

ALTEF

WORKPLACED INTEGRATED LEARNING

Output 2 of the ALTEF-Project

Competence Development in the Workplace The „Agile Learning“- Approach



Co-funded by the
Erasmus+ Programme
of the European Union

Content

The „Agile Learning“- Approach.....	3
Learning at work based on real-life tasks	3
Requirements for learning in practice	5
Agile Learning compared to Agile Methods of Project Management	7
Introduction, Elaboration and Implementation.....	7
Introduction of the “Agile Learning” Method in the company.....	7
The elaboration: analyzes and clarifications.....	8
The implementation of a learning project	10
Potentials and limits of Agile Learning.....	12
Appendix	13
A short introduction to ‘what is a problem?’ and ‘what is problem-orientation?’ in a problem-based learning (PBL) environment.....	13
Bibliography	14

Authors

Jörg Longmuß

Sustainum – Institute for Sustainable Economy Berlin

j.longmuss@sustainum.de

Benjamin Höhne

Beuth University of Applied Sciences Berlin

bhoehne@beuth-hochschule.de

Appendix:

Bente Nørgaard

Aalborg Universitet

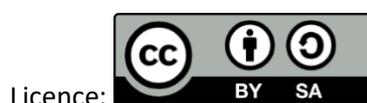
bente@plan.aau.dk

This paper is an output of the ALTEF project:

“Workplace Integrated Learning for Technical Experts with a Vocational Background”

Berlin, Aalborg, Leiderdorp 2019

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Competence development in the workplace

The „Agile Learning“- Approach

Shorter innovation cycles in the work cause an increasing frequency and intensity, with which employees must study further and acquire new competences. So far, however, there are hardly any suitable continuing education formats for this need, since classical forms of qualification (e.g. seminar courses, continuing education courses) do not fit precisely enough with the individual competence requirements and at the same time react too slowly to the dynamics of change in companies.

Under these conditions, for in-service competence development three requirements must be met:

- *High scalability*, to enable qualification measures from a few hours to several hundred;
- *Content adaptability*, to include new topics as quickly as possible;
- *Connectivity* to existing organizational structures and software infrastructure in order to start with little effort.

To implement such competence development in companies, the "Agile Learning"-Approach was developed. Its aim is to promote learning within the work process and by means of real tasks, thus making competence development and knowledge transfer a continuous component of company organization.

Learning at work based on real-life tasks

For a targeted development of competences required in the company, it makes sense that the employee does not learn on general tasks or case studies from a different environment, but in processing real problems from their own field of work. This means that:

1. First, the new competencies that are relevant or will be foreseeably relevant for the employees ("**learning topics**") are precisely determined, then
2. Appropriate tasks from the operational practice, in which these competences are needed ("**learning occasion**"), are identified and finally
3. these tasks are exemplarily processed with technical and didactic support ("**coaches**").

Practical example: **learning on real tasks**

A department had been given a new area of responsibility requiring additional knowledge and skills. To develop these, the following has been done:

1. Talks were held with the HR department, supervisors and employees of the department. Also, a concise work analysis was done. In the beginning, as a wish, general learning subjects such as "materials engineering" and "spreadsheets" were mentioned. Finally, two specific learning topics could be identified where current needs existed: first, possible correspondences between current and outdated material names, and second, working with if / then rules and between different worksheets when calculating with tables.
2. As learning tasks, material lists and worksheets from the daily work were used, which contained these requirements and were suitable for an exemplary processing.
3. These learning tasks were worked on in small groups in the alternation of subject-specific input, exemplary work by themselves, editing notes, stop-overs with comparison of the learning results and a final reflection on the process.

This learning directly on and in real practice has several advantages:

- **The employees learn exactly what they need for their work**, not what is offered in general seminars. Admittedly, the required content can usually be acquired there as well, but together with many unnecessary content. This makes general seminars extensive and annoying for the participants.
- Accordingly, the learning results **are directly applicable in everyday life**. This does not only refer to the content, but also to the work equipment used (computers, software, data and filing structures) as well as communication structures, responsibilities, and experts in the company.
- The usefulness of each learning step is immediately apparent. **It is not learned "in advance"** in the hope of using it someday. This increases the motivation to solve even difficult or lengthy tasks.
- The learning topic becomes more accessible to the employees because significantly less abstraction and transfer performance is required of them to recognize their practical problem behind the task. **This facilitates access to the topic especially for practice-oriented persons.**
- The participants experience a higher degree of **self-efficacy** because they can successfully try out new skills in a previously unknown field of learning and thus experience their own competence increase directly and related to their daily work.
- For comprehensive projects, **the handling of operational tasks is also resource-efficient**, since these tasks would have to be processed anyway. In addition, the employees remain in the work process and are not completely out of house for a longer training.

Practical example: **Advantages of workplace-integrated learning**

In a large company, in a newly built up division with young, motivated employees, there were so far no stable processes of order acceptance and execution and no established cooperation across departmental boundaries.

Here, the learning topic was cross-departmental collaboration. The learning task of the team from different departments was to define some key processes based on current orders and to develop the corresponding documents. Learning on this task from practice meant, among other things:

- To become acquainted with existing tools such as the SharePoint platform or a videoconferencing tool and practice techniques such as working with a Kanban board.
- The material outcome of the learning task, the documents to be developed, were needed even without the learning project.
- The cooperation of the participants in the project had to take place in everyday life in the future as well. The learning project thus offered the opportunity to practice this cooperation in an accompanied situation and to reflect on it under guidance.

Requirements for learning in practice

Learning on real life tasks from the operational practice requires three types of participants:

- A person who represents the content of the learning topic, i.e. defines the objectives of competence development, decides on the specific learning task, and examines the results of the learning process and either accepts them or demands additions or corrections. The tasks of this person can be summarized with the term "**sponsor**";
- The employees who work on this learning task as a **team**, acquire the necessary knowledge, share learning progress and reflect together, and in the end present the results;
- Tutors who supervise the learning process organizationally and didactically, remove obstacles, provide input when needed - by either giving it themselves or by consulting experts - and guide the team to reflect on the learning process. For these persons, the term "**coaches**" is used below (for the roles and their interactions see Figure 1).

Working on the learning task takes place in alternation of individual and group work, with a stopover at each stage of the individual work, where results are shared and compared within the team to synchronize the work. As length of these phases, **work in the extent of eight hours** has proved to be successful. After this time, generally, a progress can be presented and any errors or deviations can still be easily corrected. If the employees deal exclusively with the learning project, daily stopovers make sense. If, as is the rule, they work only part of their working time on the learning project, these distances extend accordingly, e.g. at 20% of the working time a weekly stopover is advisable.

At longer intervals - the learning stages - the learning progress is presented to the sponsor and accepted by him/her or necessary follow-up work is made clear. After that, a reflection on the learning process as well as an agreement on goals and procedures for the next stage take place.

Roles and Interactions

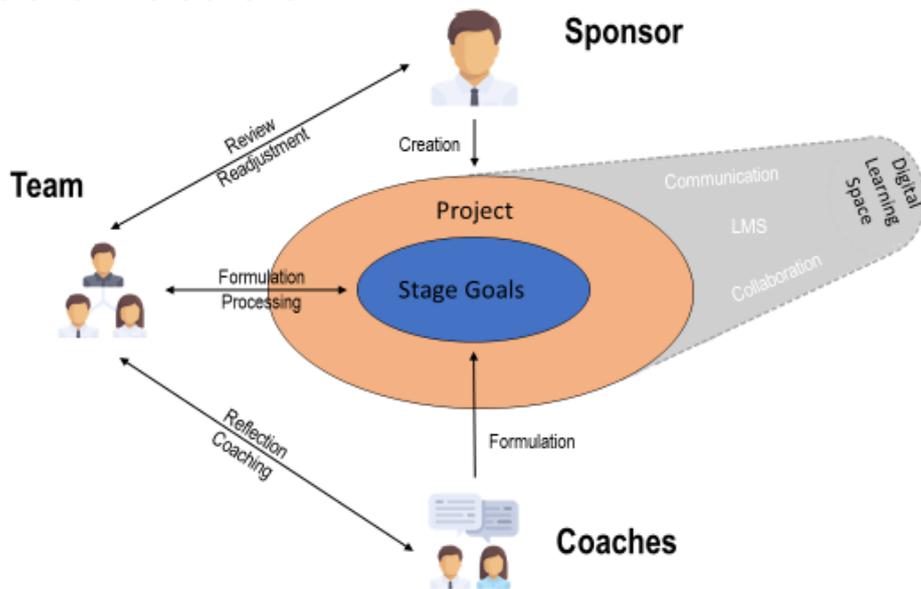


Figure 1: Roles and Interactions in the Agile Learning Project

There are several reasons for this form of working:

- Switching between becoming acquainted with new areas, trying out ideas, and getting feedback, followed by discarding, adjusting, or adopting work results is an important didactic principle for self-directed learning.
- The work in the learning project takes place on real tasks from the company. Accordingly, practical solutions must be worked out for these tasks. The practical suitability of the newly acquired competences is thus checked directly in the context of their own working environment.
- The necessity for technical follow-up plays a special role in learning projects, because the subject area is new to the learners and, moreover, they must act in an incompletely defined action space (who in the company is important for my project, which tools are usually used). If individual aspects of the learning task turn out to be too demanding, too tedious, or too simple, they can be modified to fit the intended scope and level of difficulty.
- The support system of the learning project can be improved in the short term by e.g. changing a learning platform, determine other times or making other rooms available, adding appointments or arranging videoconferences.
- A reflection is facilitated if it refers to a manageable period. This is especially important for practice-oriented employees, who in all experience have considerable difficulties in talking about their work on a meta level.

This form of learning in stages based on tasks from one's own practice in interaction with a sponsor and with coaches is called "Agile Learning". Thereby, a competence-oriented, media-based learning in the work process within companies should be enabled. The "teachers" rather have the role of a learning companion or supporter.

Agile Learning compared to Agile Methods of Project Management

Agile learning has a structural similarity with the so-called Agile Methods of project management, especially with "Scrum". The latter is used extensively in software development, but also in physical product development. The parallels are mainly in the triangle constellation consisting of

- a responsible sponsor (here called "project owner"), who receives the results,
- a team that jointly works on tasks,
- a person supporting the (learning or work) process without being responsible for the technical content.

as well as a process in short stages (there, called "sprints") between which the work status is checked and the process is reflected on.

In contrast to Scrum, however, the team does not (yet) fully master the task to be solved, but can and will make mistakes. This must even be expressly possible and accepted for a productive learning process. The coaches in Agile Learning do not only have the function of ensuring a smooth learning and working process, but also to provide or organize professional support if necessary. Moreover, in many cases, the learning team will not work exclusively on the learning task, but will do their daily work most of the time. The learning stages are thus lengthened in time. Despite these differences, in many cases it will be possible to fall back on the multifaceted methodological toolbox developed for Scrum, which supports a work process with the roles mentioned above.

Introduction, Elaboration and Implementation

This chapter is based on the assumption that a successful and sustainable introduction of Agile Learning requires a process of organizational development that integrates the departments involved, as well as the human resources department, the IT department and, if necessary, other stakeholders. It is advisable to introduce the method first with external support, but the company should not be dependent on it in the long term. Therefore, the prerequisites for an introduction are described before the operational elaboration and the implementation are explained.

Introduction of the "Agile Learning" Method in the company

If the method of Agile Learning is to be successfully introduced into a company permanently, various preconditions must be created. These are intended to ensure that the introduction has sufficient backing in the company management, is supported by the relevant stakeholders and can be carried out by the company in the long term. Thus, the following steps should be taken prior to the identification of the current competence needs and its transmission into a learning project:

First, there needs to be:

- a clear decision of the company or division management to make the method (after probation in a pilot project) a standard procedure, and the designation of a person with the appropriate decision-making authority ("**initiator**") who will be responsible for the introduction and further progress;
- the designation of a "**product owner**" who is responsible for the operational implementation in everyday life and of those who are to organize and carry out Agile Learning themselves in the long term ("**internal coaches**");

- the clarification of the necessary **IT infrastructure**: setting up a new or opening an existing communication platform, storage and processing options for teamwork and, if required, virtual conference rooms;
- an understanding of how the learning projects and method in general **should be evaluated altogether and how the results should be documented**;
- A decision on the **certification system**, i.e. how the services provided and the competences acquired are classified and certified: e.g. based on operational competence profiles, analogous to other training measures on behalf of the company, awarding in-house certificates or - in cooperation with a university - credit points according to ECTS (European Credit Transfer System).

During first pilot projects the following is added

- a steadily growing involvement of the product owner and the (future) internal coaches in the learning projects,
- the qualification of the (future) internal coaches within the pilot projects, and separately,
- a clarification of the role external support should play in the longer term: supervision, evaluation, counseling, or no continuous role
- Selection / development of suitable structures:
 - Should the primary responsibility be with the departments or with the human resources department?
 - Communication within the company and especially to potential target groups
 - Forms of involvement of the works council and other participation structures
- A gradual transfer of responsibility to these structures

The elaboration: analyzes and clarifications

The course of a learning project usually has three phases:

1. The assignment clarification with the sponsor. Typical points of clarification are:
 - a) What are the cause and the topic of the competence development?
 - b) Who is the target group: qualification, current position, age, future tasks, previous experience?
 - c) How is the competence development organizationally embedded: responsibilities, instructions, procedures to be followed, overall corporate policy?
 - d) Who else is or should be involved: human resources, works council, adjacent departments, service departments, IT?
 - e) Which resources are available: financial resources, duration of the learning phase, time budgets of the learners (per day / per week and total), available infrastructure (IT, work equipment, rooms, etc.)?
2. The clarification of the **competence needs**. Which competences does the target group already have, which ones should they acquire, for what purposes should they be used? There are three perspectives to be considered:
 - a) Those of the line managers, in many cases supplemented by specialist departments and the human resources department: where do they see the current strengths and needs of the target group, in which direction should they develop, what are their future tasks and what are the company's requirements in the future?

- b) The one of the target group: where do they see their strengths, where their development needs, what would they like to learn, where do they see their personal prospect?
- c) An external expert opinion: what could be unrecognized implications of the planning, what is common / important in this area in other companies, where can you find already existing good practice examples that could help?

With a triangulation of these different perspectives, the competencies to be taught in the learning project must be brought into a manageable concept, which the line managers and the learning team's full support. An example of such a procedure is given in the box below.

3. Then the specific **learning project** can be defined. This includes:
 - a) To determine the employees who are to participate in the learning project and, as far as possible, already clarify and consider differences within the target group.
 - b) To identify a suitable practical problem (either one for the entire team or individually for each participant) as a learning task in accordance with the sponsor and the team. Thereby, the learning task can be oriented on the abilities of the participants or the participants of a learning group can be determined according to who fits best for a specific task.
 - c) To clarify resources in detail (time, rooms, IT, learning resources) and agree on them with the stakeholders.
 - d) To clarify the roles of the participants: who is the sponsor, who is technically responsible for the task, to what extent must operational experts be involved, are the direct supervisors involved?
Once the roles have been clarified, it must also be ensured that all parties have sufficient commitment.
 - e) To determine the schedule. Which dates for which tasks? How is communication organized within the team, with the coaches and with the sponsor? Until when should which level be reached?

Practical example: **Clarification of competency requirements**

In a large company, competence development should be carried out as part of employee development. The target group was homogeneous in terms of age (40 to 50 years) and background: industrial education and a prominent position for non-academics at master craftsman or technician level. The particular challenge was that the target group did not come from a uniform work context but was entrusted with very different tasks in different fields of activity. For this group of employees learning topics should be identified that were relevant to as many of them as possible.

As part of the analysis, the area manager, who was also the principal, as well as all the department managers involved were contacted first. To be able to work out generalized competency requirements despite the differences between the employees, on eight people from the target group a workplace analysis was done, in which they detailed their activities and a participating observer supplemented an independent external view. Recurring elements were worked out from the multitude of individual activities thus gained.

A compilation of these elements was presented to the interviewees, rated by them according to the degree of difficulty and importance for their own work and then prioritized how helpful a further education in the respective subject areas would be for them. From the most important elements five learning topics were compiled, which were once again evaluated by the target group. The result was presented to the management circle and accepted as the basis for a competence development project.

The implementation of a learning project

Working in an agile learning project is characterized by a stage-by-stage approach. A stage refers to the period necessary for the preparation of intermediate results, which represent a progress compared to the previous status and therefore should be presented to the sponsor. If the learners can only deal with the learning project as an accompaniment to their work, a period of four weeks is a realistic size. In principle, however, it should be noted that distance intervals of more than six weeks between the stages should be avoided as far as possible, otherwise a falling apart of the group and its dynamics can be expected.

During each stage

- the team works to reach the **stage goal** of the learning project using the agreed **tools**, e.g. a Kanban board and a SharePoint;
- the **coaches** support this work by eliminating obstacles, e.g. Problems with the IT, or the procurement of various resources such as subject matter experts, rooms, or work material;
- After approx. 6-8h of project work, a **stopover** takes place, in which the team presents to each other their work status, clarifies points of intersection, synchronizes the process and arranges the next steps,
- the work is continuously **documented publicly within the project**, i.e. everyone has always access to all documents in their current version
- Any insight that is made individually, collectively, or organizationally beyond the specific technical problem is recorded in a **learning diary**. The format of the learning diary should, on

one hand, be based on existing structures of knowledge management and, on the other, should represent the lowest possible hurdle for the creation of new entries.

At the end of the stage there is

- the **presentation of results** of the learning project to the sponsor, who receives the technical results, comments them and either accepts or returns them to the team for revision;
- the **reflection** on the learning task at the technical level: which goals have been accomplished, missed, or dismissed, what would have been better or easier, how would this problem be dealt with next time?
- the necessary **appointments** for the next stage: what goals should be accomplished, which procedure should be chosen, what is needed and how should it be organized?
- the **reflection on the process** between coaches and team (possibly with the participation of the sponsor): how did the learning process proceed, which entries were added to the learning diaries, what do they want to maintain in the future, what do they - individually, collectively, or organizationally - want to do differently in the future and how can the coaches help with that?

At the close of the learning project there is

- the **final presentation**, if possible in front of an extended circle, to distribute the results and to pay respect to the team;
- the **final reflection** on the learning process, including the personal learning needs of each team member for the future, and
- a dignified conclusion with the handover of the **certificates**.

Practical Example: A learning project with team and individual components

In a company, the subject area project management was determined as a learning topic and a group of employees was selected for it. The members of the learning team were to acquire practice-relevant competencies based on current projects in their field, including the handling of interfaces and overarching functions in the company (controlling, quality assurance, purchasing, regulatory approvals, supplier support, etc.). Therefore, it was decided that there should be a two-part learning project.

In the first phase, the team members worked on a study that was equally relevant to all of them and their areas of work. With this study, they learned about and used basic elements of project management (including project structure plans, work packages, set-up and scheduling, time and cost control). In the second phase, each member worked on a separate project from his area. The individual work was synchronized and compared during the stopovers. The team presented the work status and personal challenges and gave peer feedback. Accompanying this, the coaches gave on-demand technical and didactic input to support the processing of the learning objectives.

Finally, in a joint presentation, the team presented the results of the individual projects - which all clearly exceeded what they had already done before - and made it clear to what extent they had learned more about project management.

Potentials and limits of Agile Learning

The development of professional competence in dynamic environments requires not only conventional formal learning but also workplace-integrated and interactive approaches. In Agile Learning, the participants - accompanied and supported by coaches - gain new competencies that are directly linked to their work context. The learning occasion is a specific challenge derived from their own work process. In pursuit of the individual problem-solving as well as in exchange with the learning team and the coaches, one's own competence increase becomes recognizable, so that successful learning strategies can also be harnessed in future. In the process, participants are guided to the pragmatic use of IT tools that support problem solving from their individual perspective.

The main potential of this approach lies in the practical relevance of the acquired competencies and in the demand-oriented communication of contents, techniques, and skills. Specifically, this approach supports learning in working contexts, which are networked as part of the digital transformation and in which communication and collaboration is becoming increasingly virtualized. Agile Learning takes place in stages that are characterized by specific, work-process-related goals of the team members and allows an incremental and self-directed development of competencies. As a result, a solution- and practice-oriented approach is established that leads to the empowerment of employees by involving them in cooperative learning with their respective expertise.

Due to the recurring reflection and the involvement of the management level through the sponsor, a process of change is initiated which can be anchored sustainably in the organization and in human resources development.

Agile Learning does reach its boundaries when, like in any project-oriented teaching / learning method, the goal is the systematic coverage of a pre-defined curriculum with defined contents. This cannot be guaranteed by exemplary learning. For subject areas in which particular importance is attached to the completeness of learning content (e.g. safety at work or fire protection), classical further education forms are to be preferred. There, Agile Learning projects can only supplement existing presence and online trainings with a transfer embedded in the workplace, which supports the sustainable implementation of the learning content in everyday working life. However, if the goal of competence development is to impart practice-oriented skills that are supposed to cause a workplace-related increase in competence in a specific subject area, Agile Learning projects do have clear advantages.

Appendix

A short introduction to ‘what is a problem?’ and ‘what is problem-orientation?’ in a problem-based learning (PBL) environment

There have been many academic discussions about ‘*what is a problem*’ and what does ‘*problem-orientation*’ mean in a problem-based learning (PBL) environment? Problem orientation basically means, that the starting point for the students learning process is a problem (Kjærdsdam & Enemark, 1974; Quist, 2004; Kolmos, Fink & Krogh, 2004; Barge, 2010; Holgaard et.al., 2015; Guerra & Bøgelund, 2014). Problem-orientation being one of the pillar principles of PBL, cannot be described and categorised as one and only type of problem. Problem-orientation is a concept that relates to various different types of problems with different points of departure, implementing distinctive theory and methods, which are the means for solving the problem.

Kolmos (2004) argues that definitions of problems are diverse in different professional areas. And further Quist (2004) has, from a literature review of diverse problem formulations, located a variety of understandings of problems. Basically, there is consensus that a problem can be initiated by ‘*wondering*’ about an observed phenomenon or an observed ‘*problematic situation*’ (Quist, 2004; Guerra & Bøgelund, 2014) or an ‘*un-explored potential*’ (Guerra & Bøgelund, 2014; Quist 2004; Jonassen, 2011).

- Wondering: This indicates an observed phenomenon creating (qualified) curiosity (Quist, 2004), which can include situations, events, persons or a thing (Guerra & Bøgelund, 2014), something that happened or happens, something heard and seen (Quist, 2004), an uncovered need or wish (Guerra & Bøgelund, 2014; Quist, 2004).
- A problematic situation: This can, according to Quist (2004), be ‘something you find a scandal’, ‘a lack of knowledge’ or ‘a lack of function’ and it can be caused by contrasts; that is, between a wish and reality, conflicts, contradictions (Guerra & Bøgelund, 2014; Quist, 2004). In the definition of a problem, Guerra and Bøgelund (2014) explain the understanding of a problematic situation as also including the student’s sorrow and/or indignation, frustration or stress, which makes them act to change this problematic situation.
- An un-explored potential. This idea is also a possible starting point for the problem formulation, such as the potential of a mobile phone not only as a device for communication but also to take photographs and video, agendas, e-mails, GPS applications and so forth.

Furthermore, consistent with the Aalborg PBL model, problem formations can be defined as theoretical, practical, social, technical, symbolic-cultural and/or scientific (Barge, 2010). One general expectation though, problems identified are authentic problems. Authentic problems are ‘not only theoretical and not only practical, but problems that are part of a process, where the problem is constantly conceptualised’ (Henriksen et al. 2004, p. 149).

Depending on the type of problem and its starting point (*wondering*, *a problematic situation* or an *un-explored potential*) there is also a distinction between ‘retrospective’ or ‘prospective’ problem formulations (Holgaard et.al. 2015, p. 37), which can be characterised by:

- Retro-spective problem formations want to find justifications and explanations for something already happened;
- Pro-spective problem formations are designed to solve practical problems and to produce concrete solutions;

- Different types of problems: theoretical, practical, social, technical, symbolic-cultural and/or scientific (Barge, 2010, p. 7);
- Different starting points of problem identification, such as a wondering, a problematic situation or an un-explored situation or idea;
- Problem formulations, which either look for explanations (retrospective) or solutions (prospective).

In summary, problem-orientation, or problem formations, as one of the basic principles of PBL, cannot be described and categorised as one and only type of problem. Problem-orientation is a concept that relates to various different types of problem formations with different points of departure, implementing distinctive theory and methods that are the means for solving the problem and which are documented by the students / learners in their project work.

Bibliography

Barge, S. (2010). *Principles of Problem and Project Based Learning: the Aalborg PBL model*. Harvard University, prepared for Aalborg University.

Du, X., de Graaff, E., & Kolmos, A. (2003). *Research on PBL Practice in Engineering Education*. Rotterdam: Sense Publishers

Enemark, S., & Kjærdsdam, F. (2008). El APB en la teoría y la práctica: la experiencia de Aalborg sobre la innovación del proyecto en la enseñanza universitaria. I U. F. Araújo, & G. Sastre (red.), *El Aprendizaje Basado en Problemas: Una nueva perspectiva de la enseñanza en la universidad* (Vol. 4, s. 67-91). Barcelona: Gedisa.

Guerra, A., & Bøgelund, P. (2015). How to make engineering students master problem identification and problem formulation. I E. de Graff, M. Farreras, & N. A. Arexolaleiba (red.), *Active Teachers - Active Students: Proceeding of The International Joint Conference on the Learner in Engineering Education (IJCLEE' 2015) and 13th Active Learning in Engineering Education Workshop (ALE)*. (s. 77-81). Aalborg Universitetsforlag.

Henriksen, L, Nørrekilt, L, Jørgensen, K , Christensen, J and O'Donnell, D 2004, Dimensions of Change, Conceptualising Reality in Organisational Research, Narayana Press.

Holgaard, J.E., Ryberg, T., Stegeager, N, Stentoft, D. & Thomassen, A.O. (2015). Problembaseret Læring ved de videregående uddannelser. Samfundslitteraturen.

Holgaard, J. E., Guerra, A., Knoche, H., Kolmos, A., & Andersen, H. J. (2013). Information technology for sustainable development: a problem based and project oriented approach. In: *Re-Thinking the Engineer* [21] Engineering Education for Sustainable Development 2013, University of Cambridge.

Kjærdsdam, F., & Enemark, S. (1994). *The Aalborg Experiment Project Innovation in University Education*. Aalborg: Aalborg Universitetsforlag.

Kolmos, A. Xiangyun, D., Holgaard, J.E. & Jensen, L.P. (2008). Facilitation in a PBL environment. Aalborg University. UNESCO Chair in Problem Based Learning in Engineering Education.

Kolmos A., Fink F. and Krogh L. (eds.) *The Aalborg PBL Model: Progress, Diversity and Challenges*. Aalborg: Aalborg University Press

Qvist, P. (2004). Defining the problem in problem based learning. In: A. Kolmos, F.K. Fink and L. Krogh (eds.) *The Aalborg PBL Model: Progress, Diversity and Challenges*. Aalborg: Aalborg University Press, p. 77-92.