesize that:

> *H2: The perceived net benefits from using the discussion tool as compared to the instructor's net benefits will have a positive effect on overall equity assessment of the discussion tool.*

Individuals will also compare their net benefits to the net benefits of other users of the technology. In the context of an ODF, if an individual believes that their own net benefits are comparable to other users' net benefits then the individual will assess the ODF favorably. Given this comparative assessment, we hypothesize that:

> *H3: The perceived net benefits from using the discussion tool as compared to other user's net benefits will have a positive effect on overall equity assessment of the discussion tool.*

Equity theory predicts that an individual's assessment of fairness in an exchange/relationship will have a positive effect on their behavior related to that exchange/relationship. If an individual finds an exchange/relationship to be favorable, then they will not be distressed and will pursue or continue the exchange/relationship. If the exchange/relationship is viewed as unfavorable, then the individuals will try to restore equity through their behavior. In the context of technology adoption, if individuals believe that using the technology is favorable then they should have positive intentions to use the technology. Therefore, we hypothesize that:

> *H4: The overall equity assessment of the discussion tool will have a positive effect on intention to use the discussion tool.*

Based on the theory of reasoned action (Ajzen et al. 1980) and prior studies of technology acceptance (Szajna 1996; Venkatesh et al. 2000), we hypothesize that:

> *H5: Intention to use the discussion tool will have a positive effect on discussion tool usage.*

Research methodology

A field study was conducted to test the proposed EIM model. Undergraduate business students enrolled in an introductory information systems course in North America participated in the study, receiving course credit for their participation. As mentioned, the context for the study was the use of a class discussion tool that was made available to both the students and the instructor, for collaborative knowledge sharing in a face-to-face course. Use of the discussion tool was voluntary, and all course content and assignments were delivered through other communication channels (the course syllabus/schedule, course notes, textbook, and class meetings). The discussion tool enabled students to ask questions regarding the course content and allowed the instructor to provide clarifying information and answer questions through one communication channel that could be viewed by all students. Alternative communication, such as email, office hours, and in-class discussion, were also available for students to ask questions regarding course content.

Study procedure

Subjects participated in the study by attending a controlled lab session. At the beginning of the session, the subjects received scripted instructions and a demonstration on how to use the discussion tool. As part of the training session, students were required to find three online job announcements (employment opportunities) that were of interest to them and then post a

description of these three positions on the class discussion forum. The training session lasted approximately 25 minutes and then the subjects were asked to complete a survey.

Survey instrument

The survey instrument included scales to assess the constructs in the EIM along with other constructs previously investigated in technology adoption research and in studies of on-line discussion tools. In addition, questions were included to assess the subject's experience with using discussion tools and to collect general demographic information. A pilot test was run prior to the full data collection using a different pool of subjects (also undergraduate business students) and resulted in the refinement of the EIM scales. The full data collection was conducted with 345 subjects. There were 506 students enrolled in the course, with 369 students attending the training session and completing the survey. Responses from 345 subjects were included in the data collection as some students did not complete the entire survey or dropped the course before usage data was collected.

Scales were developed to measure the three levels of equity assessment, as provided later in Table 3. The first level measures the subject's perception of whether she/he is better off as a result of using the discussion tool. The second level measures the subject's perception of whether they benefit more or less than the instructor as a result of using the discussion tool, while the third level measures subject perceptions of whether they are better off than other students as a result of using the discussion tool. These scales were developed based on Joshi's description of the conceptual EIM (Joshi 1991) and existing studies in other disciplines that have measured equity assessments at multiple levels (Oliver et al. 1989a; Oliver et al. 1989b). Other constructs measured within the survey instrument included perceive ease of use, perceived usefulness, perceived voluntariness, and intention to use the system (Venkatesh et al. 2000). Actual usage was recorded throughout the course as a count of the numbers of times the subject accessed the discussion tool.

Data analysis and results

Data analysis was performed using AMOS 4.01 for structural equation modeling (SEM) with maximum likelihood estimation. The average age of the subjects was 20.7 years and 63 percent were male. Most subjects were moderately experienced with using discussion tools as evidenced by a mean response of 2.39 on a five point scale (anchored with 1=no experience and 5=expert user). Descriptive statistics for all constructs are provided in Table 2. The subjects also evaluated whether use of the discussion tool was voluntary on a scale from 1 (strongly disagree) to 7 (strongly agree) with a mean score of 5.23. The results show that the subjects did perceive their use of the discussion tool as voluntary.

Table 2. Descriptive statistics

	Equity-Self	Equity-Instructor	Equity-Other Students	Intention to Use	Ease of Use	Usefulness
Mean	5.154	4.042	3.576	4.474	5.4257	4.312
St. Dev.	1.180	1.217	1.143	1.529	1.110	1.411

Measurement model

Confirmatory factor analysis was performed on the measurement model to assess the loadings of the measurement items on the related constructs. Standardized loadings for all items are shown in Table 3 and were greater than the recommended cutoff value of 0.7 (Hair Jr. et al. 1998) suggesting good construct validity. Composite reliabilities were calculated using a formula from Werts, Linn and Joreskog (1974), and all reliability scores exceeded the recommended threshold of 0.7 (Hair Jr. et al. 1998) as shown in Table 3. Fit statistics for the measurement model were all acceptable with CFI, NFI, and GFI >.95, AGFI >.9, RMSEA <.05, and the ratio of chi-squared to degree of freedom < 2.

To further assess convergent and discriminant validity, the average variance extracted (AVE) was calculated (Straub et al. 2004) for each construct and reported in Table 4 along with the squared correlations among the constructs. Convergent validity was supported as the AVE for each construct was greater than .5 as recommended (Fornell et al. 1981). Discriminant validity was supported as the AVE for each construct was greater than the squared correlations with other constructs (Anderson et al. 1988).

Table 3. EIM-measurement model: CFA statistics

Construct	Measurement Items	Std. Loading	Reliability
Equity – Self	The overall benefits of using the Discussion Tool outweigh the efforts involved in using it.	.750	.862
	On the whole it is beneficial for me to use the Discussion Tool.	.910	
	The overall impact of using the Discussion Tool is positive.	.801	
Equity – Instructor	My overall benefits from using the Discussion Tool are greater than my instructor's benefits.	.777	.854
	On the whole, the Discussion Tool is more beneficial for me than for my instructor.	.916	
	The overall impact of using the Discussion Tool is more favorable to me than to my instructor.	.739	
Equity - Other Students	My overall benefits from using the Discussion Tool are greater than other students' benefits.	.870	.900
	On the whole, the Discussion Tool has been more beneficial for me than for other students.	.919	
	The overall impact of using the Discussion Tool is more favorable to me than to other students.	.808	
Intention to Use	Assuming I have access to the Discussion Tool, I intend to use it.	.978	.963
	Given that I have access to the Discussion Tool, I predict that I would use it.	.949	

Table 4. Estimated squared correlations and AVEs*

	Equity-Self	Equity-Instructor	Equity-Other Students	Intention to Use	Usage
Equity – Self	**0.677**				
Equity – Instructor	0.148	**0.663**			
Equity - Other Students	0.042	0.203	**0.751**		
Intention to Use	0.534	0.137	0.080	**0.928**	
Usage	0.088	0.001	0.002	0.117	**n/a**

*AVE figures are shown in bold along the diagonal

Structural regression model

Results for the structural regression model are shown in Figure 2 along with the fit statistics for the model. The standardized regression weights are shown along each relationship in the model and the variance explained (squared multiple correlations), is shown within each endogenous variable. All of the fit statistics are within the recommended ranges, suggesting a good model fit (Gefen et al. 2000). All but one hypothesized relationship was supported at $p<0.001$. H2 proposed that the perceived net benefits from using the discussion tool as compared to the instructor's net benefits would have a positive effect on overall equity assessment of the discussion tool. This hypothesis was not supported and will be addressed in the discussion section. The model explained 59.2% of the variance in intentions to use the discussion tool, and 12.0 % of actual usage.

Alternative equity factor structures

As previously discussed, the factor structure for the equity construct was represented as a formative second-order construct with three reflective first-order constructs. Additional data analysis is provided to assess whether this is an appropriate factor structure, as a second-order reflective factor structure has been suggested for overall equity in the EIM (Hess et al. 2002). Table 5 lists the proposed factor structure along with two alternative structures (first order factors only and second-order reflective factor). Figure 3 provides a visual representation of the three alternative structures. Model 3, the second-order,

reflective model, is not an appropriate factor structure based on the reported fit statistics and the lower standardized loadings for some of the first-order constructs (452 and .326 for Equity-Instructor and Equity-Other Students, respectively). The fit statistics for model 2 (first order factors only) are slightly better than those for model 1 (second order formative factor), as we would expect given the less complex model structure. Given the theoretical support for a higher-level construct and strong fit statistics, it seemed appropriate to retain the second-order, formative construct representation in the EIM.

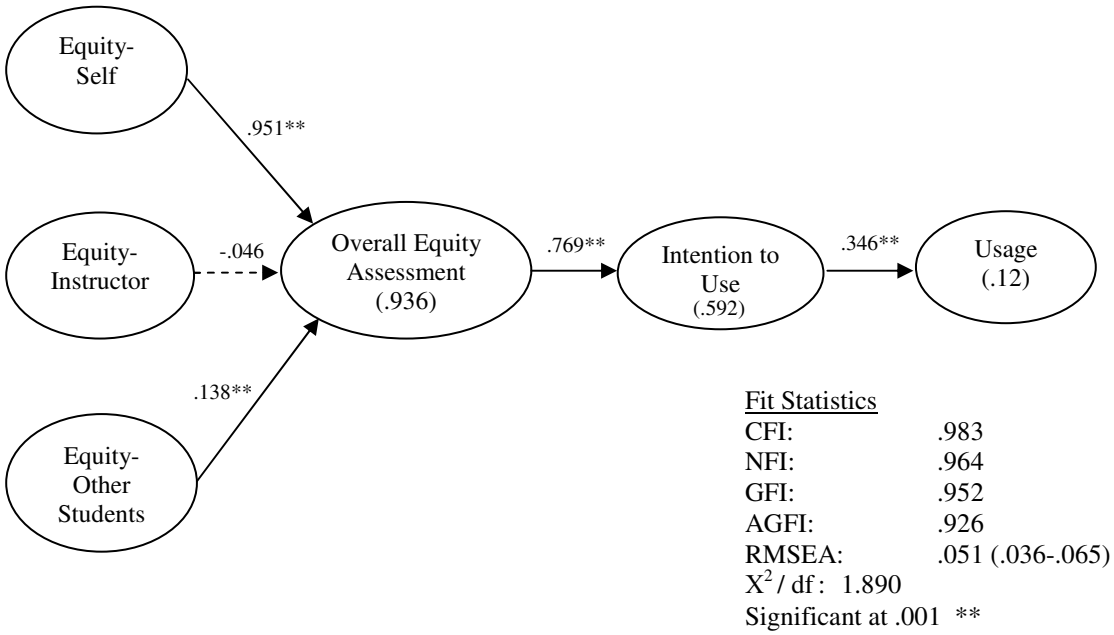


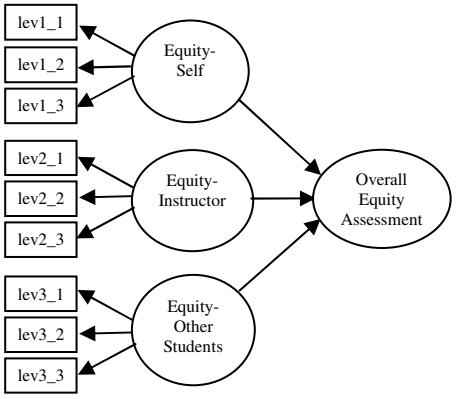
Figure 2. EIM structural regression model results

Table 5. Fit statistics for equity factor structures

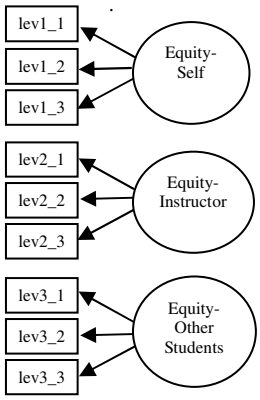
Alternative Models	χ2 /df	CFI	NFI	GFI	AGFI	RMSEA
1) 2nd order formative construct	1.890	.983	.964	.952	.926	.051
2) Three 1st order reflective constructs	1.666	.988	.971	.962	.938	.044
3) 2nd order reflective construct	2.403	.974	.956	.946	.917	.064

Explanatory Power of EIM

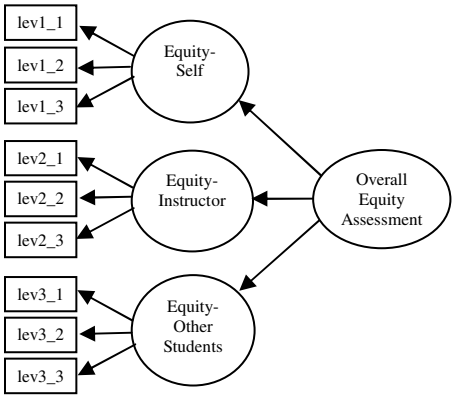
As previously shown in Figure 2, the EIM structural regression model explained 59% of the variance in usage intentions. In an effort to assess the explanatory power of EIM in comparison to other models of technology adoption, measures of two known determinants of intentions to use technology (ease of use and usefulness) were included in the survey instrument. These two determinants were selected as these constructs explain a sizeable proportion of intentions to use a system in comparison to other models of technology acceptance, adoption, and diffusion, while requiring only eight additional survey items. We tested the structural regression model shown in Figure 4 to provide a comparative benchmark for the explanatory power provided by EIM. The variance explained in intention to use and usage was 56.1% and 11.8% respectively. Both percentages were slightly less than the variance explained by the EIM, suggesting that EIM provides comparable explanatory power to one of the more common models of technology adoption/acceptance.



1) Second-Order Formative Construct

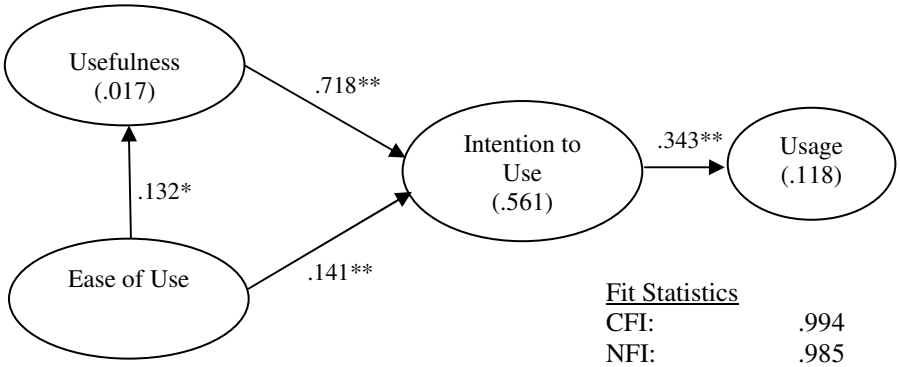


2) Three First-Order Constructs



3) Second-Order Reflective Construct

Figure 3. Equity factor structures



Fit Statistics

CFI:	.994
NFI:	.985
GFI:	.975
AGFI:	.952
RMSEA:	.045 (.019-.069)
X^2 / df :	1.890

Significant at .001 **
Significant at .05 *

Figure 4. Technology acceptance model results

Discussion

This research examined the measurement properties and explanatory value of the EIM for understanding technology adoption of an ODF. Three levels of equity comparisons were measured and modeled as formative, first order measures leading to an overall equity assessment. Two levels of equity comparisons, equity-self and equity-other students, were found to have a significant effect on overall equity assessment, while the equity-instructor comparison did not have a significant effect. Overall equity assessment explained 59.2% of intentions to use the technology and intention to use had a significant effect on actual usage behavior, explaining 12% of the variance in this measure. The relationship between intentions and usage and the variance explained in usage strengthen the contribution of the model as past studies of actual usage have failed to find a significant relationship between reported intentions and actual usage (Szajna 1996).

In summary, the model exhibited good measurement properties, and the data analyzed supported four out of the five proposed hypotheses. The lack of support for H2, the equity-instructor evaluation, may be due to the subjects' lack of awareness of the instructor's outcomes and inputs in using the discussion tool. The lack of a significant effect does not necessarily suggest that this level of equity evaluation is not a potential determinant of overall equity assessment. Given the formative nature of the equity construct, it seems reasonable for this comparative evaluation to affect overall equity only when users' are aware of the outcomes and inputs that may impact the technology stakeholder. The overall results of the study suggest that valid scales have been developed to assess EIM and that the model may provide new insight for understanding technology adoption.

Conclusion

This research contributes to the technology adoption literature by 1) providing an alternative lens for understanding user adoption of technology, 2) developing and validating scales to measure equity in the context of on-line discussion tools; 3) empirically testing the structure of the multi-dimensional equity construct; and 4) assessing the explanatory power of EIM in comparison with another model of technology adoption/acceptance. From an applied perspective, empirical assessments with the EIM could help IS managers identify which groups of users might not find a new technology to be favorable to them, or when users may resist a technology due to perceptions that the organization is benefiting too much from a new technology at the expense of the users.

Limitations of the study include the use of student subjects. The context for the study, discussion tools, is appropriate for student subjects, but a less homogenous group of users would provide a more robust test of the EIM. Another limitation of the study is the limited testing of the model in one technology adoption context. While discussion tools provide a relevant instance of knowledge-sharing technology, additional testing is needed.

Future research is needed to understand the relative impact of the comparative levels of equity on overall equity assessments, and when some levels may not affect overall equity. Future studies should also investigate the net benefits of technology stakeholders in more detail by measuring outcomes and inputs separately, and by identifying the more relevant outcomes and inputs based on the technology context. In assessing net benefits, the EIM focuses on the distributive aspect of equity/justice; the procedural and reciprocal forms of justice may also inform our understanding of adoption. Lastly, the relationship between equity constructs and previously studied determinants of technology usage should also be investigated. Additional data was collected on known determinants of usage intentions, but due to space limitations was not reported in the current study.

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