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TRAINING SUPER USERS IN LARGE HEALTH CARE FACILITIES

CORINNE M. KARUPPAN

SOUTHWEST MISSOURI STATE UNIVERSITY

ABSTRACT

Training users to learn a new computer application can be a daunting task in large organizations. One solution involves selecting super users who will receive more extensive training and will serve later as the primary source of help to other users in their work unit. Tailored rather than generic training programs seem better suited to providing these super users with the required knowledge base. This article focuses on learning styles as a basis for tailoring training to super users' needs. Results of a study conducted in a large health care organization suggest that the popular hands-on approach favors individuals with certain learning styles, as indicated by their higher test scores. Implications for providing effective training more uniformly across all super users are made.

INTRODUCTION

In order to remain competitive, health care organizations have made huge investments in new computer systems and applications. As a result, it is estimated that, in 1999, 95% of organizations involved in health services had their users trained in new computer applications [6]. Hospitals present a unique opportunity to study the training process under the most taxing conditions: number of employees to train, cost and time constraints, and criticality of employees' work and actions involving patient care.

The latest applied research on training methods has focused mostly on the cost benefits of using technology to provide training and on the effectiveness of computer-based teaching/training methods. Experimental research has explored the influence of individual differences such as learning styles on user performance and, in doing so, has defined effectiveness boundaries for specific training methods [1] [10]. Although valuable, these experimental designs using students as subjects fall short of capturing the inherent complexity of training large numbers of users with very diverse backgrounds and educational levels to interact with large, integrated systems in fluid as opposed to controlled learning environments. Therefore, previous research examining the relationship between learning styles and user performance needs to be confirmed in a field setting.

The study reported here examines the training issues associated with the introduction of an integrated health system including laboratory, radiology, and pharmacy modules, and an ordering and browsing system for nursing. Consequently, a large number of diverse users from different departments were training candidates. Because the sheer number of employees did not permit the thorough training of all users, a limited few received extensive training and served as "mentors" to other, less trained workers in their unit. These individuals were named "super users." Their role was essential because their knowledge and perceptions of the new equipment/machine/software would, in turn, affect those of the people who depended on them. Properly training super users is thus a critical task in the overall IS implementation process. This study examines the importance of cognitive styles in learning a new computer system and suggests a tailored approach to training.

TRAINING CHALLENGES IN HOSPITALS

Parallel vs. Crash Conversion

The information system literature generally advocates the parallel implementation of systems as opposed to a crash conversion. Simply put, upon introduction of a new computer system, both the old and new systems are on-line and used concurrently. The advantages of this parallel approach are obvious. When introduced, a new system is prone to glitches – minor and major – which disrupt the organization and may result in the loss of data. In that case, the old system provides the necessary backup. Moreover, a parallel conversion makes the transition smoother for the users. As change is introduced, even the most adept user will feel tension and uncertainty. The old system then provides a reassuring "presence" as one knows that the consequences of one's misguided actions will not be catastrophic.

Despite these benefits, a parallel conversion may not be a feasible solution in all environments. First, this approach requires considerable additional work [9]. In hospitals, the personnel requesting blood work, X-rays, and other tests does not have time to input data in two systems concurrently. Second, this conversion may not be technically feasible. The lab uses medical instruments that are interfaced to the lab system component. It would be extremely difficult, if not impossible, to interface a medical instrument to two different systems. Therefore, the only possible transition between the old and the new systems is a "crash" conversion. On a particular day, at a particular time, the old system is shut down, and only the new one is operational. This is a very risky alternative, and the importance of user training in such an environment cannot be stressed enough. Not only is the transition sudden, but patients' lives may also depend on the users' actions (e.g., failure to order the right test for a patient in critical condition in the emergency room, unavailability of critical results, etc.). A crash conversion was undertaken in the present study.

Company Size

Another issue is the large number of trainees. In a large organization, integrated systems affect many users. Since training is usually delivered in-house – 71% according to a recent survey [6] –, it creates two challenges for trainers. The first one involves the scheduling of training sessions that will accommodate all the users from different units. Let us consider the hypothetical example of a company needing to train 2,000 users. If there are 3 instructors that can accommodate 10-15 users at a time, and it takes a minimum of 2, four-hour sessions to adequately prepare the users, each instructor will have to teach for a total of 356 to 533 hours. Even if we assume that instructors can teach 8 hours a day, 5 days a week with no break, that no delays or scheduling conflicts ever occur, and that they are dedicated to training users on a single system in the organization, the training period will last from 9 to 13 weeks!

The second challenge is timing. New, complex material is not understood easily, but is rapidly forgotten [8]. It is thus possible and quite likely that the users who were trained and certified early will have forgotten a substantial amount of material by the time the system is introduced. Therefore, users trained and certified immediately prior to new system implementation would have a clear advantage.

Patient Care Issues

To provide quality patient care, it is necessary to order the proper tests and procedures, obtain the results promptly, and convey them to the patient care provider as soon as possible. Time is critical, especially in emergency situations. Health systems are designed to enable such a speedy and accurate process. However, it is obvious that users must be properly trained to take advantage of those capabilities. Therefore, in health care organizations, there is a definite sense of urgency in getting an optimal interaction between the user and the system. In the next section, learning styles emerge as a useful conduit to design effective training programs.

LITERATURE REVIEW AND HYPOTHESES

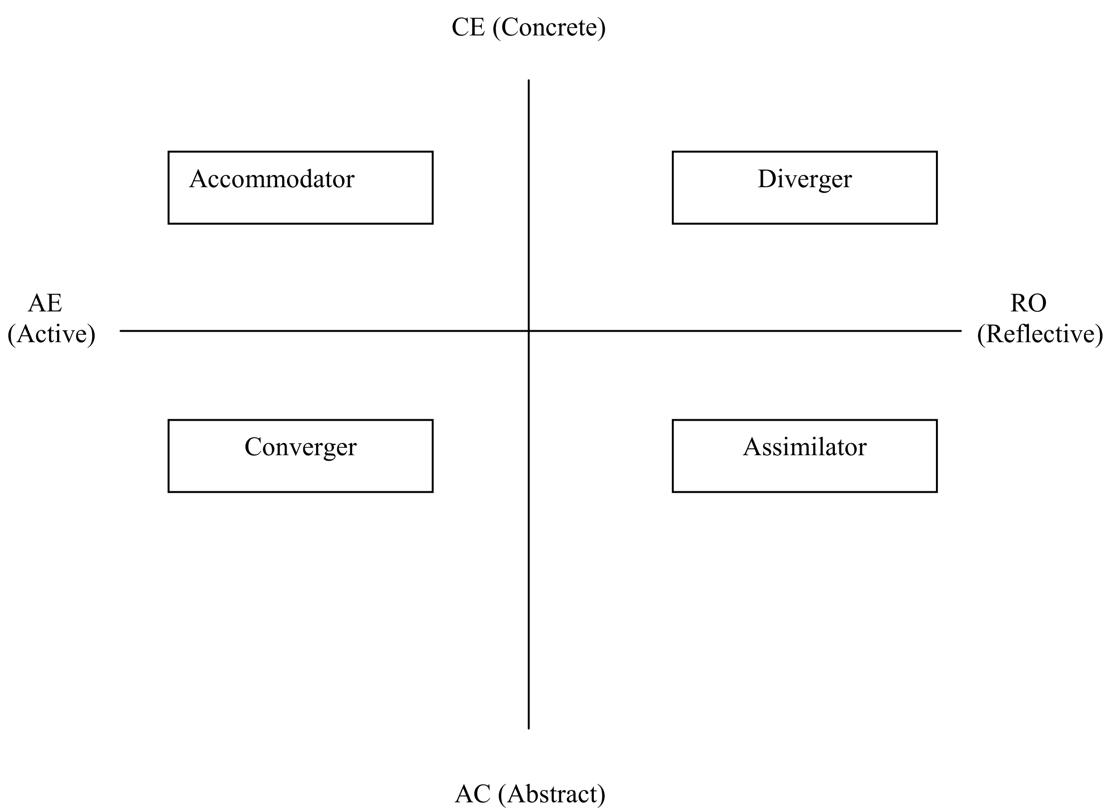
In order to circumvent the training challenges faced by hospitals, it is recommended to create a pool of super users who will become mentors. Ideally, a priori knowledge of super users' potential competence should determine their inclusion into that pool. Realistically, such knowledge is rarely available, and superior training becomes a must. Superior trainers are attentive to their students' learning needs. Identifying individual learning styles can be a useful approach to uncover such needs.

The way in which individuals process information is often termed cognitive style. A learning style refers to the way individuals acquire and use information. The terms 'cognitive style' and 'learning style' have been used interchangeably in the literature. In fact, Kolb defined learning style as a cognitive style that manifests itself in a learning environment [7]. Learning and personality-type instruments provide insights into individuals' chosen strategies to process information in learning and problem solving situations.

In this study, the super users were given Kolb's Learning Style Inventory [7]. This instrument has been widely used in more than 150 studies with diverse groups of individuals [4]. Moreover, Kolb's theory is widely used in practical information systems applications such as formation of project teams [1]. It identifies four learning abilities: 1) concrete experience (CE), i.e., learning from feeling; 2) reflective observation (RO), i.e., learning by watching and listening, 3) abstract conceptualization (AC), i.e., learning by thinking, and 4) active experimentation (AE), i.e., learning by doing (Figure 1). An individual who scores high on active experimentation would learn in a diametrically opposed manner as that of a reflective observer, and vice versa. Similarly, an abstract conceptualizer would approach learning in a totally different way from someone favoring concrete experimentation. Individuals who are CE-oriented tend to learn from specific experiences and rely on their feelings in solving problems, whereas abstract conceptualizers logically analyze ideas and act on an intellectual understanding of a situation. Reflective observers carefully observe before making judgments and tend to rely on their own thoughts and feelings in forming opinions, whereas active experimenters typically take a practical approach involving experimentation and strive to get things done [7].

Based on the scores on the two axes, there are essentially four learning styles: 1) accommodator, 2) diverger, 3) converger, and 4) assimilator. Accommodators (AE/CE) learn best from "hands-on" experience. In solving problems, they tend to rely more heavily on "gut" feelings and other people's judgments than on technical analysis. Divergers (RO/CE) tackle concrete issues from different perspectives. They are imaginative and good at recognizing problems and generating a wide range of ideas. Convergers (AE/AC) have the capability of finding applications for ideas and theories. They excel in problem solving and enjoy dealing with technical issues. Assimilators (RO/AC) are good at integrating diverse sources of information and organizing them into a logical set. They are especially interested in abstract ideas and concepts.

Figure 1: Learning Styles



Several empirical studies suggest that individuals favoring abstract conceptualization understand how new computer systems work more easily and rapidly than individuals favoring other learning modes. The rationale is that abstract learners (i.e., convergers and assimilators) are better equipped to decode and understand the underlying rules and structures of a computer system. By definition, they rely on logic and are good at synthesizing information. Concrete learners (i.e., accommodators and divergers), on the other hand, rely on prior experiences, which may be irrelevant when learning a new computer system [5]. In a controlled experiment involving novice users of an electronic mail filing system, Sein and Bostrom [10] found that abstract learners did significantly better than concrete learners on tests measuring complex task performance and system comprehension.

Due to the popularity of the hands-on training approach, it is expected that individuals favoring active experimentation will outperform reflective observers since the emphasis is on "learning by doing" [1]. An experiment testing the effects of training procedures and learning styles on performance showed that novices who are active and exploring when learning a new computer system achieve better results because they develop a more coherent internal representation of the system, irrespective of the training method [3]. Bostrom et al.'s [1] experimental study of learning styles and end-user training confirmed these results and concluded that active learners took marginally less time to complete experimental tasks than did reflectives. In some cases, the active learners also scored significantly higher on a test measuring accuracy.

Convergers are both active experimenters and abstract conceptualizers and should therefore outperform others in learning a new computer system. Indeed, they favor the learning modes that have been found to be most appropriate for learning about a new computer system. The same pattern was expected in this study, which led to the formulation of the following hypotheses.

> **Hypothesis 1**: Convergers will outperform (in terms of accuracy) novice users with other learning styles.
>
> **Hypothesis 2**: Convergers will outperform (in terms of speed) novice users with other learning styles.

METHOD

At the health care organization described in this article, four instructors were in charge of training approximately 1,800 users on the patient care management system. However, a special corps of trainees (n=246) was selected based on their perceived level of comfort with computers in general, or simply because they were nurse managers or unit secretaries. The procedure was tentative at best. The number of 246 super users exceeded the minimum requirement of one representative for each unit during each shift. The excess was considered a backup or safety cushion in case the selection process had been inefficient and some super users were unable to fulfill their duties. The super users received 8 hours of training, whereas the 1,500+ general users' training was limited to 4 hours. The trainees were paid at their normal wage rate during the training sessions. The class size was approximately 15. The training program was designed to teach users about Windows-based graphical interfaces and operation of the patient care management system. The training material included terminology, order entry and cancellation protocols, authorization procedures, lab order priorities, reporting and notation, and drug protocols.

A mix of training media was used, including regular lectures, handouts, and hands-on sessions. The trainees also had the opportunity to review the lectures, i.e., PowerPoint slides on the Intranet and practice in the lab at their own leisure. The super users attended 3 training sessions staggered over a period of 6 weeks (March 15- April 29). A typical session would last 2 to 3 hours and would involve a PowerPoint-based lecture presenting the system's features and functions combined with demonstrations and hands-on applications. The participants had the opportunity to ask questions during those sessions. Although the training staff made every effort to provide a diverse mix of training media, the emphasis was placed on "using the system" in order to prepare the users for the "go-live" date of June 2. The session format was rather similar for the general users' training, but the material was limited to simple concepts and a broad overview of the system's features.

At the end of the last training session, the super users were asked to fill out Kolb's LSI and an instrument tapping demographics and personality. They then took an on-line exam in order to get credentialed to use the system upon implementation. The exam, administered by the educational staff, contained 35 questions that measured the super user's knowledge of the system. Most of the questions were similar to actual situations that a user might face. Because the test was taken on-line, the time it took the user to answer all questions was automatically recorded on the test. The participants who failed the test were required to take it again at a later date. Because these people were already familiar with the test questions, only their first scores were used for data analysis purposes. The credentialing process for super users ended approximately three weeks prior to system conversion. The remaining time was devoted to completing the general users' training.

The reliance on test scores as opposed to actual field performance measures is a potential weakness in this study. The dynamics of the work environment in which the study was conducted made it impossible for the researcher to single-handedly observe the super users' mentoring performance on the field. It was originally thought that users' calls to the help desk would provide useful and objective information regarding the super users' performance. Since super users were supposed to help general users in their unit, calls to the help desk would reflect their inability to solve application problems. Unfortunately, the calls were not well documented. It was difficult to determine whether the need for help was the result of a network problem, a system problem, or a user problem. Therefore, test scores and time to take the test provided the only reliable measures of super user performance. Although imperfect, these measures had also been used in other studies linking learning styles and end user computing [e.g., 1, 3, 10].

RESULTS

Each learning style was equally represented, with 62 accommodators, 60 assimilators, 61 convergers, and 63 divergers. The results of an ANOVA test supported Hypothesis 1 by showing a significant relationship between learning style and performance on the tests (Table 1). Even though the mean scores are quite close, it is important to notice the variability in scores as shown by the standard deviation. Convergers' scores have the highest average and the lowest variability, whereas divergers' scores have the lowest average and exhibit the highest variability. Pairwise comparisons of the means (Scheffe, α=.05) indicated that convergers significantly outperformed assimilators and divergers. The results of the present study therefore indicate that active experimenters perform better than reflective observers. Another ANOVA test comparing active experimenters (i.e., convergers and accommodators) and reflective observers (i.e., assimilators and divergers) confirmed these findings (F=14.45; p=.0002). In other words, people who learn by doing did better than those who prefer to learn by watching. These results confirm prior expectations linking active experimentation and better performance in using computer systems. The implications for training are important as they stress that the hands-on approach is a critical element of the training package. As new training media such as Intranets are introduced in organizations, they should incorporate active experimentation. But the results are also a warning that training programs that overemphasize the popular hands-on approach are not uniformly beneficial.

Table 1: Relationship between Learning Style and Performance (Score)

Learning Style	Mean Score (max.=35)	Standard Deviation
Accommodator	31.13	3.11
Assimilator	30.03	3.29
Converger	31.97	2.44
Diverger	29.52	5.33

The ANOVA procedure was used. F= 5.35; p<.01

Knowledge of the system implies that a user would provide accurate answers and would do so fast. Therefore the time taken to answer the test questions was another important performance measure. The same analysis was conducted with time as the dependent variable, and there were no significant differences between means at the .05 level. Hypothesis 2 was not supported in this study.

Table 2: Relationship between Learning Style and Performance (Time)

Learning Style	Mean Time (min)	Standard Deviation
Accommodator	26.97	11.60
Assimilator	29.05	10.31
Converger	24.59	8.47
Diverger	26.38	9.20

The ANOVA procedure was used. F= 2.06; p=.10

CONCLUSION

This study suggests that a simple questionnaire requiring only a few minutes to fill out can help tailor training media to better reach users. Convergers unequivocally outperformed the other three groups. These individuals had a better understanding of the system and provided answers quickly. A super user's role is to further train the other users who received less training due to scarce resources and, therefore, to further diffuse knowledge about the system. Moreover, a super user will be the first source of help when a user "is lost" or has made a mistake. On the surface, convergers, and to some extent accommodators, appear to be better candidates for these roles than divergers. However, two elements are worth considering. The first one is that the divergers did not perform poorly on the test. Albeit statistically significant, the difference in scores was relatively small. The second one is that the emphasis on the hands-on training method favored convergers and accommodators and probably influenced the results. In underscoring this possible interaction between training methods and learning styles, this study affirms the principle that training programs should be designed to accommodate novices with diverse learning styles so that they equally benefit from training.

This study's implications for training are important. First, as indicated by the recent training literature, cost should not be the only deciding factor in pushing for on-line training methods such as Intranets. The quality principle of "doing it right the first time" prevails as the most inexpensive alternative. As a result, it is critical that trainers design flexible programs that provide equally useful learning materials to all groups. In doing so, the need for personal attention should not be underestimated. This is especially true in the early stages of training, when the information to be disseminated is "rich," and users may be anxious or uncertain. In this situation, face-to-face communication is more effective [2]. In a large organization, super users extend the benefits of personal attention beyond the classroom setting and help the organization go through the original chaos of system conversion.

There is today an abundance of training tools and media to impart knowledge. Technology now complements or even replaces the traditional lectures delivered in a classroom and printed materials. Videotapes, audiotapes, computer-based training via CD-ROM, computer-based games and simulations, and Intranet have become familiar figures on the training landscape. Using a variety of tools is probably the best course of action in order to provide training that benefits everyone. Table 3 below proposes some strategies for training individuals with different learning styles. From a practical perspective, it should also be noted that the use of multiple training media does not guarantee successful outcomes unless trainees are able to exploit these resources during their regular work hours. In the present study, the training staff had assumed that the users would want to practice their skills or review material at their own leisure. However, very few trainees took advantage of the open lab sessions and PowerPoint slides on the Intranet. There could be several reasons for these media's lack of popularity. However, it seems rather certain that nurses would prefer to go home after a 10 to 12-hour day rather than perfect their skills with no monetary incentive.

Table 3: Recommended Training Strategies by Learning Style

Learning Style	Learning Preferences	Best Training Strategies
Accommodators	Learn primarily from hands-on experiences; Rely more on people than technical analysis for information	Have them work in groups, provide multiple hands-on opportunities, have them test out different approaches as this group learns best by trial-and-error. Computer simulations of real world problems should be effective. May enjoy participating in online discussion groups.
Assimilators	Typically interested in abstract ideas and concepts	Conduct lectures; provide handouts and online information about concepts, models, and diagrams.
Convergers	Enjoy technical tasks and problems; find applications for theories	Provide multiple hands-on opportunities; challenge them to find actual examples of concepts discussed in class. Computer simulations of real world problems should be effective.
Divergers	Like to generate ideas, multiple alternatives	Have them work in groups. This group is less "technical" and will benefit from additional explanations and personal feedback. May also enjoy participating in online discussion groups. Involve them in testing the system prior to implementation since they tend to generate ideas.

This article does not imply that learning styles should be the only criterion used in training a super user. Communication and interpersonal skills are other traits a super user should possess. These abilities were not tested here, but trainers may find it worthwhile to incorporate them in their training programs. Although reliable, observable measures of super user performance could not be obtained in the present study, further research is warranted to assess super user performance in terms of proficiency and mentoring abilities directly on the field.

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