Electronic Performance Support For Telephone Operators

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This research is about the effectiveness of Electronic performance support systems (EPSS). Some of the assumptions related to EPSS are evaluated. This paper describes the analysis, construction and evaluation of a performance support system for telephone operators. From the research some conclusions can be drawn that may be important for other projects in the field of Electronic Performance Support.

Since the large scale introduction of computers in the early eighties a lot has changed. In the field of performance technology several electronic support systems are introduced. Nowadays keywords are "just in time training" and "learning by doing". Computer support and electronic job-aids are approximating the master in the master and journeyman relationship used in earlier days. This article is a report of a project in the field of Electronic Performance Support Systems (EPSS). Firstly the focus is on "What is an EPSS?". Secondly the theoretical advantages of EPSS use are stated? At last findings of a research project are discussed. In the project an Electronic Performance Support System for telephone operators is optimised and evaluated.

An EPSS is an integrated computerised environment that supports and occasionally monitors employees while they perform their jobs. In general an EPSS contains the following four components (see figure 1): tools (to perform the job), information (needed to do the job correctly), advice (for the difficult parts of the job) and training (to extend the employees' knowledge and skills). It substitutes for or enhances the support of a master.

Figure 1. The components of an EPSS
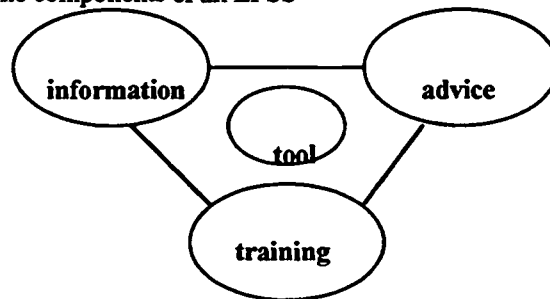
In literature several possible advantages of the use of an EPSS are reported. These are assumptions of possible advantages of EPSS use in practice. The first advantage relates to on-the-job training which leads to high transfer, no need to leave the workplace, and more-active learning processes (Bastiaens, 1995). Probably the most important advantage is the immediate access to information, training and advice (Gery 1989, 1991). The just-in-time access to information leads to an extension of the employees' long-term memory and a reduction of the working load memory (Law, 1994). Having continuous access to training means a reduction of formal training in advance of task performance. Because employees can constantly consult the

advice part of the EPSS the need for supervisor's guidance is expected to be less. This has the additional advantage that the responsibility focus shifts from trainer and training program to the individual's learning needs (Gery, 1991). Moreover, performance support can be important for employees self-management of for the guidance of self-directed teams (Bramer & Senbatta, 1993) and such has the potential to improve the worker's productivity (Raybould, 1990; 1991).

Problem Statement

In the previous section assumptions on the advantage of EPSS have been mentioned but little has been empirically proven. This research project attempts to evaluate the effectiveness of an EPSS. A few disadvantages were found in the literature that could affect the effectiveness of an EPSS. These disadvantages are split in to three categories.

The first category is related to the learning process. "Just-in time" training at the workplace, providing employees with small task-oriented training granules and employees taking control of their own learning process can create problems. Clark (1992) argues that employees may fail to build a unified picture of their job when they have to extract information from an EPSS. Several small information parts will create a fragmented knowledge base. Novices especially need a high level overview of the content to relate details of training. Clark doubts about the learner control in EPSS and she illustrates it with research of Milheim and Martin (1991) which indeed proves that learner control is not as effective as instructional control.

The second category involves problems related to innovation. It is expected that the introduction and implementation of EPSS will summon resistance. Employees are not likely to give up working 'the old way'. Even if they are willing to try a new method there is the problem of pressure in their work. Employees will simply not have the time to engage the training support.

The third category is related to support and work. Is the support adequate? Will "just-in time" support 'de-skill' workers? Will it 'demotivate' workers? Or will it automate the low level tasks and bring in more time to perform tasks on a higher level (Carr, 1992)?

Within the framework of this study it is impossible to give answers to all the questions. The research is therefore restricted to the questions stated in the section 'research questions'.

Research questions

The main purpose of the research is to evaluate the developed support environment and optimise it. The main question is as follows: What is the effect of the existing support environment on the performance and learning of the telephone operators?

Further the following sub-questions are distinguished:

How can an optimisation of the existing support environment further improve the effectiveness of the support environment?

After the optimisation the effects are evaluated on improvement. So the third research question is: "What is the effect of the optimisation on the performance of the telephone operators?"

Regarding the research questions we have the following hypotheses:

Hypothesis related to differences between novice and experienced operators:

There is a difference between novice and experienced operators. Novice operators need more and other information than experts.

Hypothesis related to the support of the information component. It is expected that novice operators will appreciate the information component more, because of a more serious need for information. Lack of information will affect their performance.

Hypothesis three related to the motivation of the operators: Novice operators have a higher motivation but are more insecure about their own performance than experienced operators. For that it is expected that novices have a higher score on innovation willingness.

Hypothesis related to the treatment: It is expected that after the optimisation the new information component is used more often. It is also expected that a new information component will reduce the use of other information sources. At last the assumptions and disadvantages stated in literature are compared with the effects related to learning, innovation, support and work in this research.

The Setting

The research project was executed in co-operation with a large Dutch banking organisation. They only provide banking services and advice by telephone. For that their telephone operators are extensively trained. As far as the training and experience, two types of telephone operators are distinguished. Firstly, experienced operators who have the skills to give advice for all the products the bank has to offer to their clients. Secondly, novice operators starting with just a few products. Novice operators combine training and working and extend their knowledge and skills during a period of six months. After six months training the novices' workers can give advice for all the products.

To give advice and information to clients and also to process their clients' data the telephone operators are supported by a personal computer that is attached to a mainframe. Each operator has a large screen monitor at his or her disposal. On this monitor it is possible to use a tool environment (to process the data) and an information environment (quick access to up-to-date information) simultaneously.

Methodology

To evaluate the support environment the methodology of the one group pre-test post-test design is used (figure 2). This design exists of a pre-test, a treatment and a post-test. For practical reasons it is not possible to use a control group.

The pre-test provides an insight in the information use of experienced and novice operators. To establish an improvement after the treatment a comparison of the results of the pre-test with the results of the post-test are made. For that the post-test is a replica of the pre-test. To improve the reliability of the findings the method of triangulation is used (Patton, 1990).

The population consists of 100 employees of the sales and service department savings-accounts. The variety in working experience, age and educational background is checked and the test groups are checked for homogeneity.

Figure 2: Overview of the methodology.

O1	O2	O3	X	O4	O5	O6

O1 Interviews	O4 Interviews	X Treatment
O2 Observations	O5 Observations	
O3 Questionnaire	O6 Questionnaire	

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The Theoretical Construct

Theoretical constructs have been extracted from an identical research project that was carried out earlier (Bastiaens, Nijhof Abma, 1995). The constructs enclose the variables that exert an influence on the EPSS (table 1). Working, treatment and background are general variables. The constructs' tool and information together are the support environment. Next to this, attitude towards work and performance are important, to measure the influence of the context. To get an insight of the knowledge, skills and attitudes learned in the introductory course some variables are identified and taken into consideration. The course may influence the use of the support environment.

From the constructs variables are derived from which items are formulated. These items were used in questionnaires and given to the operators.

Table 1: A list of constructs

Constructs	Variables
Work	
attitude towards work	motivation, self-confidence
performance	independence
Tool	
communication	interface, technical construct, technical realization
help	content, communication
menu	service and advice
Information	
communication	interface, technical construct, technical realization
information	service and advice, usefulness, structure
information (other origin)	information
Course	
preparation on performance	Knowledge, skills, attitude
Background	
Personal	age, sex
Experience	educational background, working and computer
attitude towards innovation	working with new technology

Results on the Pre-test

The pre-test started with semi-structured interviews (n=8). From the interviews the researchers wanted to learn more about the work conditions in the section, working with the tool, the use of information and the use of the information part in the support system. It is not possible to go into detail in this paper so in short; The interviews showed that the operators in general were very satisfied with their job. They liked their jobs and the tool. About the information part in the support system they were not so satisfied. That resulted in a low average use of the information component caused by obsolete detailed information and a dull interface with to many levels in a hierarchical structure. It was easier to consult a colleague or to use your own notes (which were used very often as little job aids).

The second instrument of the pre-test were the observations. In this part an observer sat next to the telephone operator when he/she was working. The most important variables used in this measurement are conversation time, information use and the nature of the conversation

(question, problem, complaint). The independent variables were gender and experience. Exactly 150 conversations were observed. In 40 cases the operator used an information source. Table 2 shows us the nature of the conversations and the use of information. The general conclusion derived from table 2 is that the information component in the support system is not used very often. The operators use more often another source. A closer look at that sources showed that they asked their colleagues for information 8 times, used written sources as folders, brochures, handbooks etc. for 28 times (not in table).

Regarding the first hypothesis which is related to differences between novices and experienced operators the observations showed a difference between novice operators and experienced operators. Not only in the information use, as expected experienced employees do need less information, but also in conversation time, the average time for experienced operators is 2.31 minutes (s.d. 2.07), for novices 3.08 minutes (s.d. 2.40).

The third instrument was the questionnaire. In the questionnaire 24 operators were asked about their motivation, work, tool and information use. First their motivation was looked at.

Our hypothesis that there is a difference in motivation between novice (n1) and experienced operators (n2) is not true (Mann-Whitney test, n1= 8, n2= 15, U= 55.0, p= .78, double tailed). Novices do not have a higher motivation related to the work.

The hypothesis, novices are more insecure than experienced operators who are more satisfied about their performance is not true(Mann-Whitney test, n1= 8, n2 = 15, U= 53.0, p= .34, one tailed) Both types of operators value their performance as high.

The hypothesis that novices score higher on innovation willingness is also not true. Both groups score also the same on innovation willingness (Mann-Whitney test, n1=8, n2= 16, U= 63.5, p= .97). There is no difference in how they look towards new technology.

Important for the optimisation they were asked about the technical realisation of the tool. When the telephone operators were asked their opinion about the tool it showed that that the two groups had the same opinion about the technical realisation (errors in software, waiting time, etc.), the help content (procedural information) and the communication with the help. Table 3 shows the results.

The following results are related to the support of the information component. The operators were asked about the technical realisation, the information accuracy and the use of other information sources. Table 4 shows no significant difference between the two groups.

There was one important difference (not in table 4); experienced operators use the information component more often and for more ends (Mann-Whitney test, n1= 8, n2= 16, U= 26.5, p= .019, double tailed). The hypothesis that novices use the information component more often than experienced operators is not true.

In general the following can be concluded. For most hypotheses the pre-test shows no difference between experienced and novice users. It is a surprise that experienced operators use the information component more and for more ends than a novice All the employees told some interesting information about how to improve the system. A new support system was constructed

Recommendations for the Construction of a New Support System

In general the findings show that the operators are satisfied about the tool. A few administrative improvements are suggested. The real improvement has to be made in the information component. The data shows that experienced users actually do use the information component more often. They use it as a reference book simply because not every detail of a product is remembered. On the other hand novices use other information sources more often, even for factual knowledge (where experienced users use the system). It appears that novices do not know how to use the system because they are confused because of the hierarchical design. For them, it

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is hard enough to advise a client and operate the telephone system without using an information system that is not user friendly.

It is also noticed that they need an other sort of information. Not only knowledge of the facts but also instructions about how to do the job. This sort of procedural information was not available in the system yet. It shows that it is also important that users can rely on the information. Information has to be up-to-date and complete. The last important recommendation is that the search and use of the information component has to be an integral part of the overall performance. That means the operators have to integrate the information search as a skill in their performance.

The recommendations require a context- and a task- analysis before a new information component can be constructed. Also some technical conditions have to be taken into account. Figure 2 shows us the schematic design of the traditional information component. Figure 3 shows us the constructed new information system with a maximum of three layers and help questions (Bastiaens, 1994).

Figure 2.   **Figure 3.**

Products
* giro savings
* youth savings
Interest
* overview
* calculation of interest
Various

Savings (general)		
* automatically	What?	How?
Products		
* giro savings	What?	How?
* youth savings	What?	How?
Data		
* address and phone		

Results on the Post-test

The post-test consisted of the same instruments and identical variables as were used for the pre-test, so semi-structured interviews (n=8) were used first. As in the pre-test the operators are in general very satisfied with their work. One important aspect they told the researchers the second time was the deficiency of standardisation in the work. Although the system provides standards to process the data, operators want more uniform procedures. The operators are also less positive about the communication process in the division. New rules, products and procedures are not communicated as quick as the should be. About the new information component they are very satisfied. They use the information component because of the new user-friendly structure, the up-to-date information. On the other hand for lack of time on the workplace they want to explore the component off the job. They miss a personal scratch-pad in the system and the possibility to structure the interface themselves.

The next part of the post-test were the observations. Again 150 calls were observed. Table 1 shows the results. It shows that the information system is used 11 times, other information sources 26 times. The total use of information is 37 times. When a closer look is taken at the data it shows that the operators consult colleagues for 9 times and use brochures and handbooks for 16 times (not in table). The observations in the post-test showed us again a difference between novice operators and experienced operators. Not only in the information use, as expected experienced employees do need less information, but also in conversation time, the average time for experienced operators is 2.19 minutes (s.d. 1.48), for novices 2.25 minutes (s.d. 2.19).

The last part of the post-test was a questionnaire. The questionnaire was filled out by 27 operators. Table 2 shows the results of a comparison between experienced en novices. No

significant difference was found when the operators were asked their opinion about the tool again (technical realisation, the content of the help and the communication with the help component).

The result related to the information component show that their opinion about the technical realisation was significantly different. The accuracy of the information in the information component is appreciated more by experienced operators (table 3). The hypothesis related to the support of the information component is not true. It was expected that novice operators would appreciate the information component more, because of a more serious need for information.

In the use of other information sources is no significant difference between the two groups.

Comparison Between Pre-test and Post-test

After the development of a new information component the hypothesis is that the new information component is used more often than in the old situation. That is true. The new information component is used more often (Chi^2-test, df= 1, p= .03). Especially novices use the information component more often. Their score on the pre-test was 0, after the treatment on the post-test their score was 7. This is a
significant difference (Chi^2-test, df= 1, p= .70).

Table 2. Observed use of information in the pre-test and post-test

nature of conversation	use of information in support system pre-test / post-test	use of other information sources pre-test / post-test	total use of information pre-test / post-test
question	2 (1.3%) / 10 (6.7%)	24 (16%) / 19 (12.7%)	26 (17.3%) / 29 (23.0%)
problem	1 (0.7%) / 0 (0%)	1 (0.7%) / 1 (0.7%)	2 (1.3%) / 1 (0.7%)
complaint	1 (0.7%) / 1 (0.7%)	11 (7.3%) / 6 (4.0%)	12 (8.0%) / 7 (4.7 %)
N total	4 (2.7%) / 11 (7.3%)	36 (24%) / 26(17.3%)	40 (26.7%) / 37 (24.7%)

Table 3. Opinion about the tool component in the pre-test and post-test

	Pre-test n	pre-test U	pre-test p*	Post-test n	post-test U	Post-test p*
technical realisation		42.5	.19		79.5	.58
experienced	8			13		
novices	16			14		
the help content		32.0	.22		53.5	.068
experienced	7			13		
novices	14			14		
communi-cation		46.5	.86		72.0	.38
experienced	7			13		
novices	14			14		

* double tailed

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Table 4. Opinion about the information component in the pre-test and post-test

	pre-test n	pre-test U	pre-test p*	post-test n	post-test U	post-test p*
technical realisation		51.0	.45		68.0	.42
experienced	8			13		
novices	16			13		
accuracy information		44.5	.24		56.0	.15
experienced	8			13		
novices	16			13		
use other information sources		45.0	.26		56.0	.15
experienced	8			13		
novices	16			13		

It is also an expectation that the new information component reduces the search for and use of other information sources. That is not true. In fact especially the consultation of colleagues has grown. Fortunately this is not a significant growth (Chi^2-test, $df= 1$, $p= .06$). On the other hand the use of written information sources did significantly drop (Chi^2-test, $df= 1$, $p= .01$).

Our hypothesis that the new information component supports the operators better than the old is not true. There is a difference in the meanscores in advantage of the new component but it is not significant (Mann-Whitney test, $n1= 24$, $n2= 26$, $U= 250.5$, $p=.12$, one tailed). Although the users think that the new support is an improvement this is not seen in the comparison between the pre-test and post-test.

When an evaluation is made on the theoretical assumptions the projects shows that the support environment leads to training on the job. The reduction of formal learning is high. In this organisation formal classroom training is reduced from one month to 6 days. The support environment also leads to a reduction of the working load memory. The assumption of resistance is not observed but it shows that it is hard for the operators to give up working the old way. The automation of tasks and the easy consultation of the support environment lead to an extension of tasks. But the results show that it is 'demotivating' when operators have to wait too long before they can broaden their knowledge about other products.

Conclusions

The results show that the use of the information component at first was very low. From that a lesson can be learned that an information component has to be up-to-date, complete and that the use has to be an integral part of the performance. Our advice was to hire one person to update the information on a daily base. This person does not only put in official information but also collects notes and small job aids which the operators use to develop. Another advice is the integration of the use of the support system in the formal learning process. Teach new employees to work with the support environment. Give them the time to explore the support environment before sending them to work.

Before constructing a support system developers have to keep in mind that the people who use the system are very diverse. These people have their own needs. Give them the ability to

change the interface their way, integrate a notepad and provide different ways to search for information.

Although it is no complete EPSS as is stated in the first section, the researchers think that the developed support system in this situation meets the needs of the company. In their opinion it is not necessary to develop a complete EPSS in every situation. In this research project some advantages of electronic support have been seen but also some serious disadvantanges. Further research in this field has to be done to gather insights not only in the construction of EPSS but more important in the analysis of the organisation, the performance and the workers. However the researchers think that performance support will be the future, it will inform and train employees and help them to do a better job in less time.

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