Training as Regulation and Development: an exploration of the needs of enterprise systems users

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Abstract

The view of the organization as a system that 'processes' information or 'solves' problems is at odds with the dynamics of change associated with the development and use of IS in an organization. A significant consequence of this mismatch is in training that does not meet the needs of either the user or management communities, giving rise to sub optimal organization performance and inertia. We explored such issues by examining recent research into organizational development and training. The particular challenges presented in the development and implementation of large-scale enterprise systems were explored to reveal a discontinuity in the constructs underpinning a development. A theoretic model that bridged some of the gaps between the bodies of research was developed and a brief empirical study provided a proof of concept for the model. The paper concludes with a discussion of the model's implications for theory and practice.

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- This research was supported by a grant from the USF Center for Research in Healthcare Systems and Policies
- The authors would like to thank Ellen M. Hufnagel, PhD for her generous help in the development of this work.

Keywords: organizational development, learning, training, implementation, enterprise systems

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1 INTRODUCTION

One particularly difficult aspect of enterprise-wide implementation efforts is in providing appropriate training for groups of users whose specialized work and occupational orientations provide little in the way of a universal skill set or knowledge base. Collaborative features of enterprise applications complicate the development of effective training; i.e., tools that are intended to foster cross-functional dialogue and shared responsibility for outcomes. Such tools have the potential to change the way work is performed across an organization if users know how to adapt and apply them in their work.

We identified the training needs that arise as new tools span increasingly diverse user communities. We began by summarizing recent research into organizational development and training. A brief empirical study was used to articulate and develop the constructs. A model that highlighted the congruence of the major constructs underpinning the research was then developed to provide a proof of concept and highlight some of the challenges faced by developers, trainers and users of enterprise systems.

2 ORGANIZATIONAL DEVELOPMENT AND TRAINING

Porras and Robertson [20] suggested that change in an organization's behaviour was at the core of organizational change, and that an individuals' behaviour was altered when aspects of their work setting was changed.

Four groups of factors affect behaviour: organizational structures and procedures; social factors; technology, and the physical setting. This categorization guided much research in organizational change, but it masks the interdependence of the factors [13]. Do managers know what behaviour their employees need? This question separates *ability* from *skills or expertise* [3]. Understanding the ways in which individuals and technology affect one another is an essential pre-requisite for effective organizational change.

It is necessary to avoid the tensions and cognitive dissonance that arise from the persistence of these assumptions. Effective change is characterized by compatible goals, where users and their managers understand their attitudes and values: the interconnection of the change 'factors' and synergy that arise from their interdependence must be addressed [1]. Training is, of course, critical.

Working hard, taking responsibility, showing initiative, being creative, etc. will increase the likelihood that the organization performs well. There is thus a need to foster the development of individuals' knowledge and skills. Missed development opportunities are bad for the organization, but the theory does not provide sufficient help in determining techniques to use to prevent this [14].

Two dimensions – mode or category of change and order of change – provided a basis and starting point for our reconsideration [9]. Change that is planned is prompted by an internal decision to improve the functioning of an organization and often focuses on developing general capabilities to deal with demands. Unplanned change, on the other hand, is characterized by response to pressures outside the organization [21].

First order change is continuous, evolving, and incremental and characterized by cause-and-effect relationships – such as effort and reward. In contrast, unplanned change is episodic, discontinuous, intermittent, and sometimes radical due to a shift in policy or legislation. If organizational conditions are altered in ways consistent with previous changes, they are first order and the frames of reference are maintained. However, if the change is radical, the organization experiences second order change: and the frames of reference are replaced. These dimensions can be combined to identify four types of organizational change.

	Change Category	
Order of Change	*Unplanned*	*Planned*
First	Evolutionary	Developmental
Second	Revolutionary	Transformational

Figure 1 Types of Organizational Change

In attempting to isolate and measure causal factors, prior research identified the results of a single intervention: however, this has tended to miss the wider ranging effects that ripple through the organization. Change gives rise to perceptions among those affected; the *intersubjectivity* is important to both the design and use of the IS but also in training prior to their introduction and use.

Most research on training relies on theories of individual learning and assimilation theory [26]. The focus on the individual does not generally, however, address the challenges of intersubjectivity. Organization-wide change affects the training needs of departments, teams, and other social groupings [4, 18]. Efforts to address reciprocity have highlighted the need to explore the sense-making and learning processes common to organizational change, development and training [11, 22].

Gnyawali and Grant described four types of sense making and learning and discussed how they may serve as strategies for acquiring knowledge [10]. They identified two primary types of knowledge existing knowledge of the individual (especially about the organization and its policies, etc.) and new knowledge acquired through interactions during the course of the work. Nonaka in his theory of organizational knowledge creation [16] argued that while new knowledge was developed by individuals, the interactions between them in teams, departments, etc. articulated and amplified it. This resulted in four modes of knowledge creation – combination, internalization, socialization, and externalization. Externalization and socialization are not as dependent on organizational development as the others. Inter-subjectivity provides for a means of examining such *tacit knowledge* to make it shareable.

The cohesion of teams, departments and similar groupings are important features of organizational structure [25]. However, theoretic frameworks do not readily accommodate the dynamics of change at this level. In order explore the interdependence of organizational and knowledge development at this level we carried out a study to identify the nature and significance of the developmental challenges faced by team members.

3 STUDY

We needed to examine a cohesive task environment supported by one or more enterprise systems and chose a clinical setting because the mission and values of clinicians are acknowledged to be coherent and well understood [6, 27]. The Sarasota Memorial Healthcare System (SMHCS) in Florida is a publicly owned Level 1 care center with 691 beds. It provides acute, ambulatory, rehabilitative and tertiary care. In addition, it has three remote rehabilitation clinics, two sports medicine clinics, a freestanding preadmission testing center, an ambulatory surgery center, and a physician clinic. The patient population is approximately 70% under US Medicare. SMHCS uses a substantial suite of clinical applications, integrated through an enterprise-wide system (the Eclipsys Sunrise Clinical Manager™ - SCM). The system's applications support specialties, such as cardiology, special care, obstetrics, and respiratory care, as well as departments that serve the broader SMHCS, such as pharmacy, radiology, and pathology.

Non-clinical and clinical support work have a suite of applications integrated into a PeopleSoft™ system that includes payroll, patient scheduling, staff scheduling, and finance.

The two major enterprise systems are supplemented by a number of generic and specialist stand-alone systems. SMHCS is typical of regional health care facilities in the USA; it provides a range of IS to support the work of its staff. They in range from self-contained, stand-alone productivity tools (such as a spreadsheet to monitor and report a budget) to enterprise wide systems that support the collaboration between medical specialties on which the continuity and quality of care for chronic and critical illness depends.

The wide range of IS at SMHCS is compounded, as usual, by the range of roles, responsibilities and specialties of the staff. Hospitals are governed and managed according to values and rules from inside and outside [19].

Our challenge was first to assess the degree of commensurability among the constructs. Our research question posited the existence of a-priori construct. In crafting our instruments and protocols, we sought to avoid their dominance and bias in order that the participants defined the issues, concerns, and constructs. We set out to retain theoretical flexibility and constrain external variation by building and testing our framework in a specific setting. We followed the process advocated by Eisenhardt [7] in attempting to build our theory from empirical case studies.

We selected three candidates for the study: a clinical nurse manager, a pharmacist, and a respiratory therapist. Although these were by no means a representative sample of the population of SMCHS, they represented different administrative and clinical responsibilities, engagement in collaborative work, and use of both stand-alone and enterprise wide IS.

This approach enabled within-case analysis that allowed preliminary theory generation. A recursive approach to data analysis also allowed us to revisit our initial interpretations and consider the results from different perspectives [17]. This reduced the possibility of a-priori constructs dominating the analysis, thus ensuring internal validity. Our unit of analysis was work-task: individual, discrete actions that comprised the participant's job. Such an approach was well suited to investigation of the tasks, plans, and goals of this specialized user community.

Cognitive Task Analysis

Cognitive Task Analysis (CTA) is a way of gaining access to the mental processes that organize and give meaning to observable behavior [23]. It includes the use of structured and unstructured interviews, step listing, questionnaires, observation, and teach-back. The methods analyze the cognitive processes that underlie performance of tasks and identify the cognitive skills needed to respond to complex situations. The results of CTA studies have been successfully applied to a range of areas that include instruction and training, system development, human-computer interface design, and organizational design.

CTA consists of three phases:

- *Elicitation:* the process of collecting and recording data about cognitive events in the domain of interest.
- *Analysis*: structuring the data, involving its inspection, selection, simplification, abstraction, and transformation; and
- *Representation.* Depicting data relationships.

We used the Repertory Grid technique (RepGrid) as a tool. Its output allowed us to display the data in ways that depicted their inter-relationships. The process took approximately five hours to complete with each participant. The elicitation phase was a semi-structured interview; its goal was to generate a list of tasks carried out by or familiar to the participant. These became the *elements* (column headings) of the two dimensional RepGrid. The participant was asked to evaluate three tasks at a time, identifying similarities and differences between them. Thus a series of bi-polar constructs were identified. These were used to label the ends of the rows in the two dimensional grid. Typically, 12 to15 task elements and 10 to 12 bi-polar constructs were identified. Figure 2 shows a RepGrid at the end of the elicitation phase.

	1 Task Elements							
2 Personal Constructs	Reconcile census	Review shift report	Liaise with Communicator	Review Staffing (OneStaff)	Task 5	Task 6	…	***2 Personal Constructs***
addresses safety issues	5	2	1	3	5	1	…	addresses unit productivity
concerned with workload	4	2	1	3	2	4	…	concerned with finance
specific to (a) patient (s)	4	2	3	3	1	5	…	specific to an employee
safety and clinical	5	2	1	4	3	1		purely financial
…			***3 Ratings***					…
…								…

Step 1. Participant identifies tasks that comprise their work

Step 2. Participant assesses triads of task elements, identifying similarities and differences, yielding a series of personal construct scales (e.g. *concerned with workload/concerned with finance*; *safety and clinical/purely finacial*)

Step 3. Participant evaluates each task element on a 5-point scale using their own personal constructs (e.g. task element *Reconcile census* scored a 5 on the scale *addresses safety issue/addresses unit productivity* and a 4 on the scale *concerned with workload/concerned with finance*

Figure 2 The RepGrid after Elicitation Phase

The analysis phase began with the participant rating each task against each of the differentiating constructs they had identified. Participants used a 5-point Likert scales to rate each task against the left (1) and right (5) poles of the construct. We attempted to optimize the reliability and validity of our analysis and findings by using the completed RepGrid as trigger for further discussion with the participant [12]. The numeric ratings of the RepGrid were subjected to a principal components analysis (PCA). This reduced the dimensionality of the dataset while retaining characteristics o that contributed most to its variance.

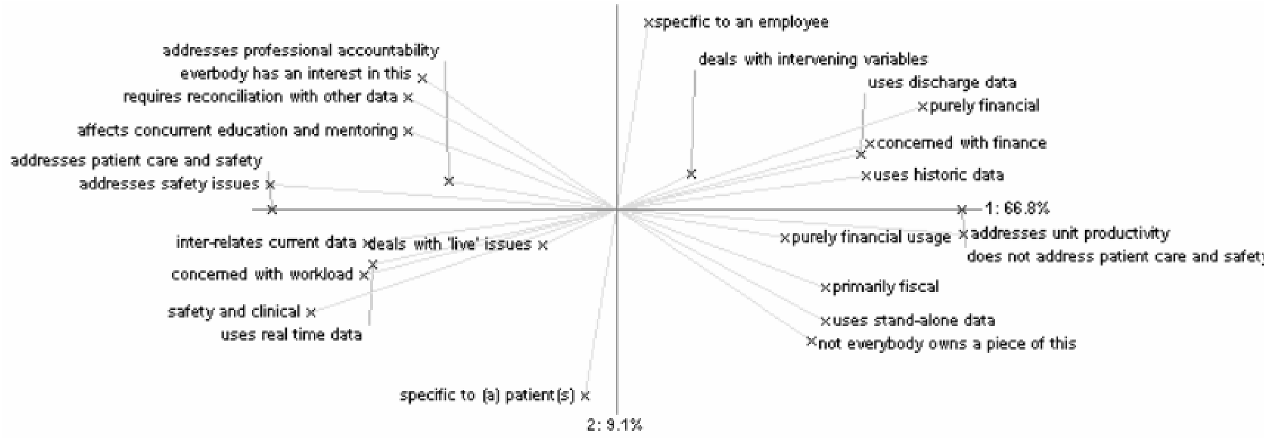

Figure 3 Representation of RepGrid Data after Principal Components Analysis

In Figure 3, the RepGrid data were treated as though the tasks were points in an *n*-dimensional space defined by the constructs as axes centred on the means of the elements. The data was then rotated through PCA to spread out the elements [8].

4 FINDINGS

The RepGrids yielded 462 ratings that provided the basis for the CTA. PCA revealed the underlying cognitive infrastructure [24] of each participant as a hierarchy of components. Loadings calculated using the RepGrid ratings enabled us to identify 5 to 8 distinct components that differentiated the tasks. The results of this phase of analysis are shown in the Appendix. Inspection of the data shows variation in the sequence or ordering of tasks. For instance, ‘reconcile patient activity log and charges’ has the highest loading on component 1 for the clinical nurse manager but the loadings for component 2 rank the same task 12^{th} of 19.

Each of the 45 tasks was ranked using PCA. They were first ranked using the loadings for component 1. The tasks were categorized into four groups according to their position relative to the (zero-loaded) mid-point of the scale. Tasks nearer the mid point had lower weightings than those at the left and right of the table. This initial categorization was extended using the loadings for component 2. The tasks were again categorized into four groups, this time relative to vertical axis of the table. Figure 4 gives a summary of this analysis.

View patient profile Review patient data (Electronic Medical Record, EMR) Review images (PACS) Direct action or intervention Review patient medical record* Consult with primary nurse Check appropriateness of therapy Monitor and review pilot programs Liaise with Communicator Update patient profile Review occurrence/fall/medical variance reports Approve drug orders **2**	Revise/update problem list Sign out narcotics Check outgoing orders Input patient education (EMR) Reconcile census Update EMR Review Observation Patient Log Review HUC Report Review medical record log (Excel) Employee Evaluations Review staffing (OneStaff) Review clinical coding Sequence orders Review order list (EMR)* **1**
4 Review notes on Shift Patient report Monitor patient status Review Shift Report Review patient flow board Review EMR patient file Respond to inquiries Provide treatment Investigate drug interactions Liaise with physician	**3** Double check orders Liaise with nursing staff* Negotiate work allocation Diagnostic testing at bedside Prepare ward statistics Reconcile Patient Activity Log and Charges Check unloads and crash carts

Figure 4 Principal Components Analysis of Clinical Tasks

(Note that some task names, indicated by *, were common to more than one participant)

The horizontal axis of Figure 4 represents component 1 [the principal component] and the vertical axis represents component 2. The right of the table (Quadrants 1 and 3) includes inventory management and compliance tasks (checking, double checking, reconciliation and signing out). These tasks were also normative [they are characterized by emphasis of protocols and standards]. This seems to reflect a need for accountability at the management level, possibly in an attempt at HIPAA compliance. The input and data creation tasks at the right of the table highlight this emphasis through testing, assurance and moderation. Tasks to the left of the table are more work-domain specific. Despite the variety of the tasks, they shared characteristics because they were routine and focus on the individual, whether a patient or a colleague. Tasks on the left (Quadrants 2 and 4) were also characterized by investigation, diagnosis, and decision-making. The horizontal distribution of tasks indicated that the principal component (1) in the CTA provided a robust discriminator. The vertical dimension shows less discrimination. Most of the tasks in Quadrants 1 and 2 were computer mediated. In contrast, most tasks in Quadrants 3 and 4 involved face-to-face interaction.

The horizontal dimension of the CTA for each of our participants was characterized by a set of generic business tasks on the right. Tasks to the left were a support for clinical processes. The emphasis to the left was on interpretation, diagnosis and patient safety. Although many of the task names are common to both sides, the intensity of their clinical focus was clearly a key differentiator.

The vertical dimension was less cohesive. Tasks at the top emphasized computer use and employee supervision, whereas those at the bottom were characterized by face-to-face collaboration about patients and others. The task classifications provided insight into the underlying system of constructs that differentiate them. Task variance due to this dimension increases (from 9.1% to 11.7% to 34.8%) depending on the clinical specialty of the participant.

5 MODEL

The dimensions of the cognitive infrastructure are similar to those used by Nonaka to differentiate four types of knowledge conversion. In Figure 5 we combined these dimensions to offer a theoretic model that used the principal components of our CTA to classify knowledge creation and learning types. Our model combined the Nonaka's four categories with the four learning types of Gnayawali and Grant. The dimensions of the model were extrapolated directly from those in Figure 4 to explain the theoretic underpinnings of the task differentiations identified in our study. The labels for the horizontal and vertical dimensions of the model - regulation and development - highlight the congruence of the underlying constructs.

		Regulation	
		High Emphasis	*Low Emphasis*
Development	*Low Emphasis*	*Internalization* Adjustive 2	*Combination* Operative 1
	High Emphasis	4 *Socialization* Reinventive	3 *Externalization* Formative

Figure 5 A Theoretic Model of Learning and Training

Regulation indicated the acquisition of explicit knowledge. When knowledge was presented in language that was familiar to the acquirer (e.g., in company policies, physical and management structures, etc.) the cognitive burden of acquiring it was relatively low. If knowledge was codified in language that is not immediately familiar, the cognitive burden was higher.

Development indicated the amplification of tacit knowledge and the critical factor was mobilization. The cognitive elements of tacit knowledge (beliefs, viewpoints, and schemata) consist of individuals' frames of reference or cognitive infrastructure. These non-codified elements cannot be converted or developed without their prior articulation or mobilization.

In combination, these dimensions can accommodate learning required by the use of a range of IS from generic productivity tools to sophisticated enterprise systems.

6 DISCUSSION

Training to support simple tasks such as record updates focuses on developing task-specific or tool-procedural knowledge. Such tasks have routine, analyzable, and predictable outcomes. There is clear consensus about the objectives of these tasks in both the clinician and management communities: all know why these tasks are performed. The emphasis here is on standardization and error reduction. The challenge facing workers responsible for these tasks is to learn how to do perform generic work using a range of tools.

Tasks that require both ongoing acquisition of existing knowledge and development of new knowledge are far less intelligible to people outside specialist communities: clinical specialties display such characteristics. The mystery of such specialist work is compounded by the professional standards by which outcomes are assessed. This issue was observed in our data: the most complex tasks were specialised and not easily specified; sometimes the objectives were weak or seemed strange when used outside the user community. Despite the commonality of their characteristics, such as creativity, problem solving, and subject-matter expertise, such tasks were both heterogeneous and 'mysterious' [3]. Goals, values and preferences may continue to evolve as new knowledge is developed and integrated into work. Consequently, systems such as the Sunrise Clinical Manager that are implemented to support such work must be flexible and aid collaboration both within and beyond organizational boundaries.

The nature of the training problem changes significantly in such task environments [2]. The range and diversity of clinical specialties reduce the immediate consensus among those undertaking them. Work processes in clinical medicine and other expert communities have tacit and socially constructed dimensions that are unclear to those outside the user community [5]. Without an understanding of the shared concepts and values underlying such work, developing effective strategies for training and change management is much more difficult.

Enterprise Systems span heterogeneous, multi-disciplinary user communities. The challenge that managers face in assessing their performance, diagnosing training needs, and managing change, arises from the need to balance community-level standards for professional practice with organization-level performance indicators. Without this, development at the individual and organizational levels become out of balance [15].

7 CONCLUSION

Implementing change by merely providing organizations with IS resources and requiring participation in training programs can result in sub optimal outcomes and poor utilization of the systems. A more comprehensive assessment of existing skills and training needs can help in preparing the organization for change.

The processes of explaining and making sense of the changes that surround the implementation of IT in an organizational setting considered in our work highlight the mutual dependence of organizational change and training on a cognitive infrastructure that enables effective communication and collaboration.

Current training approaches and techniques can facilitate the conversion of knowledge through combination where the cycles of innovation in organization and systems development are relatively short and concurrent. However, the introduction and use of enterprise systems involves more unplanned and second order organizational change. In order to be effective, these changes require training that supports adjustive, formative, and reinventive learning. However, these training needs f are more difficult to assess. The misalignment of training and learning outcomes is largely responsible for the inertia evident in projects that fail through resistance to change or poor change management.

Our research suggests that enterprise systems are increasingly used to exploit opportunities for new inter- and intra-organizational processes and organizational forms. Consequently, there is a need to adopt a more developmental perspective of the organization as a creator rather than mere processor of information. The principal components that emerged from our study highlighted the congruence of the constructs that underlie the classificatory schema of organizational change, learning and knowledge conversion.

The framework that emerged from our developmental work provided a useful way of identifying and analyzing the training needs of organizations with diverse user communities and continuous change. The limitations of our research are clear, given the specialty of work in the clinical community and the systems that support that enterprise. However, although not immediately generalizable to other settings, the initial test of our framework provided a robust proof-of-concept.

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Appendix: Principal Components Analysis (PCA) Statistics

Participant 1 (Clinical Nurse Manager)

	Percentage Variance in Each Component							
Component	1	2	3	4	5	6	7	8
Variance %	66.8	9.1	6.8	4.5	4.0	3.0	2.3	1.9
Cumulative %	66.8	75.9	82.7	87.2	91.2	94.2	96.5	98.4

		Element Loadings on Each Component							
Task (element)		1	2	3	4	5	6	7	8
Review occurrence/fall/medical variance reports	1	-1.31	0.79	-0.30	-0.54	0.65	0.20	0.88	-0.18
Review EMR patient file	2	-1.14	-0.27	0.67	0.21	-0.92	-0.44	0.22	-0.17
Review clinical coding (HUC Report)	3	1.30	-0.10	0.53	-0.62	-0.16	0.79	-0.26	0.03
Review Medical Record Log (Excel)	4	2.03	0.43	-0.72	0.82	-0.21	0.18	0.06	-0.07
Employee evaluations	5	0.03	0.78	-1.33	-0.60	-0.24	-0.61	-0.48	0.05
Review patient medical record	6	-1.62	-0.10	0.00	0.10	-0.63	-0.09	0.08	-0.28
Review Observation Patient Log	7	2.10	0.24	0.01	0.08	-0.39	0.17	-0.09	-0.18
Review Patient Flow Board	8	-1.48	-1.97	-0.41	0.30	0.61	0.02	-0.17	-0.18
Direct action or intervention	9	-1.95	0.54	0.71	0.23	-0.20	0.27	0.03	0.02
Prepare 7 Waldemere stats	10	1.30	-0.95	-0.70	-0.45	-0.46	0.57	0.10	0.16
Monitor and review pilot programs	11	-2.38	0.23	-0.21	0.08	0.22	0.05	-0.29	-0.52
Consult with primary nurse	12	-1.92	0.72	0.19	-0.12	0.37	0.35	-0.46	0.33
Review Staffing (OneStaff)	13	0.56	0.03	-0.17	0.27	0.26	0.16	0.15	-0.70
Review HUC Report	14	2.47	0.16	-0.12	0.69	0.46	-0.31	0.16	0.19
Review notes on Shift Patient Report	15	-0.09	-0.30	0.66	-0.31	0.31	-0.50	-0.31	0.35
Reconcile Patient Activity Log and charges	16	2.67	-0.25	0.48	-0.48	0.04	-0.30	0.26	0.24
Liaise with Communicator	17	-2.12	0.03	-0.14	0.62	-0.16	0.07	0.15	0.77

Review Shift Report	18	-0.58	-0.36	0.09	-0.53	0.05	-0.47	0.28	- 0.07
Reconcile Census	19	2.14	0.34	0.75	0.25	0.42	-0.10	-0.30	- 0.42

Construct		***Construct Loadings on Each Component***							
		1	2	3	4	5	6	7	8
requires reconciliation with other data--uses stand-alone data	1	1.89	-1.02	-0.58	0.04	-0.36	-0.69	- 0.50	-0.62
addresses safety issues--addresses unit productivity	2	3.14	-0.24	0.39	0.22	0.56	-0.01	- 0.33	0.03
addresses professional accountability--purely financial usage	3	1.53	-0.26	1.14	0.88	-0.83	0.26	0.06	0.33
deals with 'live' issues--deals with intervening variables	4	0.68	0.32	1.64	-1.08	-0.03	-0.20	- 0.47	-0.06
concerned with workload--concerned with finance	5	2.30	0.60	-0.26	-0.39	0.09	0.65	0.17	-0.08
specific to (a) patient (s)--specific to an employee	6	0.30	1.69	-0.17	0.69	0.58	-0.36	- 0.53	0.15
safety and clinical--purely financial	7	2.78	0.93	0.03	0.22	0.18	0.28	0.20	-0.53
inter-relates current data--uses historic data	8	2.26	0.31	0.17	0.32	-0.29	-0.96	0.53	0.23
addresses patient care and safety--does not address patient care and safety	9	3.13	0.00	-0.48	0.00	-0.68	0.51	- 0.24	-0.07
everybody has an interest in this--not everybody owns a piece of this	10	1.76	-1.19	-0.27	0.13	0.66	0.21	- 0.36	0.62
affects concurrent education and mentoring--primarily fiscal	11	1.90	-0.71	0.42	-0.10	0.86	-0.11	0.67	-0.21
uses real time data--uses discharge data	12	2.21	0.51	-0.76	-0.95	-0.29	-0.31	0.14	0.56

Participant 2 (Pharmacist)

	Percentage Variance in Each Component				
Component	1	2	3	4	5
Variance %	75.7	11.6	5.9	3.0	2.5
Cumulative %	75.7	87.3	93.2	96.2	98.7

Task (element)		***Element Loadings on Each Component***				
		1	*2*	*3*	*4*	*5*
Review order list	1	2.12	0.76	-1.16	0.57	-0.28

Check outgoing orders	2	2.60	0.35	-0.93	-0.52	0.59
Liaise with nursing staff	3	-1.61	-1.31	-0.26	0.21	-0.09
View patient profile	4	-2.07	0.82	-0.11	-0.15	-0.16
Double check orders	5	1.67	-0.80	-0.13	-0.42	-1.02
Investigate drug interactions	6	-1.97	-0.12	0.56	-0.17	0.41
Check appropriateness of therapy	7	-2.07	0.82	-0.11	-0.15	-0.16
Sign out narcotics	8	2.92	0.53	1.44	0.55	-0.21
Approve drug orders	9	-1.97	0.80	0.24	-0.31	0.09
Update patient profile	10	-1.79	0.87	0.22	-0.28	-0.13
Respond to Inquiries	11	-0.88	-1.29	-0.88	0.38	0.39
Check unloads and crash carts	12	3.13	-1.00	0.44	-0.74	0.23
Liaise with physician	13	-2.28	-0.99	-0.18	0.45	-0.04
Sequence orders	14	2.20	0.56	0.06	0.56	0.39

		Construct Loadings on Each Component				
Construct		1	2	3	4	5
a didactic task--an interactive task	1	-2.78	-0.44	0.09	-0.08	0.66
uses patient profile--an auditing task	2	3.47	0.17	-0.24	0.25	0.07
interaction with a person--interaction with a computer	3	0.83	2.87	0.07	-0.48	-0.09
a diagnostic task--a routine task	4	3.23	-0.16	-0.04	0.14	0.13
requires pharmacy expertise--requires math skills	5	2.32	-0.86	1.04	-0.22	-0.90
to do with diagnosis--to do with compliance	6	1.97	-0.87	-1.10	-1.25	0.11
deals with patient problem--not related to a specific patient	7	3.21	-0.11	-0.29	0.57	0.52
deals with patient concerns--an inventory management task	8	3.47	0.17	-0.24	0.25	0.07
exercising judgment--seeking information	9	1.66	-0.12	1.59	-0.51	0.75

Participant 3 (Respiratory Therapist)

	Percentage Variance in Each Component					
Component	1	2	3	4	5	6
Variance %	41.3	34.8	9.9	7.6	4.0	1.9
Cumulative %	41.3	76.1	86.0	93.6	97.6	99.5

Task (element)	***Element Loadings on Each Component***

		1	2	3	4	5	6
Update CareVue	1	1.96	0.94	0.01	0.24	0.01	-0.06
Input patient education to SCM	2	2.06	0.53	-0.44	0.19	0.23	-0.12
Transport/Monitor patient status	3	-0.69	-1.31	-1.07	0.46	-0.78	0.07
Liaise with nurses	4	0.07	-1.51	0.21	0.90	0.28	-0.28
Patient rounds (treatment)	5	-0.02	-1.13	0.21	-0.60	0.35	-0.38
Review/Input orders (SCM)	6	0.38	0.94	1.06	-0.20	-0.62	0.05
Diagnostic testing at bedside	7	0.41	-0.03	-0.98	-1.11	0.13	0.16
Review Images (PACS)	8	-1.57	1.05	-0.1	0.32	0.39	0.21
Review patient data (CareVue)	9	-1.57	1.05	-0.1	0.32	0.39	0.21
Negotiate work allocation	10	0.26	-2.03	0.83	-0.24	0.11	0.49
Revise/update problem list	11	0.61	1.03	0.13	0.18	-0.24	0.09
Review (paper) patient data	12	-1.88	0.47	0.25	-0.46	-0.25	-0.43

		Construct Loadings on Each Component					
Construct		1	2	3	4	5	6
collecting data--inputting data	1	1.78	-0.13	0.63	0.07	0.24	-0.25
a face-to-face task--a computer task	2	0.25	2.72	0.57	0.79	0.13	0.34
involves review of orders--direct contact with patients	3	1.05	-0.48	-1.29	0.61	0.71	0.23
making a diagnosis--creating data	4	2.26	0.31	-0.05	0.05	-0.79	0.27
patient-specific data--multi-unit level data	5	0.18	-1.61	1.26	-0.16	0.41	0.39
a collaborative task--an individual task	6	0.13	2.03	-0.03	-0.77	0.32	-0.26

a testing process--providing treatment	7	-0.16	-0.55	0.32	1.24	-0.19	-0.46
a review process--an input process	8	2.31	0.05	0.28	-0.11	0.38	-0.26
documenting actions and future actions--reviewing historic data	9	-1.72	0.48	0.36	0.28	0.26	-0.01