Managing User Acceptance Testing of Business Applications

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Abstract. User acceptance testing (UAT) events gather input from actual system users to determine where potential problems may exist in a new software system or major upgrade. Modern business systems are more complex and decentralized than ever before making UAT more complicated to perform. The collaborative nature of facilitated UAT events requires close interaction between the testers and the facilitation team, even when located in various locations worldwide. This study explores the best approaches for facilitating UAT remotely and globally in order to effectively facilitate geographically-dispersed actual system users in performing UAT exercises. While research suggests user involvement is important, there is a lack of understanding about the specifics of how to best engage users for maximizing the results, and our study addresses this gap. This study examines the following research questions: How should UAT facilitators (1) schedule user participation with a minimum impact to their regular work duties and maximum ability to be present when testing and not be distracted; (2) enable direct interactions with users including face-to-face conversations during the UAT event and access to user computer screens for configuration and validation; and (3) utilize quality management software that can be used seamlessly by all involved in UAT. To examine these questions, we utilize Social Presence Theory (SPT) to establish a conceptual lens for addressing these research questions. SPT supports that the communication environment must enable people to adopt the appropriate level of social presence required for that task. This study proposes a theoretically-derived examination based on SPT of facilitated UAT delineating when and how facilitators should involve actual system users in the UAT activities either through local facilitation or remote hosting of UAT exercises, among other options.

Keywords: User Acceptance Testing, Social Presence Theory, Computer Mediated Conferencing, Quality Management Software.

1 Introduction

The purpose of user acceptance testing (UAT) is to gather input from actual system users, those who have experience with the business processes and will be using the system to complete related tasks (Klein, 2003; Larson, 1995). Actual users bring knowledge of process flows and work systems and are able to test how the system

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meets all that is required of it, including undocumented inherent requirements, and where potential problems may surface. UAT is a critical phase of testing that typically occurs after the system is built and before the software is released. Modern business systems are more complex and decentralized than ever before making UAT more complicated to perform. The global nature of commerce continues to push business systems deployments well beyond traditional geographic boundaries. The global nature of such deployments has created new challenges for the execution of UAT and the effective participation of geographically dispersed actual system users. The collaborative nature of facilitated UAT events requires close interaction between the testers and the facilitation team (Larson, 1995), even when located in various locations worldwide. However current obstacles exist such as, global dispersion of the user base, travel expenses and extended time away from regular work assignments. This study explores the best approaches for facilitating UAT remotely and globally in order to effectively facilitate geographically-dispersed actual system users in performing UAT exercises.

Systems development theory suggests users should be involved throughout the development lifecycle, yet involving the users is often difficult. One study of case organizations found different approaches and strategies for the facilitation of user involvement (Iivari, 2004; Lohmann and Rashid, 2008). An important aspect in human computer interaction is usability evaluation that improves software quality (Butt and Fatimah, 2012). User involvement occurs between industry experts who use the system and the development team suggesting it is imperative to have senior and experienced user representation involved (Majid et al., 2010). One study of the degree of user involvement in the process indicates that user involvement is mainly concentrated in the functional requirements gathering process (Axtell et al., 1997). Software firms spend approximately 50-75% of the total software development cost on debugging, testing, and verification activities, soliciting problem feedback from users to improve product quality (Muthitacharoen and Saeed, 2009).

Today, the distinction between development and adoption are blurring which provides developers with opportunities for increasing user involvement (Hilbert et al., 1997). User involvement is a widely accepted principle in the development of usable systems, yet it is a vague concept covering many approaches. Research studies illustrate how users can be an effective source of requirements generation, as long as role of users is carefully considered along with cost-efficient practices (Kujala, 2003). User's participation is important for successful software program execution (Butt and Fatimah, 2012) and business analyst facilitation and patience in UAT events is critical whether the system is a new installation, major upgrade, or commercial-off-the-shelf package (Beckett, 2005; Klein, 2003; Larson, 1995). In summary, while research suggests user involvement is important, there is a lack of understanding about the specifics of how to best engage users for maximizing the results, and our study addresses this gap.

This study examines the following research questions: How should UAT facilitators (1) schedule user participation with a minimum impact to their regular work duties and maximum ability to be present when testing and not be distracted; (2) enable direct interactions with users including face-to-face conversations during the UAT

event and access to user computer screens for configuration and validation; and (3) utilize quality management software that can be used seamlessly by all involved in UAT.

To examine these questions, we recognize the need to resolve the complexity of communication challenges among technology facilitators and business users. We draw on Social Presence Theory (SPT) to establish a conceptual lens for addressing these research questions. Traditionally, SPT classifies different communication media along a continuum of social presence. Social presence (SP) reflects the degree of awareness one person has of another person when interacting (Sallnas et al., 2000). People utilize many communication styles when face-to-face (impression leaving, contentiousness, openness, dramatic existence, domination, precision, relaxed flair, friendly, attentiveness, animation, and image managing (Norton, 1986) or when on-line (affective, interactive, and cohesive (Rourke et al., 2007). SPT supports that the communication environment must enable people to adopt the appropriate level of social presence required for that task. This study proposes a theoretically-derived examination based on SPT of facilitated UAT delineating when and how facilitators should involve actual system users in the UAT activities either through local facilitation or remote hosting of UAT exercises, among other options.

2 Theoretical Background

To examine the challenges of facilitating actual system users in UAT events, SPT incorporates a cross-section of concepts from social interdependence and media richness theories. SPT promotes that through discourse, intimacy and immediacy create a degree of salience or being there between the parties involved (Lowenthal, 2010). Researchers have found perception of the other party's presence is more important than the capabilities of the communications medium (Garrison et al., 2000). Thus, UAT events will need to enable the appropriate level of SP for users to learn their role in UAT and execute testing activities.

Facilitating users in remotely-hosted UAT events draws similarities to online teaching activities. The similarities emanate from both activities comprising novice users working with expert facilitators to learn new knowledge, tackle new skills, and express confusion and questions in text-written print. SP has been established as a critical component of online teaching success. Table 1 encapsulates select research in the online teaching domain, illustrating the growing support for designing courses and maintaining a personal presence to influence student satisfaction and learning. This research helps us identify factors needed for user success in an online UAT event context. SP largely reflects the trust-building relationship a facilitator or instructor creates with users or students. SP is more easily developed in face-to-face richer media settings, however SP can be encouraged in computer-mediated learner media settings as well.

Table 1. Select studies of online teaching and social presence

Reference	How Social Presence (SP) was Established	Key Findings
Hostetter and Busch, 2006; Swan and Shih, 2005	Course design by weekly threaded discussion, course credit for discussion participation, provoking discussion questions. Also with instructor and peer presence in online discussions promoting sharing personal experiences and feelings	SP leads to student satisfaction and learning Perceived presence of instructors may be more influential factor than perceived presence of peers for student satisfaction
Richardson and Swan, 2003	Course activities with class discussion, group projects, individual projects, self-tests, written assignments, lectures, readings	SP leads to satisfaction with instructor and perceived learning Women have higher social presence than men No age or experience influence
Russo and Benson, 2005	Course components organized for cognitive learning (student assessment of their learning), affective learning (attitude about the course), perception of presence (peers, instructors, and self)	SP leads to instructor presence and peer presence SP leads to affective learning and student learning satisfaction Important to establish and maintain SP including own SP which leads to higher grades
Tu, 2000	Attention process by drawing interpersonal attractions (inviting public speakers, Good communication style) Retention process by showing images that increase sensory stimulation Motor reproduction process by cognitive organization Motivational process with incentives to learn	SP leads to learner-to-learner interaction SP increases student's performance, proficiency, retention and motivation Student attitudes towards the subject are increased
Picciano, 2002	Course is structured around readings and weekly discussions, students as facilitators Asynchronous and synchronous discussion session with peers and instructors Instructor immediacy	SP leads to student interaction and perceived learning SP has a significant relationship with performance on written assignments which requires discussion with instructor and peers
Aragon, 2003	Course design, instructor, and participant strategies	Creating a platform for SP Instructors can establish and maintain SP encouraging student participation

Research examining UAT activities suggests both facilitator and users need face-to-face communication options when the system under test is newly developed (Larson, 1995). Typical UAT timelines involve: A system almost fully developed, user guides and training materials developed by the technology group, business analytic review and input on these materials then drawing up the test scripts, users performing tests based on the scripts and with open unscripted use, user reporting issues to the business analyst who reviews and logs the appropriate defects for the development team to address. This is repeated until the users sign off that the system works as needed (Larson, 1995). Research illustrates the UAT process can be improved with users having the ability to engage in direct interactions with both the business analyst and development teams when questions arise (Larson, 1995).

Facilitated testing by the real time users can be implemented in 3 ways (Seffah and Habied-Mammar, 2009): 1. Require remote users to travel to a local facility, 2. Send facilitator to remote locations, 3. Facilitator from local facility does computer mediated conferencing (CMC) with users in remote location. Each of these approaches establishes different communication environments. SPT suggests facilitated UAT local facilitation or remote hosting of UAT exercises will require different dimensions of where and how facilitators should involve users in the UAT activities. Table 2 demonstrates researchers' views on facilitated UAT approaches and how SPT attributes are expected to affect three different UAT approaches based on studies of SP in online teaching. Remote users travelling to local facility and facilitator travelling to remote locations are treated as same in Table 2 as both are similar to instructor teaching to students face to face while remote UAT is compared with online teaching. As Table 2 illustrates how attributes of SP tend to be low for remote UAT events because face-to-face communications are highly advantages when establishing high SP. Also, online research on SP for online learning is high if SP is established using various techniques like incentives, course design, etc.

Table 2. Facilitated UAT Approaches

	Remote users travel to local facility	Facilitator travel to remote locations	Computer mediated conferencing between facilitator at local facility & users at remote locations
Facilitator	Local	Remote	Local
User	Local	Remote	Remote
Challenges in approach:			
Type of system[1]	New	New or Upgrade	Upgrade
Costs[2]	$100,000-$150,000 US dollars, excluding cost of deployment, management, training, upgrades, and test analysis software	$15,000-$20,000 US dollars, including test software, per location	More participants form diverse backgrounds, lower budget, and less time

Table 2. (*Continued.*)

Size of group[2]	Limited	Limited	Greater participation
SPT Attributes adopted from online teaching environments[3]:			
Expression of emotions	High	High	Low
Use of humor	High	High	Low
Self-disclosure	High	High	Low
Dialogue	High	High	Low
Asking questions	High	High	Low
Compliment, express appreciation, agreement	High	High	Low
Assertive/ acquiescent	High	High	Low
Informal/formal relationships	High	High	Low
Trust relationship	High	High	Low
Social relationships	High	High	Low
Attitude toward technology	Positive	Positive	Apathetic
Access and location	Easy	Easy	Hard
Timely response	High	High	Low

[1] (Klein, 2003; Larson, 1995; Seffah and Habieb-Mammar, 2009)
[2] (Seffah and Habieb-Mammar, 2009)
[3] (Rourke et al., 2007; Tu and McIsaac, 2002)

Mostly used in research examining online education, SPT informs remote communications environments by examining the way people represent themselves online through the way information is shared (e.g., how messages are posted and interpreted by others) and how people related to each other (Kehrwald, 2008). When face-to-face, people use everyday skills to share information through multiple cues using rich nonverbal communication inherent in tone of voice and facial expression. Richer communications allow individuals to provide and respond to the sight, sound, and smell of others which inherently provides an awareness of the presence of others (Mehrabian, 1969). Online information sharing lacks the cues needed to create an awareness of the presence of others and offers the ability to discuss information but not to connect or bond with others on a more personal level (Sproull and Kiesler, 1986). Research studies of online education have found that the lack of SP impedes interactions and as a result hinders student-learning performance (Wei et al., 2012). One proposed solution is to combine the use of both asynchronous (pre-produced

content accessed by users when needed) and synchronous (real-time, concurrent audio and video connections) components, with synchronous efforts providing a much more full social exchange greatly increasing the potential for SP. Thus, SP is an important factor in information exchange when learning and performance are required, as is the case of user participation in UAT events.

3 Case Study Methodology

The research methodology follows a qualitative approach in gathering case study data on UAT practices in order to provide descriptive and explanatory insights into the management activities in software development work. This approach has been used successfully in prior research (Pettigrew, 1990; Sutton, 1997) and allows us to induce a theoretical account of the activities found in empirical observations and analysis of team member's viewpoints. This approach is also known to lead to accurate and useful results by including an understanding of the contextual complexities of the environment in the research analysis and outcomes. Finally, this approach encourages an understanding of the holistic systematic view of the issues and circumstances of the situation being addressed, in this case the issues of managing development projects from team member perspectives about their testing practices (Checkland et al., 2007; Yin, 1989). To identify the practices, we selected a large multinational fortune 500 company known to have successful UAT events. The focus of our study is specific to the UAT practices of large scale complex globally-deployed software development projects.

4 Data Collection

The results reported in the present study are based on interviews with UAT facilitators. Our data gathering began with the creation of semi-structured interview protocols which comprised both closed and open-ended questions. To inform our interview question development, we reviewed documentation about the company, and held background discussions with company personnel. The data collection methods employed focused on interviewees' perspectives on UAT issues, roles played by various stakeholders involved, and the challenges of incorporating actual systems users in the process. Face-to-face interviews of approximately 1 to 1.5 hours were conducted with various project stakeholders. The goal of these interviews was to identify and better understand the issues related to UAT. In total, we interviewed 8 stakeholders. Interviews were conducted between November 2013 and January 2014, with additional follow-up clarification Q&A sessions conducted over e-mail. Job descriptions of those interviewed are shown in Table 3.

Table 3. Job Descriptions of Interviewees

Job Title Description	Years of Experience	Responsibility	Times Interviewed
Business Systems Quality Analysis Analysts	2	UAT test plans, writing UAT test cases, UAT facilitation and defect management	2
Business Systems Quality Analysis Analysts	6	UAT test plans, writing UAT test cases, UAT facilitation and defect management	1
Business Systems Quality Analysis Advisor	6	UAT test plans, writing UAT test cases, leading teams of quality analysts, UAT facilitation, defect management, quality process and standards design, 3rd party contract quality analysis and management	2
Business Systems Quality Analysis Advisor	18	UAT test plans, writing UAT test cases, leading teams of quality analysts, UAT facilitation, defect management, quality process and standards design	2
Business Systems Quality Analysis Manager	16	leading a team of quality analysts and quality advisors responsible for enterprise level activities globally including process and standards, UAT management and execution and third party contracts	2
UAT Tester 1	n/a	testing the "administrative functions" of an app as part of an end user support role	1
UAT Tester 2	n/a	Same	1
UAT Tester 3	n/a	Same	1
		Total Interviews	12

By collecting and triangulating data across a variety of methods, we were able to develop robust results because of the perspectives we gained about UAT issues. This approach provides in-depth information on emerging concepts, and allows cross-checking the information to substantiate the findings (Eisenhardt, 1989; Glaser and Strauss, 1967; Pettigrew, 1990).

5 Findings

In this research, we gathered and analyzed interview data from a large multinational company with multiple stakeholders of UAT events along with best practices from the research literature. From these data sources, we next address the research questions

proposed earlier to offer insights about managing UAT events. For completely new complex systems and novice UAT participants, SP will be a critical factor enabling better testing outcomes. In this case, facilitators should schedule user participation locally at the testing location where face-to-face interactions can occur. While cognizant of the need to minimize the impact to users' regular work duties and keep from having work requirements outside of regular working hour, these events can be concentrated into a shorter timeframe and more efficiently administered when everyone is together. Accommodating users locally maximizes users' ability to be present when testing and not be distracted. Complicated tasks and difficult questions can be addressed and more readily communicated. Additionally, peer-to-peer face-to-face learning can be enabled, which has been shown to improve outcomes (Tu, 2000).

Media richness theory has long held that richer media are the key to building trusting relationships (Campbell, 2000). Media richness theory suggests settings should be assessed on how well they support the ability of communicating parties to discern multiple information cues simultaneously, enable rapid feedback, establish a personal message, and use natural language. Richer media tend to run on a continuum from rich face-to-face settings to lean written documents. Thus, consistent with above, for completely new complex systems and novice UAT participants, richer media settings are needed to enable direct interactions with users including face-to-face conversations during the UAT event and access to user computer screens for configuration and validation. Richer settings also enable facilitators to collaborate and train users to improve information sharing. Furthermore, peer-to-peer learning and immediacy of replies for help and answers enables a more productive UAT outcome. When users are located in distant remote locations, time lags between queries and answers impedes productivity and dedication to task.

Quality management software (QMS) enables standard procedures and processes, effective control, maintainability, higher product quality at a reduced cost (Ludmer, 1969). In our interviews with facilitators and user acceptance testers we found that QMS plays a critical role while performing UAT. UAT testers use QMSs to read and execute test scripts, input result of their tests, log defects and verify defects are fixed. Facilitators use QMSs to write test scripts, review the results of test runs, track defects, prioritize defects, and assign defects to developers. In summary, QMS serves as a common platform for facilitators and UAT testers.

Facilitators are tasked with training non-technical business users on how to use QMS technical tools. QMS that are globally available in the market include HP Quality Center, IBM Rational Quality Manager etc. These tools have a plethora of multilingual support with study materials, user guides and social networking communities. The next steps with this research is to determine how to replicate SP created in a face-to-face UAT event within a remote UAT experience.

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