

**How to evaluate the effects of learning at the workplace:
Presentation of an Instrument for Competence Assessment**

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Assoc. Prof Annika Lantz
Fritz Change Company AB
Olof Hermelins väg 8
S-182 75 Stocksund
Sweden
e-mail: fritz@jobtransfer.com
phone + 46 8 85 37 47
fax: + 46 8 85 37 47

Dr. Peter Friedrich
Fritz Change Company AB
Olof Hermelins väg 8
S-182 75 Stocksund
Sweden
e-mail: fritz@jobtransfer.com

Introduction

In recent years, increasing emphasis has been placed on the importance of life-long learning at work and elsewhere. Many enterprises have adopted the vision of becoming a learning organisation, and much time, money and energy is put into employees' competence development. Engeström (1999) states that three questions need to be answered when applying the concept of learning: "Who is learning?", "Why is learning taking place?", and "What is being learned?" Our aim is to present an instrument that assesses competence as an outcome of learning at work, and results concerning its reliability and validity. Our instrument represents an attempt to make a systematic assessment of *what and how much has been learned* by the individual employee at a certain point of time spent in his/her career as a result of everyday learning and/or of education and training aimed at competence development. The information can be used for planning systematic competence development as well as for evaluating the results of education and training.

The original forms of human learning are those that appear predominantly as unintentional and inseparable aspects of the basics of work activity (Engeström, 1987). This presupposes that account is taken of unintentional learning that is not communicated as learning per se but as a by-product of everyday work. Further, we need closely to examine specific work activities. From different traditions, job-design theorists, such as Hackman and Oldham (1980), and action-regulation theorists, like Hacker (1998), Volpert, Österreich, Gablenz-Kolokovic and Resch (1983) and Ulich and Weber (1996), come to the same empirically well-grounded conclusion. *Problem-solving as a cognitive complex process is an essential part of a humane work situation since problem-solving is an key-element in learning.* But what problems should be solved? That is, what should be learned? The latter question is essential both to employer and employee.

Learning in the workplace can be understood in two ways – either as essential to acquisition of the vocational skills and competencies needed for performing work activities *planned by others and given* (as e.g. the socio-technical perspective), or as a springboard for qualitative change and part of an open-ended developmental process throughout life (as e.g. the activity theory-perspective). The distinction between learning what is needed in a current work situation planned by others (and which is more or less complex in the sense of problem-solving) and the concept of learning as the result and by-product of an open-ended process is of key importance in discussing the learning organisation and possibilities for individual life-long learning. Learning to handle work activities and perform given work tasks planned by others is, by nature, a reactive form of learning no matter how complex the work happens to be. In consequence, learning is defined so to exclude the possibility of finding or creating new contexts and other work tasks with different objectives. The so-often mentioned increasing pace of change means that some old competencies become obsolete ever more rapidly, but any lag that arises cannot be overcome by reactive learning. By contrast, learning as a by-product and result of involvement in a developmental open-ended process cannot be foreseen. What should be learned cannot be fully planned in advance, and the learning is proactive by nature. Engeström (1987; 2000) concludes that this form of learning requires that the individual himself plans and brings about the qualitative changes. Engeström describes this kind of learning as "expansive".

In looking for models and instruments to assess the result of learning at the workplace, we need to be open to both reactive and proactive (expansive) learning. Work activities are social and intrinsically co-operative. A certain work task can be performed individually, but it is always related to a context in which others are present. With or without words the activity is communicative, and we need to understand the context in order to understand the meaning of the task (the "Why?" or underlying motive). *Thus, we have to analyse the systemic relations between the individual and the others involved in the work process empirically.*

The Instrument for Competence Assessment

The instrument focuses on work activities for different theoretical and practical reasons. The learning results of the individual's formal education and from other educational settings are, of course, not to be neglected. On our view, the outcome of these are visible in what the individual does in the workplace. We regard competencies as the results of learning either in the workplace or elsewhere. Account needs to be taken of competencies that, for many possible reasons, are not used. However, although such capacities can be used in a different situation or context, when assessing what is being learned within an organisation and how much, they are irrelevant. Further, it is our and others' experience that when asking individuals concretely and in detail to describe what they are capable of, i.e. what their abilities, skills or competencies actually are, they find it difficult to respond. They find it much easier to describe what they actually do.

The methodological consequence of this is that we cannot investigate what and how much an individual has learned at any given time with ready-made questionnaires or by listing different vocational skills. We need to capture the meaning of work activities, i.e. *the link between activity and objective in a social context*. Work activities and objectives, and also contexts, differ between enterprises, between cultures and over time. So, what can be regarded as being competent at work? For our purposes, we are in need of a model for describing in general terms what work activities are carried out in most workplaces. We use Mansfield's (1996) model to describe what competencies are needed and sought for in a modern workplace. We find the model especially useful because it describes qualitatively different competencies (by contrast with the common perception that competency is a one-dimensional construct).

The presented "Instrument for Competency Assessment" represents an attempt to *make a systematic analysis of an individual's competence profile*. It is influenced by activity theory (Engeström, 1987), action regulation theory and Mansfield's (1996) model of how competencies within an organisation can be assessed. The instrument involves application of an interview-based assessment procedure (Lantz and Friedrich, 1999). The purpose of the procedure is to map out the result of what the interviewee has learned at a specific point in time, unintentionally or intentionally. It is in this that the individual's *competence profile* consists. The profile includes *what* competencies (to carry out the different work activities) and *how much* competence in each work activity (i.e. level of competence).

To carry out different work activities

The model presented in by Mansfield (1996) provides a way of obtaining a general description of the competencies that all of us in all types of organisations possess to varying degrees. The dimensions that build up the content of the interview are described below.

1. Work activities: Functional work task, to achieve various expected goals on the basis of specific occupation/function/work

Expectations are imposed on the individual with regard to achieving a variety of outcomes on the basis of specific function within the company. (see “Work activities” in Figure 1). For example, being an assembler in industry may involve receiving customer orders, collecting parts, assembling parts, packing, delivering, and so on. These are the competencies usually described when questions are posed concerning “what you do and what you know how to do”.

Note: Mansfield (1996) uses the term work activities for describing functional work activities, we choose to use the term “activity” in a broader sense and for describing activities in all of the seven dimensions described in the model.

2 Managing Contingency: Handling unexpected situations

Unexpected situations arise in all work contexts, usually in the form of production disturbances or problems. In a modern organisation, skills demands are imposed on members at all levels with regard to discovering risks of disturbances and problems, and actively contributing to their solution. What do you do to prevent disturbances and to solve problems? If you do nothing at all, but wait until someone else discovers the problems and solves them, you are not in possession of this kind of competence.

3 Managing different work activities: To prioritise and co-ordinate

A modern organisation expects you to have the ability to handle several different work tasks at the same time. This involves competence in prioritising between and taking decisions on frequently competing tasks and maintaining a balance between the long-term and short-term goals of work. Here, the focus is on which priorities are set and why, and how decisions are taken and why. Information on who sets the priorities makes up an important background in this context. How do you deal with a situation where various key work goals are in conflict?

The surrounding work environment is complex and differs considerably between workplaces. Nevertheless, it always has the following components.

4 Natural constraints: Handling the physical circumstances of the workplace

This refers in a broad sense to where work is performed, and what material and equipment are used. It is the aspect of the surrounding environment that is most specific to a particular workplace, and is concerned with both physical environment (outdoor/indoor, and so on) and materials (expensive, hazardous, etc). The most important competency that can be developed for handling the physical environment lies in simply being aware of its significance to health, safety, quality and work organisation.

5 Quality measures

Different quality demands are imposed in various kinds of organisations, but there is always the expectation that the outcome of work shall be of a certain quality. This requires the ability both to understand quality requirements and to realise that this may vary according to what is

to be produced. This is an area that is becoming ever more important for all organisation members. Yet again, the focus is on what you are doing to achieve expected results or outcomes in terms of quality.

6 Work organisation

There are a variety of ways of organising work (flat organisation or hierarchy, working-in-groups or solitary work, and so on); expectations are imposed with regard to living up to outcomes required and to functioning in a particular organisational setting. This involves competence in handling the demands that the organisation imposes on the performance of work, and also in handling the degrees of freedom offered by the organisation. Such skills and competencies require understanding of the work-organisational context, and – in a learning organisation – the ability to develop the work organisation so that outcomes are enhanced, that is to *expand* the organisational structure. The competence lies in understanding the organisational setting's significance to work and in organising so that work performance is enhanced or expanded. Again, the focus is on why you do what you do and what you want to achieve.

7 Working relationships

In most workplaces there are a variety of different relationships both inside and outside the organisation. Externally, these may concern relations with customers and suppliers, or with clients, and so on. Within the workplace, there are relations between work mates, with other occupational groups, and with supervisors/managers etc. Having competence in handling relationships at work does not only involve maintaining and preserving relations but also developing them so that they promote effective work and are a means for goal achievement. What do you want to achieve through collaboration?

Level of competence

We have produced a general model for determining the competency required for all the various work activities (see above). The interviewee's competence in performing a particular work activity is assessed in accordance with a four-point scale that measures the extent to which an individual actively contributes to developing and changing his/her task. The aim is to establish whether the interviewee has a certain competency and, if so, how much of it, i.e. the degree of competence the interviewee has for performing his/her work within each of the established tasks. We use a scale ranging from no competence (0) to less-to-more (1–3).

To place a person on one of the points on the scale, we differentiate between actions and their contexts (what the interviewee has described that he/she does and in what context) in two respects: the breadth of the description of context, and the resource-goal relationship (actions as a behavioural response, actions performed to achieve a specified given goal, or actions related to a changed goal developed by the individual). Accordingly, the two aspects jointly serve to determine the interviewee's position on the scale.

The points on the scale are mutually related. In other words, a prerequisite for determining a position at Step 3 is that the interviewee has fulfilled the criteria for inclusion at steps 1 and 2 (at some time). The criteria constitute different ways of characterising each point on the scale, and both criteria (means-goal relationship and contextual description) must be fulfilled for an interviewee to be positioned at a specific point on that scale.

0 = No task is being conducted (for various reasons).

1 = The task is being conducted within the interviewee's own work area (for this to be determined, the interviewer must know the interviewee's work area in advance) but without any relationship to the goals of the task.

2 = The task is being conducted within the interviewee's own work area and in interaction with the work areas of other employees within his/her unit/department and in relation to given goals for the work.

3 = The task is being developed as a result of the interviewee, in interaction with his/her own unit/department and other affected parts of the organisation, having contributed to the establishment of new goals for developing the task.

Below a concrete example of level of competence in handling work relations is given.

Extracts from interviews with three workers performing assembly work are used as an example of the different levels of competence.

0 = no co-operation is undertaken for various reasons

"I am somewhat of an ambulant psychologist you know, never have had any problems with the workers..... do not interfere that is my motto..... always tease Fred a little, his team has been losing the whole season... I work on my own....like it better that way...don't have any contacts about work...".

1 = co-operation is undertaken in the interviewee's own work area but has no relationship to the co-operation goals, which is to utilise and develop the most efficient way possible the interaction between people to achieve the goals in other work areas.

"I always help out when someone in the group asks me, ... do not need the others to achieve my results....I don't say anything on the meetings, (the meetings) take less time that way..... try to be nice to everyone.....we are supposed to rotate, I don't do that....."

2 = co-operation is conducted within the interviewee's own work area and in relation to the work areas of others and is directly connected to the specified goal for co-operation, which is to utilise and develop the most efficient way possible the interaction between people to achieve the goals in other work areas.

"we are all different, you need to find different ways,, Susan is learning and insecure, I try to work beside her so she can see how I do, cannot always tell what do and not to, she can't take criticism, cried one time,....., I told the others to stop nagging.... At the next meeting I raised the issue, we got to tolerate that we are different and learn in our own ways...we need to find a way to cope with differences, otherwise the newcomers will not learn from us.. if they don't they can't rotate....".

3 = co-operation is created and developed based on a goal set by the interviewee, at his/her initiative, for developing the co-operation

"We have different problems in the group and with groups outside....some of the experienced are not so motivated any longer, ...problems with the quality of in-coming goods and relations to suppliers, ...new people (in the group) who need to learn more tasks..... I suggested... (to manager) ..that the experienced got the task to sort that out (the problems

with the co-operation with suppliers). Need to get closer bonds (to suppliers)...and we invited them (the suppliers) to us.....to give them an understanding of how it is from our point of view, to learn how it is for them, and come up with new routines for handling disturbances and delays, we need to get them to work by our quality standards, can't do that can they, if they don't see why...and find out what information they need and when, find an easy way for communication, e-mails aren't always the best way to handling problems....The others (in the group) learn for the future, why we use the ISO-standards, and the experienced got a chance to do not only routine work.”.

Application of the instrument involves conducting a structured interview, and a qualitative and quantitative analysis. The instrument with instructions for conducting the interview and the guidelines for analysis are available in print or on CD-Rom in English, German and Swedish.

Reliability and validity

The results of tests of reliability and validity are presented in Table 1 below. Results from the series of workshops (see 1 in Table 1) showed that when aspects of everyday work were spontaneously listed at the first workshop, representatives did not strictly differentiate between descriptions of work activities and descriptions of personality traits. During the second workshop they were asked to restrict themselves to work activities. Ten dimensions were found, seven of which corresponded to Mansfield's (1996) dimensions. Three others were identified: a) “Miscellaneous” which included twelve descriptions as “to be flexible”, “to cope with stress” and “to combine family and work”; b) “Learning” consisted of statements as “life-long learning” and “willingness to learn”; c) Change and development activities consisted of statements as “to develop work”, “take initiative to changes” and “adaptable to changes”. Learning is here regarded as an outcome of work activities and the dimension of change is included in the quantitative measurement, as it is always related to a specific work task (and not a separate qualitative work task).

At the manufacturing firm a difference was found between the two groups. Union representatives spontaneously employed all seven categories (and no others) and distinguished between “poor work” and “good to excellent work”, and also between “just do what you are told, regardless of whether it is always useful to others in production or not”, “work together towards set goals and criteria”, and “take part in development projects”. There was no consensus within the manager group regarding whether work-organisational activities and environmental activities are part of shop-floor workers' responsibilities. Three of the managers regarded work-organisational responsibilities as their mandate, and four regarded work-environmental activities as “common sense” rather than work. There was much confusion with regard to describing differences in how well activities were carried out. There was consensus that developmental activities should be performed, but no consensus over whether all workers should take part in these or just a few individuals selected by management. All agreed, however, that working to achieve management-set goals was an expected outcome. Whether this was “good” or “average acceptable” work could not be agreed upon. During their lengthy discussions, managers clearly confused work organisation and work activity, and also personality traits and work activities. It was concluded that the instrument's dimensions are meaningful and describe work activities carried out in different organisations and at different hierarchical levels. Further, organisational degrees of freedom for different functions within an organisation naturally influence who carries out work-developmental activities, which is no theoretical hindrance to quantitative measurement.

Table 1. Reliability and validity of the Instrument for Competence Assessment (ICA).

Test	Aim/question/hypotheses	Method	n	Results
1) Content validity	To identify components of "everyday work" through descriptions of work activities and compare these with the model (fig.1)	Three (a,b,c) separate series of five workshops. Recorded discussions. Qualitative data-analysis.	a) representatives of employment services, vocational training institutes and human - resource departments from the public and private sectors (n=12), b) shop-floor managers in a large manufacturing firm (n=8), and c) union representatives at the same firm (n=7).	Eight dimensions were found, seven of which corresponded to Mansfield's (1996) dimensions; the eighth was labelled "Miscellaneous" and included 12 descriptions like "to be flexible", "to cope with stress", "to combine work and family", and so on.
2) Content validity	To identify components of "everyday work" and test the applicability of the model (fig.1)	Employees were asked to describe in detail their work activities, and asked a single open question: "What do you do at work during any one week?" Qualitative analysis performed independently by two students	A convenience sample of 182 employees in 22 different organisations (including public and private operations, industry, service, health care and schools, and employees at different hierarchical levels)	All descriptions of concrete work activities could be placed on one or another of the dimensions in Mansfield's model.
3) Criterion validity	Correspondence with other measurement	Comparison between a manager's ratings of his subordinates and the instrument	n=10 employees	r = 0.91
4) Criterion validity	H1: Individuals with functional work tasks, low in objective cognitive demand, should show less competency than individuals with functional work with higher objective cognitive demand	Comparison between objective work analysis, the VERA instrument and the ICA (Instrument of Competence Assessment). Anova	Three groups of assembly workers (n = 37)	F = 2,81
5) Criterion validity	H1: Individuals working in a group organisation should be more competent in handling work relations and organising than individuals with solitary work	Anova Objective work task analysis, VERA, of functional work task	Assembly workers (group work, n= 17) Workers at a warehouse (solitary work, n= 28)	Co-operation: F = 4,24 Organising: F = 4,20
6) Face validity	Do respondents find the work activities and corresponding questions understandable and meaningful?	Follow-up interview after competence assessment	Convenience sample of 80 employees at shop-floor level in seven SMEs (manufacturing); two industrial organisations (assembly work and warehousing) 50 interviews were rated	79 % (n=80) reported that the different work activities were understandable, meaningful and possible to identify in their workplace r= 0.87
7) Inter-rater reliability	Do ratings correspond?	Three independent experts		
8) Inter-rater reliability	Do ratings correspond?	Three independent raters (practitioner and two experts)	280 interviews were rated	r=0.82 - 0.89**

** Following a follow-up session where the criteria were re-iterated by the researchers, a blind new rating was performed by the practitioners.

Qualitative analyses performed independently by two students (see 2 in Table 1 above) showed that all descriptions of concrete work activities could be placed on one or another of the dimensions in Mansfield's model. The conclusion drawn was that the instrument is valid for describing work activities, i.e. for measuring the range of behaviours represented by the theoretical concept qualitatively.

To our knowledge no other comparable instrument has been developed. To test *criterion validity* three different tests were conducted. A manager (see 3 in Table 1 above) was asked to describe the work activities of ten of his subordinates and rate them with regard to all seven different work activities. These ratings were compared with the results of interviews with employees conducted by an expert. Although the manager's ratings tended to be more positive than the expert's, inter-rater reliability was as high as .91. It was hypothesised that cognitive demand in and complexity of functional work task should correspond with level of competence (see 4 in Table 1 above). An comparison between objective work task analysis VERA (Volpert, Österreich, Gablenz-Kolokovic & Resch, 1983) and the ICA-instrument was conducted. The hypothesis was confirmed. It was hypothesised (see 5 in Table 1 above) that individuals working in a group-organisation should show more competency than individuals working on an assembly-line (complexity of work task, measured with VERA, being held under control) in handling work relations and organising. The hypothesis was confirmed.

A preliminary version of the interview schedule was used to interview employees in order to establish if questions on all seven dimensions were meaningful to respondents regardless of whether or not they carried out all the different work activities themselves, i.e. to test the so-called *face validity* of the instrument (see 6 in Table 1 above). A vast majority of the respondents reported that the different work activities were understandable, meaningful and possible to identify in their workplace, although many reported that they did not take part in all of the different activities themselves. Thus, the dimensions as well as the questions "made sense" to them.

Two further tests of inter-rater reliability were conducted. A sample of 50 interviews, conducted at a warehouse, were independently assessed on the four-point scale by three experts (see 7 in Table 1 above). A larger sample of interviews (see 8 in Table 1 above) were each rated by a practitioner (a shop-floor manager, union representative or student), and two experts. This resulted in an acceptable inter-rater reliability. Analysis showed that, in most cases, discrepancy was due to missing or insufficiently detailed data – reflecting either poor interviewing or a lack of understanding of how to differentiate between points two and three on the scale.

The results from different tests of validity and reliability show that the Instrument for Competence Assessment (ICA) is sufficiently valid and reliable.

Discussion

The presented "Instrument for Competency Assessment" represents an attempt to *make a systematic analysis of an individual's competence profile at a certain point in his/her career*. It is influenced by Engeström's (1987; 2001) theoretical concept of expansive learning, Action regulation theory (Hacker, 1985) and Mansfield's (1996) model of how work activities (work roles in Mansfield's terminology) within a modern organisation can be assessed. An individual's competence in handling 7 different work activities (functional work; disturbances; prioritising; co-operation; organising; quality and environmental work) is assessed on a four-point scale that measures to the extent to which an individual contributes to developing and changing his/her task. Application of the instrument involves conducting a structured interview with open-ended questions, and a qualitative and quantitative analysis of what and how much any individual employee has learned at work. It captures the results of both

reactive and proactive/expansive learning in the workplace, and can be used to analyse the effects of learning in a conventional workplace as well as in a learning organisation (in its original sense). The instrument and guidelines for interview and analysis are available in Swedish, English and German – both in print and on CD-Rom. The results of different tests of validity and reliability are presented, and (subject to further discussion) it is concluded that the instrument is sufficiently valid and reliable.

Cognitive demand in terms of problem-solving and work complexity in the functional work task has shown to be related to competence in handling the functional work task. It could be argued that the ICA-instrument assesses work demand and not competence. However, empirical results (see Figure 2 above) show that individuals within the same organisation performing almost identical work vary in degree of competence.

Validity in quantitative research depends largely on meticulous instrument design to ensure that the instrument measures what it is supposed to measure. In qualitative research the researcher is the instrument, and validity depends to a large extent on the skill, competence and rigour of the person performing data collection. By different means we have tested the construct validity of the instrument. Less-experienced interviewers (students, shop stewards, managers, and representatives of labour unions, employment offices, and human-resource departments) have been able to collect detailed enough data for analysis. It is important to note that, in our experience, lack of validity is largely due to poor interviewing, i. e. a failure to obtain detailed data. The interviewer must fully understand the conceptual model behind the instrument.

Although well aware of the drawbacks of the interview technique, we have preferred it to other methods for a variety of practical reasons. We see no other way of obtaining the information we require. Our need is to examine the motives that underlie overt behaviour, and investigate the various motives and behaviours that apply in different contexts. Further, the inclination to present socially desirable answers is likely to be high unless they can be probed by questioning work activities in relation to goals/motives (Freese, Kring, Soose and Zempel, 1996). There are many instruments for the assessment of competencies available on the market, but they tend to be restricted in scope – either focusing on functional work task competencies or sometimes employing the blurry concept of “soft skills”. As well as lacking theoretical backing, a common drawback lies in the dichotomous categorising of a person into “competent” or “not competent”.

The instrument has already been used by consultants in Sweden, Austria and Denmark to promote work and organisational-change activities. For example, personnel at a large library in Denmark have been interviewed to obtain a description of what activities are currently carried out, and to initiate a process where new goals are set for the seven different work activities as a basis for organisational restructuring; over the year ahead, new interviews will be performed for evaluation of competence development and goal achievement. The instrument is also being fruitfully employed for the assessment of a competence-based pay system. As a research instrument it has been used for capturing learning processes.

In the European Commission's so-called Green Paper (1997) it is stated that job security is dependent on flexibility (and vice versa) – since job security is essential to trust between employee and employer. That may well be, but we do not believe that any enterprise can achieve a trustful relationship on the basis of a contract for job security alone. Such a contract cannot in itself inspire trust. We do believe, however, that any enterprise can invest in

learning processes so that its employees obtain “skill and competence security”. By skill and competence security we mean providing the means for the individual to develop workplace-independent competence – transferable competencies as a basis for mobility and employability. So far our research arena has been restrained by study designs that exclude the investigation of the learning process. We hope our instrument and results can contribute to longitudinal studies of learning processes and of how such processes can be facilitated. Work design can be enhanced by highlighting the importance of differentiating between work activities and learning, and also by considering transitions between different levels of competence in each of these areas.

The information can be used for different purposes by researchers, management, consultants *and perhaps most importantly, by employees themselves*. Of special interest to the interviewee is a competency that might be utilisable in a new type of work in a new type of organisation. Further aims are to stimulate reflection on needs for development of competencies and to increase awareness of their applicability in the current workplace or in new work settings. Most employees lack words to describe their competencies, which are therefore often hidden and not made use of.

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