Reflections on making a change towards Project Oriented and Problem-Based Learning (POPBL)

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ABSTRACT: In this article, the author reflects on the various levels of change towards Project Oriented and Problem-Based Learning (POPBL). Resistance to change is discussed, including a change matrix that defines how successful change can come about and the adverse results if key elements are missing. The author also looks at two key aspects from this matrix, namely the vision and action plans. The three levels of implementation that need to be considered incorporate: the *institutional level*, the *system/group level* and the *individual level*. Key elements at each of theses three stages are covered in the article. Types of change in organisations are looked at with regard to the successful implementation of a new educational model. An example of a successful overall implementation is also shown, including the long-term transition period from the old model to the new model. Staff behaviour is an important concept that can impact directly on the implementation of change, and can feature staff who are pioneers of change to those who are resistant to change. In the article, the author also presents how to work with projects through different levels, and how progressive change in this can lead to institutional change through collaboration. Problems with examinations are also analysed.

INTRODUCTION

There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new.

(N. Machiavelli, *The Prince*, 1505)

Today, many educational institutions undertake analyses that lead to educational change in a form that reflects more on the requirements and needs of modern communications and a collaborative society, and one that reflect more on the demands of modern students. This means institutional rethinking and restructuring – not only for an organisational change, but for personal change and cultural change as well.

Furthermore, it is necessary to identify an educational model that focuses on professional subjects and on students' personal skills and their abilities to learn, as well as life-long learning abilities.

One of the techniques focused upon that can comply with the above-mentioned demands is so-called Problem-Based Learning (PBL). The acronym PBL has been used in many different situations and it has a wide variety of interpretations. Due to this, PBL is often supported by an additional letter to make a more understandable acronym in a given setting. The author wishes to follow this line by using the acronym POPBL, which stands for Project Oriented and Problem-Based Learning carried out in teams. This has been done so as to make a distinction between a PBL taught course with minor problem solving attached to the lecture, and large and comprehensive projects that run over a longer period, maybe for a complete semester. POPBL is utilised in the latter situation, but it can sometimes be difficult to make a sharp distinction between the two interpretations. In this article, the author uses POPBL as a general acronym. At some institutions, POPBL is called POL, but still covers mainly the same wider set-up of PBL.

During the author's work with the practical implementation of POPBL at institutions, it has been his experience that if institutions do not have a very clear idea of what they are venturing into, and how to plan the implementation, transitions and the steady state situation, the outcome will most likely be far from the expectations that had been set up initially. The implementation and actual institutional transition process can take many years to consolidate. As such, making this kind of institutional change is a long haul; but the author believes that the end results are worthwhile.

RESISTANCE TO CHANGE

The expression *everything is possible, except change*, has many sources; but the fact remains that it is so widely known that change in organisations is not easily achieved. This should give rise to reflections on how to conduct change in one's own organisation.

The matrix in Figure 1 can be useful in gaining an overview of some of the crucial elements that are important to a successful change process. The matrix shows different scenarios in a change process. The elements in the matrix are comprised of vision, consensus, skills, incentives, resources and an action plan. All of the *elements* in the matrix must be present in order to overcome resistance to change.

The matrix visualises different situations that may occur in a change process, based on the elements present or lacking in the process. It indicates various kinds of organisational behaviours

Vision +	Consensus +	Skills +	Incentives +	Resources +	Action Plan	= Change
	Consensus +	Skills +	Incentives +	Resources +	Action Plan	= Confusion
Vision +		Skills +	Incentives +	Resources +	Action Plan	= Sabotage
Vision +	Consensus +		Incentives +	Resources +	Action Plan	= Anxiety
Vision +	Consensus +	Skills +		Resources +	Action Plan	= Resistance
Vision +	Consensus +	Skills +	Incentives +		Action Plan	= Frustration
Vision +	Consensus +	Skills +	Incentives +	Resources +		= Treadmill

Figure 1: The change matrix [1].

to be expected or recognised if one or more elements are missing in the process. Furthermore, it illustrates why change does not always happen. The matrix illustrates how and why change, sabotage, confusion, anxiety, resistance, frustration and so-called treadmill scenarios are generated.

The matrix has been adapted from a presentation by Knoster at a TASH Conference in Washington DC, USA [1]. It shows the complexity involved in making changes, and it can also provide an explanation of some organisational behaviours that may occur if some of the elements have been neglected in the process. It is a good platform to obtain an overview of the complexity involved in change processes.

If teachers in general do not feel any need for change in their present situation, they will reasonably ask, *why make a change?* That is a very good question – especially if good answers cannot be given! If there is no dissatisfaction with the present situation, then the change process will be more difficult, and strong arguments must be presented to make teachers work for change. The situation can be worsened if the organisation has made unsuccessful changes in the past. Teachers will hesitate to enter into yet another *adventure* if the change is not well argued and the process not well described.

Boyett and Boyett tell this story to tune into reality:

> *Edgar Schein of MIT has told a story illustrating this very well. Schein says: Imagine the following. You place a dog on a black platform in a green room, ring a bell, and give the dog a painful shock any time he tries to get off the platform. The dog, being a reasonably intelligent animal and sensitive to pain, will quickly learn that it is better to stay on the platform than to venture into the unknown in the green room. The dog will learn that the green room is to be avoided at all costs; and if it has sufficient food and water, it will live happily on the black platform forever. Schein says our learning habits, beliefs, values, assumptions and ways of doing things in organizations represent our black platform. They are comfortable and secure. In most organizations, employees have been taught that getting off the black platform – venturing into the green room of change – can be painful. Very painful indeed. As a consequence, we fear change* [2].

After having introduced some general information as reference for this article, the author wishes to focus on two of the elements shown in Figure 1, namely: the vision and the action plan, respectively. Even though they are all important in the change process, the author chooses to only focus on these two, as the author sees these two aspects as key topics for this article's intentions.

VISION AND ACTION PLANS

A *vision* is needed in order to be able to formulate the objectives and the aims for the change process and to be able to define the criteria of success for the organisation, teachers and students. Most likely, it is necessary to set up visions not only for the entire organisation, but also for the sub-levels. This will help the organisation to become united in a common goal, and will further support cohesion in the organisation through the active involvement of staff in the discussion towards formulating sub-visions.

In training workshops, the author usually starts by having participants formulate a vision based on a discussion on what the objectives and aims should be in a new educational model and why they want to make a change. This vision then forms the bases for the remainder of the activities in the workshop. By having participants formulate a vision, many of the vital issues are discussed prior to the actual change process.

Formulating a vision is utilised in workshops that are aimed at executives, academic directors or teachers to set the groundwork for the coming activities and tasks. This approach is taken even though they are at different levels in the organisation; visions can be successfully utilised at all levels as a means of fostering understanding for different tasks and the politics that occupy the different levels in an organisation, thus ensuring the formation of a more coherent organisation. Many of the principles discussed in the process of formulating a vision are very valuable for further processes, as it forms a common platform of understanding of what they are venturing into. Being a part of the wider discussion that leads to a vision helps participants with the task of explaining and supporting the forthcoming change process. In short, the vision is a keystone in the change process.

Another fundamental in the matrix shown in Figure 1 is the *action plan*. The matrix indicates that the organisation can enter a treadmill situation if an action plan is not present, thereby becoming a barrier for the change process. Those responsible for implementing the change must develop an action plan. This is important for teachers in order to be involved in the change process in a structured and well-defined way, so that they are able to plan their involvement and participation in training, courses, workshops, etc, and to gain confidence and ownership of the change of which they are a part. This plan can be expressed in general terms at the executive level, but it must be followed up by increasingly specific and detailed plans the closer one gets to those directly involved in the process.

One of the author's experiences has been that teachers need to have a good introduction to the change and the action plans, as well as have time to discuss it internally afterwards. In this way, it is also clear that the information about the change must be

clear and well defined in order to avoid creating grounds for erroneous conclusions during subsequent discussions among teachers. The message must be clear and the presenters must be ready to answer many questions from teachers. Not all questions may seem equally important for the change planners, but they are important to teachers for reasons that may not be known to others. However, presenters must be well prepared and be able to answer the best way that they can.

The following section gives examples that can help facilitate the change process by showing a possible structure to follow in order to acquire some of the topics that must be discussed during the formulation of the visions and action plans.

Levels of Implementation

To be able to consider the vision and action plans, it must be discussed to which level the institution wishes to implement the new educational model. Figure 2 is a model that shows different levels of use of PBL/POPBL in teaching and learning organisations.
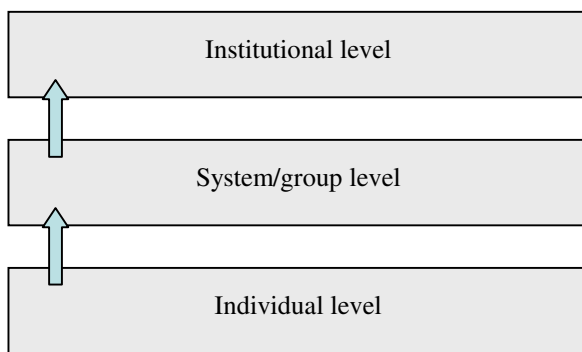

Figure 2: Different levels of implementation of PBL/POPBL in organisations.

The *individual level* can be described as having the following key characteristics:

- *New* practice is within the traditional framework of the present educational system;
- It is related to each individual teacher's performance and, as such, it is a very *private* situation;
- There are no changes in the examination or evaluation.

At this level, changes do not have a big impact on the organisation. In fact, they can be carried out without even anyone else but the teacher involved being aware of it. In short, it is not a *threatening* change to the organisation.

Moving to the next level in the model shown in Figure 2, the *system/group level*, the situation for the organisation begins to change. This level is characterised by the following aspects:

- Cause for considering change in the course or programme objectives;
- Cause for considering change in the organisation's teaching and learning methods;
- Cause for considering change in the organisation's examination methods;
- Cause for considering change in the organisation's teaching and learning culture;
- Cause for considering change in the organisation itself;

- Cause for considering change in the evaluation methods and objectives.

The phrase *cause for considering change* is utilised here in order to indicate a transition, as this change does not happen absolutely at one point in time. It also indicates that the changes themselves can vary from very few to more complex in the organisation. However, the organisation does not need to change totally, although the process will lead to change in (some) parts of the organisation.

At this level, the institution most likely begins to organise teaching in systems and there is a risk that the process starts to become mechanised and very controlled.

The final and highest level in Figure 2 is the *institutional* (or *political*) *level*. At this level, the impact on the organisation, as well as on students and teachers, is total. It can be described by the following desirable characteristics:

- Students take an active and collaborative role at the management level;
- Learning is contextual and experience-based;
- Projects are cross-disciplinary (interdisciplinary);
- Students are a direct part of the institutional planning and conduct;
- There is change in the organisational culture;
- There is change in the organisation;
- There is change in the examination format towards an assessment (at least partial);
- Changes occur in evaluation methods and objectives.

At this level, the organisation changes its present ways of approaching teaching and the administration of it. The entire culture is experiencing change. This situation is not possible to reach by an executive decision in a very short time. Indeed, it is the author's experience from changes in other institutions that the course of action from starting the process to being at the institutional level for the whole organisation, or almost all of it, takes years to accomplish.

One of the more important changes at this level is the involvement of students as an active and collaborative component of the process. This means that students actually have a role in decision-making in the organisation. A high degree of democratisation is essential: not just formal, but genuine and real democracy. In particular, students should be heavily involved in every planning meeting for the change, and later (maybe with less contribution) participate at all levels when the structure is up and running.

The change in an organisation's evaluation methods (evaluating the organisation and resources) is a topic that the author has seen neglected. Keeping *old* methods of evaluating teachers' performance often forces teachers to play along as if the new educational model was up and running, but in fact structured to fulfil the evaluation criteria of the old system! This is a counter-productive situation.

By describing these levels in a simple manner, the author hopes to have focused on some of the discussions needed before the decision is finally made regarding the level of change the organisation targets. If there has been no discussion on the possible level to reach, at what time and on how the new

educational model successfully fulfils the vision, one or more of the important elements in the matrix of resistance in Figure 1 is missing. This creates a difficult problem for the adoption and implementation of a new educational model.

TYPES OF CHANGE IN ORGANISATIONS

When analysing how to implement a new educational model, the approach must be discussed and a plan must be developed for the adoption and implementation. It should be noted that it is not within the scope of this article to further discuss this topic, but the author intend to follow this up by describing a tested way on how to set-up an organisational change process by focusing on training programmes.

In principle, there are many ways to plan an implementation, but it is generally accepted that executives must make the *political* decision in order to establish the overall framework for this change. Discussions on how the adoption and implementation can be realised will depend on the type of institution, the size of the institution, the readiness for change, etc.

The extremes of these possibilities are a radical approach at one end; and a slow, progressive approach at the other end. The pros and cons have been discussed intensively in the literature, and Trice and Beyer have come up with a matrix that shows three types of cultural change in combination with four dimensions of change [3]. A summary is shown in Figure 3. Their matrix is based on cultural change, and they define it as follows:

> *We will reserve the term cultural change to refer to planned, more encompassing, and more substantial kinds of changes than those which arise spontaneously within cultures or as a part of consciously efforts to keep an existing culture vital. Cultural change involves a break with the past; cultural continuity is noticeably disrupted. It is an inherently disequilibriating process* [3].

Placement on dimensions ⟍ Types of cultural change	Pervasiveness	Magnitude	Innovativeness	Duration
Radical	high	high	var.	var.
Subunit or subculture	low	mod/high	var.	var.
Progressive	high	mod	mod	high

Figure 3: Three types of change in combination with four dimensions of change (based on Trice and Beyer) [3].

The *pervasiveness* of an envisioned cultural change is closely correlated to the proportion of the activities in an organisation that will be affected by it. The *magnitude* of a change involves the distance between old understandings and behaviours and the new ones that teachers are expected to adopt. *Innovativeness* refers to the degree to which ideas and behaviours required by a desired culture are unprecedented or have some similarity to what has already happened somewhere

else. *Duration* refers to how long a change effort is likely to take and how permanent the change will be (limited description based on Trice and Beyer) [3].

In the author's experience, the best practice in implementing a new educational model is to combine two types of change. Firstly, a radical approach for the executive overall decision on the change and for setting up overall objectives and criteria of success based on a formulated vision. Secondly, a progressive approach for the actual implementation and the beginning of the transition at the academic directors' level, teachers' level and staff level in general.

Executives must also demonstrate their commitment to their decision by supporting it in all aspects and living by it themselves as role models in the process. They must act with their decision from the day it is declared – with no exceptions – and give organisational support to the change. The following Figures show the two-step approach.

Figure 4 illustrates a top-down decision for educational change. It is generally accepted that this must be a top-down decision, but executives must have teachers to implement it in practice. Academic directors, and their involvement in the process, are very important, as they are the ones who will conduct the change process on a daily basis.
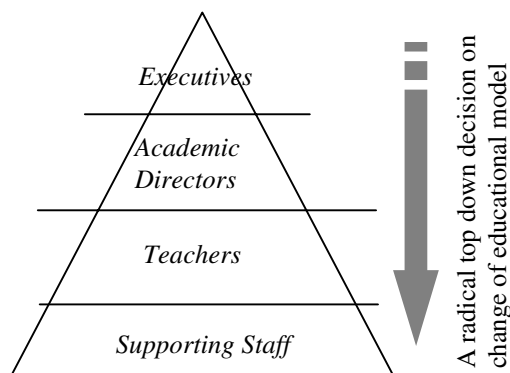

Figure 4: A radical top-down executive level decision to make the change.

The training of teachers is a reversed process as training for the new model begins with each individual teacher. In this training it is crucial to make certain that teachers actually develop the desired behaviour in accordance with the objectives of the new educational model. In addition it is important to make sure that there is time allocated for collaborative work and activities that support the learning of the new culture.

In Figure 5, there are two arrows that show the development and training at the different levels in the organisation. The arrow between academic directors and executives may be expected to appear before the training of teachers and other staff.

The training of teachers may be approached in several ways. One approach is to have teachers undertake hands-on training on an individual basis as a start to the process; this can be seen in Figure 6. This means that teachers start at the individual level and, as they gain experience, they will enter into the system/group level. In time, they might enter the institutional level – *if the institution lets them*. This depends on the institution's organisation of the implementation and its transition.
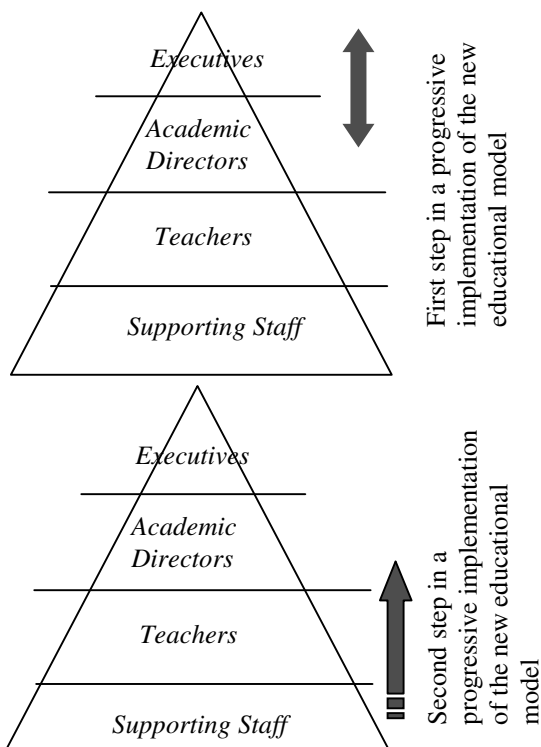
Figure 5: A progressive two-step model for the implementation of the change through the different levels in the organisation.
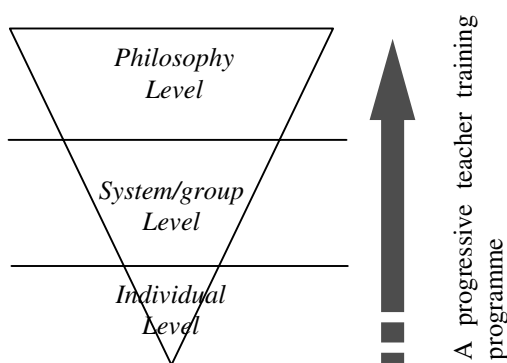

Figure 6: A cumulative staff training programme through the different levels originally shown in Figure 2.

Some institutions will never succeed in reaching the institutional level in implementing a new model if whole-hearted support is not given. Many warnings of the risks of an unsuccessful implementation and transition have been given in the literature:

> *A few examples of new practices here and there throughout an organization do not represent* cultural change*; they need to be woven into the entire fabric of the system* [4].

> *If components like curriculum change, or professional development or new teaching strategies are tackled in isolation while others are left unchanged, the success of reforms will most certainly be undermined* [5].

> *When Authentic PBL (APBL) is interwoven into an existing curriculum, it does not work. This is known as the injection approach, where some educators inject APBL into their existing subjects. Nothing is removed. At most, the instruction method is based on*

some essence of APBL. In most cases, the introduction of problems to be solved is perceived to be doing APBL [6].

EXAMPLE OF AN OVERALL IMPLEMENTATION PLAN

Organisations that decide to make a radical and fast change into a new educational model can be predicted to generate big and unnecessary problems. In order to make a big change in a very short time is – in the author's opinion – not possible! It will not be whole-heartedly adopted by the involved parties. Organisations are in general – again in the author's opinion – not prepared for radical changes.

In 1994, Esbjerg Engineering College joined Aalborg University, Aalborg, Denmark, as a full-member institution within the *Aalborg System*. A five-year implementation period was planned, commencing from a traditionally taught learning institution to an institution that runs 100% at the philosophy level in the so-called Aalborg system.

It was an executive-level decision to run two educational models at the same time. The old education model was continuing, as all students had already enrolled, but new students were to enter a new programme at the University. The successful transition into a fully new undergraduate and graduate curriculum took five years. This slow, firm and progressive implementation plan is recommended to others when transforming educational institutions – especially if they do not have a well-established, nearby scheme in which they soon hope to *dock*. In this plan, the year one experience is transferred to year two, etc. Figure 7 displays the implementation plan.

Figure 7: An example of a five-year implementation plan for introducing a new educational model at an institution.

The advantages of this approach are many: it gave members of the existing staff time to make their decision to join the POPBL educational system or leave the institution for another job. Furthermore, it gave the organisation sufficient time to train the teachers and the administration. The author notes that the most difficult part in the process was, in fact, the change in the administration! Maybe dissatisfaction, as mentioned previously, was not present: why should they change? They did well in the present system.

STAFF BEHAVIOUR

Change – as a start – is a personal issue and Hord, Rutherford, Huling-Austin and Hall have developed a seven-step Concerns Based Adoption Model (CBAM), which shows the stages of concern that most teachers move through as they implement a

new innovation (see Table 1) [7]. Not all teachers will actually follow all the steps, but *until the question* What is in it for me? *is resolved by working through the Personal Stage, the innovation will not take root and become institutionalised* [7]. The *what's in it for me* must be realised to get a new plan adopted.

Table 1: Stages of concern [7].

Level	Stage of Concern	Description
0	Awareness	Little concern or involvement
1	Informational	Awareness and interest in learning more
2	Personal	Uncertainty about personal competence to meet demands of this innovation
3	Management	Attention to the process and tasks of using innovation
4	Consequences	Attention is focused upon the impact and results of innovation
5	Collaboration	Working with others on application of the innovation
6	Refocusing	Exploration of additional, universal application of the innovation

It is not within the framework of this article to offer suggestions for teacher training programmes, but simply to comment at this stage that such a programme must comply with all levels of staff. A matrix can be generated to uncover the different training needs for the staff. Generally, it is a good idea to first listen and be *told* what the teachers see as their needs! The training programme must be developed by looking at each individual staff member and recognising that not all staff members are equally motivated.

There are always various teachers, who, for whatever reason, want to participate in a change that promises to enhance their practice. They will be highly motivated and will normally do well and be wonderful pioneers in the process. But what about the rest?

In a much-generalised way, teachers may be divided into at least four groups:

- Those who want change (the pioneers);
- Those interested, but discouraged by logistics, lack of vision, skills, resources or action plans;
- Those reluctant to change;
- Those against change.

As mentioned previously, this article does not intend to generate a training plan. However, looked upon as a part of the process, pioneers are motivated and easily trained. They also usually generate successes. This is a situation to be taken advantage of in the implementation period, as pioneers can be used as trainers for the next cohort of teachers entering the programme. They have gained experience; those who follow can actually see from them that it is possible to make changes.

Some teachers are interested, but, for various reasons, have been discouraged in their experiences of previous *adventures*. However, with a thorough set-up (as shown in

Figure 1) and a training plan that takes into consideration the individual concerns as listed in Table 1, they can, most likely, be persuaded to overcome their discouragement. A coherent and reliable plan is the key for such people.

The reluctant ones are a bit trickier, but, as time goes by, they might see that the changes are not threatening to their position or professionalism, so most of them will enter the programme gradually. However, this is not always the case. It should be noted that what seems to be the reason for resistance to change may not be the actual reason.

An example can be given here. A colleague was very much against the change. He did not want to participate and was very much against all ideas put forward in the process. Later, under quite different circumstances, he asked a simple question: *If we do change, can I still keep my office?* The answer was that of course he could, as it had nothing to do with the educational change that was going on. Then he changed his attitude and wanted to work with the programme. In this case, the fear of the losing his office was blocking him from even being open to see the possibilities that were in it for him.

Those in the reluctant group may have to be pushed by the institution, and perhaps even more *direct encouragement* methods must be brought into use. However, it is possible to make them work in the system. However, whether all of them will actually be convinced by the new model is questionable; they might just play along. Again, some of the reluctant teachers are like that for reasons not immediately transparent; in some cases, they are reluctant simply because the institution is not able to give answers to some of their points of hesitation. But, after a period, some of them can turn into very inspiring teachers and work constructively within the programme. Nevertheless, maybe they are reluctant because there is a valid reason for it!

The last group is the critical part in the change process: those who actively oppose change for whatever reason. In this case, the institution has to emphasise the new rules and, as a consequence, some might choose to leave the institution. It may also be necessary to dismiss people, but this is a rare situation and also rather difficult.

A situation for consideration is if the organisation really wants to use much in the way of resources on a person who will retire in a couple of years. It is always up to the institution to make these kinds of comparative evaluations of efforts and benefits.

Having described the possible different levels of implementation, an overall transition plan and having addressed some staff-related issues, the next step is to manoeuvre the organisation into the levels that best suit the situation and its possibilities. Maybe this will not be what is actually stated in the original vision, but then the vision must be reviewed, or maybe approached in two stages: A short-term vision and a long-term vision.

Figure 8 shows the principal structure of the semesters at Aalborg University [8]. It was an executive-level decision to have this split between project and courses; this is followed by all the programmes in the Faculty of Science and Engineering. Interestingly, all later evaluations from students, graduates, etc, reinforce this to be the best split [9]. The dotted line indicates *the project unit* and shows the relationship between the project

and the courses that support the project. This figure is chosen to show how to focus on a common barrier when beginning to work with projects: finding the necessary time. The time for project work will always be subject for debate and, most likely, the *time* must be given as an executive decision to avoid *Empyreal Wars* between the various groups of interest in the institution.
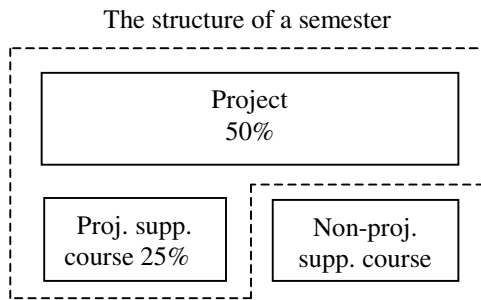
The structure of a semester

Figure 8: A typical semester structure [8].

WORKING WITH PROJECTS AT DIFFERENT LEVELS

During international cooperation with other institutions, the author has noticed that one of the most characteristic barriers against reaching the institutional level (shown in Figure 2) has been the process of making the project an independent activity, more than merely an embedded use of Problem-Based Learning (PBL).

Most often, the project is planned as an activity *inside* a course or *across* a couple of courses. Most institutions do not actually support the cultural change necessary to implement the new educational paradigm at the highest possible level. It is not sufficiently clear if the objective is to implement POPBL as a *tool* or if the objective is to implement the *philosophy* of POPBL with all the organisational and cultural changes it involves. This latter has been further described by Chen [10].

With overall reference to the terms utilised in Figure 2, the following sequence of illustrations shows typical examples of the relations between courses and projects, and focuses on the differences in curriculum development between a course approach and a theme/project approach that eventually reaches the highest level of POPBL use. In these figures, one may also find a development of the complexity of the projects and, as such, the objectives can/must be set higher. In this development of complexity, the project orientation approach becomes more obvious as a means to reach the formulated learning outcomes and desired performances for students, as hopefully stated in the vision.

The figures illustrate a development in the use of PBL matching the levels shown in Figure 2, and the institution's vision, wherein it should be stated what level of PBL/POPBL the institution wants to achieve. The following figures illustrate the increasing use of PBL/POPBL from a simple form of PBL towards a complex and coherent use of POPBL.

Figure 9 illustrates a situation that consists of one course with a project inside the course. This is a typical *individual level* situation. The project utilises the theory taught in the course and is limited to the subject of this course. The teacher is supervising (controlling) the project – and the teacher sets the aims.
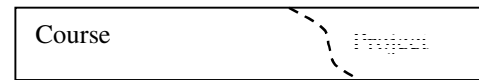

Figure 9: The project as a part of a course.

Figure 10 displays two courses, each containing a project inside the course. The level is still at the *individual level*. A situation like this is acceptable from the students' learning point of view, but otherwise, the situation begins to be critical. The key word entering the field now is *time*. What will happen if the situation develops further and teachers in other courses want to make projects in their courses in the same semester as well? The project work will overload the students. The organisation of the project works needs to carried out differently.
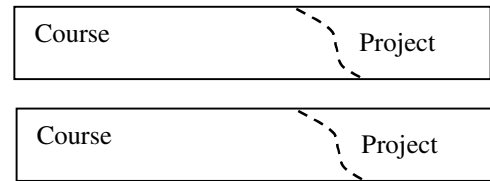

Figure 10: A situation with two courses and two projects independent of each other.

Figure 11 is an example where two courses set up a *common* project. This is a way to combine the content of two courses in one project. It can be further developed into a three-course project and so on. However, in such a situation, the organisation is entering the *system/group level*, as previously illustrated in Figure 2.
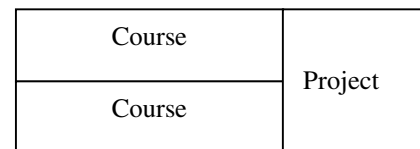

Figure 11: The project across two courses.

This situation calls for collaboration between the teachers of the courses and the project. First, they must agree on a common project in order to make it work for the involved courses; and then they need to work on how to conduct the examination and how to evaluate the process. A *collaborative* culture is in the process of being created.

The situation in Figure 12 illustrates how three courses form the theoretical background for a project *separated* from the courses. In this way, the project can be defined more freely and leave room for students to follow their interests independent of the courses, but still utilising the theory given in the courses. However, it is still a course-directed project. In the curriculum, nothing significant has necessarily changed so far. There have simply been changes within the traditional curriculum. However, the culture is changing further as the collaboration between teachers' increases.

Figure 13 serves to illustrate how far it is possible to attain the *system/group level*. It is still a course-centred project, but the courses are now interrelating through the project. The examination is still on the basis of the course content, even though the project is most likely examined separately from the courses.
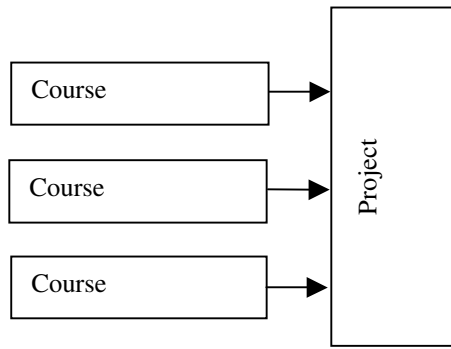
Figure 12: The project is separated from the courses even though it is still related.
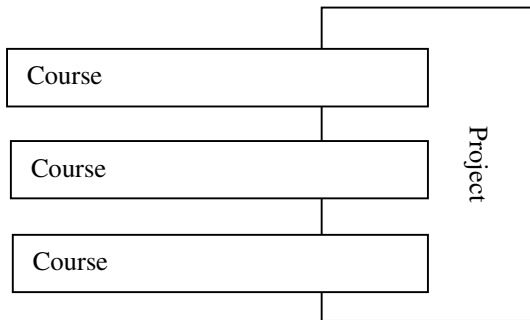

Figure 13: A project where the courses interrelate through the project.

However, it is important to avoid a double examination of the content. Problems with examinations are covered at the end of this article.

A revision of institutional thinking is needed if a full implementation of POPBL and the *philosophy of PBL* are to be implemented. Institutions need to make a change in their culture regarding how to develop curricula, how to focus on student-centred learning, and how to match the examinations/ assessments with a new teaching and learning philosophy.

The situation illustrated in Figure 14 can be used to clarify the further change at the institutional level. A way of change is in the curriculum rethinking process to prioritise the project and later choose the courses that will facilitate the learning objectives and student performance. Notably, this is the *focus point* in the *cultural change process* in the organisation.
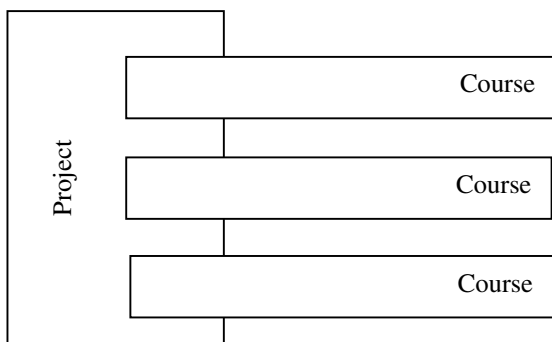

Figure 14: The project is the focus and the courses have a project supporting function.

Figure 14 amply illustrates the cultural change towards having the project at the centre of the learning environment. A definite

commitment to POPBL is needed here. The project is decided upon *before* the determination of what courses should – or can – support it. This *change* in the *planning approach* is *significant*! It is a change in the normal way of educational thinking, as the focus is now on the project and not on the courses. The courses are not the direct central issues in the planning.

The step of *liberating the project from the courses* is the *most difficult change process* in curriculum redesign or the educational paradigm change. This is one way to identify if organisations have moved from the *system/group level* to the *institutional level*. It is a mental change for executives, academic directors, teachers and supporting staff. Many institutions never manage to make this change. In some cases, perhaps, institutions do not reach this point because the teachers lack proper training or have insufficient experience to support an organisational change into the institutional level.

Figure 15 ends this line of illustrations. The thick frame illustrates the theme under which a project is developed and the project supporting courses interrelate. This is a typical *institutional level* final situation.
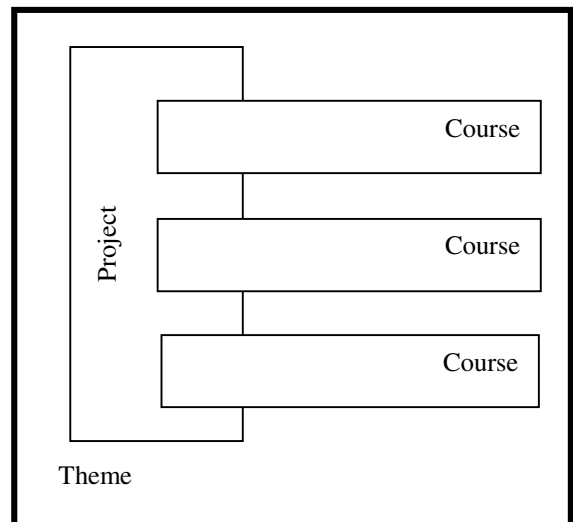

Figure 15: The project and the courses are under a common theme (illustrated by the thick frame) and the three elements are within the same objectives or goals.

In *The Aalborg Experiment*, Kjersdam and Enemark affirm the following:

> In order to provide for the use of project work as a basic educational element the curriculum has to be organized in general subjects or themes, *normally covering a semester. The themes chosen in a programme must be generalized in such a way that the combination of themes will meet the aim and constitute the professional profile of the institution* [9].

As an example, the themes for undergraduate studies in Civil Engineering, with a specialisation in a BSc in Civil Engineering, are listed below:

- 1st Semester: *Reality and its Models*;
- 2nd Semester: *The Model's Reality*;

- 3rd Semester: *Construction in Rural Areas* (this theme could just as well have targeted urban or even highly industrialised areas).
- 4th Semester: *The Building and its Surroundings*;
- 5th Semester: *The Building and its Elements*;
- 6th Semester. *Design and Construction of Buildings.*

There is a wide entrance defined by the theme for the first semesters and, as the students progress to higher semesters, the theme narrows more and more, going from the overall and contextual content entry to more specific technical content.

In the first semesters, the focus is very much on the transition from pupil to student, and on general and transferable skills. From the 3rd to the 6th semesters, the focus is more on the technical content, as many of the basic personal skills have been developed. The student could then make his/her diploma work in the 7th semester or else continue with a two-year Master's degree with further specialisation from the 7th to 10th semesters. From the 7th to 10th semesters, the wide approach is natural as students participate in solving real problems in their projects. The contents of the first-year studies are described in detailed elsewhere [8].

To support the line of thinking presented in this article, the author would like to add this *real life story*:

At the Instituto Tecnologico Y de Estudios Superiores de Monterrey - *Tec de Monterrey* (ITESM) campus in Hermosillo, Mexico, the Department of Industrial Engineering undertook a project under the problem *Can Recycled Polystyrene be Utilised as a Building Material?* This was conducted by the Dean at the Hermosillo campus, Prof. Román M. Moreno. The problem is interesting as it is a genuine problem, yet very open in its approach. As such, it is a genuine problem-based project. The problem is real and a possible solution could potentially be commercialised.

The first time the ITESM ran the project, it was designed like the model in shown in Figure 9 and students were limited to the course content and the utilisation of the subjects taught. The next time, the project was designed more like that shown in Figure 12, with one course as a supporting course only. The results were remarkable. Since the project was made free of the courses, the students began to work more freely as they had to define the project themselves and their ideas and solutions were not dictated by the teachers and the subjects of the course.

During their work, students came up with completely new ideas and ways to solve the problem with new ways to tackle the problem and new non-traditional answers. Among the different solutions, one was unique and was later commercialised. The Dean of the campus was very pleased with the result and, as he expressed it, *They came up with solutions that I as a teacher would never have come up with myself! The students' learning was way beyond that of a traditional taught education*.

The author believes that this example is similar with the line of thinking illustrated in the above figures, and explains very well the benefits of having a *free* project, as it does not limit the students' performance. They worked very much as professionals do in the *real* world.

PROBLEMS WITH EXAMINATIONS

Finally, a word on examination: in some countries, it is not possible to make an examination based entirely on a project and its supporting courses as it is being performed at Aalborg University. However, this should not create a barrier to using the described approach for a new educational model. Figure 16 shows a model that the author has developed for use in his training courses worldwide to illustrate how to overcome this issue without entering into the problems of double examinations and fulfilling local demands.

Figure 16 illustrates the possible ways to separate the courses from the project examination-wise, while also avoiding a situation where a course is examined twice. If there is a demand for an individual examination of each course, this can be overcome by having examinations for the course itself by focusing on the *strictly theoretical issues*.
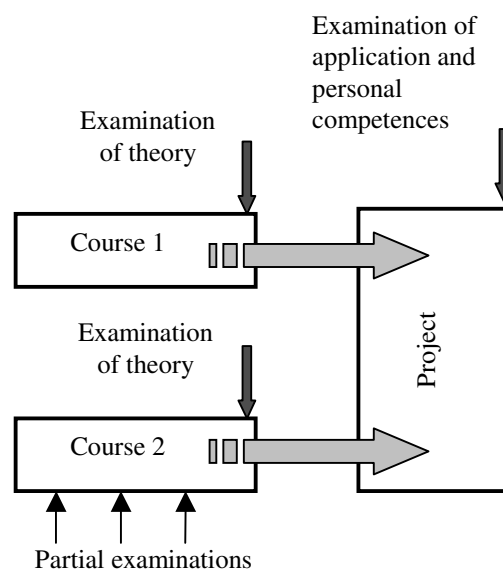

Figure 16: Examination of courses and project by focusing on the theories in the course examinations and on the applications and personal skills and competences developed in the project work.

Notably, this can be extended if there is a demand for partial examinations during the course as well, which would also avoid any interference with the project examination. The examination of the project can then be focused on the *application* of the theories given in the courses and on the personal *competences and abilities* developed through the project; this may also be cultivated by writing a project report as well as drafting a reflection document to demonstrate the personal learning outcomes for the student. If there is a demand for stating the progress in the project, the reflection document is an excellent tool to measure the student's *progress and performance in the project*.

The examination through the projects would be in addition to the above mentioned method, and would offer an excellent approach to continuously survey the curriculum's sustainability. It would also provide the institution with signals on the relevance of the course for students, as well as for industry and society. If students gather more information from the Internet, journals, experts, etc, than from the courses taught, then a redesign may well be appropriate.

DISCUSSION

This article is very much based on the personal experiences developed through the author's position as Director of Studies for first year students at Aalborg University and by experiences gained when conducting workshops on POPBL and on planning for implementing a new educational model at universities in a number of countries and in different cultural settings (eg see ref. [11]).

These experiences have been used to improve the workshops towards a more clear and logical structured presentation of the complexity in making organisational and educational change, and how to make a change process work by the hands-on training of executives, academic directors and teachers in the complete setting in which the change should appear.

In this article, the author has sought to summarise these experiences and make it public for institutions and persons interested in the *practical* aspects of a change process for a new educational model.

FINAL REMARKS

An article like this is not intended to make any strict conclusion, as it is an article that is more focused on the practical aspects in a complex process. However, since the aspects written here are based on experiences from international and national activities and on actually tested models, the author concludes that the models presented can be a practical approach to initiate and implement a change process that has a chance for success.

Nevertheless, as mentioned in the article, this cannot stand alone. Rather, it must be based on a well-structured plan on how to train all levels of the institution so that it can inspire the organisation's members and lead to a successful change process through an accepted plan.

It is the author's hope, that this article can support strategic reflections and the analyses that institutions initiate to evaluate new educational approaches that will be beneficial and worthwhile for the institution and for the future professionals educated by it.

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