TRANSFERRING SKILLS FROM TRAINING TO THE ACTUAL WORK SITUATION: THE ROLE OF TASK APPLICATION KNOWLEDGE, ACTION STYLES AND JOB DECISION LATITUDE

Patricia von Papstein
Bayerische Motoren Werke AG
P.O.Box 40 02 40
8000 Munich 40
F.R.G.

Michael Frese
University of Munich
Dept. of Psychology
Leopoldstr. 13
8000 Munich 40
F.R.G.

ABSTRACT

In a field study (29 engineers), the transfer from expertise acquired in training to software use at work was shown to be mediated by task application knowledge (i.e. knowledge used to connect skills learned in training with tasks at work). Moreover, person variables like setting long range goals and developing detailed plans and an organizational variable like job decision latitude (i.e. how much freedom do workers have to do their work) influenced the transfer process. People with high goal orientation and planfulness and with high job decision latitude showed a higher transfer.

KEYWORDS: User training, skill transfer, task application knowledge, action styles, job decision latitude

TOPIC AREAS: Psychological models or user learning and performance and Sociology of system implantation and use.

INTRODUCTION

There is now a large body of research on training in the human computer area (cf. e.g. Frese, 1987). This research suggests that there is a need for training even in systems which are supposed to be easy to use (Carroll & Mazur, 1985), that exploratory training is particularly useful in this area (Carroll, et al., 1985, Frese et al. in press), and that metaphors are important in the training process (Carroll & Mack, 1984; Douglas&Moran, 1983; Waern, 1985). Thus, this research has focussed on how the training process has to be designed to optimize skill acquisition.

While there is an interesting debate on transfer in the human-computer interaction literature (e.g., Polson, Bovair & Kieras, 1987; Tetzlaff, 1987), transfer is only conceptualized as the switch from one system to second one. However, another issue is curiously absent from this discussion: the transfer of skills learned in training to the use of these skills in the work situation.

Training is supposed to make sure, of course, that the trainee is able to *work* with the skills acquired. However, since work on the job will always demand more complex skills than are provided by training, there is a gap between learning the skills in the training situation and actually applying them in the work situation. We suggest that specific factors need to be addressed to bridge this gap. At least the following aspects play a role in transferring skills from training to the real work situation: (1) the work tasks and the trainees' understanding of the applicability of the software to the task, (2) person parameters, and (3) the organizational context in which the work tasks are embedded. These areas characterize a whole field of research. Since this cannot be researched within a single study, we picked out the following factors from these broader areas: (1) *task application knowledge*, (2) *action styles*, and (3) *job decision latitude*. In this article, these factors are explored in theory and in a field study.

1.1 Task Application Knowledge

It is necessary to develop a concept of task application knowledge because it may bridge the gap between software knowledge acquired in training and the use of this knowledge to solve concrete work tasks. Task application knowledge is not the same as knowledge or skills acquired during soft-

ware training. The latter implies that the trainee knows how to handle the software functions and has a mental model of the software. We call this "expertise in training." Task application knowledge connects this expertise in training with the work task knowledge that has been previously acquired on the job. A work task implies that there is an assigned or self-generated production goal and some knowledge on how to achieve it (cf. also Hackman, 1970). Obviously, knowledge on how to use a software is not sufficient when the software has to be applied as a tool to solve production goals. For example in text processing, writing letters may be facilitated by developing a standard form of how to write them. Knowledge of delete and insert functions is not enough since the text processing system is not just used as a better typewriter but as a tool that changes the tasks to a certain extent.

Thus, a certain task application knowledge is needed in addition to expertise in training for being able to use the software at work. This implies that the correlation between expertise in training and use of software at work should be mediated by task application knowledge (more technically, this means that partialling out task knowledge should reduce the correlation).

1.2 Action styles

Personal traits or better propensities to act might influence the transfer from training to work. Such propensities to act are called action styles. Action styles are general ways of how a person sets goals (goal orientation) and plans his actions (planfulness) (Frese, Stewart & Hannover, 1987). A high degree of goal orientation and planfulness should facilitate the transfer process because the expertise in training is better applied to new tasks at work when a person sets clear-cut and long range goals and plans things out in detail. Thus, action styles moderate the relationship between expertise in training and the use of software at work. That is, workers with high goal orientation and planfulness should show a high transfer from expertise in training to the use of software at work, in contrast to people with low goal orientation and planfulness.

1.3 Job decision latitude

One organizational factor that might determine transfer is job decision latitude, which is part of the control at work concept (Frese, 1987b). People with a high job decision latitude in the job are able to decide how the work has to be done. This implies that they can decide on the sequence and timeframe of tasks, goals and plans. A small decision latitude results in little transfer because it leads to helplessness, reactance and overconformity.

A person with a low decision latitude job gives up planning and setting goals and will therefore become passive and helpless (Frese & Greif, 1978; Seligman, 1975). This means that new solutions are not tried out. There is little effort to solve the problems of applying a software to the work tasks and, therefore, there is little transfer.

Reactance appears when freedom is reduced (Wicklund, 1974). If the worker's decision latitude is reduced, she will attempt to fight to restore her freedom again and resist the introduction of new technology. Thus, there is little willingness to apply the expertise learned in training.

Overconformity means that one is anxiously sticking to the rules. When few decisions have to be made, one learns to stick to the rules. Therefore, creative and exploratory strategies are not used and, thus, the software knowledge is not adapted to one's work tasks. This in turn leads to a low transfer.

This means that job decision latitude should be a moderator of the relationship between expertise in training and the use of software at work. If job decision latitude is high, there should be a high correlation between these variables, if job decision latitude is low, expertise in training should not influence the use of software at work.

2 SUBJECTS

Twenty nine engineers of the research and development group of a German automobile factory participated in a training program done by a commercial training institute. There are missing data for action styles and job decision latitude because four subjects did not fill out the questionnaire. The software to be learned was Symphony, an integrated software package developed by Lotus Development Corporation. The training program is representative for other training programs in this area and it was, therefore, not designed to optimize transfer effects. The subjects were comprised of three training groups at three different times. The groups did not differ in the type of training they received. They were tested after the training and there were follow-ups for half a year to ascertain the subjects' task application knowledge and their use of software in their work.

3 VARIABLES

Since we could not find any other studies of work transfer in our area, the variables had to be developed from scratch. Wherever useful, we tried to quantify qualitative impressions with rating scales and we used objective test situations and not subjects' ratings. However, given that this was a field study, there were certain practical limitations.

Expertise in training: At the end of training, 14 spreadsheet calculating tasks were given to the subjects. A protocol of the keystrokes was kept (using Symphony's macro program). These protocols were then rated by the experimenter. The rating scale was on how much the subjects had used the potential the system provided. For example, most people were able to create a worksheet, but only a few people were able to combine files. The ratings of the 14 tasks gave a Cronbach's Alpha of .81. For a sample of protocol ratings, the correlation between two raters was r=.82 (p<.05).

Use of software at work: Half a year after the training, the subjects rated how many hours on the average per week they used Symphony in their work. This is the dependent variable of the study.

Task application knowledge: This is a composite of two indexes. The first index - concreteness of application idea - was ascertained directly after the training. The subjects were asked to describe an idea of how they could use Symphony in their work. These ideas were rated on whether they were concrete, non-concrete or whether they did not mention any idea. Concreteness implies that they had a definite conception of how to use the software at work. An example for an abstract idea was to use Symphony worksheet when one had to calculate things in the future. A concrete idea was to use Symphony in the calculation of the emission of exhaust. This calculation should also simulate the maxima to stay below legal limits. Since the differences between concrete ideas and abstracts ones were rather clear-cut, there was no need to have a second rater in this case. The second index - example for work use - was collected from the trainees three months after training. They were asked to develop a typical example of calculating some part of their work using the software. The experimenter only ascertained whether or not they gave a work example at all. No further rating of the quality of the work example was done. Both indexes are part of task application knowledge, the application idea emphasizing mental preparation, the example for work measuring the action parameters of software use. These two indexes are independent of each other as shown by their small intercorrelation (r=.14, n.s.). Both indexes are used as mediators in this study.

Action styles of goal orientation and planfulness: The scale on goal orientation ascertains a general tendency to set long range goals and to conceive of them in detail. The scale on planfulness measures a general tendency to plan in detail, to develop back-up plans in case a plan goes wrong, and to persist in the pursuit of plans. Adequate reliability and validity of these questionnaire scales were shown in Frese, Stewart & Hannover (1987).

Job decision latitude: This variable was operationalized with a scale by Semmer (1982; 1984) showing good reliability and validity. For example, the scale correlated highly with observers' ratings of the job. Thus it can be taken as a proxy to measures of objective conditions at work. It assesses whether the worker has options with regard to sequencing and timing of work tasks and plans.

4 RESULTS AND DISCUSSION

4.1 Task Application Knowledge as a Mediator of Transfer

Traditionally, training research implicitly assumed that a good knowledge of training procedures would lead to a good use of the software. We suggest that there is no direct effect of expertise in training on use of software at work but that task application knowledge mediates between the two variables: expertise in training --> task application knowledge --> use of software at work. Only when a person

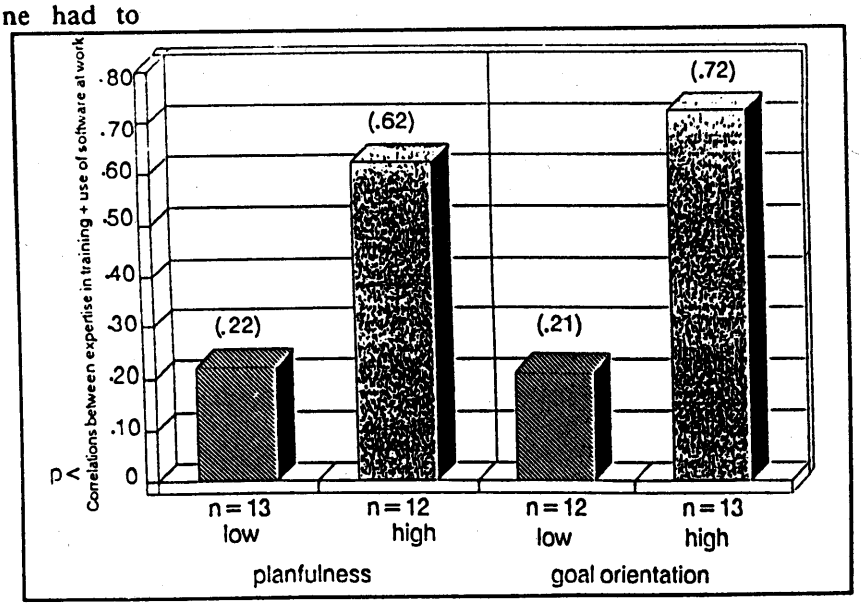

Table 1: Goal orientation and planfulness as moderators

develops a good conception of how to make use of the software at work will he apply what he has learned in training.

The zero order correlation between expertise in training and use of software at work is r=.34 (p<.05, N=29). When the two indexes of task application knowledge are partialled out, the correlation drops to .14 (n.s.). Both indexes are of equal importance in the reduction of the correlation. This shows that task application knowledge is indeed a mediator of the transfer process. Only when the worker develops task application knowledge, does expertise in training help him to do the job. Apparently, the worker is then able to integrate knowledge of the software with his knowledge of work tasks.

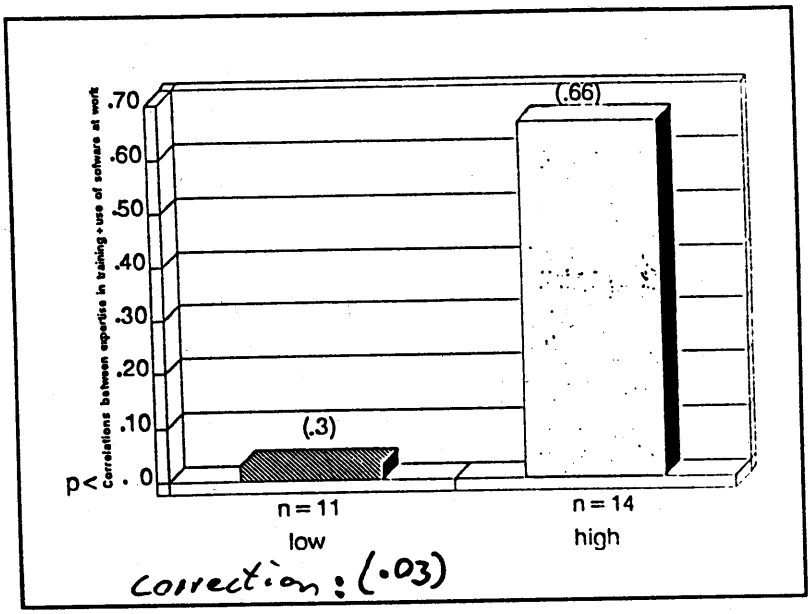

Table 2: Job decision latitude as a moderator

4.2 Action Styles as Moderators

We hypothesized that goal orientation and planfulness should moderate the transfer process. Thus, users with high goal orientation and high planfulness should show a high correlation between expertise in training and use of software at work. Correspondingly, workers with a low score on these moderator variables should show a low correlation. This is indeed the case as demonstrated in Table 1. The correlations of expertise in training with use of software at work are significant only for trainees with high goal orientation (p<.01) and high planfulness (p<.05). In contrast, the trainees with low scores in goal orientation and planfulness show insignificant small correlations. The difference between the correlations for the low and high goal orientation groups shown in Table 1 is nearly significant (z=-1.52, p=.06) but the respective difference for the two planfulness groups is not significant.[1] Thus, there is evidence for the moderator function of action styles. Users with high goal orientation and planfulness are better in transfer than users with low goal orientation and planfulness. This is so because they probably develop longer range goals and more detailed plans on how to use the software taught in training.

4.3. Job Decision Latitude as Moderator

We assumed that trainees who have jobs with low degrees of job decision latitude are also helpless, reactant, or overconforming more often and will therefore show little transfer. Thus, these people should show a low correlation between expertise in training and use of software at work in contrast to workers with jobs that allow a high degree of job decision latitude. The results are shown in Table 2. Indeed, only workers with high decision latitude show a significant correlation (p<.01). The difference between the correlations shown in Table 2 is significant (z=1.66, p<.05)[2]. Thus, an organizational context variable such as job decision latitude can be influenced by management proves to be important for transfer.

5 OVERALL DISCUSSION

In summary, the results show that transfer is indeed more complicated than is implicitly assumed in much of training research. Task application knowledge, action styles and job decision latitude play a role in whether one is able to transfer knowled acquired in training to actually using it in the work situation.

The study reported here obviously has limitations. It is necessary to develop in some more detail the variables used in this study, particularly the indexes of task application knowledge. The sample is rather

1 There is actually a statistically more sophisticated way to analyze the moderator effect with the help of hierarchical regression analysis (Cohen & Cohen, 1975; Zedeck, 1971). Since the moderated regression analysis is a very conservative procedure (Morris, Sherman & Mansfield, 1986), we used a different significance criterion suggested in the literature (Weede, 1977): an increase of the determination coefficient by 1% when the moderator (or interaction) term is included. When using such a procedure, the inclusion of the moderator planfulness (i.e., the interaction term: planfulness x expertise in training) leads to an increase of R^2 by 9% and of goal orientation to an increase by 2%. Thus, this procedure showed an appreciable impact of these moderator variables. Note, that planfulness showed a higher moderator effect than goal orientation with this procedure.

2 When using the moderated regression analysis approach (cf. Footnote 1), the R^2 increased by 4% with the inclusion of the moderator, thus showing an appreciable effect even with this procedure.

small and the results, therefore, need cross-validation. On the other hand, the effect size is appreciably high to warrant attention.

If these results can be cross-validated in other studies, there are far-reaching implications on how to conduct training. Since the goal of training is to make people able to use the software in their work situation, the issue of transfer needs to be elucidated more. This study suggests that training should be more strongly oriented towards the real work tasks done by the trainees. The work tasks should be integrated into the training process because this is one measure that helps the trainees to develop task application knowledge.

Moreover, training should allow and encourage setting long range transfer goals and detailed plans on how to do this. While action styles are operationalized in this study as generalized propensities to act (i.e. as a sort of personality variable), it follows from their conceptualization that there is also a chance to teach goal orientation and planfulness (Frese et al., 1987).

The moderator effect of job decision latitude points to the necessity of integrating classical industrial psychology variables with software ergonomics research. There is a large body of research on the positive effects of enhancing job decision latitude in the work place on health, job satisfaction and performance (e.g., Emery & Thorsrud, 1976; Ulich, Groskurth & Bruggemann, 1973, Wall & Clegg, 1981). The area of human computer interaction may do well to take advantage of these classical industrial psychology approaches. The results of this study show that it may be necessary to change jobs in the direction of higher job decision latitude to make training effective for high work place performance.

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