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User Satisfaction as a Measure of Success in End User Application Development: An Empirical Investigation

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ABSTRACT

End user application development to support organisational tasks is a phenomenon that is becoming increasingly important to organisations, yet there is little empirical research evaluating its effectiveness. Measures of user satisfaction, which are commonly used to evaluate organisational systems, may be inappropriate when end users assess systems they have developed themselves. This study compared the satisfaction ratings of applications which were evaluated by their end user developers with ratings of the same application by other end users. End users were significantly more satisfied with applications they had developed themselves. Possible implications of this finding are discussed.

INTRODUCTION

End User Computing

End user computing (EUC) is a phenomenon of increasing importance to organisations and expenditure on it continues to grow. Current estimates indicate that expenditure on EUC accounts for greater than 50% of the information systems (IS) budget of many organisations (e.g., Guimaraes & Igarria, 1994; Nord & Nord, 1994). According to Amoroso and Cheney (1992) this growth has been 'fostered by the proliferation of microcomputers, the availability of powerful, user-friendly software, and the move toward distributed information processing'. EUC provides users with an alternative to the traditional process of systems development: today, computer applications are increasingly being developed by the users who need them for their work. Amoroso and Cheney (1992) have defined EUC specifically as the use of 'information technology to develop specialised applications for (the user's) personal use, department use, or in some cases organisation-wide use'.

Applications developed by end users to support organisational tasks are known as user developed applications (UDA) (Cotterman & Kumar, 1989). Common UDA include

budgeting systems, product pricing models and workload planning systems, developed using software tools such as spreadsheets, database management systems and programming languages. The development of a UDA is a direct response to a particular organisational task or duty, undertaken by staff involved in that task or duty.

Despite the potential benefits to an organisation of user development of applications there are many risks associated with it that may lead to potentially dysfunctional consequences for the organisation's activities. These risks result from a potential decrease in quality and control as individuals who have little or no formal information systems training increasingly take responsibility for developing and implementing systems of their own making (Cale, 1994). This raises the important issue of the need to be able to measure the effectiveness and success of UDA. However, organizations generally undertake little formal evaluation of the nature and quality of applications developed by end users (Bergeron & Berube, 1990), and generally do not formulate policies requiring or supporting formal testing and documentation of end user developed software (Cale, 1994). This places a heavy reliance on the individual end user's assessment of quality.

User Satisfaction as a Measure of Information Systems Success

There is a scarcity of literature that addresses the success of information systems from a UDA viewpoint. However, the literature on organisational informational systems effectiveness has proposed numerous measures of success, including decision quality, frequency of use, and volume of output (for a review see DeLone & McLean, 1992). The most commonly used measure of IS success is user satisfaction (Melone, 1990).

User satisfaction has been defined as 'the affective attitude towards a particular computer application by an end user who interacts with the application directly' (Doll & Torkzadeh, 1988). Several instruments have been developed to measure user satisfaction; amongst the most widely used are Bailey and Pearson (1983), Baroudi and Orlikowski (1988) and Doll and Torkzadeh (1988). Undoubtedly one of the reasons that user satisfaction is commonly used to assess success is that it is a more convenient measure than performance-related measures. However, there is also an implicit assumption that user satisfaction with an information system results in some positive change in user behavior resulting in increased effectiveness (Davis & Srinivasan, 1988).

Many researchers have pointed out that problems exist with the use of satisfaction as a measure of success (e.g. Etezadi-Amoli & Farhoomand, 1996; Galletta & Lederer, 1989; Melone, 1990; Thong & Chee-Sing, 1996). Melone (1990) notes that the user satisfaction construct has been used to refer to a user's perception of the system in some instances and an assessment of its output goals in others. Etezadi-Amoli and Farhoomand (1996) discuss the problem that user satisfaction instruments rely on the affective/cognitive dimension of satisfaction without accounting for the performance-related dimensions. There is little research attempting to link user satisfaction directly with any measures of user behavior such as improved productivity, fewer errors or better decision making, although a study by Gatian (1994) found a positive relationship between user satisfaction and system efficiency based on user efficiency measures.

Melone (1990) provides a critique of the theoretical issues involved in the user satisfaction construct, noting that many theoretical and practical issues remain to be resolved. User satisfaction is an attitude, and attitudes that users hold may play a role in establishing and maintaining self esteem (Pratkanis & Greenwald, 1989). Melone (1990) cautions that ‘to the extent that attitudes are held to establish or maintain a positive image of the self, they are less likely to serve the evaluative function implied in information system research’. Similarly, Hufnagel (1990) suggests that an individual’s affective response to a given performance outcome is often highly subjective and in some cases, highly ego-defensive.

The appropriateness of user satisfaction as a measure of system effectiveness may therefore be even more questionable in the UDA domain. Users who assess their own computer applications may be less able to be objective than users who assess applications developed by others. The actual development of an application, which may involve a significant investment of time and creative energy, may be satisfying other needs beyond the immediate task. User satisfaction with a UDA could therefore reflect satisfaction with the (highly personal) development process as much as with the application itself.

RESEARCH QUESTION

Overall, the scarcity of literature exploring user satisfaction measures of IS success from the UDA perspective indicates a need for more research in this area, particularly given the burgeoning of UDA and its growth as part of EUC expenditure by organisations. The appropriateness of employing end user satisfaction as a measure of success of UDA may be questionable, especially when end users evaluate their own UDA. How impartial can end users be in rating their own UDA as opposed to one developed by someone else?

The primary research question investigated in this study was: Do end users experience higher user satisfaction using applications that they have developed themselves than do other end users using the same application?

It was hypothesised that:

H1: A UDA will receive a higher user satisfaction rating when evaluated by its own developer, than when evaluated by other end users.

The importance of individual characteristics in influencing user attitudes and information systems success has been considered in a number of studies with mixed results (e.g. Harrison & Rainer, 1992; Igbaria & Nachman, 1990; Yaverbaum & Nosek, 1992), so the potential influence of individual end user developer characteristics on satisfaction is of interest in this study. The roles of gender, skill and experience were therefore also investigated, although no specific hypotheses were formulated.

RESEARCH METHOD

Subjects

The study was conducted with a group of 40 Business students (15 males and 25 females) enrolled in a second year university information systems service course. The course is designed to prepare students to participate in EUC activities in organizations once they graduate and join the workforce, rather than to become IS professionals. Students in the course had already completed an introductory first year course that included basic spreadsheet skills.

The general applicability of research findings derived from student samples is an issue of concern (Cummingham, Anderson, & Murphy, 1974). However, Briggs, Balthazard and Dennis (1996) found MBA students to be good surrogates for executives in studies relating to the use and evaluation of technology. The students who participated in the present study can be considered as typical of professionals who will be involved in user development of applications in organizations.

Experimental task

Prior to the experiment, each of the subjects had completed a case that required them to design and develop a spreadsheet application to provide financial reporting to, and aid financial planning by, a small business. The case was selected because it represented a realistic problem for an end user to analyze, and the scope and complexities were typical of the type of applications that end users would be likely to tackle in a 'real' work situation. It also involved the application of spreadsheet software, which is the most popular end user tool in organizations (McLean, Kappelman, & Thompson, 1993). This case constituted 10% of each student's overall course grade.

All the subjects developed the same application. This provided an excellent opportunity to study the potential effect of end user development on satisfaction, without the subjects' perceptions being influenced by the nature of the application itself. It would be difficult to obtain this level of control in a field study in an organisational setting.

Procedure

Each subject was given 2 labelled disks, one containing his/her own spreadsheet application and the other containing another subject's application (labelled only by research number). Assignment of the second application (the one developed by some other end user) was done on a random basis, so that the subjects were not aware of whose application they were assessing. As an extra precaution, anything that would identify the developer, such as the name of the developer being embedded in the spreadsheet, was removed.

Each subject was asked to use each application to undertake analyses typical of those involved in the case and then to complete a questionnaire. The questionnaire consisted of 3 sections. The first section requested details about the subjects and their experience with spreadsheets and their perceived skill with spreadsheets. The second and third parts of the questionnaire were designed to measure user satisfaction with each of the applications. User satisfaction was measured by the 12 item scale developed by Doll and Torkzadeh (1988). The scale provides a measure of overall end user computing satisfaction (EUCS) as well as

satisfaction with information content, accuracy, format, ease of use, and timeliness. Each item was measured on a 5 point Likert scale ranging from (1) almost never to (5) almost always.

RESULTS

Table 1 shows the mean ratings for overall EUCS and for the components of EUCS for both the developers and the other end users. The end user developers' overall EUCS ratings and the ratings for each of the EUCS components were compared statistically with those of the non-developers using paired t-tests. The hypothesis was supported as end user developers' EUCS ratings were significantly higher for overall EUCS ($t(39)=3.29$, $p=0.001$) and for each of the EUCS components (content: $t(39)=2.31$, $p = 0.013$; accuracy: $t(39)=1.75$, $p=0.044$; format: $t(39)=3.06$; $p=0.02$ ease of use: $t(39)=4.52$, $p=0.000$; timeliness: $t(39)=2.96$, $p=0.002$).

EUCS components	Developer EUCS rating		Other end user EUCS rating		Significance
	x	(sd)	x	(sd)	
Content	15.18	(2.74)	13.65	(3.43)	p=0.013
Accuracy	7.38	(1.60)	6.80	(1.81)	p=0.044
Format	7.73	(1.40)	6.60	(1.88)	p=0.002
Ease of use	7.83	(1.45)	6.13	(1.80)	p=0.000
Timeliness	7.78	(1.33)	6.80	(1.64)	p=0.002
Overall EUCS	45.88	(7.55)	39.98	(9.34)	p=0.001

Table 1. A comparison of developer and non-developer ratings for overall EUCS and for the EUCS components

The roles of gender, spreadsheet experience and perceived spreadsheet skill in the evaluation of EUCS were investigated by comparing the mean EUCS ratings of end user developers for each of the developer characteristics using t-tests (Table 2). No significant differences were found between the mean ratings of males and females, developers with low and high spreadsheet experience, or developers with perceived low and high spreadsheet skill.

Developer characteristic	Mean EUCS rating		
	x	(sd)	significance
Gender			
<i>male</i>	46.20	(5.80)	0.836
<i>female</i>	45.68	(8.54)	
Spreadsheet experience			
<i>low</i>	45.56	(6.83)	0.782
<i>high</i>	44.82	(8.72)	
Perceived spreadsheet skill			

<i>low</i>	43.44	(8.66)	0.600
<i>high</i>	45.75	(9.08)	

Table 2. A breakdown by developer characteristics of overall EUCS rating by end user developers

The potential influence of end user developer characteristics was further investigated by comparing the difference between the EUCS satisfaction rating of the developers and the non-developers for each of the developer characteristics using t-tests (Table 3). None of the developer characteristics were found to significantly influence the magnitude of the difference between developer and non-developer ratings of EUCS.

Developer characteristic	Mean difference in EUCS rating		
	x	(sd)	significance
Gender			
<i>male</i>	4.60	(9.26)	0.582
<i>female</i>	6.68	(12.56)	
Spreadsheet experience			
<i>low</i>	6.93	(11.16)	0.135
<i>high</i>	0.91	(10.57)	
Perceived spreadsheet skill			
<i>low</i>	6.77	(12.03)	0.565
<i>high</i>	3.12	(13.61)	

Table 3. A breakdown by developer characteristics of the difference in EUCS rating between end user developers and non-developers

DISCUSSION

The results of this study suggest that the process of developing an application to facilitate an organizational task predisposes an end user developer to be more satisfied with the application than they would be if it were developed by someone else. This is consistent with the results of the literature on user involvement in the development of organisational systems. For example, Doll and Torkzadeh (1988) found user participation in design to be positively correlated with end user computing satisfaction, and Lawrence and Low (1993) found that the more a user felt involved with the development process, the more satisfied they were with the system.

In the case of UDA, a user's increased satisfaction with an application developed by themselves may also be a reflection of the role of attitude in maintaining their self esteem, acknowledging a more complex view of attitudes than is often adopted in IS research (Melone, 1990). As an unsolicited comment on one of the questionnaires stated: 'This is my spreadsheet, of course I think it's good'.

The increased satisfaction of the end user developers with their own UDA appears to be independent of gender, experience with spreadsheets or perceived spreadsheet skill. No consistent effects of user characteristics on satisfaction have been reported in the literature:

e.g. gender (Guimaraes & Igbaria, 1997; Igbaria & Nachman, 1990); skill and experience (Al-Shawaf, 1993; Guimaraes & Igbaria, 1997).

It is possible, however, that the observed increased end user satisfaction is transitory and may diminish with time. Lawrence and Low (1993) raised the possibility that higher satisfaction resulting from user involvement may diminish over time as system quality comes to dominate the user's perceptions. This is an issue that should be explored in future research. Many UDAs are developed for immediate use and may never be used to the extent that their shortcomings become apparent.

Increased end user satisfaction with applications they have developed themselves may have positive consequences for organizations. This is consistent with evidence that EUC enables end users to feel greater significance in the tasks they undertake (Safayeni, Purdy, & Higgins, 1989) and to feel more personal control in the workplace (O'Donnell & March, 1987). Barker (1995) suggested that increases in core job characteristics would be expected to lead to positive job outcomes and found end user satisfaction to be positively associated with job motivation. Similarly, Lee, Kim and Lee (1995) found a strong positive relationship between end user IS satisfaction and job satisfaction.

The increased satisfaction that end users feel may however blind them to problems that exist in the applications they have developed. Organizations generally undertake little formal evaluation of the nature and quality of applications developed by their end users (Bergeron & Berube, 1990; Cale, 1994). This suggests that in the majority of organizations user developers' subjective assessments of their applications are the only measures of whether an application is suitable for use. Yet there are many reports in the literature that cite problems or errors in UDA (e.g. Brown & Gould, 1987; Cragg & King, 1993; Edberg & Bowman, 1996; Panko & Halverson, 1996). It is possible that errors may remain unnoticed because of inflated user satisfaction.

Increased satisfaction of end user developers may also limit their desire for IS development by professionals, who may be able to provide more useful functionality in applications. Edberg and Bowman (1996) found that when end user developers saw equivalent applications developed by IS professionals they were very surprised at their functionality, and had not even considered that many aspects of the applications were possible. This could mean that valuable opportunities for utilising information technology to support decision-making are missed.

In conclusion, this study has been able to isolate the effect of end user development on satisfaction with a system and has shown that end users are more satisfied with applications they have developed than with equivalent applications developed by another user. This is of concern when organisations rely so heavily on user perceptions of their own applications to evaluate application success.

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