HIGHER EDUCATION: LEARNING IN REAL-LIFE

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Abstract: Higher Education operates in the real-life context of a Knowledge Society driven by innovation. Students are preparing to become knowledge workers in that society where ICT, innovation and knowledge work are closely interwoven. Three elements are essential in knowledge work: creation of innovative solutions, knowledge creation about these solutions (and how to get such solutions) and personal development. For without innovative solutions there are no satisfied customers, without new knowledge there will be no future customers and without personal development there will be no future job. Higher education students need real-life learning environments in which they can learn to deal with processes of real-life knowledge work. Real-life learning implies solving of key innovation problems in academic or professional practice, in accepted and acceptable ways. Real-life learning implies implicit and explicit learning while solving these problems. And real-life learning implies development of knowledge. Validation and critical reflection form the key to quality assurance of the problem solving process, to explicit learning and to knowledge development. Key characteristics of real-life learning environments that stimulate validation and critical reflection are presented.

Keywords: Implicit learning, explicit learning, learning environment, knowledge development, problem solving, reflection.

1 WORKING IS LEARNING

A Knowledge Society is developing in which Information and Communication Technology (ICT) is both a catalyst and a necessity. Knowledge is an invaluable asset in this ICT-integrated society where

production, services, consumption and trade are rapidly changing. "Technological change and innovation drive the development of the knowledge-based economy through their effects on production methods, consumption patterns and the structure of economies. Both are closely related in recent growth performance. Some changes in innovation processes could not have occurred without ICTs and conversely, some of the impact of ICTs might not have been felt in the absence of changes in the innovation system (OECD 2000). "A knowledge-based economy relies primarily on the use of ideas rather than physical abilities and on the application of technology rather than the transformation of raw materials or the exploitation of cheap labour. Knowledge is being developed and applied in new ways. ... In the knowledge economy, change is so rapid that workers constantly need to acquire new skills. Firms need workers who are willing and able to update their skills throughout their lifetimes". (World Bank 2002, p. ix).

To keep up with developments (knowledge) workers need to adapt continuously and acquire new competences: at the work place new knowledge is created to keep up with developments, both *tacit knowledge* in the heads and hands of the workers and *explicit knowledge* (codified, operational knowledge). The concept of knowledge is changing from scientific, theoretical knowledge ('old knowledge') to more operational knowledge ('new knowledge'). *Human capital* is becoming more and more important and workers are becoming more and more responsible for all dimensions of their work (Weert 2004).

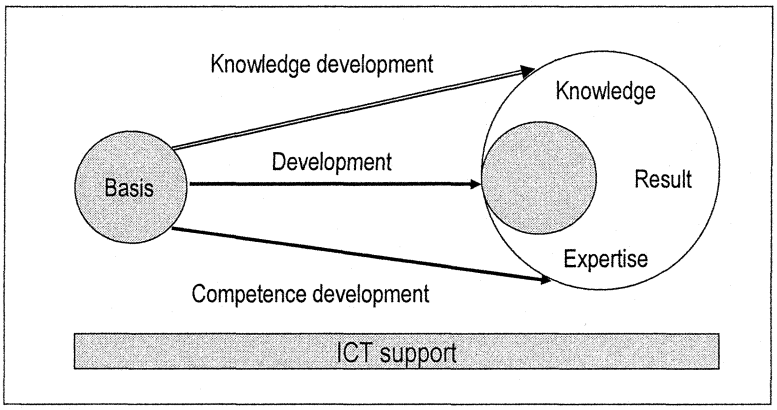

Figure 1. Working is delivering results, learning and creation of knowledge

2 LEARNING IS WORKING

Higher education should help students to become knowledge workers of tomorrow. In their future work 5 key problems play a role (Onstenk 1997):

1. Problem solving (delivering results in context), involving:
   a. Decision making
   b. Design and development
2. Knowledge development
3. Construction of meaning (learning)

Only knowledge that is closely connected to an application context, can be transferred to other, comparable, situations and contexts, as literature on 'situated cognition', for example (Larkin 1989), shows. Also implicit knowledge is stored in human memory in direct connection with contextual and situational information. And finally Ryan and Deci (2000; p. 76) conclude that "contexts supportive of autonomy, competence, and relatedness were found to foster greater internalization and integration than contexts that thwart satisfaction of these needs".

It therefore follows that higher education should arrange the learning of students in such a way that this learning is closely connected with the future academic or professional practice of the students: learning is real-life solving of real-life problems.

3 IMPLICIT AND EXPLICIT LEARNING

In potential learning situations persons can react in three ways: not learning, implicit learning and explicit learning (Jarvis 1987). In implicit learning the activities are controlled by what Argyris and Schön (1974) call the '*theory-in-use*'. Explicit learning involves '*espoused theory*', the activity theory of which we think that we bring it into practice. '*Theories-in-use'* control our behaviour and are mostly implicit (tacit). As Agyris en Schön state: the relation of a '*theory-in-*use' to activities "is like the relation of grammar-in-use to speech; they contain assumptions about self, others and environment - these assumptions constitute a microcosm <of science> in everyday life" (Argyris & Schön 1974: 30). '*Theory-in-use*' is a characteristic of '*experiential learning*' (in the behavioural sense), where learning is a side effect of activities undertaken. '*Espoused theory*' explicitly describes what we do, or what we hope others think we are doing. "When someone is asked how he would behave under certain circumstances, the answer he usually gives is his espoused theory of action for that situation. This is the theory of action to which he gives allegiance, and which, upon

request, he communicates to others. However, the theory that actually governs his actions is this theory-in-use." (Argyris and Schön 1974; 6-7).

4 THE ROLE OF REFLECTION IN LEARNING

The concept of *reflection* has several meanings (van Woerkom 2003: 46):

1. '*Reflection*', as defined by Mezirow (1991): an individual activity in a problem solving process, supporting instrumental, mostly implicit learning.
2. '*Reflection in social interaction*': helping to make implicit ('tacit') knowledge explicit in order to achieve quality improvement in problem solving processes; this reflection supports explicit learning.
3. '*Critical reflection*', as defined by Mezirow (1991): an activity in the communication domain aimed at making explicit the value of the problems to be solved and of the problem solving method; this reflection also supports explicit learning.
4. '*Critical self-reflection*': aimed at emancipation, i.e. the development of the individual in the context of the organisation of the problem solving process; this reflection also supports explicit learning.

5 FIRST LOOP, SECOND LOOP AND THIRD LOOP LEARNING

According to Swieringa and Wierdsma (1992) we can distinguish three types of learning:

1. First loop learning: Doing what must be done (rules);
2. Second loop learning: Learning to do what must be done (insight);
3. Third loop learning: Learning to learn to do (principles for organisation and individual).

First loop learning is associated with '*Reflection*' as defined above, which is the '*reflection in action*' of Schön (1983). Reflection in action is based on the actor's own observations and stimulates primarily implicit learning. When the '*theory-in-use*' is supported by own observations there is a situation of non-learning. If there is a discrepancy we have a situation of single loop learning (Argyris & Schön 1974).

Second loop learning is based on '*Reflection in social interaction'* which is '*reflection on action'* as defined by Schön (1983). It is based on external feedback and therefore has a social dimension. This reflection confronts '*espoused theory*' and '*theory-in-use*' and supports explicit learning that

influences the regulation of actions. It represents double loop learning (Argyris & Schön 1974) of the '*reflective practioner'* (Schön 1983).

Third loop learning is based on '*critical reflection*' and '*critical self-reflection*' which imply a reflection on method. The method is a fixed, well-thought out way of potential action to gain a purpose. The method makes actions transparent and requires responsible practice (praxis). Praxis refers to actions to which values are attached: human well-being, a quest for truth, and respect for others. Praxis requires that a person "makes a wise and prudent practical judgement about how to act in *this* situation" (Carr and Kemmis 1986; p. 190). Praxis requires a '*reflective professional'*.

6 THE ROLE OF REFLECTION IN PROBLEM SOLVING

In the problem solving process reflection is a tool for quality improvement. However, reflection also brings problem solving and learning together. The '*reflective practitioner*' will, for example, use validation, i.e. '*reflection in social interaction*', in and at the end of the **project development** phase (Figure 2.) to ensure that the problem is worthwhile solving, that the problem solving method and the cost of the process are acceptable. And at the end of the **project development** phase the '*reflective professional*' will review, via '*critical reflection*' and '*critical self-reflection'*, that the problem solution process and the eventual solution will meet accepted professional standards, that team members know what their professional roles are and are capable to fulfil these roles, etc. Also the process of competence development, with its resulting level of competence will be reviewed, just as the process of knowledge development. The same pattern appears in the phase of **project execution** where the review of 'mid-term' results will be future oriented to enhance quality of the processes involved and the final results. In the phase of **project finalisation** first the project result is validated with the problem owner(s) and after that competence and knowledge development are validated. The project ends with the final project review taking account of the quality of all three project deliverables: effective result, level of competence and re-usable knowledge (how can we do it better next time?). Validation and review are integral part of the problem solving **method** that is used, just as the quality criteria to apply while validating and reviewing.

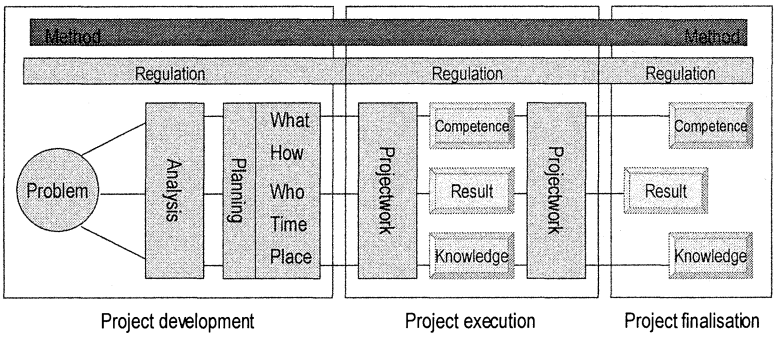

Figure 2. The problem solving process

7 LEARNING TO SOLVE PROBLEMS

According to Mulder (1997) complexity of a learning task may be characterised in four dimensions: the expertise of the actor, the complexity of the task at hand, the level of support and the external importance of the results. It is "common wisdom" in education that expertise has to be built up by going from the less to the more complex, from a high level of support to lower levels, and from simple, educational tasks to more complex, real-life tasks. However, recent research shows that this approach undercuts motivation and transfer. It is important to let students work in authentic situations with authentic problems as soon as possible (Kearsly & Shneiderman 1999). The addressed problems should be in the zone of nearest development of the students.

According to Ellström (1999) complexity of learning intensive work is decided by the type of work regulation required (Table 1.). He distinguishes four levels:

a) Reproductive learning: solving of routine problems without much attention to regulation which is also routine.
b) Productive learning I: the problems allow for degrees of freedom in the required result with only limited adaptation of the working method.
c) Productive learning II: the problems allow degrees of freedom in both working method and result.
d) Creative learning: Situations have to be analysed, the working method has to be selected, result requirements have to be formulated.

	Levels of learning			
	Reproductive	Productive I	Productive II	Creative
Problem	*Given*	*Given*	*Given*	*To be chosen*
Method	*Given*	*Given*	*To be chosen*	*To be chosen*
Result	*Given*	*To be chosen*	*To be chosen*	*To be chosen*

Table 1. Levels of learning; adapted from van Woerkom (2003; p. 72)

Van Weert (2001) uses a typology of learning situations with the same levels of learning as Ellström:

a) *Assignment based*: the student/professional functions in a reproductive role in which standard problems are recognised and solved in a standard way; the student/professional assesses way of working and result against standards.
b) *Task based*: the student/professional functions in an executive role in which typical, task related problems are solved using task oriented methods; the student/professional assesses method selection, way of working and result against standards.
c) *Problem based*: the student/professional functions in a tactical role in which non-standard problems are solved using adapted methods; specifications for the result have to be developed; the student/professional assesses specifications, method selection, application, way of working and result against standards.
d) *Situation based*: the student/professional functions in a context determined, strategic role in which worthwhile problems have to be identified, just as suitable methods for solving; the student/professional assesses selection of problem and methods, application, way of working and results against standards.

In most learning situations team work is implemented to enhance learning. Characteristics of these typical learning situations are summed up in Table 2.

Learning situation	Student responsible for	Available to student	Way of working	Student role	Overall characteristic
Assignment based	Execution Assessment	Problem Result standard Standard method Assessment standard	Prescribed	Reproductive	What Know
Task based	Method Execution Assessment	Problem Result standard Method meta-standard Assessment standard	Adapted	Executive	How Know
Problem based	Result Method Execution Assessment	Problem Result meta-standard Method meta-standard Assessment standard	Dependent on problem and context	Tactical	Why Know
Situation based	Problem Result Method Execution Assessment	Problem meta-standard Result meta-standard Method meta-standard Assessment standard	Dependent on situation	Strategic	Why Care

Table 2. Characteristics of typical learning situations (Weert 2001; p. 49)

8 AUTHENTIC LEARNING ENVIRONMENTS

"In direct contrast to the academic approach, practical problems tend to be characterized by: the key roles of problem recognition and definition, the ill-defined nature of the problem, substantial information seeking, multiple correct solutions, multiple methods of obtaining solutions, the availability of relevant prior experience, and often highly motivating and emotionally involving contingencies" (Sternberg, Wagner & Okagaki 1993, p. 206).

Herrington, Oliver, and Reeves (2002) have defined ten design principles for developing and evaluating authentic activity-based learning environments. Authentic activities must:

1. Have real-world relevance;
2. Be ill defined, requiring definition of tasks and sub-tasks needed to complete the activity;
3. Comprise complex tasks to be investigated over a sustained period of time;
4. Provide the opportunity for students to examine the task from different perspectives, using a variety of resources;

5. Provide the opportunity to collaborate;
6. Provide opportunity to reflect, involve students' beliefs and values;
7. Be integrated and applied across different subject areas and extend beyond domain-specific outcomes;
8. Be seamlessly integrated with assessment;
9. Yield polished products valuable in their own right, rather than as preparation for something else;
10. Allow competing solutions and diversity of outcomes.

9 LEARNING ENVIRONMENTS STIMULATING EXPLICIT REFLECTION

Reflection is a pre-condition for learning. Therefore a suitable learning environment must invite reflection, and specifically explicit reflection ('*reflection in social interaction*', '*critical reflection*' and '*critical self-reflection*'). Argyris, Putnam & McLain Smith (1985) distinguish two different types of learning environment. One that suppresses explicit reflection (Figure 3.) and one that stimulates explicit reflection (Figure 4.).

Model I

Governing values are:

- Achieve the purpose as the actor defines it;
- Win, do not lose;
- Suppress negative feelings;
- Emphasize rationality;
- Primary Strategies are:
    - Control environment and task unilaterally;
    - Protect self and others unilaterally.

Usually operationalized by:

- Unillustrated attributions and evaluations e.g.. "You seem unmotivated";
- Advocating courses of action which discourage inquiry e.g.. "Lets not talk about the past, that's over";
- Treating ones' own views as obviously correct;
- Making covert attributions and evaluations;
- Face-saving moves such as leaving potentially embarrassing facts unstated.

Consequences include:

- Defensive relationships;
- Low freedom of choice;
- Reduced production of valid information;
- Little public testing of ideas.

Taken from Argyris, Putnam & McLain Smith (1985, p. 89)

Figure 3. Learning environment that suppresses reflection

Model I does not stimulate explicit reflection: you can only loose when you make explicit reflections. Model II differs in that validity and public evaluation are core values.

Model II

Governing values include:

- Valid information;
- Free and informed choice;
- Internal commitment;
- Strategies include:
  - Sharing control;
  - Participation in design and implementation of action.

Operationalized by:

- Attribution and evaluation illustrated with relatively directly observable data;
- Surfacing conflicting view;
- Encouraging public testing of evaluations.

Consequences should include:

- Minimally defensive relationships;
- High freedom of choice;
- Increased likelihood of double-loop learning (explicit reflection).

Taken from: (Anderson 1997)

Figure 4. Learning environment stimulating reflection

More specifically van Woerkom (2003) has researched what dimensions influence '*critical reflection*' by '*reflective professionals*' and which contextual factors influence this reflection. There are seven contextual factors:

1. Reflection (being a reflective practitioner and a reflective professional);
2. Taking part in critical opinion forming;
3. Asking for feedback;
4. Participating in challenging '*groupthink*';
5. Learning from mistakes;
6. Experimenting;
7. Perceiving career possibilities.

'Critical reflection' and 'critical reflection on self' are influenced by:

a. Participation (in itself influenced by social integration with peers);
b. Own effectiveness (in itself influenced by variety in tasks and by being informed about tasks to be undertaken), but also by participation.

A learning environment that stimulates critical reflection has the following characteristics (van Woerkom 2003; p. 74-75):

a) Learning climate: characterised by the amount of time available for collective reflection for strategic learning, contacts across the working environment, learning from the experience of others and tolerance for other opinions;
b) Participation in innovation and decision processes;
c) Transparency and integral communication by the management.

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