# Implementing Just-In-Time Maritime Training using Electronic Performance Support System

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## ABSTRACT

Use of Electronic Performance Support System (EPSS) is seen as an appropriate tool for more demanding requirements of maritime training today. Presently Maritime Technology and Transportation (MTT) Department of Singapore Polytechnic along with their industrial partners are engaged in a number of pilot projects for EPSS implementation in the maritime sector. This paper relates EPSS concepts as seen useful in the context of just-in-time and just-in-place training for maritime education and provides a brief description of the two pilot projects, which are being pursued by MTT department towards an EPSS goal.

## 1 INTRODUCTION

Content-based training in conventional maritime schools provides knowledge and skills with much shorter shelf life than what it used to be, say, just a decade ago. Both equipment and their operating procedures on board are changing at a phenomenal rate driven by increasing environmental awareness, need for safer shipping and overall requirement for enhanced performance in maritime sector. Use of Electronic Performance Support System (EPSS) will help us in implementing just-in-time maritime training at the place of work and will support the ship-board personnel in keeping pace with new knowledge and skills required for efficient running of the modern ships of today. Figure1. Shows the proposed EPSS model. Cote (1996) summarises the benefits of an EPSS as follows:

- no delay between refresher training and the moment the knowledge is required,
- immediate access to latest information,
- availability of expert and detailed advice on procedures whenever sought,
- large potential for savings as JIT performance support is always at hand.

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Remmers (1998) claims that *immediate and on-demand access is not enough, EPSS must be designed to meet the unique demands of the work environment and the job-specific situations.* Remmers (1998) also quoted the following examples as task- and situation specific examples:

- technical schematics
- trouble shooting instructions
- online documents
- reference materials
- case history data
- lists of persons
- prices or locations etc.

Thus, Remmers(1998) emphasised the access of information which is *task-specific* as well as *situation-specific.* Additionally, use of expert systems or some form of decision support system should also be a common component of an EPSS (Gery, 1991) to provide intelligent advice or coaching (McGraw,1994). The two pilot projects, EPSS-I & EPSS-II are being developed at MTT's recently opened R & D centre using these methodologies.

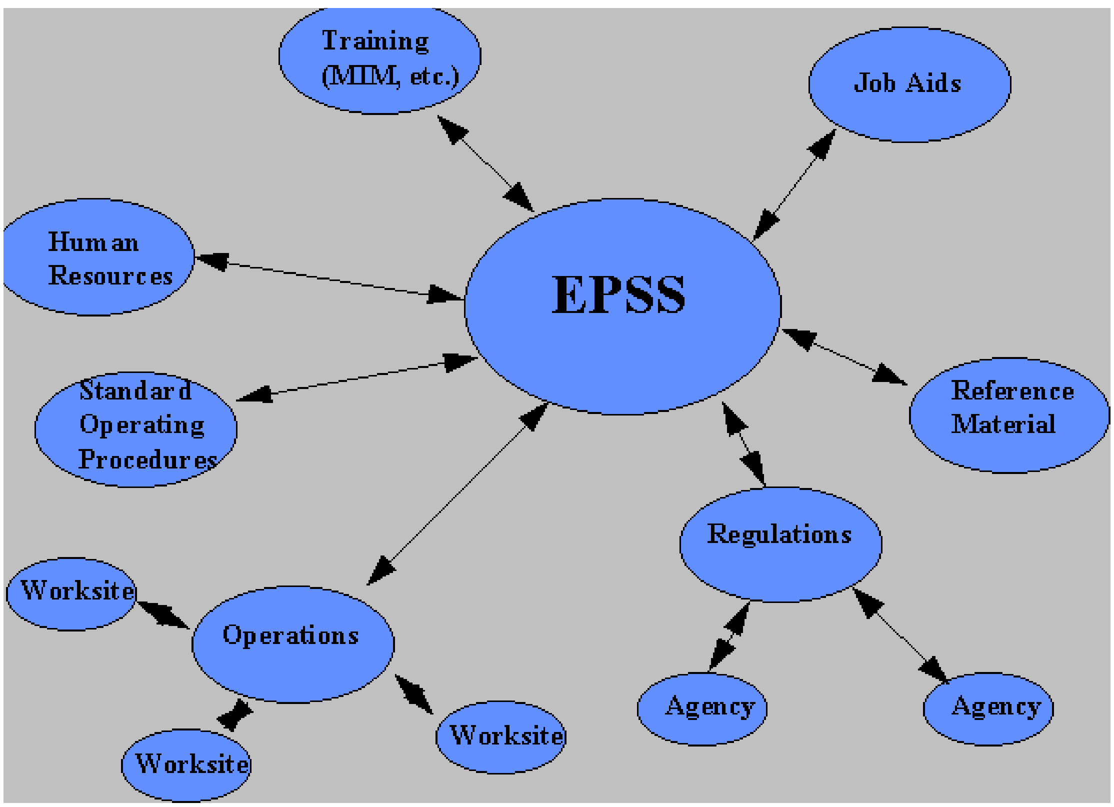



Figure 1. EPSS Model (Banerji & Bhandari , 1997)

## 2 EPSS I

An EPSS for “Handling of Life Saving Appliances” has been identified through discussion and analysis of shipping industry’s immediate need. The framework will include three items of the model namely: job aid, training, and operating procedure guidance. The main components of the software is shown in Table 1.

| Topics | Knowledge | Comprehension | Application | Components |
|---|---|---|---|---|
| **Introduction** | 100% | | | Text, Audio & Graphics |
| **Regulations** | 50% | 50% | | Text, Audio, Graphics |
| **General Familiarisation** | 20% | 40% | 40% | Text, Audio, Graphics, Video |
| **Specifics of equipment** | 20% | 40% | 40% | Text, Audio, Graphics, Animation |
| **Operation demonstration** | 10% | 40% | 50% | Text, Audio, Graphics, Animation, Video |
| **Maintenance Check list** | 10% | 40% | 50% | Text, Audio, Graphics, Video |
| **Assessment** | | 100% | | Text, Audio, Graphics |

Table 1. Components of EPSS I

In addition, there will be a data link via satellite between the ship based computer and the shore based computer in the operational headquarters. This will be utilised to transfer the assessment data and maintain performance records of all the fleet personnel. The software will be developed by Singapore Polytechnic in collaboration with a large shipping company. A shipping company has several different classes of ships. Each class has a different type of lifeboat, having different makes, models, which could be totally enclosed, free-fall or open type. Thus, being familiar with handling a lifeboat proficiently on one ship does not necessarily translate into proficiency in lifeboat handling on all kinds of ships. It is imperative that members of staff are fully conversant in safe handling of this essential safety equipment. Extensive familiarisation program is necessary as members of staff are transferred to different vessels. Shipping companies encounter large number of lifeboat accidents due to inappropriate handling.

A shipping company tabulated the following records of accident (Table 2.), which amplifies the need for an EPSS application to provide the necessary performance-support and increase level of safety for lifeboat handling.

| | |
|---|---|
| Accident related to release mechanism | 36% |
| Accident related to brakes | 27% |
| Accident related to hooks | 18% |
| Accident related to davits | 9% |
| Accident related to lifeboat falls (wire ropes) | 9% |

Table 2. Components of EPSS I

EPSS is considered suitable for this type of situations. Simulation of the handling of lifeboat and emergency drills using computers would give the personnel real-life experience. Further, with a high level of interactivity in-built in the software, it is expected that the training will increase operational confidence level of the users. The software will incorporate competency assessment, which the company can monitor remotely from the head office.

## 2.1 Some Project Details

Figure 2 shows the main menu of EPSS I. The menu provides gateways to main modules. Additional interactivity is possible using the buttons at the bottom of the screen. The program attempts to provide enhanced understanding by use of visuals and ample self-paced interactivity. Additionally, realistic simulations are used to create authentic environments for users to try out various what-if scenarios in a safe environment. Figure 3 and 4 shows some areas where users can interact freely to improve their understanding of the operational procedures of release mechanisms and davits.

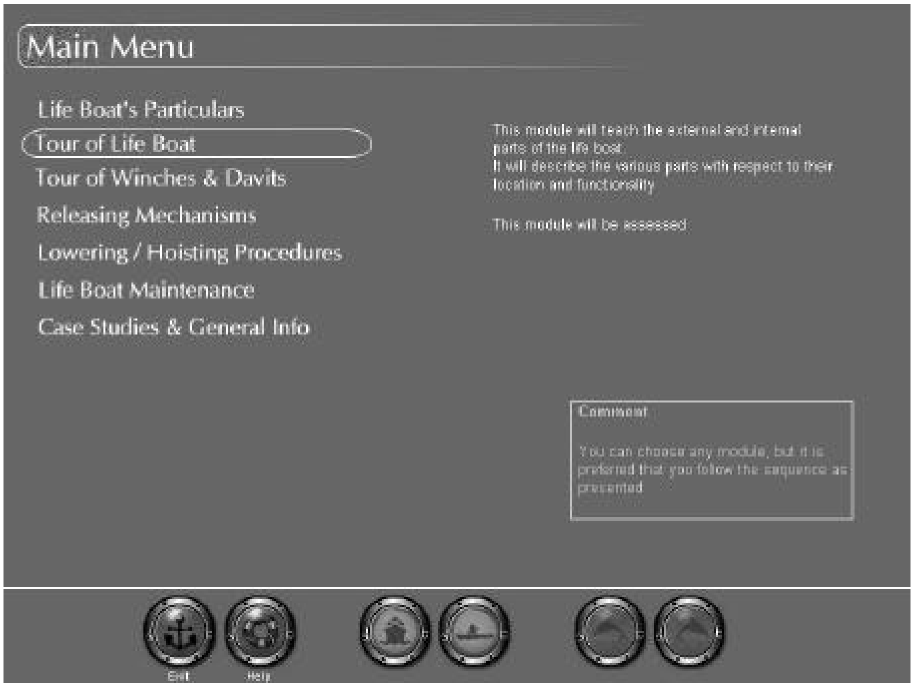



Figure 2. Shows the MainMenu and the interactive buttons with some marine flavour.

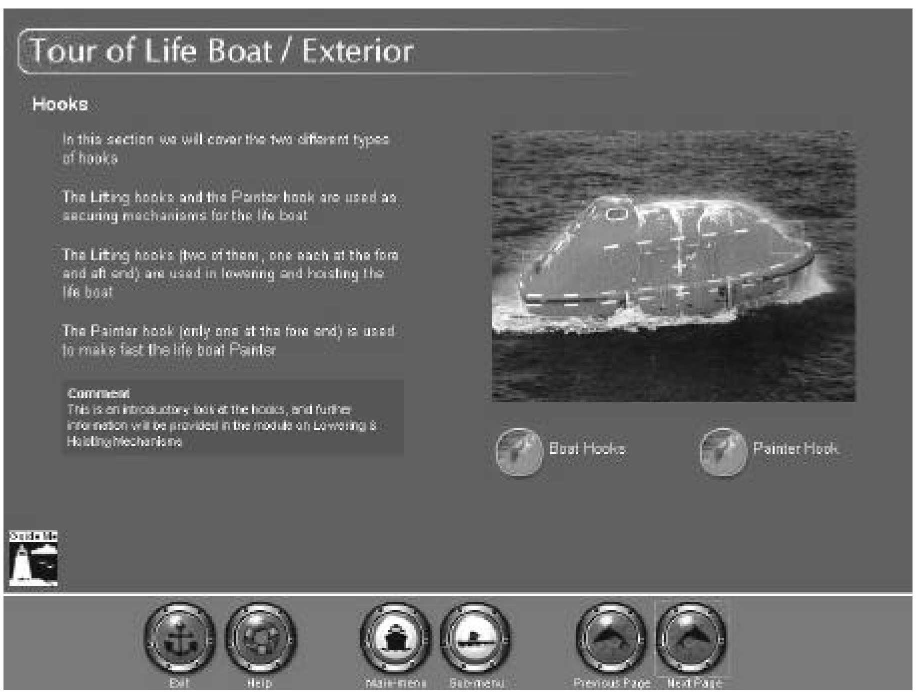



Figure 3. Shows the section dealing with boat hooks and painter hooks

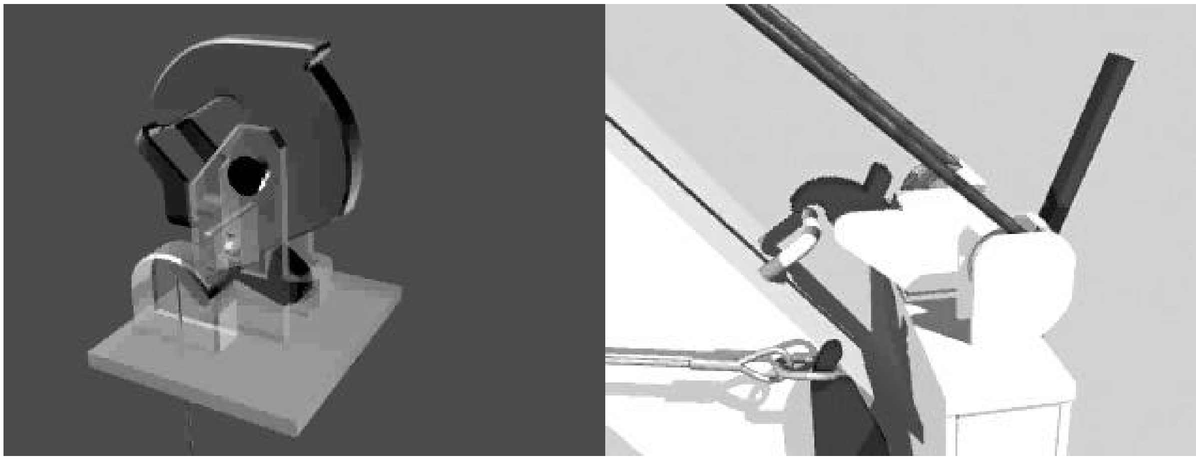


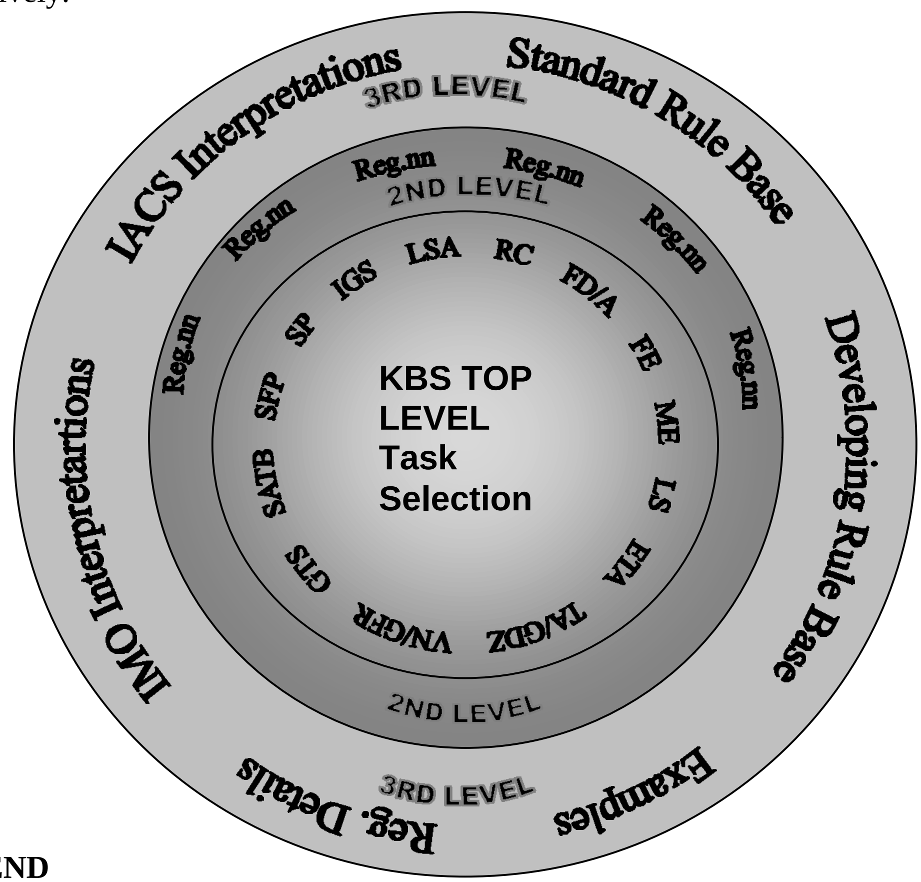
Figure 4. Shows a hook release mechanism and davit activating gear. The interface incorporates interactivity in a near authentic environment.

## 3. EPSS II

EPSS II attempts to manage the voluminous nature of maritime regulations and their associated complexities. The domain chosen for the pilot project is the SOLAS requirements for oil tankers. A knowledge-based system (KBS) is being developed to cater to the needs of approval engineers in a classification society. When successfully implemented, the KBS could provide a shorter learning time for new approval engineers and offer performance support at expert as well as at novice level. Thus, it could be used as a teaching tool for those requiring familiarisation with maritime regulations and interpretation of these regulations in the context of a particular application. The software structure is planned for event-based application, which gives flexibility for various levels of users. The various events could be one of the following:

- check for a particular case, which regulations are applicable,
- look through the applicable regulations, which has hypertext links for easy navigation,
- check through the IMO and IACS interpretations,
- view examples of past cases.

Additionally, there is a guidance section, called Standard Rule Base, which may be accessed to seek for advice in sequencing these various events and on how to undertake their related processes to accomplish a particular approval task. The system would also provide a dynamic section, which is called a Developing Rule Base, to capture new or un-captured knowledge. Figure 5 and 6 show the basic structure of the proposed KBS and a sample screen interface respectively.




**LEGEND**
(Details of tasks at the top level)

| | |
|---|---|
| LSA | Life saving appliances |
| RC | Radio communication |
| FD/A | Fire detection and alarm |
| FE | Fire extinction |
| ME | Means of escape |
| LS | Location of spaces |
| ETA | Emergency towing arrangement |

| | |
|---|---|
| TA/GDZ | Tank Arrangement/Gas dangerous zones |
| VN/GFR | Ventilation/ Gas freeing |
| GTS | Gas tight seals |
| SATB | Safe access to tanker bow |
| SFP | Structural fire protection |
| SP | Safety plan |
| IGS | Inert gas systems |

Figure 5. KBS Structure at three levels (Chatterjea *et al*. 1998)

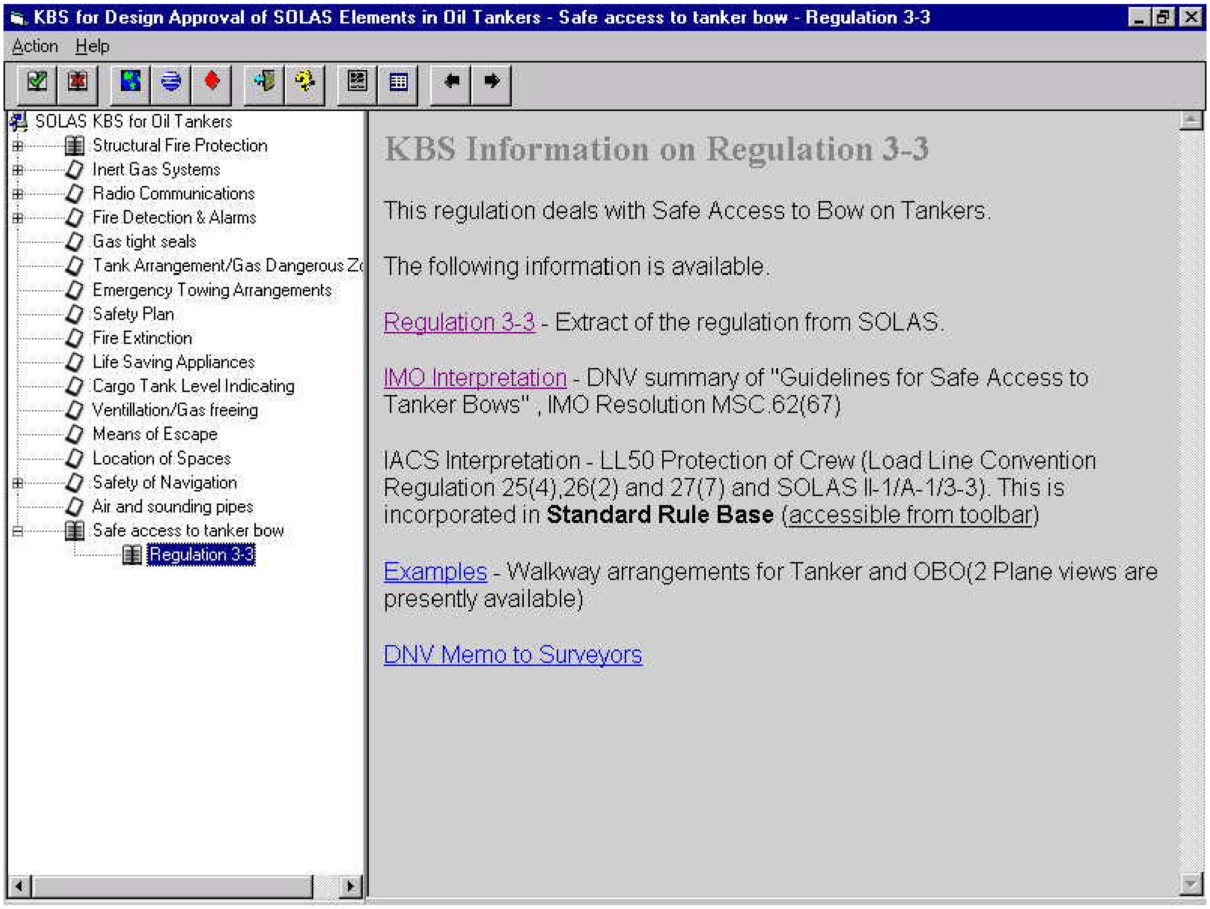



Figure 6. KBS Screen Interphase

## 4. FUTURE APPLICATIONS OF EPSS

We intend to scale up our EPSS thrust to address the needs of STCW '95 and other industry needs. STCW 95 requires crew to demonstrate their competence in operation and maintenance and provide such evidence to port state control. They have to be familiarised with certain equipment before the ship sails from a port. Listed below are some of the critical and special operations and maintenance on the ship, which will be addresses progressively.

1 . Deck Department

- Navigational Equipment such as RADAR, GPS, Echo Sounder, etc.
- GMDSS equipment and apparatus
- Communication equipment such as RT, Inmarsat, Navtex, etc.
- Cargo handling system such as pumps, pipelines, cargo measuring device, etc.

- Main Deck equipment such as winches, derricks, gangways

2. Engine Department
   - Main Engine,
   - Auxiliary plants such as boilers, purifier, generator, etc.,
   - Emergency plants such as generator, air compressor, etc.
3. Safety
   - life saving appliances,
   - fire fighting equipment, detection and extinguishing system,
   - breathing apparatus and resuscitator,
   - Use of gas detection instruments.

Under one of the provisions of the International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code), Chapter IX of the SOLAS, ships personnel are required to demonstrate their familiarity with the assigned tasks. The company or the ship's master is obliged to provide evidence of this familiarity. In this respect, the EPSS can provide a platform to improve competence and record evidence of performance in a simulated authentic environment.

## 5. Conclusion

The importance of Electronic Performance Support System (EPSS) is expected to grow in the coming years. Two pilot projects described in this paper will provide valuable experience in familiarising with these new tools. Experience gained would be used for developing large scale EPSS for training and performance support of maritime personnel.

## 6. Bibliography


Banerji, A and R. Bhandari (1996). Virtual Laboratory in Engineering Education and Training, *Proc.Fourth Pacific Rim International Conference on Artificial Intelligence (PRICAI-96) Workshop on Knowledge-based Instructional Systems in an Industrial Setting*, Cairns, Australia, 26-30 August, 1996.

Banerji, A and R. Bhandari (1997). Designing EPSS for Marine Industry, *Proc. International Conference on Computers in Education*, December 2-6, 1997 Kuching, Sarawak, Malayasia

Chatterjea, K. and T. A. Piyasiri (1996). Capturing Expertise in Marine Regulations on a Knowledge-based System, *Proc. MARTECH '96 International Conference,* Singapore Polytechnic.

Chatterjea, K., G. Higgins, Wen Xiaobei and S.Kannan ( 1998) Knowledge-based System Development Process in a Maritime Regulatory Domain, *Proc. MARTECH '98 International Conference,* Singapore Polytechnic.

Cote, D. (1996). *EPSS tutorial.* [WWW document]. URL: http://home.istar.ca/~djcote/epss/epss.htm

Gery, G. (1991). *Electronic performance support systems: How and why to remake the workplace through the strategic application of technology.* Boston, MA: Weingarten Publications.

McGraw, K (1994). Performance support systems: Integrating AI, Hypermedia, CBT to enhance user performance, *Journal of Artificial Intelligence in Education,* 5(1), 3-26.

Remmers, E (1998). *Guidelines for WWW-Based Support Environments for Educational Professionals.* [WWW document]. URL: http://mw75.student.utwente.nl/~elka/litstudy/



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