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Evaluating an electronic performance support system for crime scene investigation units in Turkey

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Abstract

The primary goal of this study was to present the summative evaluation findings of an initial implementation to investigate the impact, effectiveness and perceived benefits of the Electronic Performance Support System (EPSS) on the performance of Crime Scene Investigation (CSI) officers in Turkey. A sequential explanatory strategy as a procedure of mixed method design was used to collect data through a survey, interviews, and computer logs. While 191 CSI officers participated in the quantitative part of the study, the researchers also conducted interviews with 12 officers. Data was analyzed by using descriptive statistics and content analysis. The results showed that intrinsic support made a major contribution to officers' performance with positive reactions. It revealed also that generating reports and establishing standardization were one of the main factors providing impacts on society. This study provides a viable application of Kirkpatrick's Four Levels of Evaluation model for the CSI Unit; however, the model's extended adaptations should also be carried out in different workplace settings for further studies.

Keywords

electronic performance support systems, summative evaluation, crime scene investigation, Turkey

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Focusing on environmental factors in performance improvement initiatives has a greater impact on human performance than addressing individual factors.

Introduction

Over the past 200 years, theoretical and practical issues within work and the workplace have turned into industrial era requirements demanding research on people living in large groups and within large communities compared to those of the agricultural period based on isolation, independence, and the importance of farming (Main, 2000; Van Tiem, et al., 2001). The same revolution has been observed between the industrial and the information era regarding organizational structures and culture. In contrast to the main focus of work design and quality during the industrial era, information and people have gained importance in the information era for the workplace (Brown, 1996; Van Tiem et al., 2001). Indeed, when focusing on work, the worker and workplace performance have become important features that organizations should take into consideration to be competitive (Main, 2000). Nowadays, the predominant position in the world of business is to meet the needs of rapid growth, technological changes and expanding global

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competition (Korth and Levya-Gardner, 2006; Van Tiem et al., 2004). Therefore, effective performance by the work force is important for organizations that they can survive and be successful in competition and an era of fast-paced change (Broad, 2000). Indeed, aligning their strategy, systems and processes with the performance concept enables organizations to obtain enormous competitive advantage (Spitzer, 2007).

The growing need for greater learning and performance requires organizations to implement technological solutions so as to improve learning and performance (Gery, 2002). As a consequence of the huge amounts of information that employees have to deal with in their job environments, it is sometimes difficult to grasp all the information required for them to do their job tasks (Williams, 2000). Moreover, today, job tasks are getting more complex. Hence, there is a growing need for support for these tasks in organizations, and performance support tools such as Electronic Performance Support Systems (EPSS) may be used to help workers meet these demands (Williams, 2000).

Electronic Performance Support System (EPSS)

In the literature, the recognized gurus on electronic performance support systems (EPSS) are Barry Raybould and Gloria Gery (McKay and Wager, 2007). While Barry Raybould stated that computers might be utilized for solving human performance, the term EPSS was used first by Gloria Gery (McKay and Wager, 2007; Stone and Endicott, 2000). In doing so, Gery (1991, 2002) suggested that the paradigm shift from traditional performance support such as classroom training to automated performance support systems should become the choice for many organizations, most notably large learning organizations. Definitions of EPSS range widely. Early understanding of EPSS is based on a conception of hard technologies and computer training (Schwen et al., 1998). EPSS is a computer system that comprises software tools, knowledge and learning experiences so as to improve performance. More recently, Gery (2002) defined performance support systems as software applications to be used for sustaining direct support regarding work processes and process support with different components.

The main goal of EPSS is to empower the users to perform as needed (Gery, 1991). Moreover, an EPSS can be designed and developed to improve the performance of an individual worker, a group, or an entire organization (McKay and Wager, 2007). Helping performers in getting expert advice and support, it is expected that an EPSS can improve the quality of the products or the end results of an organization (Wang et al., 2007).

EPSS levels

In general terms, although the ultimate goal of the EPSS remains the same, presenting contextualized support when needed, applications vary extensively with many potential components (Villachica et al., 2006). In that sense, having decided that an EPSS is a viable solution for an organization, each performance problem should correspond to the EPSS components (McKay and Wager, 2007). As Van Tiem et al. (2001) point out, designing EPSS levels might vary in complexity, from simple to complex. In fact, an EPSS may combine different elements of interactive learning, electronic communications, and expert systems. Gery (1991) identified performance support of three types: (1) external, (2) extrinsic and (3) intrinsic.

External support provides performance support for users outside the workplace; that is why they have to break from work to obtain support (Rosenberg, 2006). In other words, users should completely leave the workspace to obtain performance support via computer-mediated or other advice channels such as manuals, websites, or from a help desk. Different from external support, extrinsic support is a subsystem that is integrated into the main system, but placed outside of the performance environment. In other words, extrinsic support is not placed within the primary workspace of the users (Stone and Endicott, 2000). Although this type of support is available to be used within the performance system, as with external support, the users have to leave the main frame of the system so as to obtain the required support (Rosenberg, 2006). As for intrinsic support, it implies a transparent interface design completely embedded within the system (Rosenberg, 2006; Stone and Endicott, 2000). In this level, users may elicit support without performing any action. Indeed, they may not realize any differences while doing their job and tasks. In most cases, users perform their job tasks using intrinsic EPSS (Stone and Endicott, 2000). Tools and interfaces that automate job tasks and processes reduce the complexity of the job processes and display embedded knowledge in the work flow.

Table 1. Support Structures of the EPSS.

Support Structures	Formats	Behaviors and Uses
Cue Cards	Single ideas or small sets of facts	Cue cards can be used to follow task guidance and content or underlying logic via linear, sequential or branched tasks.
Explanations or Demonstrations	Mini lessons or graphical presentations	Orientation, skill development and understanding are the main objectives of these structures, presented interactively or otherwise.
Wizards, Assistants or Helpers	Sets of queries and prompts	They can be used for task execution and guidance. They can be designed to provide progress to users through work tasks, to summarize choices or conditions, and produce outputs while presenting options, choices and different sources of data.
Coaches or Guides	Step by step instructions	Task guidance and completion through work flow can be controlled by coaches or guides.
Searchable Reference	Presentation of information via charts, tables and graphs	Searchable reference can be used in information search, retrieval and browsing via accessing content or knowledge databases.
Checklist	Mini checklists of flowcharts or processes	Lists of items or task completion criteria can be filled out by performers or systems.
Process Map	Graphical representation of flow charts or decision trees	Charts, diagrams, flow charts and lists can be used to overview all processes.
Examples	Mini cases	Examples are more powerful in idea development and understanding.
Templates	Pre-existing solutions to design or process problems	Templates consisting of pre-structured formats or shells are used for consistent and rapid task completion.
Tips	Hints to optimize efficiency	Hints, tips and alternatives are used to give short information about contexts or conditions.
Practice Activities	Sample problems or exercises	These types of activities are used for skill and confidence building.
Assessments	Clusters of questions	Assessments can be considered as performance and knowledge evaluation.

Support structures (components) of the EPSS

In the literature, there are many views about the components of an EPSS. Gery (1995) presents 12 support structures and their uses. Maughan (2005) lists the support structures' possible formats adapted from Gery's (1995) classification (Table 1).

Evaluation, models and evaluation of the EPSS

The existing body of research shows that two important concepts are important and play a pivotal role in the definition of evaluation: judgment and value. From Rossett's (2006) view, evaluation is composed of judging approaches. Chyung (2008) defines evaluation as making a value judgment of the evaluation phenomenon. The key question to be answered in the evaluation process is how well we have done it (Rossett, 2006). It refers to any initiative maximizing the merit, or the importance or usefulness of the individual or organization (Dessinger and Moseley, 2004). Rothwell (1996, 2005) defines evaluation as the process of identifying value. Simply put, judgment can be seen as an outcome while value is in the process of the evaluation (Spitzer, 2007).

Van Tiem et al. (2001, 2004) express four types of evaluation method: (1) formative, (2) summative, (3) confirmative, and (4) meta evaluation. Different from other types, the aim of the summative evaluation is to identify the immediate competence of performers and the effectiveness of the intervention(s). It could be applied during the implementation and change management phases. It can be also conducted immediately after implementation of the interventions (Dessinger and Moseley, 2004). It can also be considered as the most objective method to obtain data about the effectiveness of the selected performance intervention solutions (Van Tiem et al., 2004). Regardless of the evaluation type used in any initiative, direct and standard measurement of the results is a prerequisite for conducting objective evaluation of any intervention (Binder, 1995). Evaluation might be conducted with multiple sources such as best practices, customers, supervisors, experts, work products, and so on (Rossett, 2006).

Kirkpatrick's four levels of evaluation model

The four-level model of evaluation allows researchers to evaluate the effectiveness of training programs using systematic and systemic approaches: (1) reaction, (2) learning, (3) behavior, and (4) results (Kirkpatrick, 1994).

The Level 1 evaluation is carried out at the end of training to gather information about participants' immediate reactions to the program (Kirkpatrick, 1994, 2000) and constitutes a measurement of customer satisfaction. The main aim for this level is to obtain a positive reaction from the participants, as the program's future relies on positive reactions, not negative ones (Kirkpatrick, 1994, 2000).

The learning level (Level 2) can be explained as the changes in participants' attitudes, knowledge and/or skills at the end of the program (Kirkpatrick, 1994). It is important to answer questions such as which skills are developed or improved, what attitudes are changed and what knowledge is learned after the training program, because without learning, no change in behavior will occur (Kirkpatrick, 1994, 2000).

The Level 3 attempts to evaluate the changes in job behavior resulting from attendance at the training program (Kirkpatrick, 1994). In some cases, participants may not use the knowledge or skills learned from the learning event in the real job setting, even if learning occurs (Dick and Johnson, 2007).

The results level (Level 4) is based on obtaining the final results of the program (Kirkpatrick, 1994). However, determining the final results of a training program is the most difficult phase of Kirkpatrick's model (Kirkpatrick, 1994; Kirkpatrick and Kirkpatrick, 2006; Rothwell, 1996, 2005). Requiring too much time and cost for the design and development of the evaluation process is the main challenge of Level 4 (Dick and Johnson, 2007; Miles, 2003; Rothwell, 1996, 2005).

Extension of Kirkpatrick's model: Kaufman's level 5

Roger Kaufman tackles mega planning about societal perspectives in his theories (Burner, 2010). Kaufman (2006) recommends that the societal value-added frame for organizational success should be defined as any performance initiative because all people and organizations are means to societal ends. Van Tiem et al. (2001) suggest that organizations should contribute to the community and also deliberate on the environmental and societal impact of everything they do, implement, use, deliver and produce. Every organization should answer the question of what societal problem is addressed when they are attempting to find solutions for any issue (Kaufman, 2006). Kaufman (2006) argues further that all organizations add value to external clients and society, and that strategic thinking and planning should be applied to all evaluation. That is to say, any evaluation effort conducted in an organization should focus on benefits and outcomes at the societal level as well as the level of the whole organization (Pearlstein, 2010).

Evaluation of EPSS

Gery (1991) asserts that evaluation of an EPSS is really difficult because its effectiveness, impact and utilization vary greatly related to the organization's conditions. Summative evaluation of an EPSS gives information about the impact and the overall quality of the system on the organization, to illustrate what worked well, what could be improved and what potential problems in the flow might affect job performance (Villachica et al., 2006). To obtain these valuable results, Nguyen and Woll (2006) suggest that Kirkpatrick's framework can be used for the evaluation of EPSS interventions.

Kirkpatrick's model started to become very popular in companies during the 1970s, and still maintains its popularity in business and industry (Dick and Johnson, 2007). Kirkpatrick's four levels can be applied in evaluating most performance improvement interventions; in other words, its area of utilization is not limited to training programs (Pearlstein, 2010). In general, the model provides an easy and useful framework to understand evaluation and its processes in general (Rothwell, 1996, 2005). As Marker, Huglin, and Johnsen (2006) claim, general consensus on defining levels of evaluation for non-instructional interventions has not been reached in the performance field. Kirkpatrick (1994) and Kaufman (2006) defined levels of evaluation for non-instructional interventions such as EPSS (Table 2). In the proposed framework, the names and descriptions of levels are the same except that 'implementation' is used as a level instead of 'learning'. Because Kirkpatrick's levels cannot be adapted directly to non-instructional interventions, as Marker et al. (2006) proposed, the success of the selected intervention can be evaluated in the second level, rather than attainment of skills, knowledge or competence.

Both the design and development of the EPSS and evaluation of its components and structures within the system are vital areas of study. It is apparent that the more an EPSS is implemented successfully in

Table 2. Evaluation levels for instructional and non-instructional interventions.

Evaluation Levels	Representation of levels for instructional interventions	Representation of levels for non-instructional interventions
1	Reaction – Attitudes toward the intervention	Reaction – Attitudes toward the intervention
2	Learning - Attainment of skills, knowledge & competence	Implementation – Successful implementation of the intervention components as planned
3	Behavior - Job performance, application, transfer	Behavior - Job performance, application, transfer
4	Results - Impact of the intervention on the organization	Results - Impact of the intervention on the organization
5	Societal Benefit - Impact of the intervention on Society	Societal Benefit - Impact of the intervention on Society

business and industry, the more growing awareness and acceptance of EPSS in the workplace will be sustained for solving performance problems of people in organizations (McKay and Wager, 2007). In other words, as success stories resulting from the appropriate implementation of EPSS increase, more organizations may be willing to use EPSS in their workplace settings. However, to date, little empirical research has investigated the determination of the most critical components of the EPSS for organizations (Chang, 2004), nor have the three fundamental types of EPSS (external, extrinsic, or intrinsic) been completely examined (Nguyen et al., 2005). In other words, there has been little research in this area pointing out how the embodiment of the components affects the benefits of an EPSS implementation (Chang, 2004). Apart from the components and types of EPSS, a conceptualization of EPSS has so far not been examined (Mao, 2004). This study will help to clarify the effectiveness and impact of each type of EPSS.

Background to the present study

As a government agency, The Criminal Police Laboratories Department (CPLD) is affiliated to the General Directorate of the Turkish National Police (TNP). TNP is one of the biggest institutions in Turkey. With approximately 190,000 personnel and being a nationally organized and centralized structure serving two-thirds of the population of the country, the organization is affiliated to the Ministry of Interior, and functions within the municipal boundaries of all cities and towns of the country. The CPLD provides forensic services to support the judicial justice decision process by identifying crimes and criminals via scientifically examining and interpreting the physical evidence during the crime scene investigation. The Crime Scene Investigation and Identification Units (CSI) were affiliated to the CPLD at the end of 2003 in order to increase the effectiveness and efficiency of the police forensic science services. The crime scene investigation sections are located in the CPLD. There are a total of 200 crime scene investigation sections in the country and most of them have been established since 1995. Eighty-one provinces and 342 districts include their own crime scene investigation sections.

The main responsibility of the CSI sections is to examine crime scenes, collect and document evidence, apply scientific examinations on fingerprints and latent prints and compare these with archived prints for assisting in the solving of crimes, and lastly to prepare detailed reports for the investigation units. The CSI Unit is comprised of seven sections; crime scene investigation, technical imaging, biometrical data processing, administrative, bodily trace processing laboratory, evidence preservation, and the quality and performance management section. The CSI unit has attempted to integrate crime scene investigation, evaluation and documentation processes with the latest techniques and technologies, and also to adapt itself to performance management and measurement legislation.

The EPSS for Crime Science Investigation Units

The EPSS presented in the study was designed by the research team. The development was done by a software firm which specialized on the development of different EPSS applications for governmental organizations. The purpose of the integrated EPSS is to provide performance support for the CSI officers

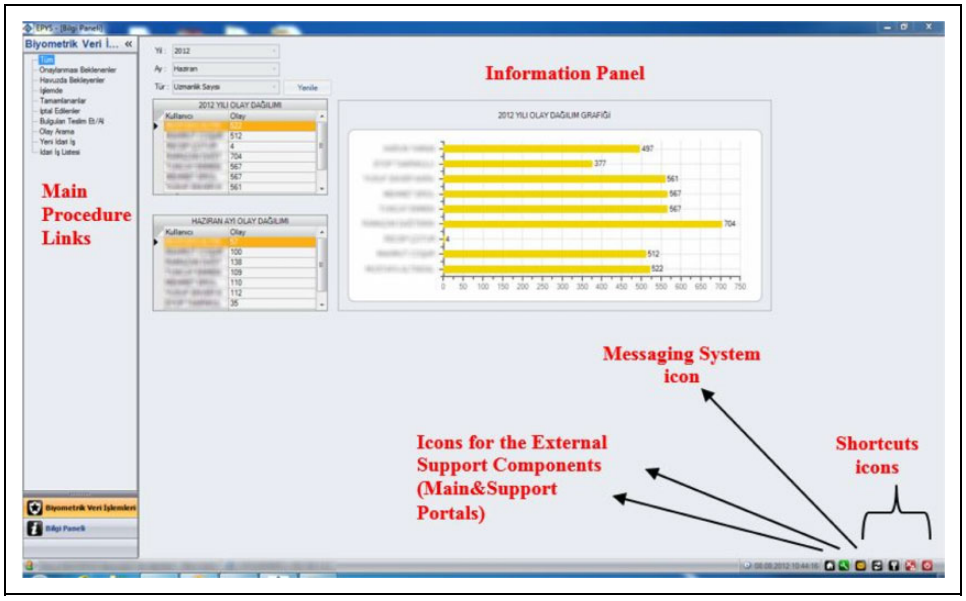

Figure 1. A sample screenshot of workflow application interface (Intrinsic Support).

with components which integrate a number of different aspects for the CSI Unit. The system combines work processes and performance support mechanisms for guiding officers through the specific outcomes required from them in order to complete the crime scene activities. The system is designed to accommodate the needs of the entire population of the CSI Unit. The large-scale, highly integrated EPSS is mounted on an intranet server so that information can be processed much faster. The CSI officers can access the job-related information and resources with multiple paths embedded in the system at the right moment they need it to increase their performance.

The EPSS offers a justifiable set of performance solutions by providing a work-flow based interface with context-specific access to support structures, tracking job-specific and performance-related information, and process support in the context of the workflow. Covering all these, the system consists of three levels of performance support as offered in the literature: (1) intrinsic, (2) extrinsic, and (3) external performance support systems. The EPSS comprises four different components: (1) workflow interface – intrinsic support, (2) support portal – external support, (3) support panel – extrinsic support, and (4) main portal – external support. To provide them with access to different representations of the content developed for the help function embedded in the support portal and the support panel, six main support structures (educational materials, pictures and figures, information cards, process maps, wizards and assistants, coaches and checklists, tips, and frequently asked questions) were integrated into the system. In other words, the external support system is similar to the extrinsic support system in that the same formats of support structures are used in both. However, two additional structures are added to the support portal: (1) educational materials, and (2) visuals. Because officers have to leave the workspace in the case of getting external support, they can spend a lot of time reading the help content and analyzing visuals. Therefore, educational materials made up of many pages and containing more information about the selected help topic, and visuals including important sketches and concepts, are developed and embedded into the support portal.

Intrinsic support. A workflow application interface embedded in the integrated EPSS simplifies procedures that CSI officers need to follow regularly. In doing so, the interface that serves the whole system and the performance support perform as one system (Figure 1). The intrinsic nature of the system behaves as part of the job routine and uses the information to apply appropriate rules based on the work flow and the actual job context of all CSI sections.

Extrinsic support. The extrinsic performance support system is designed and developed for CSI officers to get performance support while they are performing their job tasks. Unlike intrinsic performance support, which the officers can access without interruption while performing their job tasks, they have to activate

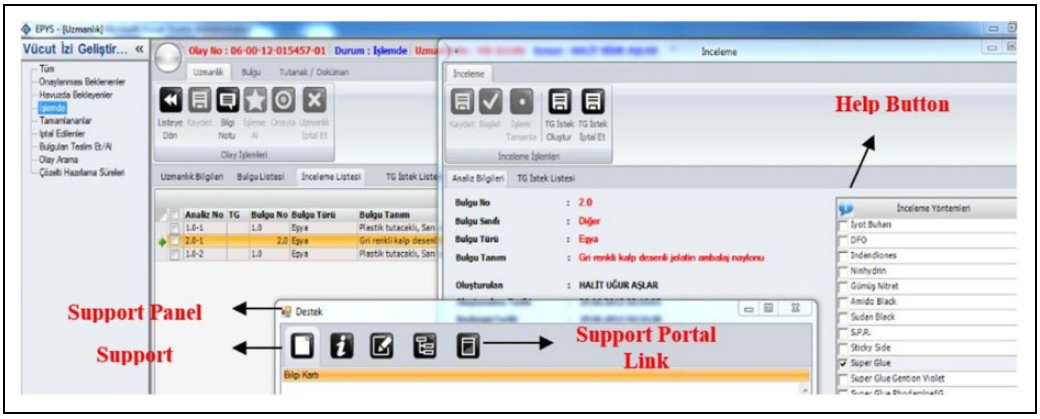

Figure 2. A sample screenshot of support panel (Extrinsic Support).

and turn on the support mechanism. Extrinsic support is accessed easily and quickly by clicking the '?' button that appears on the interface screen (Figure 2). When clicked, a popup window opens. The support information associated with the job task is displayed automatically along with a list of support structures in the "support panel". The extrinsic performance support system consists of six main support structures.

External support. If intrinsic and extrinsic support systems are not sufficient to provide necessary information, officers can access the external support component to gain required information instantaneously. In doing so, CSI officers have to leave the workspace to get performance support. The "support portal" is designed and developed to provide help contents, while the "main portal" provides documentation (short history of the CSI Unit, organization schema, mission, vision, regulations, user manuals, and important links), asynchronous communication among the officers from different locations, and links to the support portal (Figure 3).

In the support portal, linked to an extensive database, the officers can access all or some of the help contents via the use of hyperlinks (Figure 4). These hyperlinks are organized with reference to CSI sections and performance criteria relating to the selected section. CSI officers from all CSI sections can find help content related to their job tasks. They follow through a sequence of hyperlinks according to their CSI section, performance criteria and preferred help contents from the list of support structures.

The present study

This study aims to present the summative evaluation findings of an initial implementation to investigate the impact, effectiveness and perceived benefits of the EPSS on the performance of CSI officers based on Kirkpatrick's Four Levels Model and Kaufman's Mega Planning framework. To fulfill the stated purpose of the research, the following subquestions were addressed:

1. What is the reaction of the CSI officers to the EPSS intervention?
2. To what extent are the EPSS types and support components being deployed and used as they are planned?
   (a) To what extent do the EPSS types (intrinsic, external, or extrinsic) contribute to the CSI officers' productivity?
   (b) Which support structures are most used? Which are preferred?
3. To what extent is the EPSS perceived to improve performance of the CSI officers?
4. To what extent does the EPSS intervention help produce perceived valuable results for the CSI Unit?
5. To what extent is the EPSS intervention perceived to have an impact on society?

Method

Design and procedure

The study was carried out 30 days after installation of the system as the system was in use by the researchers. The mixed method research design was used during the research study. Mixed methods research combines the use of quantitative and qualitative methods together (Fraenkel et al., 2012). The first step for the evaluation of the EPSS began with a

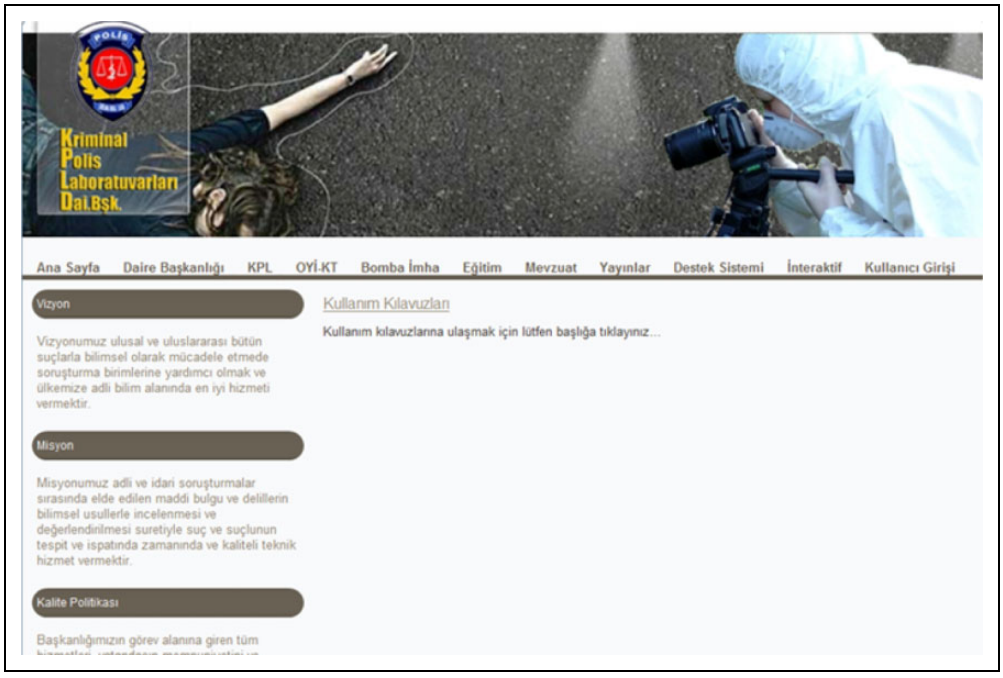

Figure 3. A sample screenshot of main portal (External Support).

Figure 4. A sample screenshot of support structures involving help contents (External Support).

quantitative study in which Kirkpatrick's Four Levels and Kaufman's Mega Planning frameworks were tested with a questionnaire, followed by qualitative methods entailing detailed exploration with individuals by interviews and other data collection methods.

Participants

The general population under study was police officers with different titles (including: superintendent, inspector, deputy inspector, police officer) from the CSI Unit in Turkey. A total of 3,396 CSI officers work in the 81 provinces and 342 districts.

Table 3. Sample demographics.

Metropolitan Areas	Titles	Research Type	CSI Sections					
			Administrative	Crime scene investigation	Technical imaging	Biometrical data processing	Laboratory	Evidence preservation
Ankara	inspector	Quantitative	1	3	–	1	1	–
		Qualitative	–	–	–	–	–	–
	deputy inspector	Quantitative	1	4	1	1	3	1
		Qualitative	–	1	–	–	–	–
	police officer	Quantitative	5	16	2	7	8	5
		Qualitative	–	2	–	1	–	–
Bursa	inspector	Quantitative	1	3	–	–	2	–
		Qualitative	–	–	–	–	–	–
	deputy inspector	Quantitative	2	5	–	1	4	1
		Qualitative	–	1	–	–	–	
	police officer	Quantitative	4	14	2	8	9	5
		Qualitative	–	2	1	–	–	–
Antalya	inspector	Quantitative	1	5	–	1	5	–
		Qualitative	–	1	–	–	–	
	deputy inspector	Quantitative	–	5	1	2	3	–
		Qualitative	–	–	–	–	–	–
	police officer	Quantitative	5	15	2	8	10	7
		Qualitative	–	1	–	1	1	–

A representative convenience and purposive sampling strategy was used to determine the participants of the study. The sample was selected from 3 metropolitan areas (N = 394) so that they would have a higher possibility of system use because of their workload. The researchers decided to select participants from metropolitan areas where the intervention (EPSS) would be most used. While 191 CSI officers from Ankara (n = 60), Bursa (n = 61) and Antalya (n = 70) participated in the quantitative part of the study, the researchers conducted a qualitative study with 12 CSI officers from CSI Units located in these same metropolitan areas. Table 3 shows the detailed sample demographics.

Instruments and data analysis

For the quantitative data collection, a questionnaire was developed and administered to the CSI officers from three metropolitan areas 30 days after the implementation of the EPSS. Computer logs recorded throughout the implementation period were also used to understand the functioning of the EPSS. After the quantitative data collection, interviews were also conducted with CSI officers of different ranks from the same areas to obtain in-depth information about the impact, effectiveness and perceived benefits of the EPSS.

In the questionnaire, measures for Level 1(Reaction) consisted of nine items. These nine items were arranged using a 5-point Likert-type scale, ranging from 'strongly disagree' to 'strongly agree'. For Level 2 (Implementation), participants were requested to evaluate the effectiveness of all four main support components (workflow interface, support portal, support panel and main portal) against a 5-point scale of 'none', 'little', 'some', 'much' and 'very much'. As for measures regarding Level 3 (Behavior), this section included 11 items designed to evaluate whether or not the EPSS had improved job performance of the CSI officers. The impact and perceived benefits of the EPSS on the CSI Unit was measured by the five items in Level 4 (Results), and the impact of the EPSS on society was measured by four items in Level 5 (Societal Benefit). The items for Level 3, Level 4, and Level 5 were based on a 5-point Likert-type range; from 'strongly disagree' to 'strongly agree'.

Throughout the implementation, tracking and logging data were stored and recorded on an external server. All activities, entries and searches executed by CSI officers were extracted from the server and merged into a Microsoft Excel data file to be used later for statistical analysis. More specifically, officers' support structure preferences and used performance types, such as extrinsic or external structures, were recorded. Therefore, the data

Table 4. Correlation coefficient values for Reaction, Behavior, Results, and Societal Benefits Levels.

	Item coefficient values	
Levels	Min.	Max.
Reaction	.27	.76
Behavior	.34	.84
Results	.49	.63
Societal Benefits	.53	.81

contained information regarding preferred support structures for both external and extrinsic levels. Based on the log statistics, the CSI officers' preferences relating to the usage of support structures embedded in the EPSS were revealed, to support the data obtained from the survey, which only recorded the users' judgments and opinions.

Quantitative data was analyzed using descriptive statistical measures to present general findings of the summative evaluation in five main categories; reaction, implementation, behavior, results, and societal benefits. In the quantitative analysis, the correlation indicator was also analyzed for the reaction, behavior, results and societal benefit level items (Table 4).

While correlation coefficient values for the items of reaction level varied between .27 to .76, the coefficients for behavior items ranged from .34 to .84. Whereas the values for results items changed between .49 to .63, the correlation coefficients for the items of societal benefit level varied between .53 to .81. These values indicated that all items for each evaluation level correlated fairly well with others and none of the correlation coefficients were particularly large; hence, there was no need to consider eliminating any items in the instrument.

As for the qualitative part, each interview lasted approximately 25 minutes. The interviews consisted of 9 structured questions, which were developed based on the results obtained from the quantitative data collection phase in terms of the five main categories; reaction, implementation, behavior, results, and societal benefits. Content analysis was used for the analysis of the results.

Several coping strategies were used to overcome validity issues for both quantitative and qualitative parts of the study. First and foremost, experts from two different departments of a school of education including Instructional Technology and Measurement & Evaluation departments and chief officers from the CSI Unit checked and edited the instruments with regard to the intended meaning, common language and clarity of the items to be used in the questionnaire. Secondly, the mixed method design and different data collection tools were selected for the study to eliminate threats of internal validity. The results of the questionnaire survey and interviews were supported with computer logs showing the exact preferences of the officers (criterion-related evidence for validity). To cope with subject characteristics, the researcher selected a sample of CSI officers from different metropolises and obtained detailed information on subjects with different ranks. Lastly, prolonged engagement, persistent observation and different triangulation strategies were applied to ensure credibility of the findings. Adequate evidence concerning the analysis of the Unit and evaluation of the EPSS was supported in the study by providing quotes from participant interviews for transferability, which refers to validity in qualitative data.

Results

Level 1: Reaction

The data for Level 1 evaluation (reaction) was gathered through the survey and from the interviews in order to understand the respondents' immediate reactions to the multiple and specific integral parts of the implemented EPSS. In Table 5 ($n = 191$), the survey items are ranked by their mean scores.

From the table, it is apparent that all reaction items had mean scores above 4.0 and a standard deviation around 0.5. The most positive reactions toward the EPSS were the presentation of help contents in different structures ($M = 4.61$), supporting the officers to do their job well ($M = 4.57$), making a significant contribution to personal development of the CSI officers ($M = 4.54$), and the importance of the user manuals for the accurate use of the system ($M = 4.54$).

Similar to the survey responses, almost all the interviewees ($n = 10$) indicated that the contribution the EPSS made to their professional development was one reason to react positively to the system. Technological ($n = 5$) and job related ($n = 4$) contributions were considered as main reasons that the EPSS supported. One police officer from the crime scene investigation section reported that,

> "... Using technology is important for us. In the daily life, we use technology. Why do we not take advantage of using technology for our job tasks? I

Table 5. The mean scores and standard deviations on the reaction items.

Items	M.	S.D.
I think that the presentation of the help contents in different structures (educational materials, information cards, tips, etc.) is very effective.	4.61	0.51
The use of an EPSS helps me to do my job well.	4.57	0.52
I think that the use of an EPSS makes a significant contribution to my personal development.	4.54	0.51
I think that user manuals are useful in terms of accurate usage of the system.	4.54	0.55
The support structures embedded in an EPSS are consistent with my job.	4.53	0.54
The use of an EPSS helps me to perform my job better by satisfying my personal needs.	4.53	0.52
I am satisfied with the general system.	4.53	0.53
Using an EPSS enhances my communication with colleagues regarding my job.	4.38	0.64
The use of an EPSS helps me to capture new knowledge about my job.	4.36	0.59

> think that keeping up with technology is a requirement for us. Using the new system [EPSS] is closing that gap now . . . "

The different presentation of the help contents (n = 8) via different support structures was also mentioned by participants. One of the CSI officers from the laboratory section commented that

> " . . . the formula of solution cannot be always remembered by experts. In case of this situation, individuals can use help contents, and remember the solution using different support structures . . . "

Half of the interviewees (n = 6) stated that their reaction to the EPSS was very positive because the EPSS helps them to do their job well. One of these respondents reported that

> " . . . Writing an expertise report is important for our job. The EPSS prevents us from forgetting the missing parts. This is one of the best opportunities that the system provides us . . . "

Level 2: Implementation

The results of the Level 2 evaluation (implementation) survey data are shown in Table 6 (n = 191); it indicates that all four main support components have contributed to the CSI officers' productivity.

While the workflow interface (M = 4.29) got the highest ranking, the support panel (M = 4.20) also made a contribution to their productivity. Table 7 depicts the numbers of support structures executed by the CSI officers during the 30 days of the implementation period. The data obtained from the computer logs indicates that the CSI officers used both external and extrinsic support structures to varying degrees when they received performance support regarding their job tasks.

Table 6. The mean scores and standard deviations on the implementation items.

Support Structures	M.	S.D.
Workflow Interface (Intrinsic)	4.29	0.52
Support Panel (Extrinsic)	4.20	0.60
Support Portal (External)	3.92	0.63
Main Portal (External)	3.84	0.65

When the CSI officers decided to get performance support via external support (support portal), educational materials were the most used support structure with 112 entries. In other words, the officers used to receive performance support via educational materials made up of many pages and containing more information about the selected help topic when they left the workspace. As for extrinsic support, the CSI officers used mostly information cards to get performance support while they were performing their job tasks. That is to say, single ideas or small sets of facts that were accessed 57 times by clicking the '?' button became the most used extrinsic support structure. Coaches and checklists, and process maps were other well-used extrinsic support structures, accessed 30 and 22 times respectively.

The qualitative results also revealed that components of the EPSS (intrinsic, extrinsic, and external) affected the officers' productivity to varying degrees according to their needs. An overwhelming majority of CSI officers' responses (n = 10) to the contribution of the EPSS support structures clearly indicated that intrinsic performance support made a major contribution to their productivity. This was illustrated well in

Table 7. Preferred Support Structures.

Support Structures	External	Extrinsic
Educational Materials	112	–
Visuals	16	–
Information Cards	77	57
Process Maps	15	22
Wizards and Assistants	16	8
Coaches and Checklists	38	30
Tips	24	13
Frequently Asked Questions	25	11

the statement made by an officer from the biometrical data processing section:

> " . . . To perform my job tasks, I use it [workflow] all the time. Anyway, the system shapes my job as now I am doing my tasks through the template. Moreover, the step by step feature and message warnings for any forgotten steps are important features of the EPSS. In short, I shape my job according to the system. I mean, I carry out my tasks together with the system . . . "

As for extrinsic support, the respondents (n = 8) pointed out the reminder function of different extrinsic supports, which were accessed by clicking '?' button. One respondent from the laboratory section reported that

> " . . . By clicking a button, I can get short information regarding an analysis procedure or I have a chance to see which steps should be followed for conducting that analysis method . . . "

The same attitude toward external supports, the support portal (n = 7) and the main portal (n = 3) was also expressed by the participants. The search features and access to help contents via hyperlinks organized with reference to CSI sections.

Level 3: Behavior

The Level 3 evaluation (behavior) data is presented in Table 8 (n = 191), ranked by mean scores.

All the items had mean scores above 4.0 and a standard deviation around 0.6. Therefore, it is possible to conclude that the integrated EPSS was considered as an effective system by the CSI officers and helped to improve their performance in some specific determinants during the implementation period. Generating expertise reports (M = 4.63), performing better with more accuracy (M = 4.54), completing job tasks quickly (M = 4.51), and reaching needed information quickly (M = 4.48) seemed to be major factors in their performance improvement.

These results were largely supported by the interviewees, who emphasized that generating expertise reports (n = 12), attaining needed information (n = 11), and performing with more accuracy (n = 9) were the most beneficial factors by which the EPSS enabled them to do their job tasks well. Firstly, all participants confirmed that, through the use of the EPSS, they could quickly generate the expertise reports which were the main outcome of the forensic process for all CSI sections. The EPSS improved their performance by generating these reports automatically. An officer working at the laboratory section underlined the value of this feature in the statement:

> " . . . For example, it is really good to generate expertise reports with the system [EPSS]. I only have to start the process, then I enter my investigation decision to the system. Then, the system writes all the process and I only print out the report and sign it. Lastly, I deliver the report to the relevant CSI section . . . "

An officer from the biometric data processing section made a similar statement:

> " . . . The report [an expertise report] is generated automatically while you are entering the data instead of doing it manually. This feature enables me to spend more time on investigating more fingerprints in detail . . . "

Level 4: Results

The Level 4 evaluation (Results) data, on the impact of the EPSS in terms of producing valuable results for the CSI Unit, is presented in Table 9, ranked by mean scores.

According to the officers, the most significant result of using the EPSS in the CSI Unit will be the creation of uniform workflow procedures (M = 4.64), followed by increasing the quality of produced work and outcomes (M = 4.58), and productivity (M = 4.57) after the use of the system by officers for 30 days.

These results were supported by those from the interviews, which showed that the most beneficial results of using the EPSS were considered to be providing standardization of workflow applications (n = 12), and increasing productivity (n = 8) and quality of produced works (n = 6). According to their responses, standardization encompassed both

Table 8. The mean scores and standard deviations on the behavior items.

Items - Using the EPSS,	M.	S.D.
I can quickly generate expertise reports which are part of my job	4.63	0.54
I can perform better and with more accuracy	4.54	0.58
I can complete my job tasks more quickly	4.51	0.55
I can quickly acquire the information needed	4.48	0.59
I can make interpretations of my performance	4.45	0.61
My 'required knowledge level to perform my job' has increased	4.42	0.58
My 'required ability level to perform my job' has increased	4.41	0.61
My 'required skill level to perform my job' has increased	4.41	0.58
The subjects for which I need to consult my superiors have reduced	4.33	0.65
My communication with co-workers has increased	4.28	0.65
I can participate in decisions about my job	4.28	0.63

Table 9. The mean scores and standard deviations on the results items.

Items Using the EPSS in the CSI Unit, I believe that . . .	M.	S.D.
uniform workflow will be followed by all CSI sections	4.64	0.53
the quality of produced work and outcomes will be increased	4.58	0.54
productivity will be increased	4.57	0.54
paper documentation will be decreased	4.52	0.56
in-service training costs will be decreased	4.48	0.61

Table 10. The mean scores and standard deviations on the societal benefit items.

Items Using the EPSS in the CSI Unit, I believe that . . .	M.	S.D.
it will improve the institutional identity in the eyes of citizens	4.59	0.55
it will help judicial authorities to reduce judicial procedures	4.42	0.59
it will help with reducing the time required for judicial decisions	4.41	0.59
it will help make positive contributions to peace in society	4.37	0.57

job processes and major tasks followed by all CSI sections in the country. One deputy inspector commented that,

> " . . . This system [EPSS] provides standardization across the country. It enables us to write uniform reports. This is a good outcome for us. If one crime scene investigator is appointed to a different province, s/he will never have a difficulty to adapt to the system . . . "

With regard to increases in productivity, one officer from the crime scene investigation section reported that

> " . . . it [EPSS] simplifies my job. It increases my performance. If you consider my job as an input, it will increase daily tasks. However, I can say that it decreases my total workload . . . "

Level 5: Societal Benefit

The level 5 evaluation (societal benefit) survey data is presented in Table 10, according to mean scores.

The CSI officers believed that using the EPSS would have an impact on society by improving the institutional identity of the CSI Unit in the eyes of the citizens (M = 4.59). They also considered that the system would help judicial authorities to reduce judicial procedures (M = 4.42), and the time required for judicial decisions (M = 4.41) and felt that using the EPSS would have a positive impact on peace in society (M = 4.37).

Qualitative results again supported those of the survey indicating that improvement of the institutional identity (n = 10), simplifying and supporting judicial processes (n = 9), and reducing the judicial time for decisions (n = 8) were the most cited impacts in the

interviews. One officer from the crime scene investigation section commented that

> "... Citizens look at these efforts as technological improvements. Therefore, these efforts improve the public image of the police because they think that the officers use technological equipment while doing their job. Of course, we act responsibly. However, they say that we investigate via the computer and they look at it with different eyes..."

Regarding the impact on the criminal justice system an officer from the biometric data processing section predicted that

> "... The EPSS simplifies my job tasks. Similarly, courts and public prosecutors will also benefit from these improvements because of the fact that they will see more detailed and standard expertise reports".

Conclusion and future research

The results revealed that the EPSS received generally positive reactions from the officers. Their reactions to the specific EPSS features and the acquisition of job performance related benefits might have established these positive behaviors. As Gery (1991) states, assessing the reactions of the performers and impact may be important at early phases of the EPSS utilization. Moreover, an intrinsic support component, the workflow application interface, made a major contribution to the officers' productivity. That is to say, intrinsic support made more contribution than other levels, such as extrinsic support (support panel) and external support (support and main portals). This finding was consistent with those of Nguyen (2005) who found that intrinsic or extrinsic performance support were considered as more useful than other levels. It might be considered as an acceptable result for several reasons. Because the application interface fulfilled the needs of performance, the officers believed that intrinsic support made much more of a contribution to their productivity. This result also supported the theoretical premise that focusing attention on information, resources, incentives (environmental factors) in any performance improvement initiatives has a greater impact on the human performance than addressing motives, capacity and knowledge (individual factors) (Chevalier, 2006).

The second reason was that the work interface designs simplified many of the officers' job tasks and helped them to perform well. The integrated feature of the system enabled CSI officers to complete the required job tasks as well as to receive the required help contents via extrinsic or external support structures. This finding also confirmed the research results of Nguyen (2006), and Nguyen and Woll (2006), who expressed that the EPSS is most effective and efficient when it is implemented directly compared to integrated types of EPSS, in the context of the work environment. Another interpretation of this result was that not only external, but also extrinsic, support components had to be activated to receive the performance support. Therefore, these components required the officers to make extra efforts to obtain help contents. As Nguyen and Hanzel (2007) assert, because the external support includes more content in the database, it is possible that finding and selecting the relevant support content may be more difficult for performers. As for the support structures' preferences, the performance data revealed that support structures which included specific information and knowledge regarding job tasks were used by the CSI officers for both external and extrinsic support, most notably educational materials and information cards. These usages might well be due to the fact that crime scene investigation processes for all CSI sections consist of detailed procedures and many steps.

As for perceived benefits of the EPSS, the users' performance improved in some specific areas. That was very important for the success of the intervention. Brethower (2007) states that improving performance as a process is more difficult and much more valuable than only changing it. If these areas are scrutinized closely, it is possible to assert that the main determinant was the intrinsic support component, the workflow interface. Generating expertise reports, obtaining the required information, and performing with more accuracy as perceived benefits might be considered as the main outcomes of the workflow interface application. Moreover, this result was also consistent with the theoretical arguments stated by different researchers. As Altalib (2002), Gery (1991), and McKay and Wager (2007) expressed, the EPSS reduces errors and mistakes because all available support and information can be accessed immediately, whenever needed. Besides intrinsic support, the CSI officers believed that their performance improved in individual domains related to their competency in addressing the repertory of behaviors, most notably knowledge, skills, and abilities. Similar to intrinsic support, this result evolved from the preference for and usage of the extrinsic and

external performance support components. These results were consistent with the theoretical and practical assumptions that EPSS increase job productivity (Altalib, 2002; Chang, 2004; Van Tiem et al., 2001), enhance the worker's autonomy (Altalib, 2002; Chang, 2004; McGraw, 1994b), improve knowledge capitalization (Altalib, 2002; Brown, 1996; McGraw, 1994a; Van Tiem et al., 2001), and provide employees with immediate access to the most recent procedures, data and required information (Lessard and Mowat, 1998; Van Tiem et al., 2001).

The results also showed that all EPSS components produced valuable results for the CSI Unit. One of the main valuable results of the EPSS was that it provided standardization. As many researchers and practitioners assert, EPSS help employees accomplish frequently repeated job tasks and procedures automatically and with uniform work practices (Altalib, 2002; Brown, 1996; Moseley and Dessinger, 2007; Rosenberg, 2006; Van Tiem et al., 2001).

Most of the CSI officers who participated in the study predicted that the EPSS would increase institutional identity in the eyes of citizens, simplify and support judicial processes, and also reduce the judicial time for decisions. These results were credible for the reason that the CSI Unit offers forensic services for the identification of both crimes and criminals by scientifically examining and interpreting physical evidence collected during the crime scene investigation. The officers' great emphasis on citizens' possible benefits, the Unit's reputation, and the criminal justice system's possible advantages were considered as outcomes produced by the EPSS beyond the organization, and as major contributions made to the community.

Limitations

The study has theoretical and methodological limitations. Since this study aimed to present evaluation findings of an initial implementation period, hard performance data resulting in objective analyses were not collected. The evaluation data gathered through research relied only on the perceptions of the CSI officers. The data obtained from perceptions cannot be independently verified. Therefore, for further studies, direct measures of performance (facts) or other objective analyses such as customer satisfaction and workflow efficiency should be obtained when the aim is to understand whether an organization is performing better as a consequence of the intervention (Rothwell, 1996). Many models have been developed by researchers to conduct evaluation of implemented interventions. Although Kirkpatrick's model is one of these, as Dessinger and Moseley (2006) assert, evaluation models for which both training and non-training performance improvement interventions are used have derived from Kirkpatrick's four levels of evaluation. However, researchers have not reached a consensus about usage of Kirkpatrick's levels in non-training performance improvement interventions. Although this study provides a viable application of Kirkpatrick's model for the CSI Unit, there is a need to study the model's successful utilizations to evaluate different non-instructional interventions in different organizations. In that sense, apart from the four levels, the model's extended adaptations such as Kaufman's Mega Planning should also be carried out in different workplace settings to show the societal impact of implementations.

In recent years, there is a growing inclination toward the use of EPSS in business and industry to improve human performance within the workplace (McKay & Wager, 2007). In this study, the integrated EPSS was employed in computers for all CSI sections and officers for crime scene investigation. The implementation and evaluation of the study were limited to these technologies. For further studies, new technologies should be integrated to the main systems and the effectiveness and impact of the components should be investigated in detail. To illustrate, as McKay and Wager (2007) express, while performing their job, employees have a great chance to access electronic support via wireless and mobile technologies. New technologies may play a key role in the widespread usage of EPSS in the future. Voice recognition, wireless, and mobile technologies and LCD panels, and different multimedia options for delivering the content may direct the evolution of EPSS (McKay & Wager, 2007), the success and efficiency of the extrinsic and external support components should be investigated with reference to new technological equipment.

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