

# **Design and Development of an Internet-Based Electronic Performance Support System for Systemic Change in K-12 Settings**

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## **Abstract**

The purpose of the Internet-based Systemic Change EPSS is to provide the systemic change facilitators with the tools, resources, and information they need in the process, and accessibility to the other facilitators and communities dealing with systemic change. Creating such a system requires a detailed analysis, comprehensive design and careful implementation stages. We analyzed the requirements for such an EPSS in a previous study. In this session, we present the development and implementation of this endeavor.

## **Introduction**

The purpose of educational systemic change is creating a better educational system than the existing one. Systemic change requires collective effort from people in a specific change context, including community and school. However, these efforts would be void without guidance and planning. Jenlink, Reigeluth, Carr, and Nelson (1996) suggested a set of guidelines offered through a systemic change guidebook to help systemic change facilitators with their change efforts.

An Electronic Performance Support System (EPSS) is a system that provides cognitive support to performers for complex information. Since the systemic change effort is a process including complex information, an EPSS is necessary to support the facilitators of systemic change. The motivation factors for designing an EPSS for the guidebook are increasing the effectiveness of the guidebook and creating a community of systemic change facilitators in educational systems change field. First, the guidebook consists of 26 discrete events that are sequential during the change effort and 18 continuous events that could be at different stages of the change process. Each discrete and continuous event consists of several activities and sub-activities. Each of these activities makes about 10 pages of detailed guidelines, considerations, and tools, which makes the guidebook so thick and heavy that it might not be practical to carry it to many meetings conducted during the systemic change effort. It would also be expensive to copy it for key participants' use. Secondly, changing an educational system in a school district is complex and non-linear process. Obtaining guidance and help from other experts in the field may become crucial in certain stages of the change process. For these two important reasons, the authors of the guidebook decided to produce it in the form of an EPSS, using hypermedia and the Internet. A team of designers and developers started to work on the EPSS by considering the motivation factors for it.

## **Definition and Characteristics of EPSS**

### **What is EPSS?**

Before explaining the developed EPSS project, it is helpful to understand the concept of EPSS and the situations in which EPSS is useful. This section provides information about current knowledge on EPSS in the literature and cases in which EPSS can be used as a performance support tool.

An Electronic Performance Support System (EPSS) is a just-in time performance support tool that is used at the place of performance. The objective of an EPSS is "to provide whatever is necessary to generate performance at the moment of the need" (Gery, 1995). EPSS is also a complete system of performance support tools to accomplish required tasks in the job setting. After the introduction of the computer networks and the Internet, performance support systems became universally accessible and now designers have opportunity to develop Internet-based EPSSs.

Historically, the roots of EPSS may reach to the mid 1940s. Due to rapid growing body of knowledge, Bush (1945) indicated the problems of storage, search, retrieval and use of information for the people who needed specific knowledge from immense amount of information. He explained an imaginary machine, which he called 'Memex'. According to Bush (1945), the Memex would allow people to conveniently access the specific

information in large information systems; in this way it would support human beings by enlarging their memory capacity. By doing so, humans could do information retrieval, modification and manipulation faster and better than with conventional methods. From this perspective, Memex may be considered as the ancestor of modern EPSS systems.

The focus of EPSS is to help people perform rather than to learn. Cole, Fischer, and Saltzman (1997) described the term EPSS as providing 'just-in-time' knowledge while performance takes place. By this definition, learning may or may not occur because the main focus is to support performance, not learning (Rosenberg, 1995; Rossett, 1996).

Since the main focus is performance, it is generally agreed that EPSSs have different attributes than instructional systems in many aspects (Cagiltay, 2002). After reviewing the literature, Cagiltay (2002) asserted three main differences between EPSSs and instructional systems. First, the purpose of an instructional system is to contribute to the achievement of certain types of learning outcomes in learning process, whereas the primary purpose of EPSS is to help people perform during the time of the performance (Witt & Wager, 1994). Second, the utilization timing of EPSS and instructional systems are completely different. EPSS is utilized at the time of the performance when the need occurs, on the other hand, instructional systems take place before the performance (Cole et al. 1997). Finally, the structural difference between instructional systems and EPSS is another major distinguishing factor. While instructional systems are well-structured and their content is well-defined toward certain learning objectives, EPSS does not necessarily follow a predetermined sequential path to support the performance (Laffey, 1995).

Brown (1996) lists four circumstances that are best for utilizing an EPSS: using immense amount of information to perform at competent levels, unavailability of experts, high expectations from the workers, and self-directed performers. Reeves (2003) provides a set of questions to determine whether an EPSS is necessary or not for performers in an organization. Reeves (2003) lists following questions to answer the larger question: "Is an EPSS an appropriate solution to this performance problem?"

1. Do performers have easy (better yet, constant) access to computing?
2. Is the task/job that requires support complex enough to warrant an EPSS?
3. How stable is the task/job? (If it changes often, an EPSS may be more appropriate than other approaches that are more difficult to maintain, change, and disseminate.)
4. How critical is the task? What is the cost of non-compliance or poor performance?
5. Is time available for support? (Some tasks are so time-critical that the notion of consulting an electronic performance support system is ludicrous.)
6. Do performers possess the necessary characteristics to use an EPSS in terms of literacy, computer expertise, or motivation?
7. Is turnover among potential users of the EPSS high? (High turnover may often justify an EPSS because an EPSS is often more readily accessible than many forms of training.)
8. Are the logistics of getting people to other approaches (e.g., leader-led training) so complicated or expensive that an EPSS is a more efficient solution?
9. Will the EPSS be used for empowerment of performers or to assure that they comply with specified standards of performance?
10. Is the task frequently repeated? If not, an EPSS may be a sound strategy.
11. Are complex decisions involved in the tasks?
12. Can an EPSS be supported/maintained? How will it be updated?

Considering the context of educational systemic change, the EPSS utilization circumstances provided by Brown (1996), and the questions listed by Reeves (2003), an EPSS is an appropriate solution for systemic change facilitators to support them in the change process.

### **Characteristics of an EPSS**

In the literature, EPSS is defined with different definitions. In parallel to that situation, several authors expressed different views about characteristics and components of EPSSs. As cited in Cagiltay (2002), first, Schwen, Goodrum, and Dorsey (1993) proposed four characteristics for EPSSs: information management, collaboration management, productivity through embedded guidance and work metaphor, and finally a problem solving environment that integrates basic tools, information management, collaboration, and productivity tools in a

seamless environment. Secondly, Reigeluth (1999) described four critical components of an EPSS: a database, an expert system, an instructional system and tools. Reigeluth (1999) defines an EPSS as a computer program that provides support for the performance of a task. According to him, an EPSS usually has four major components: a database, an expert system, an instructional system and tools. These components are explained below:

- *A database.* A storage area of information that is necessary for the experts to perform their tasks. A database should be equipped with appropriate menu interface and search functions for easy accessibility of information when it is needed.
- *An expert system.* A system that helps experts decide on the performance steps or provides guidance to make decisions while the experts completing tasks.
- *An instructional system.* A guidance or help system to show how the EPSS can be used best for the users.
- *Tools.* Parts of an EPSS that help a performer to complete different tasks, such as collaboration, e-mail programs and Web browsers.

According to Reigeluth (1999), a human computer interface system serves as an integrator of these components. The designed internet-based EPSS for systemic change facilitators nests all these components and combines them under a website umbrella. The following section discusses the functional specifications of the designed EPSS and explains each component in detail.

### **Systemic Change EPSS**

#### **Functional Specifications of the Systemic Change EPSS**

As discussed above section, an EPSS is an integrated system of performance support tools to achieve certain tasks in the place of performance. The goal of an EPSS is “to provide whatever is necessary to generate performance at the moment of the need” (Gery, 1995). With the wide availability of the Internet and computers, designers have opportunity to produce universally accessible EPSSs, which can be available at any time any place. EPSS for systemic change facilitators has been decided to be accessible via the Internet. The primary mission of the Internet-based Systemic Change EPSS is to provide the systemic change facilitators with the tools, resources, and information they need in the process, and accessibility to the other facilitators and communities dealing with systemic change efforts (Cakir, Tuzun, & Reigeluth, 2002). Considering the primary mission of the system, the final product provides more functions than merely an electronic version of the guidebook.

Prior to the development effort of the EPSS, Cakir, Tuzun and Reigeluth (2002) conducted a detailed needs analysis by following a model developed by Tuzun and Cakir (2002). In this analysis stage, they analyzed the system from four different perspectives:

- *Organizations' or individuals' needs (clients' needs):* What performance, how and in which direction performance will be increased.
- *User analysis:* Demographics and computer literacy level of the potential users.
- *Scope analysis:* Performed in two stages, content analysis and task analysis. Content analysis; what content will be covered in the EPSS. Task analysis; what tasks will be accomplished by using the EPSS.
- *Technical analysis:* Considering the technical aspects of the EPSS such as feasibility of technologies, connection speeds, Internet Service Provider (ISP) software support capability, browsers, and– site address.

Analysis stage was conducted with the two systemic change facilitators engaged with the systemic change process in a school district located in Indianapolis, IN and two designers of the system. Based on the data collected in the analysis stage, functions of the EPSS can be categorized according to EPSS components explained by Reigeluth (1999):

- *The database.* The database consists of several elements of the system. The main part of the database is the guidebook which is also main content of the developed system. Through taking the advantage of various interface technologies, appropriate chunking of the guidebook is necessary in the system. Other content parts of the database are frequently asked questions and resources related to the systemic change efforts.

- *An expert system.* During the analysis stage, facilitators expressed a need for a guidance system that would provide key information and guidance about certain issues that are important during the events of the systemic change effort.
- *An instructional system.* The analysis showed that the content and the required tools to accomplish the tasks needed a system that explained users how to use them.
- *Tools.* Initial analysis showed that a tool that creates a community to exchange information between the facilitators is a necessity for the EPSS. Besides a community tool, a search and print the page tools are required for the system.

## **Development of the System**

The development stage of the systemic change EPSS is a synthesis of the emerged components in the analysis stage. These components were integrated in a human computer interface with using hypertext/hypermedia systems. Three main components are discussed below; interface, content and tools, and tutorial. The systemic change EPSS should be designed with considering the novice computer and Internet users. Dillon and Gabbard (1998) stated that for novice users, hypertext/hypermedia based systems should be highly structured to prevent the 'lost in hyperspace' phenomenon to occur; hence the user interface should be simple, clear and understandable. Content and tools are considered together in the system and discussed in detail below. Lastly, in order to assure that users get the maximum benefit from the system a tutorial component is added.

### ***User Interface Related Components***

The interface component of the system must facilitate easy navigation and clear orientation for the user. Such a system is designed based on the frame feature of HTML. Using the frame feature enables designers to make changes on the interface independently from the content. The interface consists of two frames, a navigation frame on the left and a content frame on the right. While navigation frame contains the links in the EPSS, content frame displays the information that is directed from the navigation frame.

**1. Navigation Frame:** The navigation frame takes place on the left side of the system's interface. It is designed based on JavaScript from the <http://www.treemenu.com> site. One advantage of the tree menu is that the structure of tree menu navigation provides a clear sense of orientation for the users. By using the navigation's structure, a user can reach any part of the system without losing the track of where s/he is in the site. The usability tests showed that the users had clear sense of orientation without thinking too much about where they are. Tree menu provides another advantage for updating the site, since the content and navigation frames are independent, any addition or removal from content or navigation frame can be implemented within very short time without rigorous experience on HTML.

**2. Content frame:** The content frame is placed on the right side of the interface. This frame contains the title, search, print, contact and sitemap functions. The title indicates the name of the section in the site. Under the main title, functional tools, search and print page take place. Although the navigation of the system is clear and easy, sometimes it may be difficult to find specific information. By typing the keywords in search box, a user can reach required information. Each page has a print button, which generates a printer-friendly version of the page on the screen. Under the function buttons, the section title appears. Basically, the section title tells the users on which event they are. The content field shows the text from the information database of the system which is the guidebook, resources and other related information. Lastly, the system is hosted by a server at Indiana University and credit is given to the university at the bottom of each page. The footer bar also contains links regarding to privacy, copyright, site map and contact information.

### ***Content and Tools Related Components***

The Internet-based Systemic Change EPSS has 6 main components:

**1. Providing guidance to the facilitators:** This component is the kernel of the system and is event based. It provides a facilitator with the big picture of currently shown event in the system, which contains the important issues about the event. It gives a general view to the users about the activities that are going to take place, the place of the event in the whole process and the points that need particular attention. Additionally, the user is able to access to the other parts of the system from this component.

**2. *Electronic version of the systemic change guidebook:*** The guidebook is designed in a hierarchical structure as, from general to specific, phases, events and activities. The book has 6 phases, each of which contains a number of events, and each event has variety number of activities. This component is an organized way of presenting the knowledge of the book conveniently and providing easy accessibility to the book.

**3. *Resources:*** This component of the site contains the resources that develop the skills and knowledge of facilitators about educational systemic change process. These resources are categorized as readings, videos, case studies, sample documents and software tools. The site coordinator maintains these resources and updates them as required. Facilitators currently do not have permission to upload any resources to this component.

**4. *Community:*** The purpose of community component is to bring people involved in systemic change activities, especially facilitators, in one accessible place. The community component enables users of the system to share their experiences, concerns, questions, resources, and documents related to their systemic change efforts. The main feature of community component is online threaded discussion groups. The discussion software can be adjusted according to the topics' and users' needs. The technology behind the threaded discussion group software includes JavaScript, PHP (hypertext preprocessor language) and MySQL database. Also the system has a directory of people who are facilitating different systemic change projects in order to introduce the members to each other. The component also provides school districts with a knowledge base to find a facilitator who has experience with similar contexts.

**5. *Glossary:*** This component provides a brief summary of the process of systemic change and related key concepts and terms about it. It has two purposes, first it provides a common language for the terms and concepts used in the change process, and second, it provides information about a brief summary of the systemic change effort, which is an article written by Jenlink et al. (1996).

**6. *Frequently asked questions (FAQs):*** This component provides archived answers to questions frequently asked. The answers are provided by experts in the field. The content is fed by discussions and e-mail messages.

### ***Tutorial Component***

In order to help people to use the system most effectively and efficiently in terms of time wise and learning curve, the system provides an introductory 'how to use the system' manual. This section serves for two purposes: first, it is a real user's manual on how to use the system and second, it is one of the diffusion of innovation tactics.

At first glance, it may seem that the use of the system is easy and one can figure out the ways to use it. It is true that the use of the system is easy and its interface is intuitive, however in order to use it at the most efficient level, one needs to know some key functions of it.

Despite the fact that computers and the Internet are ubiquitous in our everyday life, some people may not feel comfortable to use them because they do not receive enough guidance on how to use those systems. The manual serves as an ice-breaker for this kind of people.

### **Benefits of the System**

The Internet-based EPSS for systemic change facilitators provides more information and tools to its users than a static website. One benefit of the system is to provide guidelines for each event of the change process. The consultation component of the system contains all information related to the events that the facilitators need to perform to achieve certain stages of the change process. Another aspect is that the EPSS has community building tools, such as threaded discussion groups and a members' directory. These tools add value to the EPSS and give power to the users to reach each other easily and to share their knowledge. Additionally, through gathering the knowledge from facilitators who use the website, it provides an invaluable knowledge base for further implementations of systemic change efforts in different school districts.

Another benefit of the system is its low maintenance and update costs relative to printed or optic media since the system is using online technology to disseminate the information via the Internet. The technology powering the system allows the administrators to maintain and update the site without much software knowledge and programming skills. The infrastructure of the system uses DHTML, JavaScripting and basic HTML, thus it does not require downloading high-end browser plug-ins such as Flash player or Shockwave, which allows users to connect the system with even very low bandwidth connections technologies, such as Bluetooth or cellular phone.

## Conclusion

An EPSS is a system that provides cognitive support to a performer at the need of complex and accurate information. Educational systemic change is a complex and difficult process which needs certain stages to be accurately implemented. The developed EPSS aims to provide knowledge, guidance and necessary tools for systemic change facilitators in the change process. Specifically, the system provides guidance on change process, an electronic version of the guidebook, community building tools, glossary and frequently asked questions. A tutorial about how to use the system is added to increase the effectiveness of the system.

The system leverages the function of the systemic change guidebook. Because the delivery method of the system is the Internet, it can be reached anywhere in the world by any facilitator. Since most of the administrative components are accessible through the Internet, the system can be maintained at a low cost and accessible at anytime and anywhere. The EPSS helps with the accumulation of knowledge contributed by experts in the field. Because of all these contributions, we perceive the EPSS as a feasible solution to similar projects, which require use of massive knowledge and precise performance.

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