

The Aalborg PBL model

– Progress, Diversity and Challenges

Anette Kolmos, Flemming K. Fink and Lone Krogh (eds.)

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PREFACE

By Sven Caspersen

When Aalborg University was inaugurated in 1974, the problem-based and project-organized teaching model (PBL) was part of the university's innovative profile, along with close interaction and dialogue with the surrounding society.

From the beginning we were met with considerable scepticism concerning our educational philosophy. This scepticism came from colleagues at other universities, from future employers of our graduates, from the Danish educational system specifically, and from the public in general.

Thus, the first years were hard work but gradually our surroundings, our partners in the society, accepted that problem-based learning was adding new value and qualifications to our students, our graduates.

Time has shown that it was the right decision. The graduates of Aalborg University are well-received on the labour market and many educational institutions - primarily universities abroad - have followed in our wake and have implemented the PBL model to a small or a large extent. Throughout the years we have had many visitors from abroad who have experienced a concrete, alternative educational practice and brought ideas back home in order to implement some of these ideas in their own educational practices.

Aalborg University has always endeavoured to further develop the educational practice, which was founded in 1974, when the demands and the conditions were different from today. Some of the educational researchers and practitioners at the university have improved elements of the PBL, such as supervision, development of the students' PBL-competencies, variations in teaching methods, development of the analytic approach to PBL etc. Another group of educational researchers have further developed the model on the basis of new target groups, internationalization, and new technology used in education. These are important elements in the development of the educational principles and models used for distance teaching and international study programmes.

During the years a number of initiatives have been launched in which Centre for University Teaching and Learning and the IT-Innovation Centre at Aalborg University have been the central actors. Later, a more externally-focused centre has been established, UCPBL, University Centre for Problem-Based Learning, which adds to the profiling of Aalborg University's PBL-competencies.

This publication is special, as it primarily focuses on the teachers and how they reflect on their own teaching. It shows a large degree of internalization of the educational thinking in the system and it also shows that the development of the educational model takes place in close co-operation with the various university programmes. The coupling is necessary to ensure the survival and further development of the model.

I am sure that this publication will contribute to the understanding of the learning ideas behind and in problem-based learning, and I expect that it will inspire and motivate the readers to include PBL-thinking in their own development of new learning models.

THE AALBORG MODEL

- PROBLEM-BASED AND

PROJECT-ORGANIZED LEARNING

Anette Kolmos, Flemming K. Fink and Lone Krogh

1. INTRODUCTION

This book is the result of an internal conference at Aalborg University focusing on development and variation of the Aalborg Model. Twenty-five teachers and researchers gave a presentation on the Aalborg University Model (AAU Model). There were 100 participants at the conference, and afterwards 30 teachers and researchers reflected on their practice, which resulted in 23 articles for this book.

This is a quite unique book, as the problem-based and project-organized models are not primarily reflected upon on the basis of educational theories, but rather upon the basis of the theories and methods of the various university programmes. Thus this book contains a profession-based approach to the further development of the problem-based and project-organized educational practice at the university. This profession-based approach, which has gradually developed at Aalborg University, shows that the educational ideas are alive and well at the decentralised departments, and that the educational model is integrated in relation to the various professions. This is a development which takes time - it takes time to integrate the educational ideas and philosophies and to develop models - but it also demands reflection and experience to discuss and develop the project-based educational approach on the basis of both professional and educational argumentation.

The contributions of the book will inspire further development of PBL at universities all over the world. Throughout the years, Aalborg University has been the object of large international attention due to the special educational model. There have been many visitors who have seen and experienced a different university system, and in the light of that experience they have been convinced that it is actually possible to practice the student-centred ways of teaching. To visit a university where the teachers are not only talking about new educational principles, but where they turn the educational principles into practise, has inspired many of our visitors. For the last 10 years

there has been a strong interest in redesigning the engineering study programmes in particular, to achieve more up-to-date educational methods.

Although the educational model works at Aalborg University, it is still important to make continuous improvements to increase the students' learning output and to adapt the educational theories to new types of young and adult students. The continuous improvements are a part of the teaching and learning culture at the university. It proves that there is a constant wish to reflect on and develop the learning principles upon which the Aalborg Model is based.

2. THE CONCEPT OF PROBLEM-BASED LEARNING AND PROJECT-ORGANIZED LEARNING

The Danish PBL tradition dates back to the 1970'ies. At that time two new universities were inaugurated in Denmark: Roskilde University in 1972 and Aalborg University in 1974. Common to the two universities was that they were founded on new educational models.

The Danish problem-based and project-organized model was developed on the basis of ideas from, among others Illeris, who formulated principles as problem-orientation, project work, interdisciplinarity, participant directed learning, and the exemplary principle and team work (Illeris, 1976). The Danish concept of problem-orientation was more or less the same as the definition of problem-based learning: a learning method based on the principle of using problems as a starting point for learning (Barrows, 1984).

It is important for the Danish approach to PBL that it is a combination of a problem-based and a project-organized approach. The students analyse and define problems within a defined interdisciplinary or subject frame. The students work together in groups on their project and submit a common project report. Furthermore, the project group has a joint examination, but the students are given individual marks.

During the years, there have been many discussions about the Danish models: many questions have been raised, such as What is a problem? When is a problem a problem? What are the criteria? What is the role of the supervisor and how can the role be conceptualized and develop? How can the students' PBL skills be improved, so that they become more skilled in co-operation and project management.

At the international arena, PBL is not an unambiguous concept. In today's international literature it means both problem-based and project-based learning. If you search on the internet for problem-based learning, you will find more than 100,000 search results. If you search for project-based learning, you will get about 50,000 search results. Thus both problem-based learning and project-based learning seem to be well established concepts. The confusion increases still more when you compare how the PBL concept is used internationally, as the concept is also used at Maastricht University, the Netherlands, Linköping University, Sweden, and in the medical programmes of McMaster University, Canada. They are all new universities - established in the 1970'ies - and founded on a problem-based learning model (Graaff and Bouhuijs, 1993; Wilkerson and Gijsselaers, 1996).

This book is about the Aalborg PBL model, and most contributors to the book use the concept problem-based learning as a meta-concept, covering the central learning principles of the educational model used at Aalborg University. However in the book a number of other concepts will also be used to describe the model, such as project-organized learning (POL) and problem-orientation.

3. LEARNING PRINCIPLES FOR PBL

Even though there are differences in how problem-based models are practised internationally as well at the university, they are founded on the same theoretical basis and thus the same principles of learning. Reference is often made to the theories of Piaget, Dewey and Lewin, who were some of the first learning theorists within this field, together with Vygotsky (Piaget, 1974; Dewey, 1933; Lewin, 1948; Vygotsky, 1978). Among the new theorists reference is often made to Kolb (1984), Lave and Wenger (1991) and Gardner (1993) (Bygholm and Dirckinck-Holmfeld, 1997; Hansen, 2000). Common to all these theorists is that they view the gaining of experience as an important approach to the further process of motivation and learning.

Still, it is not possible to explain practice only by forming a theory. There are so many elements involved in the problem-based and project-based models, as they represent the establishment of a quite new learning environment and have far-reaching consequences for the universities' culture and organization as well as for the students' development of competencies. The comprehensive understanding necessary to be able to analyse PBL models does not exist within the theory alone and can only be understood once the cognitive approach, the social learning, and the motivation and social psychologies are coupled. The PBL models have thus not developed on the basis of a consi-

stent comprehensive theoretical understanding. Instead they have developed on the basis of a number of - often isolated - theoretical principles, which have found their way to a pragmatic development.

The central theoretical learning principles in both problem-based and project-organized learning concern three dimensions: the problem, the content and the team (Graaff and Kolmos, 2003). The problem approach means that *learning is organized around problems*. It is a central principle for development of motivation. A problem is the starting point for the learning processes. It can be all types of problems from a concrete, realistic problem to a theoretical problem. The problem serves as the basis for the learning processes, because it determines the direction of the learning process, and places weight on the formulation of a question rather than an answer. Integrated in the problem approach is learning in context. The formulation of problems allows the learning content to be related to the context, which promotes the students' motivation and comprehension. *Experience learning* is also an implicit part of the formulation of problems, and especially important in relation to which problems the students are attracted, and to which problems are formulated by the student on the basis on his/her own experiences and interests.

The content approach is especially concerned with interdisciplinarity and exemplary practice. *Inter-disciplinary learning* relates to the dimension of knowledge as the solution to the problem formulation and may span across traditional subject-related boundaries and methods. This principle is critical for the organization of the teaching, in that teachers often consider objectives within the known subject-oriented framework, and do not consider problems or situations. *Exemplary practice* is concerned with ensuring that the student's learning output is exemplary in terms of the framework of the objectives. This is an extremely central principle in that the student must engage in a deeper understanding of the selected complex problem formulation. On the other hand, it is an inherent risk in PBL that it does not provide a sufficiently broad subject-area overview. The students must therefore have the ability to transfer knowledge, theory, and methods from the learned areas to new material areas.

Social learning - or team-based learning - is the last core principle, and specifies that the majority of the learning processes take place in groups and teams. Also *student centred*, *self directed*, or the very Danish concept of participant directed learning, indicates ownership of the learning process and especially the formulation of the problem. Personal competencies are therefore implicitly developed in order to handle the group co-operation processes.

The above described principles are drawn from various learning theories and form an abstract theoretical level, a »point of reference«, for designing and modelling the concrete education. The principles cover the problem-based learning models, as they are practised for instance at the universities in Maastricht and Linköping; but they also cover the project-based models as they are practised in Aalborg and Roskilde.

4. THE TRADITIONAL AALBORG PBL MODEL

The project work model is used in all study programmes at Aalborg University within the Faculty of Humanities, the Faculty of Social Science, and the Faculty of Engineering and Science

The traditional Aalborg model is founded on problem-based project work, in which approximately one half of the students' time is spent on project work in teams, whereas the other half is spent on more or less traditional lectures. All project work is made in groups, and the same model is followed from the 1st semester until the completion of a masters' degree (10th semester). During the span of the university degree programme, the groups normally become smaller, starting with typically 6-7 students in the 1st year, and reduced to maximum 2-3 students in the final semester.

Project-organized, problem-based learning as it is implemented at Aalborg University is described in the booklet »The Aalborg Experiment - project innovation in university education« (Kjærdsdam and Enemark, 1994; Fink, 1999). The main principles can be described as in figure 1.

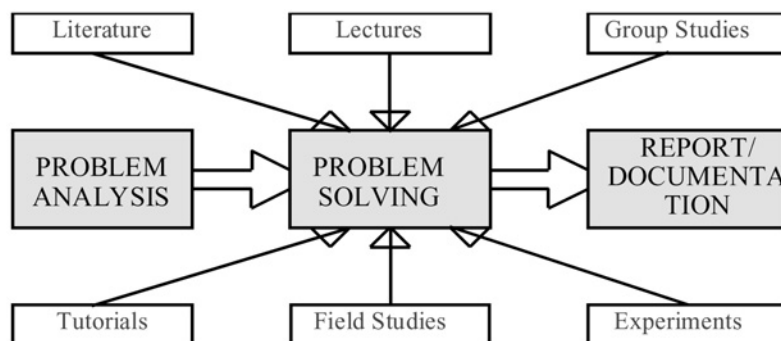


Figure 1: Principles of project-organized problem-solving (Kjærdsdam and Enemark, 1994)

The curriculum is organized into semesters - 10 semesters leading to a Master's degree, organized in a very deterministic structure with a very well-

prescribed output. The project work is formulated within the framework of the given theme, related to the overall educational objectives, which can be a broad, open theme or a subject-related limited theme. The students are allowed to formulate their project proposal themselves, but there is always a supervisor who approves the proposal.

In each semester the project and the majority of the courses must relate to the theme of the actual semester. The students are supposed to attend the courses and apply them in their project work, and the output of the courses is assessed along with the project report at the end of the semester. The examination is a joint group examination with individual marks and takes up to six hours. The work with the project report and the courses - the theme - covers approximately 80 % of the semester, equivalent to 24 ECTS (European Credit Transfer System). A full semester is 30 ECTS points. The rest of the semester includes fundamental courses or other compulsory courses (study courses) assessed by more traditional examinations (see figure 2).

The structure of the curriculum is fundamentally progressive, and in addition each step in this progression implies a large degree of flexibility. Within a specific theme projects can and do change from year to year. A theme covers a great variation of problems - and as the projects selected will be a combination of 1) proposals from industry, public administration etc 2) interests among students, and 3) interests among staff etc., and new problems will always be in focus. Therefore, even though the purpose and the content of the theme is well prescribed using Bloom's taxonomy of learning depth (Bloom, 1956), the curriculum is very flexible and can follow the scientific development and integrate application of new research results.

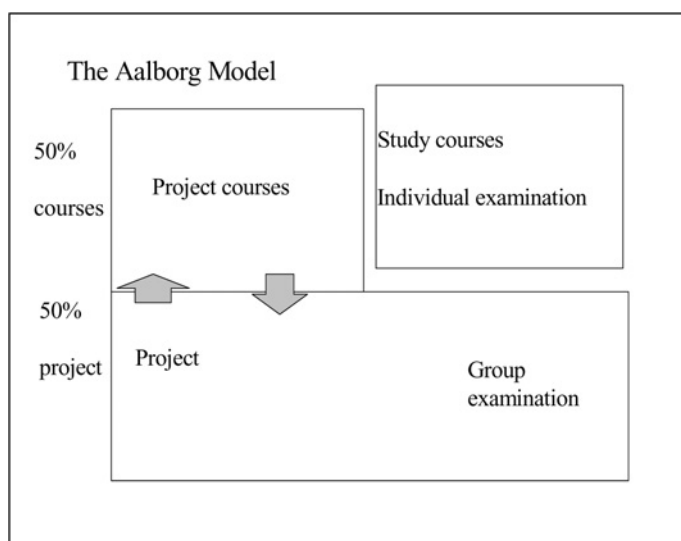


Figure 2: The traditional Aalborg PBL model

Each group has one or several supervisors (faculty member). The role of the supervisor is to respond to the students' project process along the way and to take the group through to the examination. The examination is a group examination, where both the supervisor and an external or an internal examiner are present.

5. VARIATIONS IN THE PBL MODEL AT AALBORG UNIVERSITY

The project-based model varies considerably in practice and these variations, which will be dealt with in this book. The subject, educational objectives, extent, placing in the study programme, group size, variations in the students' liberty of choice, the relation between courses and project, the form of examinations, and use of resources are just some of the differences that are often mentioned when project work at different institutions is compared.

In nearly all programmes the project work corresponds to half of the students' time. Although the typical project lasts five months, there are exceptions. In some programmes, for instance at the Department of Architecture and Design, the students work with a series of shorter projects of less extent, because that approach suits the educational objectives better.

The understanding of the educational principles will vary from department to department, and these variations will affect aspects of the program, including the implementation and the curriculum formulation:

- The **themes** can be defined in different ways as themes describing various types of problems, or as themes directed towards certain subjects
- The choice of **projects** can be based on open or more controlled problem formulations depending on the educational objectives and the understanding of »problem-based«. In the open situation the students are supposed to prepare and word the problems and the projects themselves, and in the more controlled situation the teachers make the preparation and wording.
- The definition of a **problem** can vary between professional areas. In some programmes the problem must be a dilemma or a social discrepancy, in other programmes the problem will be an issue calling for an engineering solution, or in other cases it is a question of turning the learning process in a certain direction.
- The definition of the **various phases** of the project, which may vary depending on the subject in question.
- The relation between **courses and project** will depend on the understanding of knowledge, traditions and culture of the various departments. For example there are large differences in the relation between courses and project