Perceived Usefulness, Perceive Ease of Use, and User Acceptance of Information Technology

By Fred D. Davis (1989)

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Outline

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Introduction

- Users' unwillingness to accept and use available systems
- Importance of user acceptance
- Shortage of high-quality measures
- Little attention to quality of the measures used or how well they correlate with usage behavior
- Unvalidated measures (Misinformation)
- Development of improved measures for key theoretical constructs

Introduction

- Purpose
  - To persue better measures for predicting and explaining use
- Focus
  - Two theoretical constructs
    - Perceived usefulness
    - Perceived ease of use

Perceived Usefulness and Perceived Ease of Use

- Perceived Usefulness
  - The degree to which a person belives that using a particular system would enhance his or her job performance.

- Perceived Ease of Use
  - The degree to which a person believes that using a particular system would be free of effort.

Theoretical Foundations

- An exploratory study by Shultz and Slevin
- Replication of the exploratory study by Robey
- Meta-analysis of Tornatzky and Klein on' innovation adoption
- Self-efficacy theory by Bandura
- Evaluation inforation reports by Larcker and Lessig
- Channel disposition model by Swanson

Scale Development

- A step by step process
  - Determination of Candidate Items
  - Pretest
  - Emprical Field Study
  - Laboratory Experiment
- 14 candidate items for each construct
- Conceptual Definition
- From past literature (37 published research papers)
- The Spearman-Brown Prophecy Formula

Pretest

- To enhance the content validity
- Pretest Interviews
- 15 experienced computer users
- Performing Two Tasks
  - Prioritization
  - Categorization

Initial Item Scales (Usefulness)

1. My job would be difficult to perform without electronic mail.
2. Using electronic mail gives me greater control over my work.
3. Using electronic mail improves my job performance.
4. The electronic mail system addresses my job-related needs.
5. Using electronic mail saves me time.
6. Electronic mail enables me to accomplish tasks more quickly.
7. Electronic mail supports critical aspects of my job.
8. Using electronic mail allows me to accomplish more work than would otherwise be possible.
9. Using electronic mail reduces the time I spend on unproductive activities.
10. Using electronic mail enhances my effectiveness on the job.
11. Using electronic mail improves the quality of the work I do.
12. Using electronic mail increases my productivity.
13. Using electronic mail makes it easier to do my job.
14. Overall, I find the electronic mail system useful in my job.

Initial Item Scales (Ease of Use)

1. I often become confused when I use the electronic mail system.
2. I make errors frequently when using electronic mail.
3. Interacting with the electronic mail system is often frustrating.
4. I need to consult the user manual often when using electronic mail.
5. Interacting with the electronic mail system requires a lot of my mental effort.
6. I find it easy to recover from errors encountered while using electronic mail.
7. The electronic mail system is rigid and inflexible to interact with.
8. I find it easy to get the electronic mail system to do what I want it to do.
9. The electronic mail system often behaves in unexpected ways.
10. I find it cumbersome to use the electronic mail system.
11. My interaction with the electronic mail system is easy for me to understand.
12. It is easy for me to remember how to perform tasks using the electronic mail system.
13. The electronic mail system provides helpful guidance in performing tasks.
14. Overall, I find the electronic mail system easy to use.

Pretest Results: Perceived Usefulness

Old Item #	Item	Rank	New Item #	Cluster
1	Job Difficult Without	13		C
2	Control Over Work	9	2	
3	Job Performance	2	6	A
4	Addresses My Needs	12		C
5	Saves Me Time	11		B
6	Work More Quickly	7	3	B
7	Critical to My Job	5	4	C
8	Accomplish More Work	6	7	B
9	Cut Unproductive Time	10		B
10	Effectiveness	1	8	A
11	Quality of Work	3	1	A
12	Increase Productivity	4	5	B
13	Makes Job Easier	8	9	C
14	Useful	NA	10	NA

Pretest Results: Perceived Ease of Use

Old Item #	Item	Rank	New Item #	Cluster
1	Confusing	7		B
2	Error Prone	13		
3	Frustrating	3	3	B
4	Dependence on Manual	9	(replace)	C
5	Mental Effort	5	7	B
6	Error Recovery	10		
7	Rigid & Inflexible	6	5	A
8	Controllable	1	4	A
9	Unexpected Behavior	11		
10	Cumbersome	2	1	A
11	Understandable	4	8	B
12	Ease of Remembering	8	6	C
13	Provides Guidance	12	(replace)	C
14	Easy to Use	NA	10	NA
NA	Ease of Learning	NA	2	NA
NA	Effort to Become Skillful	NA	9	NA

Study 1

- To assess the reliability, convergent validity, discriminant validity, and factorial validity of the 10-item scales resulting from the pretest
- A sample of 120 users within IBM Canada's Toronto Development Laboratory (Responses from 112)
- 2 familiar systems
  - PROFS electronic mail
  - XEDIT file editor
- 7 Point Likert Scale

Study 1 (Cont.)

- Reliability and Validity
  - Multitrait multi-method analysis
  - Factor Analysis
- Actual Usage
  - Six-position categorial scales

Study 1 Results

Scale Items		Factor 1 (Usefulness)	Factor 1 (Ease of Use)
Usefulness			
1	Quality of Work	.80	.10
2	Control over Work	.86	−.03
3	Work More Quickly	.79	.17
4	Critical to My Job	.87	−.11
5	Increase Productivity	.87	.10
6	Job Performance	.93	−.07
7	Accomplish More Work	.91	−.02
8	Effectiveness	.96	−.03
9	Makes Job Easier	.80	.16
10	Useful	.74	.23
Ease of Use			
1	Cubersome	.00	.73
2	Ease of Learning	.08	.60
3	Frustrating	.02	.65
4	Controllable	.13	.74
5	Rigid & Inflexible	.09	.54
6	Ease of Remembering	.17	.62
7	Mental Effort	−.07	.76
8	Understandable	.29	.64
9	Effort to Be Skillful	−.25	.88
10	Easy to Use	.23	.72

Study 2

- Spearman-Brown Prophecy Formula to reduce items
- 40 Participants
- Two unfamiliar systems
  - Chart Master
  - Pen Draw
- One hour hands-on experience
- Self predicted future use
  - 2 seven point scale
    - Likely... ...Unlikely
    - Improbable... ...Probable

Study 2 Results – Factor Analysis

Scale Items		Factor 1 (Usefulness)	Factor 2 (Ease of Use)
Usefulness			
1	Work More Quickly	.91	.01
2	Job Performance	.98	−.03
3	Increase Productivity	.98	−.03
4	Effectiveness	.94	.04
5	Makes Job Easier	.95	−.01
6	Useful	.88	.11
Ease of Use			
1	Easy to Learn	−.20	.97
2	Controllable	.19	.83
3	Clear & Understandable	−.04	.89
4	Flexible	.13	.63
5	Easy to Become Skillful	.07	.91
6	Easy to Use	.09	.91

Study 2 - Correlations

	Correlation		
	Usefulness & Usage	Ease of Use & Usage	Ease of Use & Usefulness
Study 1			
Electronic Mail (n = 109)	.56***	.32***	.56***
XEDIT (n = 75)	.68***	.48***	.69***
Pooled (n = 184)	.63***	.45***	.64***
Study 2			
Chart-Master (n = 40)	.71***	.25	.25
Pendraw (n = 40)	.59***	.47***	.38**
Pooled (n = 80)	.85***	.59***	.56***
Davis, et al. (1989) (n = 107)			
Wave 1	.65***	.27**	.10
Wave 2	.70***	.12	.23**

*** $p<.001$ ** $p<.01$ * $p<.05$

Study 2 – Regression Analysis

	Independent Variables		
	Usefulness	Ease of Use	R^2
Study 1			
Electronic Mail (n = 109)	.55***	.01	.31
XEDIT (n = 75)	.69***	.02	.46
Pooled (n = 184)	.57***	.07	.38
Study 2			
Chart-Master (n = 40)	.69***	.08	.51
Pendraw (n = 40)	.76***	.17	.71
Pooled (n = 80)	.75***	.17*	.74
Davis, et al. (1989) (n = 107)			
After 1 Hour	.62***	.20***	.45
After 14 Weeks	.71***	−.06	.49

Discussion & Conclusion

- The new scales were found to have strong psychometric properties and to exhibit significant empirical relationships with self-reported measures of usage behavior
- Psychometric strength of the new measurement scales
- Perceived usefulness is a strong correlate of user acceptance and should not be ignored by those attempting to design and implement succesful systems.
- The regression results suggest that ease of use may be an antecedent to usefulness, rather than a parallel, direct determinant of usage.

Final Measurement Scales

Perceived Usefulness

Using CHART-MASTER in my job would enable me to accomplish tasks more quickly.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

Using CHART-MASTER would improve my job performance.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

Using CHART-MASTER in my job would increase my productivity.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

Using CHART-MASTER would enhance my effectiveness on the job.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

Using CHART-MASTER would make it easier to do my job.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

I would find CHART-MASTER useful in my job.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

Final Measurement Scales

Perceived Ease of Use

Learning to operate CHART-MASTER would be easy for me.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

I would find it easy to get CHART-MASTER to do what I want it to do.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

My interaction with CHART-MASTER would be clear and understandable.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

I would find CHART-MASTER to be flexible to interact with.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

It would be easy for me to become skillful at using CHART-MASTER.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

I would find CHART-MASTER easy to use.

likely |_____|_____|_____|_____|_____|_____|_____| unlikely
extremely quite slightly neither slightly quite extremely

Thank You

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