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Impacts of electronic process guides by types of user: An experimental study

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ABSTRACT

The design and utilization of Electronic Process Guides (EPGs) have been studied in Software Engineering (SwE) since the 1990s. However, the empirical findings from surveys, case studies, and experiments on the beneficial effects of their utilization are still lacking. Thus, we suggest that further research on the utilization of EPGs is required. In this study, we are interested in gaining insights on the effects of using EPGs on objective metrics (learning score, time effort) and subjective metrics (perceived usefulness, ease of use, and value), by comparing three EPG designs (a simple PDF-based EPG, a normal HTML-based EPG, and a sophisticated Java-based EPG) with different blocks of experimental subjects (practitioners, academicians, novices, and experts). To this end, we have conducted a controlled experiment with a sample of international participants in the domain of IT Service Management. We found that the utilization of EPGs improves the objective metrics while no improvements were perceived on the subjective ones, and that the sophisticated EPG design is more appropriate for the academic and expert types of users than for the practitioner and novice types. Thus, our main recommendation for the design and utilization of EPGs is to consider the type of end-user.

1. Introduction

In the Software Engineering domain a problem faced by software engineers—learning from inherently complex documents for executing a software development process correctly—has been under study from the 1990s (Kellner, Becker-Kornstaedt, Riddle, Tomal, & Verlage, 1998; Makela & Kunnamo, 2001; Neerincx, 2011). This complexity arises for the huge number of concepts (e.g., terms, phases, activities, tasks, roles, work products, techniques, tools, templates, guidelines) that are employed and their interrelationships (Dougmore, 2006; Mora, Cervantes-Pérez, Garrido, Wang, & Sicilia, 2010). Thus, the utilization of software engineering process frameworks such as CMMI-DEV (SEI, 2006) and ISO/IEC 12207 (ISO, 2008) involves a complex knowledge structure, which limits the ease of implementation of such frameworks in organizations (Roedler, 2006). CMMI-DEV (SEI, 2006), for instance, is reported in a document of 561 pages that describes 2 representations (continuous and staged), 5 maturity levels, 6 continuous capability levels, 22 key process areas, 5 generic goals, 17 generic practices with about 150 elaborations (specific recommendations for each one of the 22 areas for some of the 17 generic practices), 47 specific goals, 161 specific practices, and about 250 typical work products.

In this research, we are interested in addressing a similar problem found in the emergent IT Service Management (ITSM) area. ITSM is an important organizational theme in large and mid-sized organizations because its utilization has the potential to deliver more efficient and effective IT management, and ultimately better organizational value (Sallé, 2004; Johnson, Hately, Miller, & Orr, 2007) than without an ITSM approach. From a research and academic perspective, elaboration of ITSM research and ITSM curriculum design has been encouraged (Gallup, Dattero, Quan, & Conger, 2009; Rai & Sambamurthy, 2006). For instance, Rai and Sambamurthy (2006, p.328) alert us to the need to integrate (p.331) IT services management frameworks (e.g., ITIL) into curricula and research. In turn, Gallup et al. assert that ITSM is an emerging discipline (2009, p.127), which requires conceptual and empirical research.

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However, ITSM practitioners and academicians interested in implementing and teaching ITSM process frameworks are faced with the challenge to learn and consult inherently complex documents similar to those found in the software engineering area (Mora, Gelman, Raisinghani, & Macias-Luevano, 2011; Mora, O'Connor, & Gelman, 2010). Thus, given that successful ITSM implementations require adequate training and staff awareness (Pollard & Cater-Steel, 2009), among other critical success factors, we believe that ITSM professionals and academicians can benefit from process guidance support on the selected ITSM process, similar aspects of software engineering, and possibly other areas.

This process guidance support has been provided in the software engineering area through Electronic Process Guides (EPGs) (Kellner et al., 1998; Makela & Kunnamo, 2001; Neerincx, 2011). EPGs are digital documents, which are designed to support the understanding, training, and execution of a particular set of processes. EPGs are not intended for enacting an organizational process (like a business process management system) but rather for supporting their correct execution by human participants (Kellner et al., 1998).

Consequently, given that the ITSM area suffers from similar problematic issues as in the Software and Systems Engineering areas, in this paper we are interested in gaining insights into the effects of use of EPGs by different types of users in the application domain of ITSM utilizing both objective and subjective metrics for data collection. Thus, we conducted a controlled experiment with a sample of 38 international practitioners and academicians in the domain of ITSM utilizing both objective (learning score, time effort) and subjective metrics (perceived usefulness, ease of use, and value) by comparing two enhanced EPG designs (HTML-based EPG, and Java-based EPG) with a PDF-based EPG, between four types of users (practitioners, academicians, novices, and experts). In summary, we found that the utilization of EPGs resulted in improvements for the objective metrics despite the lack of differences for the subjective ones for all experimental subjects, and that the sophisticated Java-based EPG design is more appropriate for the academic and expert types of users.

The remainder of the paper continues as follows: in Section 2, a review of the foundations of ITSM process models and EPGs is reported; in Section 3, the formulation of this research is described; in Section 4, the insights of this experimental research are reported; in Section 5, a discussion of findings and implications for ITSM theory and practice is presented. Finally, this paper provides conclusions, limitations, and recommendations for further research.

2. On IT Service Management and EPGs foundations

2.1. IT Service Management

An IT service is a more complex entity than a software system or an information system. An IT service involves the interactions of several human and technology components (hardware, software, DBMS, networks, data, applications, environment, and internal and external teams) (Mora, Raisinghani, O'Connor, Gomez, & Gelman, 2014b). Consequently, a software system or an information system is a critical part of an IT service (Mora, Raisinghani, O'Connor, Marx-Gomez, & Gelman, 2014a; Uebernickel, Bravo-Sànchez, Zarnekow, & Brenner, 2006). An IT service can be defined as a service provided to one or more customers by an IT service provider, based on the use of IT, which supports the customer's business processes and consists of a combination of people, processes, and technology as defined in a Service Level Agreement (OGC, 2007).

IT Service Management (ITSM) process models (and standards) are conceptual process frameworks, which report the best managerial and engineering practices for delivering high quality IT services. In general, IT Service Management (ITSM) can be defined as a management system of organizational resources and capabilities for providing value to organizational customers through IT services (van Bon et al., 2008). Several ITSM process models have been reported: ISO/IEC 20000 (ISO, 2005, 2010) ITIL v2 (van Bon, Pieper, & van deer Veen, 2005); ITIL v3 (Cartlidge et al., 2007; van Bon et al., 2008); CobIT 4.0 (ITGI, 2005); CMMI-SVC (SEI, 2010); ITUP® (EMA, 2006; Ganek & Kloeckner, 2007; IBM, 2010); and MOF® 4.0 (Microsoft, 2008). From these ITSM process models, in particular the CMMI-SVC is unique in its free-access, and in this research it is the ITSM process model, which is studied.

The purpose of the CMMI-SVC ITSM process model is to provide guidance for applying CMMI best practices in a service provider organization (SEI, 2010; p.3). CMMI-SVC integrates best practices from several previous ITSM process frameworks and the CMMI models developed for the software and systems engineering disciplines. CMMI-SVC is organized into four process categories: Support (SUP), Process Management (PRM), Project Management (PM), and Service Establishment and Delivery (SED). It includes 24 process areas where 7 are focused on service process areas (capacity and availability management, service continuity, service delivery, incident resolution and prevention, service transition, service system development, and strategic service management).

The other published ITSM process models share similar structures with categories of processes, process descriptions with goals, activities, tasks, procedures, roles and artifacts. Hence, all of the ITSM process models can be considered inherent complex documents to be learnt and correctly applied.

2.2. Electronic process guides

According to Kellner et al. (1998) a Process Guide (EPG) is "*a reference document for an intended process*, *providing guidance to process participants in carrying it out*" (p.11), and its core function is "*to facilitate process understanding*" (Kellner et al., 1998; p.12). An EPG is a process guide released in electronic format. Thus, an EPG can be defined as an: electronic document with graphical and textual representations of a process model, which enable multiple views of such processes (Koolmanojwong, Aroonvatanaporn, & Charoenthongtrakul, 2008).

EPGs have been posited for overcoming the natural limitations of printed documents or their digital versions (without a specific EPG design), which are: deficient in form and content; difficult to understand, to use, and to access; and scarcely used in practice (Hauck, von Wangenheim, de Souza, & Thiry 2008; Kellner et al., 1998; Leuser, Porta, Bolz, & Raschke, 2009). Research findings on EPGs have found benefits of EPG utilization such as: training and process execution improvement (Kellner et al., 1998); gradual tailoring of process, reuse, process conformance, resulting in better process management (Becker-Kornstaedt, 2000); and process communication improvement (Koolmanojwong et al., 2008). In contrast, the paper-based process guides have several limitations: absence of updated critical process information (Kellner et al., 1998); a linear-based organization (Becker-Kornstaedt, 2000); omission of process hierarchically-based views (Koolmanojwong et al., 2008); poor navigation capability (Kellner et al., 1998); version control and update problems (Becker-Kornstaedt, 2000); and poor utilization of diagrams and guidance charts (Koolmanojwong et al., 2008). In particular Dingsøyr, Moe, Dybå, & Conradi (2004) visualize the traditional printed process guides with such negative effects as: few consulted, difficult to read, and as just "dust collectors".

However, EPGs have also some limitations: the development of EPGs for small and mid-sized organizations may not be affordable given their complex design and high development costs (Kellner et al., 1998); EPGs can be wrongly designed and become isolated documents not linked with relevant current process information