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Implementing On-Line Learning and Performance Support Using an EPSS

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Abstract

Electronic Performance Support Systems (EPSS) is a method for on-line learning and performance support applied in organizations for the last 20 years. EPSS integrates learning as well as task performance into a single action. It does so by providing information and guidance regarding the task according to a specific need and situation, thus allowing learning while working. Up to now, only a few empirical studies have been conducted on the effectiveness of EPSS in supporting task performance, while its ability to provide effective on-line learning remains in question. The current research goal is to assess EPSS effectiveness for both learning and performance support considering a number of primary organizational factors including work/learning environments.

The results indicate that EPSS effectiveness is highly dependent on organizational environments and user experience. The findings also suggest a new perspective on former studies which claim EPSS superiority and others who disputed its effectiveness altogether. The research conclusions help in formulating development and implementation guidelines for both learning and performance support personnel by matching EPSS strategies to users' attributes and organizational environments

Keywords: Performance Support, EPSS, On-line learning, Corporate Learning, Knowledge Management.

Introduction

Learning efforts in the organization aim to achieve a competency level that meets workers' job description. Over the years organizations have applied different learning strategies to cope with the growing complexity of jobs and work environments. "E-learning" which integrated learning into the work environment, thereby reducing the enormous cost of learning, was introduced in the 1980s. Though e-learning achieved considerable effectiveness it still failed to meet organizational demands for maximized learning. In the early 1990's another new method was introduced offering a potential solution for both increased learning expenses and growing job complexity. The method is named after the tools (systems) by means of which it is applied: Electronic Performance Support Systems (EPSS).

EPSS is a method of on-line learning and performance support which has been in use in organizations for the last

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twenty years. It integrates learning and task performance into a single action by providing information and guidance about the task in response to specific needs and situations, thus allowing learning while working. In spite of the high potential attributed to EPSS only a few studies have empirically tested its effectiveness. While research proved the ability of EPSS to support task performance, its capacity to provide effective on-line learning remains in question. The current research aims to assess EPSS effectiveness for both learning and performance support by considering a number of primary organizational factors, including the work/learning environment. The design and scope of this research help overcome limitations of earlier studies. The results and conclusions offer a new perspective on the role of the EPSS methodology in contemporary organizational learning and performance support efforts.

The Origin of EPSS

Gery (1991) introduced the term Electronic Performance Support Systems (EPSS) in the early 1990's, describing it as a method aimed to enable human performance through just in time learning and task support. The method originates in the most basic and ancient organizational training professional method: apprenticeship. The apprentice-expert relationship is a "performance support" relationship. In the historic organization new recruits were admitted directly to the work environment and assigned an expert (veteran worker) to supervise and support their performance during the initial acquisition of relevant skills and knowledge. Once skills were mastered the support was gradually reduced up to the point when the worker was fully independent and no more help was needed. Industrial and information age workplaces mostly abandoned the apprenticeship method because of its considerable demand on expert resources in a situation where mass training was required. On the Job Training (OJT) strategies have mostly been replaced by preliminary job-related skills acquisition and certifications in a "learning environment" before workers are introduced to the work environment. The preliminary learning method has proven to be efficient when mass training is concerned. As to its effectiveness, the method is highly criticized due to its low skill and knowledge retention rates and high costs.

Starting in the early 1990's a modern version of the apprenticeship method was introduced in organizations. The human expert was replaced by an expert system. The computerised work environment allows integration between performance and supported information, thus enabling, as in the historical apprentice situation, learning on the job. Modern characteristics mark this promising training method which is called: Electronic Performance Support System.

EPSS as a Learning Tool

Though the original definitions of EPSS focused on performance enhancement (Bastiaens, Nijhof, Streumer, & Abma, 1997b; Gery, 2002), some practitioners identified its potential to provide an effective on-line learning platform (Barker, 1995; van Schaik, Barker, & Pearson, 2002, 2005). The debate concerning the extent to which EPSS actually allows effective on-line learning claims a significant place in the overall discussions of the method. Two seemingly opposing approaches are associated with this topic:

1. Support reduces the need for learning. The first and main approach claims EPSS should reduce and even eliminate the need for learning (of system procedure at least). Work skills are acquired via application of EPSS, namely through worker-system interaction thus making preliminary studies redundant.
2. Support leads to learning while at work. The second approach underlines the roots of the method derived from organizational training and learning theories. Practitioners supporting this approach often refer to common cognitive learning theories which can be put to

practice using an EPSS: Constructivism, Situated Learning, Cognitive Apprenticeship, Adult Learning (andragogy) and Context Based Learning (Mao, 2004).

Rosenberg (1995) sums up the debate quite accurately by claiming that although much of the roots of electronic performance support can be traced back to the field of education and training, EPSS's greatest potential is associated with its unique ability to solve business, not educational, problems. This does not mean that learning is not a result of interactions with EPSS; it's just that, in this new paradigm, performance rather than learning is the direct goal

EPSS Types

Gery (1995) defined a wide range of technologies all included in the original term "EPSS". She did so by classification of EPSSs according to the level of their integration with the supported (work) system. This yielded the following three clusters of support technologies:

- External Support. The EPSS stores content used to support task performance in an external database. This content is not integrated within a user's work interface. This group of systems includes search engines, help files, A&Q and knowledge portals also known as "Knowledge Management Systems". (For example see KANA at www.kana.com).
- Extrinsic Support. The EPSS is integrated with the work system but is not part of the primary workspace. The content is sensitive to the user's work interface but is displayed elsewhere. See "2Work!" application by "ThinkSmart" www.thinksmartps.com.
- Intrinsic Support. The EPSS provides users with task support that is incorporated directly within their work interface. See "Real-Time Process Optimization" by "Nice" www.nice.com/smartcenter-suite/real-time-guidance.

Previous studies comparing types of EPSS proved decisively that intrinsic EPSS is the best approach for both performance support needs and on-line learning (Nguyen, 2008; Nguyen & Hanzel, 2007; Nguyen & Klein, 2008; Nguyen, Klein, & Sullivan, 2005). As in most empirical research on EPSS, the following limitations of these innovative studies must be kept in view: research tasks were out of context for the employees, the systems used (EPSSs) were very different from current EPSSs, and data gathering process affected EPSS operation. As revealed in the "Results" section of this article, the current research invalidates some of the conclusions of former studies and offers possible reasons for effectiveness differences among EPSS approaches.

EPSS Effectiveness Research History

Although EPSS has been discussed for two decades, very few studies have been conducted to measure its effectiveness (Nguyen et. al., 2005). Research supports EPSS's ability to offer effective performance support of a task (Bastiaens, Nijhof, Streumer, & Abma, 1997a; Nguyen & Klein, 2008; Nguyen et al., 2005) but its ability to provide effective on-line learning is disputed. Most studies were limited by several factors, for instance, work environment inauthenticity, early technological constraints, the short term nature of the study and omission of primary organizational and user attributes such as experience levels and environment.

Purpose of the Current Study

The current study aims to assess EPSS effectiveness for both on-line learning and performance support and to identify the factors instrumental in the realization of EPSS's potential in corporate settings.

Research Questions

The research poses three questions concerning EPSS effectiveness according to system type, user attributes, and organizational environments in which the EPSS is applied. The current article addresses the first two of these questions:

1. What are the effectiveness differences between an external EPSS (no direct interface with the working systems) and an intrinsic EPSS (embedded in the working systems)?
2. What are the effects of experience and of organizational environments on EPSS effectiveness?

The current article presents and discusses results concerning the first question and a segment of the second question concerning the combined effect of EPSS type and organizational environments on EPSS effectiveness.

Method

Participants

Participants were 276 service representatives from a large telecommunications company who were randomly selected. The service representative training track in the company includes a four-week initial training at the company's training facilities. Following certification the representative joins a work team in one of the company's call centers. Fifty-two percent of participants in the study were trainees (about three weeks into the course). The rest of the participants were working service representatives with 2-18 months seniority. Demographic details were collected during the research. Following is a detailed description of the research population's demographic attributes.

Gender. Most participants were female (70%). Gender distribution in the research population is detailed in Table 1.

Table 1. Gender Distribution of the Research Population (N=276)

Gender	N	% in population
Female	193	70%
Male	83	30%

Age. Mean age was 24.7 years. Participants indicated their age in a pre research questionnaire by selecting a predefined age group. Table 2 lists number of participants in each group and the group size in the population.

Table 2. Age Distribution of the Research Population (N=276)

Age Group (years)	N	% in population
18-19	10	3.2%
20-21	64	20.6%
22-24	70	22.6%
25-28	68	21.9%
29 and older	64	20.6%

Education. The mean number of years participants spent in formal education programs was 14.5 years. More than 50% of all participants are academics (have earned at least a first degree at a university). Table 3 details the education level of the participants.

Table 3. Education Level of the Research Population (N=275)

Level of Education	N	% in population
10 years or under	4	1.3%
High school Diploma	112	36.1%
First degree	86	27.7%
Second Degree and over	73	23.5%

Materials

Support and work systems

The company which facilitated the research implements three main information systems: an external and an intrinsic EPSS and a Customer Relationship Management system (CRM) with which most every day tasks are being performed. Thus the last system is referred to as the "Work System". Below is a short description of all three systems included in the study:

- **Work System**. The company's main work system is the CRM (Customer Relationship Management). The system lists all subscribers' details, history, and current billing status. Most service and sale procedures are conducted using the CRM system. During the initial training course representatives learn and practice common procedures with the system. Certification procedure includes integrated scenario-based tests related to trainees' system operation skills.
- **External Support System**. The company applies an information portal accessible to all employees via company's intranet. The portal includes all professional data and information to support mainly service and sale procedures. During a service or sale call the representative will access and use the information portal parallel to procedures performed in the CRM system. Service representatives are trained in the use of the information portal from an early stage in the training course.
- **Intrinsic Support System**. The company also applies an "interaction management system" which displays information and data within the CRM system screens according to pre-programmed rules. For example: the support system identifies that a refund procedure was initiated by the user. It will automatically display a step-by-step support system including mathematical calculations and suggested formulations for explaining the procedure outcome to the customer. Figure 1 displays a demonstration of the intrinsic support system applied by the company. The step-by-step support call out is displayed next to the relevant field for the current step in the CRM system. The entire procedure is displayed step-wise in an additional window at the bottom right side of the screen.

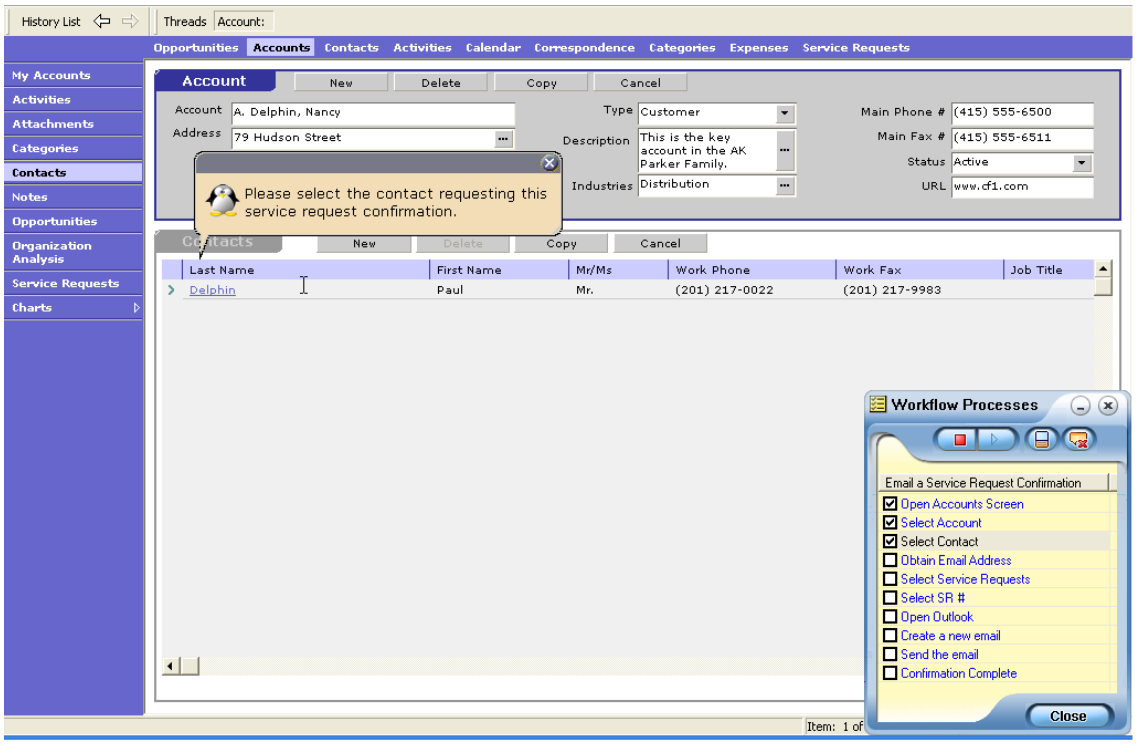

Figure 1. Intrinsic Support System Step By Step Support Demonstration. "Real-Time Process Optimization" by "Nice". Used with permission.

Task scenario

In order to measure the support system's effectiveness on authentic tasks, a virtual lab was formed using the company's e-learning and training systems. Three authentic and common service scenarios were selected by senior trainers in the company. In each scenario a service call was described requiring the service representative to seek data and explain it to the customer or perform certain actions in a customer's account and explain the outcome of the procedure to the customer. The selected scenarios focused on service areas that were unfamiliar to the participants (novice and experienced alike). Participants were randomly assigned to work with one of the support systems (external or intrinsic) during performance.

Variables

1. The dependent variables were as follows: time on task, quality of performance, comprehension level (test) and confidence level.

2. The independent variables were: EPSS type (external/intrinsic); organizational environment (learning/working); user experience with the EPSS; user seniority. Also measured were: demographic attributes and subjects' attitudes towards computers, e-learning and EPSS.

Procedures

Data collection procedures in the study took approximately 14 months. Data were collected from a small group of representatives at the call center during their work days and from trainees during training in class. Once introduced to the e-learning system in which all research questionnaires were embedded, participants were asked to follow the instructions and fill in the questionnaire.

During the scenario phase participants were asked to make as much use as needed of the EPSS assigned to them (external or intrinsic) while the EPSS not assigned was shut down for that time. The scenario execution phase took place as follows: participants read the scenario in the e-learning system and performed the designated procedures in the CRM while being supported by one of the EPSSs; once they completed the task, they returned to the e-learning system to complete a questionnaire regarding quality of service and a post experience feedback. The data collected via the e-learning system's questionnaire allowed us to assign a score for each scenario according to a predefined scoring system. Scores were admitted to the four dependent variables according to the authentic business goals set for those parameters in the company (Speed, Quality, Comprehension, and level of Confidence). The scoring system enabled us to study EPSS contribution to each core business and learning goal in addition to the comparison of the different types of EPSSs. Each score scale was set between 0 and 100. The mark 80 in each scale represents the competency level threshold the company set for the designated parameters. All experienced service representatives in the company were expected to score 80 or higher in each parameter.

Data Analysis

Analysis was done by comparing EPSS type groups and sub-groups according to environments (learning and work) using a t- test analysis. Scores of dependent variables were also compared against an absolute competency score marking desired level of worker's competency at the call center (competency level is a score of 80 in all dependent scales).

Results

Following are the results of the study, presented according to the two research questions addressed in this article.

Question 1: EPSS Effectiveness According to System Type

Effectiveness results according to EPSS types appear to confirm the findings of former studies

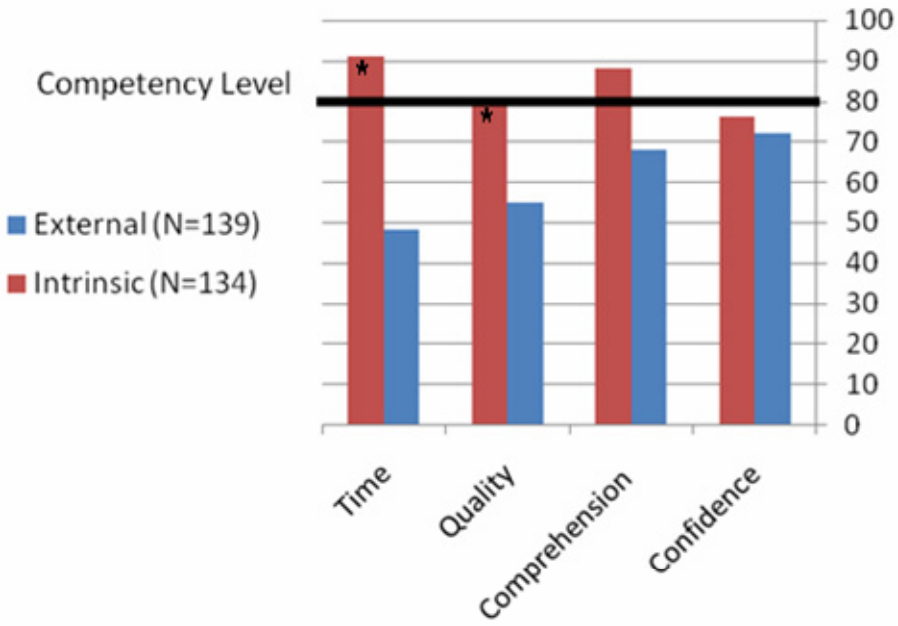

Figure 2. EPSS Effectiveness According to System Type

(Nguyen, 2008; Nguyen & Hanzel, 2007; Nguyen & Klein, 2008; Nguyen et al., 2005) and earlier claims (Gery, 1995) suggesting the absolute superiority of the intrinsic approach over the external one. As demonstrated in Figure 2, significant differences ($p < 0.05$) were found in the performance support variables only. Intrinsic EPSS users reach the designated organization competency level on all variables except the confidence variable. External users fail to meet the competency level on all of the variables.

Question 2: EPSS Effectiveness According to System Type and Organizational Environments

Once participants are divided according to environments (Learning/Work) as well as EPSS type, however, results appear to dispute the superiority of intrinsic support (see Figure 3 – EPSS Effectiveness According to Environment and System Type).

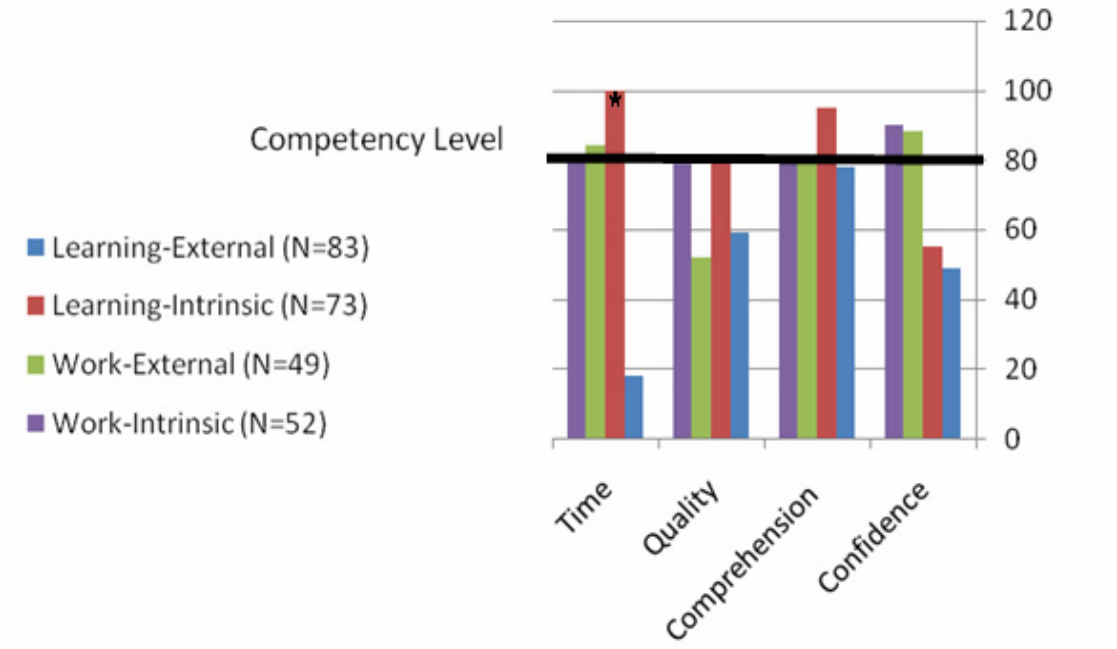

Figure 3. EPSS Effectiveness According to Environment and System Type

Figure 3 displays results regarding the four dependent variables investigated in the current study. Thus the research population is divided accordingly to four groups: External vs. Intrinsic users, learning environment vs. working environment. The combined effect of EPSS type and environment has a significant influence only on the variable "time on task" [$f_{(1,155)} = 9.91$ $p<0.01$] . As demonstrated in Table 4, the simple effect (t test) between the four groups produces two significant differences: In the learning environment EPSS type has a significant influence on the time it takes participants to complete their tasks. Intrinsic users are much faster than external ones [$t_{(88)} =3.14$ $p<0.01$]. In this case intrinsic users, though only in preliminary training, achieve a perfect score in the time on task variable. However, once users enter the work environment the differences between the two EPSS types disappear completely and both groups (in the working environment) seems to perform their task in similar time frames. As shown in Figure 3, both groups in the working environment achieve the designated competency level set by the organization for the time on task goal. External users in the learning environment perform their task at a very slow pace. Users using the same system in the working environment are much faster [$t_{(97)} =3.2$ $p<0.01$].

Table 4: Simple Effect Analysis of "Time on Task" According to EPSS Type and Organizational Environments			
t (environments)	Intrinsic EPSS	External EPSS	
t (88)= 3.14 **	M(SD)=4:18 (1:53)	M(SD)=5:43 (2:08)	Learning Env.
t (95)= -0.19	M(SD)=4:40 (1:49)	M(SD)=4:36 (1:16)	Work Env.
	t (78)= -0.87	**t (97)= 3.2 ****	t (EPSS type)

** P<0.01

The other three variables scores' differences cannot be attributed to the combined effect of EPSS type and organizational environments. These differences can be attributed however to the influence of either EPSS type or environments when comparing scores according to a single independent variable at a time:

Quality of Performance. It seems the main variable influencing quality of task performance is EPSS type. Intrinsic users in the learning and working environments achieve very similar scores reaching the competency level set for quality. External users on the other hand fail to reach the desired level in both the learning and working environments.

Comprehension Level. It seems neither EPSS type nor organizational environment has any impact on the level of comprehension achieved by performing a task with the assistance of an EPSS. All four groups achieve similar scores in the variable, above the designated competency level. EPSS does support better understanding of the task performed whether the user is an external or an intrinsic user, and whether she or he is a new-comer or a veteran.

Confidence. It seems that environment, which in this case also represents experience level, significantly affects the confidence level of users while they perform a task with the assistance of an EPSS. Though intrinsic users in the learning environment achieve high scores on time and quality, they still report low confidence levels on task.

Conclusions

The current study aimed to assess EPSS effectiveness for both on-line learning and performance support with reference to two main factors: EPSS type and organizational environments. Two EPSS types were compared: an external EPSS (not integrated with the supported system), and an intrinsic one (fully integrated in the supported system). Two organizational environments were also examined: the learning environment in which users are trained to perform everyday tasks and the working environment where everyday tasks are performed using designated tools and systems. The limited research on the issue of EPSS effectiveness according to type (Nguyen, 2008; Nguyen & Hanzel, 2007; Nguyen et al., 2005) and the EPSS literature on the whole (Gery, 1995) claim the superiority of intrinsic support over the external version. The current findings suggest that organizational environments and workers' experience determine EPSS effectiveness. They yield a new perspective on Nguyen and colleagues's conclusions which did not take into consideration either environment or experience-related factors. In a non-empirical article regarding EPSS strategies, Nguyen (2006) referred to user experience and made some suggestions that match the current findings: experienced users who have mastered content area search skills should be supported by an external system.

Working with an EPSS

The main goal of EPSS is to provide performance support that enables the user to perform better than he or she would in a non EPSS work environment. The current study compared two EPSS

types in their ability to support faster and more accurate performance of job related tasks. Findings suggest EPSS performance support effectiveness is environment dependent. Though literature suggests performance support superiority of intrinsic EPSS, the current study results suggests that experienced users had skills which allowed the external system to function just as effectively as the intrinsic one. Barker (2010) suggests that experts differ from novices in that they acquire skills as they gain experience, and these enable them to understand and solve problems. It seems the current research findings confirm the notion suggested by the literature that external support requires certain skills in order for users to achieve effective learning and working with such support. These skills are:

1. Locating and processing information while working (Bastiaens, 1999; Bastiaens et al., 1997a; Nguyen, 2006).
2. Converting declarative knowledge into procedural knowledge (van Schaik, 2010).

Findings regarding the intrinsic EPSS suggest it allows novice workers to achieve competency levels at an early stage of preliminary training. Findings also indicate novice workers using the intrinsic support were significantly faster and more accurate as they performed similar tasks compared to novice workers using the external support

Learning with an EPSS

Early EPSS literature (Gery, 1989, 1991; Barker, 1995) suggested EPSSs can be applied as powerful online learning tools in parallel with their performance support abilities. Users performing a task aided by an EPSS should gain better understanding of the procedure and nurture confidence in their ability to perform the task. Learning attributes of EPSS were partly confirmed by the former limited research in this matter. The current study contributes significantly to the debate regarding EPSS learning abilities. Findings suggest comprehension of a procedure can be achieved with very little prior training by performing the procedure using an EPSS. All participants in the current study showed good understanding of the procedures performed with the EPSSs, with no differences between EPSS types. In the matter of self efficiency however, the current study's findings contradict most earlier publications. Users in the learning environment working/learning with an external or an intrinsic EPSS demonstrated low level of confidence regardless of the high performance achievements gained by intrinsic EPSS users. On the other hand, users more experienced in the work environment demonstrated a relatively high level of confidence regardless of the poor quality of performance by external EPSS users in that environment. The current study therefore suggests that confidence is highly dependent on experience and that EPSS interventions (either external or intrinsic) cannot overcome novice worker's basic low confidence.

Further Findings and Conclusions

More data yielded by this research includes users' attitude towards the EPSS before and after implementation and users' willingness to reuse the EPSS. Findings and conclusions drawn from this part of the research will help us to further understand implementation issues and suggest further guidelines for successful use of the technology in corporate settings. Future publications reporting on this research will suggest factors that support or prevent the proper implementation of EPSS in corporate settings.

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Biographies

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