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# Dealing with Insecurity in Problem Oriented Learning Approaches - The Importance of Problem Formulation

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## ABSTRACT

*Introduction of a pedagogical concept, Kubus, in a problem oriented learning context – analysed within the framework of an activity system – indicates what might happen when offering tools tempting to influence and regulate students' learning approach and hereby neglecting the importance of existing habits and values. Introduction of this new approach challenges existing "truisms ". It implies a reconsideration of the role of insecurity and how it is connected to questioning the given thus supporting development of new knowledge. However, dealing with insecurity seems to be a neglected area within a problem oriented learning approach.*

## INTRODUCTION

Knowledge creation, invention and the ability to handle risk are often linked to entrepreneurial and innovative pedagogy and the concept *of transformative learning* (Engeström & Sannino, 2010). Besides learning about a subject, students in general are expected to develop competences such as the ability to collaborate, share knowledge, be focused, committed, innovative, creative etc. when the intention is to transform students into self-directed and active *knowledge creators as well as problem solvers* (Lund 2017). Problem oriented learning in complex situations is highly dependent on knowledge sharing and problem framing. In self-directed group work, students ideally negotiate, discuss and challenge each other's framing of the research question. Students' handling of this situation is

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consequently important. Students are expected to be persistent and stay in this insecure process in order to develop their ability to judge the usefulness of ideas and knowledge, by investigating and arguing. Hence students are exposed to complexity and insecurity. We argue that dealing with insecurity is a fundamental aspect of students' potential for learning and development of innovative and creative skills. Consequently, pedagogical framing of this is important. We regard this a neglected pedagogical challenge within a problem oriented learning approach. Based on this we raise the question:

"How to deal with insecurity in problem oriented learning approaches?"

We address this question within the framework of problem based group organised learning setting at Aalborg University and we are inspired by Knud Illeris' concept of problem orientation and student direction (Illeris 1974, 2015). Illeris, a former professor of Lifelong Learning, played a significant role in formulating the pedagogical foundation of a problem oriented learning approach in Denmark. This implies that the problem students are dealing with is formulated by the students, and is perceived to be essential to all participants in the group. In this educational setting we introduced another problem oriented learning concept, Kubus, developed by H. Herlau and H. Tetzschner aiming at training self-directed innovative teams. Kubus is based on the assumption, that groups will have certain knowledge as well as uncertainty and ignorance to deal with, and offers tools to handle these challenges in order to build an "artificial innovation climate" (Herlau and Tetzschner, 2006 a). The intention is to train students to manage innovation in groups in a very instable situation where neither the problem nor the needed information or knowledge is present.

The article is based on the meeting between these different pedagogical approaches in order to discuss the outcome when students (and educators) within a problem oriented learning environment are expected to adapt to a new tool aimed at supporting students' problem finding process.

In the article we will present the general principles of the problem oriented learning approach and the principles of the Kubus approach. These approaches are then analysed by means of Activity Theory (Engeström 1997, 2009) to highlight how they influence the way students are expected to deal with insecurity. We will then briefly account for our students' attitude when introduced to this tool and discuss the learning perspectives.

## THE LEARNING CONTEXT – PROBLEM ORIENTED LEARNING

Learning occurs in a social and cultural context and this necessarily influences what and how people learn. Consequently, we must be sensitive to the learning context we offer students and how changes in the setting may influence students' learning.

There exist a number of forms of problem-based learning, and the concept in our context, problem oriented learning, is not to be confused with forms of problem solving learning (see e.g. de Graff & Kolmos (2003) for a typology). Problem-based learning (PBL) is based in an experimental learning tradition that has grown in breadth and depth across the world since the 1970. Maggi Savin–Baden (Savin-Baden, 2000) addresses PBL by its origin in McMaster University in Canada where Barrows designed a medical school curriculum based solely on small group, student-centred learning. The rationale for problem-based learning stemmed from years of observing experts engaged in clinical reasoning. Savin-Baden refers to four key reasons for the use of problem based learning (originally suggested by Barrows and Tamblyn 1980): to develop student's reasoning skills; to create a learning context which is relevant to the students, to ensure that learning is attuned to the world of work; to promote students' self-directed learning abilities, that is, learning that fosters independent enquiry (Ibid p. 15). The curricular content is based on problem scenarios rather than subjects or disciplines. Students work in groups to solve or manage problems, they are expected to engage with the complex situation, examine the gaps in their own knowledge and skills, and decide what information they need to learn, and what skills they need to gain to resolve or manage the situation effectively (Ibid). Savin-Baden stresses:

"Problem-based learning can help students *to learn with complexity*, to see that there are no straightforward answers to problem scenarios, but that learning and life takes place in contexts, contexts which affect the kinds of solutions that are available and possible"(Ibid p.5)

Health and medicine has a strong underlying disciplinary base, which is not the case in all disciplines, which means there is a more open space for both defining and solving problems. The learning context in the present case is a problem based learning environment at Aalborg University, and its tradition and origin is different from the approaches above primarily due to the role of the problem formulation. Students are required to formulate their own problem, and we regard this as an important difference. It is then important that students are open to different concepts and understandings, but also challenge those in order to progress.

A pedagogical challenge to problem oriented project work is to balance between accommodative and assimilative learning processes bearing in mind, that motivation through disturbance and conflicts of different kinds often is the starting point of significant learning processes: "There is a sense in which learning occurs whenever harmony between us and our world has been broken, so that the relationship between our present understanding and our experience of the 'now' needs to be established, or re-established. In other words, learning begins when we recognise that we are in a state of ignorance but a great deal of our everyday learning occurs at such times as the disjuncture is so slight that we barely notice it" (Jarvis, 2012, p.12)

Disjuncture may lead to fruitful wondering and questioning that enhances learning. This process may lead to transformative and accommodative learning processes activated when the individual meets situations, which challenge existing mental structures and patterns. This may led to changing of ideas or knowledge as this requires the learner to reshape concepts, referred to as *accommodative* and *transformative reconstruction*s. These processes can be more or less offensive or defensive, as impulses that are at odds with existing structures may be treated like *assimilation* of knowledge, which occurs when new ideas must "fit" into what is already known, and hereby prevent accommodation processes leading to defence mechanisms, as a response to the insecure situation.

Emotional interaction processes as responses to formative learning processes may then be regarded as a challenge to students' collaboration and knowledge sharing, as radical reconstruction of the individual's comprehension of certain sets of condition in a context may be a corresponding radical shift in emotional patterns (Illeris, 2007, p.83). Learning in project groups means dealing with own as well as other students' responses to the learning process. This opens for conflicts and may appeal to both emotions and to insight and understanding. (Illeris, 2007, p.93). In project groups students are dealing with a high degree of uncertainty. Consequently, the students' responses and dealing with this situation will influence the learning outcome of the project work, as transformative learning is linked to the creative dimension of a problem oriented learning approach, being open to challenges and dealing with insecurity.

### *Outline of the General PBL Structure*

The PBL pedagogy practiced at Aalborg University is based on the research and theoretical work of, among others, Illeris (Illeris 1974, 1981), Hultengren (1976, 1979) and Negt (1975) and has over the years been further developed following research in the university's practices and due to influence from other PBL institutions (Krogh & Jensen 2013). However, the general structure still follows the outline described in Illeris' work, which we present below. Each semester (5 months) typically follows a structure consisting of 5 phases (Illeris, 2015):

1. *Introduction and group formation*, including clarification of practical rules and conditions, introduction and readings related to the subject area in question. This includes group formation (optimal size is 3-5 members) and choice of relevant, exemplary project theme.

2. *Problem formulation and practical planning*. This phase is considered very important, and the part of project work we take a particular interest in. Students' problem formulation should be experienced as relevant for the individual student in order to ensure involvement, and it is the phase where the group must reach an understanding of an experienced problem, and a subject for negotiation (Illeris, 1974).

"In this phase the specific problems of the project must be formulated precisely – a process that will also uncover a lot of biases and differences in the project group, forcing the group to make a series of fundamental decisions. Problem formulation is a very significant issue in the project method, and it is important that both students and supervisors pay the utmost attention to all details in the formulation so that the formulation can function as a common statement of what precisely the group has agreed on. It must be emphasized that this is fundamentally different from what has sometimes been called Problem Based Learning, because the problems are chosen and formulated by the students themselves and not by the curriculum, the teacher, or a textbook." (Illeris, 2015 p.48)

Practical planning of time, delegation of tasks, internal and external appointments is of great importance in this phase.

3. *The investigation phase* is the lengthy central phase during which the selected problem area is probed. This includes understanding the subject and to find relevant theory. A high degree of internal coordination and documentation of all agreements, decisions, references, ideas, drafts, etc. is important. Communication between the project group and the supervisor must, according to Illeris : " strike the difficult balance of providing professional guidance without forcing the group to accept his or her own interests or points of view."(Illeris, 2015, p. 48).

4. *The product phase* is usually about writing up the report and learning to outline, coordinate, and produce the report.

5. *External examination*, including assessment and individual grading. The examination is based on the report and not a randomly chosen topic from the curriculum, usually as a group examination with individual grading.

During a project period students are dealing with insecurity at different levels. Firstly, about who they are going to collaborate with and on what. This kind of insecurity is related to social skills: 'am I the kind of person anyone wants to have as a group member?' The selection process of group formation introduces some psychological insecurity as students know they are dependent on their group members and know that all are expected to become member of a group. This means that reputation is important. When settled in a group students are facing another kind or insecurity related to academic knowledge building, namely formulating an appropriate and relevant research question (problem formulation), which it is feasible to investigate within the time frame given.

***The Problem Formulation in a Learning Perspective***

Illeris states that transformative learning may take place at any time during the course of the project:

"But experience shows that the possibility of transformative learning is concentrated in connection *with problem formulation* (our emphasis), internal evaluation during the investigation phase, and the final internal evaluation and post-evaluation. This, of course, has to do with the fact that these phases include important considerations and decisions, as well as the possibility of internal disagreement, compromises, and other elements in which the individual's role in and contribution to the project are challenged." (Illeris, 2015, p. 49)

The learning potential of this phase, according to Illeris, is related to its embedded challenges. In order to learn students move from not-knowing (enough) to knowing (enough), and during this process they try out different methods and strategies in order to make sure that they know enough to formulate an (academic) relevant research question. The insecurity is linked to the fact that they primarily work with ill-defined problems. This means that the problems have no clear initial state, so the nature of the solution is not predictable or convergent. Insecurity is here related to their subject oriented lack of knowledge i.e. they do not know a priori how to understand, describe and problematize the phenomenon. This kind of insecurity should not be confused with feelings of personal insecurity in a psychological sense, but is related to the emotional aspect of learning and acts as a driving force of the learning processes. Defining the problem might require knowledge of different subject areas and theories, which mean that students are dealing with a high degree of complexity which should gradually be reduced by means of the problem formulation as well as feedback from their supervisor. Students are creating knowledge through working with the problem during all phases and the research problem may take different forms though the learning process.

The problem formulation is supposed to guide and focus their research of the problem, but must also be sufficiently dynamic as it part of a circular process: more knowledge may entail adjustments in the problem formulation. During this process students are expected to be involved in the knowledge creation process of group members, and they may be constantly questioning the relevance and the quality of their common product, so insecurity shows in questioning their current knowledge. This questioning is expected to secure the quality of the product, but it also means questioning the quality of other group members' contribution, which might be an emotional challenge. As each project is new in the sense no one has created a similar project before, no one can guarantee that the learning process will succeed in a project, which can pass examination. Furthermore, students may choose to explore a problem, which is new to their supervisors. In this sense they create a real situation of insecurity, as the outcome may be unpredictable (Lund, 2015; Lund & Jensen, 2013). Dealing with insecurity is consequently an important part of the process.

Adding to the insecurity is the fact that students sometimes have conflicting interests in the group when choosing and finding the problem to investigate. They have to make a choice without having the needed information. From a learning perspective this open phase is regarded as being both frustrating and necessary if students are to develop innovative and creative skills. Being able to deal with insecurity is part of an explorative and creative learning process (Darsø, 2001; Kupferberg, 1996; Kupferberg, 2006). Other challenges of the problem formulation are that students experience it as time consuming and resource demanding, and as a consequence may be tempted to end the process too quickly.

We therefore took an interest in ”tools” attempting to support and manage students' time and collaboration. In the Master's program in question the students' subject was learning and change processes within a course dealing with pedagogical innovation. Consequently, we were looking for tools, which would familiarise our students with different ways to foster innovative capability. We therefore introduced a tool named Kubus, in order to deal with both aspects at the same time.

## PRESENTATION OF KUBUS – THE INTRODUCTION OF A 'PRE-JECT' PHASE

The Kubus model has been applied and tested in various settings as a method for training entrepreneurship and designed to frame and support the work of self-directed groups.

The inventors of Kubus regard knowledge production as a practically oriented interactive process. The Kubus model was developed for a business school setting and is based on empirical case studies of how interdisciplinary groups (primarily student groups) work in projects (Herlau & Tetzschner, 2006). Kubus supports, directs and visualizes the working process and knowledge building and sharing within a group in interaction with networks and partners outside the group. Kubus has special concerns for the *problem finding phase* - a dynamic phase of problem identification, problem framing and re-framing. The assumption is that ill-defined problems demand more complex knowledge to frame and to solve. *Problem finding* in complex situations is hence dependent on knowledge sharing and *problem framing.* In self-directed group work students' learning object is to negotiate, discuss and challenge the others' framing of the problems. Herlau and Tetzschner refer to this problem finding phase as a *pre-ject phase.*

The general idea of the *preject* phase is to gather as much information and gain as much knowledge as possible on a subject, a question, a problem, an idea *before* deciding on the action to take, whether it should be to discard that line of work or whether it should be to pursue it further. During the preject phase students work in *a divergent mode*, i.e. by researching an increasingly broader area based on their point of departure; to identify and analyse potential sources of innovation; and to build a solid foundation of knowledge. The

preject phase is terminated when the group, who ideally is a cross disciplinary team, identifies such sources. After that they enter into the goal directed and goal fulfilling *pro-ject* phase, using known methods for project management. The Kubus method is defined as a management method designed for use during the pre-ject phase.

Throughout the problem finding process – the preject phase - the students are in contact with a company/others involved through a database called the Template . This allows the company to follow the process and to comment on it. Students must try to solve a problem defined by the student group itself through a careful investigation of the company's "surroundings" and inner resources. This is carried out in a structured way by means of a model for collaboration and information gathering.

A vital part of the concept is the database: KUBUS Template, which is specifically developed to manage entrepreneurship understood as innovation processes. Ideally students' object is to learn to cooperate, to network, to collect knowledge about problems, and to find viable solutions. Using the database involves collecting and structuring knowledge about who will be able to solve the problems – within as well as outside the group. During the process of analysis the students communicate with different parts (employees) of the company to access their tacit knowledge. The idea is that the students are trained to use their academic knowledge and transform it to a new and useful practice trough action learning in dealing with "real" problems.

A Kubus-group has a task related to external interaction involving development of network (finding key people, partners, and specialists, social and business contacts) and transform results to external data (from the market, competitors, customers, libraries, internet, databanks) and to share these with their peers. By following (embedded) rules for sorting the different data different sources of knowledge become visible to all members of the group. The template keeps track of all internal and external communication, and must continually be updated in order to visualise who is doing what, what has already been done, and who is communicating with who in order *to share and visualise the task and its progression*. Distribution of assignments and their completion thus becomes transparent. All data must be coded abiding certain rules according to the content of the conversation and divided into the 6 different areas (hence the name 'Kubus'): reflections of the team, external data, network, documented knowledge, project resources, and open questions. In this way all data can be quantified afterwards.

Kubus encompasses several formats of application, like meeting agenda as well as two different types of minutes from the meetings, which prescribe the meeting forms and agenda. The group has two kinds of leadership, which all group members are supposed to take: Red leader takes care of network, project resources, and knowledge distribution. Green leader keeps track of what needs to be investigated, access to external data and group climate. Green

leader is supposed to handle the situation related to "not knowing" by addressing open wh-questions and hereby gaining knowledge. Green leader then focuses on the internal knowledge, as Green leader is supposed to find the most rewarding suggestions for knowledge gathering in order to facilitate Red leader's strategic function. The group searches for the lacking knowledge and Red leader must ensure reasonable management of time and resources while following the group's strategy. The group itself is to be managed through the group's social codex and the internal management function. The Kubus Template hereby visualises the complex management of a group, when being in constant interaction with external partners (network and external data), contributing to data and knowledge as well as the resources of the group, meaning how many assignments are to be fulfilled compared to the actual resources in the group.

In this way the group is explicit about group culture and otherwise implicit rules for behaviour and creates rules to access the community. This codex combined with the clear distribution of leadership roles means that there is a basis for performing transparent leadership. As all the members of the group will, at some point, be Red and Green Leader they get to understand the role of the decision maker as well as the role of the person in charge of the group climate, and they ideally understand the necessity of being or becoming 'leadable', i.e. accepting the decisions of the group and the leader and contributing to the group's work. These rules are expected to be followed and to affect the students' division of labour, with consequences for the outcome. The Kubus tools hereby deliberately intend to build an activity system by creating new rules and objects, with consequences for the community – Kubus aims at influencing the students' interaction by division of labour and operation by being concerned with the pre-ject phase – and naming this process in order to separate it from the pro-ject phase.

***To summarize:***

The purpose of using the model is not primarily to create radical innovations but to create knowledge potential and knowledge depth, which may be the basis of future innovation. Communication and knowledge building appear as central concepts and there is a strong emphasis on transparency of group processes through documentation and articulation.

## COMPARISON OF THE TWO PEDAGOGICAL APPROACHES

The main difference between the two problem oriented learning approaches is how they consider the importance of problem formulation as well as the role of the supervisor. In the problem oriented pedagogy the supervisor plays an important role, whereas the Kubus model intends to create autonomous groups.

Both the problem oriented learning concept and the Kubus concept are concerned with the knowledge creation process. Both recognise the managerial aspects of group work and the process of "not-knowing", but the managerial aspects are "hidden" or tacit knowledge in PBL. Both concepts recognise knowledge transformation as challenging, especially, in the early stage when the group is left with very vague ideas about the problem they want to address. The problem-oriented pedagogy describes the ideal elements of this process, but does not support it with specific tools and thus leaves this (relatively) frustrating process for the students to handle. Though it might be regarded as educational from the perspective of transformative learning, the general view is that group conflicts should be avoided, and it is a general view among our students, that they find group conflicts and disagreements unpleasant, time and energy consuming.

Kubus aims at avoiding this problem by an enforced focus on management and creation of a structure which makes the students independent of guidance and makes all processes transparent when it comes to group management, the students' handling of knowledge, the idea development and students' work and work ethics. Kubus hereby creates a structure to minimise conflicts and create a foundation for efficient teamwork preparing the students to enter the project phase – a goal directed and solution oriented process.

Kubus intends to create and frame students' ability to recognise the phase of insecurity by naming the process – the pre-ject phase – and claims that it needs special management, since the process is characterized by being non-linear, divergent and process driven. The assumption is that it is very challenging to collaborate without a defined problem to solve. Consequently students tend to avoid this situation by rushing into the problem solving phase too early and define the problem without being fully aware of the "the missing knowledge". Kubus draws attention to the dynamics and reiterative process of generating ideas as part of problem finding.

## DIFFERENT ACTIVITY SYSTEMS

We analyze the Kubus tools with inspiration from an activity theory perspective, which claims that teaching and learning are activities that are socially situated and influenced by the culture and the community of its context. From this perspective, tools - including mental models - mediate the learners' actions. Our intention is to analyze and compare in which ways the students' use of Kubus mediates their learning activities and whether it influences/reduces uncertainty.

Activity theory is founded in the cultural-historical school/tradition. It builds on the basic assumption that human action is a combination of intellectual and manual activity. Relations between human beings and between the individual human being and its surrounding world is

established and further developed through the activities in which the individual takes part. The practical and productive interaction with the surroundings is thus decisive also for the psychological processes. A basic assumption is therefore that learning and development becomes a question of exploiting / making use of the cognitive resources which are embedded in artifacts such as information, procedures and routines. Consequently, in a learning perspective it is important to analyze which mediating effect or influence language and technology have on the learning activity. In this analytical frame dialectics and dynamics are important features. Cognition is not only impacted by "context" but it is also co-constructive of "context" (Otero, 2003). Within this framework we expect the "tool" to influence the students' action.

In an activity theoretical perspective the relation between Subject, Object and Tool/Instrument is considered of crucial importance to learning (development of intellectual and physical competences). The relation between Subject and Object is not immediate and individual – it contains a collective dimension as knowledge, insight, conventions and concepts have been integrated into the Tools, and are something we interact with - and through - when we act. Consequently, persons gain experience based on the mediating tools. The mediation influences our thinking and imagination and is both a product of and influenced by our culture and its intellectual and physical tools.

Center for Activity Theory and Developmental Work Research at Helsinki University in particular has developed models for the analysis of the numerous relations which structure and create sense-making in human activity. We are inspired by Yrjö Engeströms Activity-Theoretical Approach to Developmental research and apply some of his models.

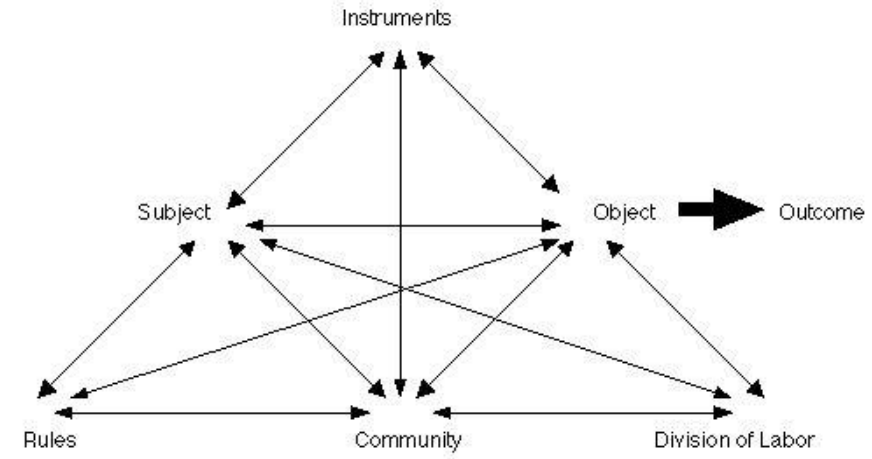


Fig. 1

The basic model consists of Vygotskij's triangle, where the subject-object relation forms the bottom and "tools" are at the top of the triangle and mediate the relation between subject and

object. Leontjev introduced division of labour to his model in order to distinguish between goal oriented actions on the one hand and object-oriented collective systems on the other hand: "*A collective activity can only be carried out by dividing the labour among the members of a community, that is, by assigning different actions to different participants. This requires rules that regulate and sanction exchange and interaction among the participants. The cultural meaning and personal sense of an individual action can only be deciphered by seeing it in the context of the activity it realizes."*(Engeström 2009: 23)

On this foundation Engeström builds his dynamic mediational system. The object creates the dynamic activity in the system, and Engeström (2009) emphazises that activities are open systems that depend on each other, forming various partnerships and networks around partially shared objects. Human activity makes its own context, which is in constant movement, historically and interactionally. Engeström argues it is analytically useful to identify the general anatomy, or inner structures, of a collective activity system, as well as some dynamic of its movement (Engeström, 2009) to analyze the dialectic between object and mediating artifacts in order to understand how tools mediate and change an activity system. Consequently we use this framework to understand what characterize Kubus as well as the conceptual construction of project work, in order to discuss which kinds of activity system they create and to understand how Kubus may change established rules and objectives regarding project work.

### *The Kubus-group as an Activity System*

In the Kubus-group understood as an activity-system the Subject are the students and in this particular case the Object was students' learning to use the tools of the Kubus-model, as they are seen as artifacts containing/embodying knowledge of the processes of innovation and entrepreneurship. The activity of the group is mediated through the tools and techniques of the Kubus-concept, laying down specific Rules regarding group management, collaboration, information-/knowledge-gathering and knowledge-creation. As the Kubus-tools and techniques consist of a number of operations (concrete actions at a micro-level) they deliver clear instructions regarding the Division of Labour within the group, and install group-autonomy through firmly regulated management, work routines and meeting procedures, some built into the Kubus Template. The group makes its own imprint on the Rules by negotiating and drawing up a Social Codex detailing the expected and acceptable norms of behavior of the group.

The Outcome of the activity may be manifold: The Subject, i.e. the students, changes due to the learning activity. They acquire group management competences through the routinization and automatization of the large number of detailed operations inherent in the tools and techniques (e.g. Red/Green leadership, time-management, decision-making, transparency); they acquire skills in gathering, managing and creating knowledge in the insecure pre-ject

phase and hereby acquire skills in being entrepreneurial, which implies risk management. All agreements and actions are recorded, and failure to fulfill agreements becomes visible, and rules for which action to take in such cases are provided by the Kubus-model. Finally the Outcome may be a solution to a real problem in a given context.

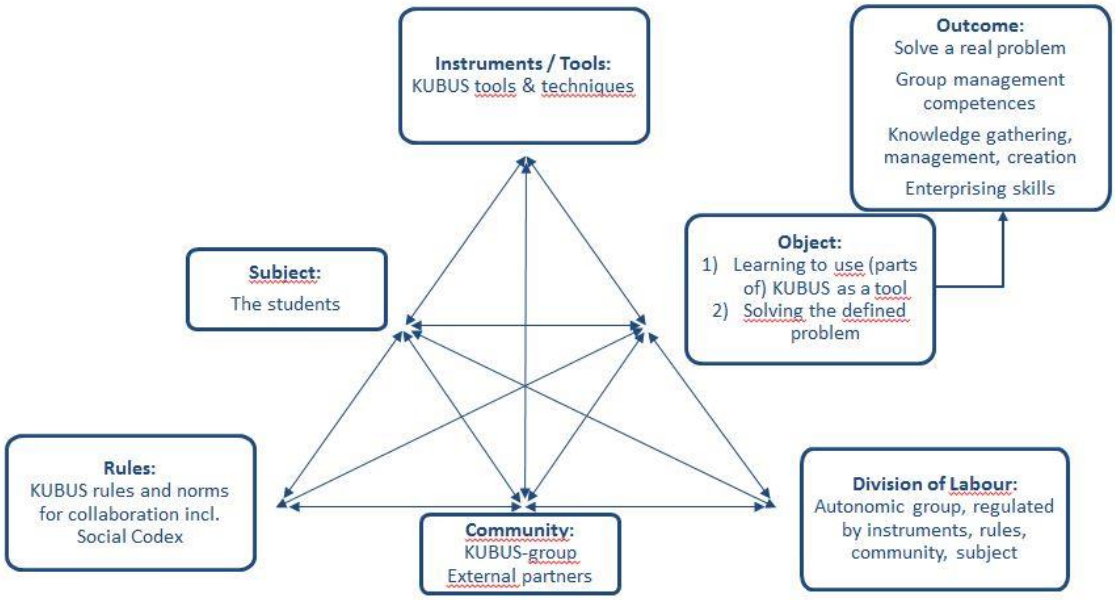


Fig. 2

Kubus reflects a specific understanding of innovation and entrepreneurship in which efficiency is important in order to speed up innovation processes by facilitating the preject phase. Students are taught to deal with insecurity by structuring and formalising collaboration in order to visualise what is already done and what needs to be done.

### *Problem Oriented Project Work in Groups*

The dominating activity system at Aalborg University is Problem Oriented Project Work (which is often referred to as the Aalborg Problem Based Learning model) and this is what the students are familiar with.

Like in a Kubus–group the Subject of the activity is the students, but the Object of the activity is the learning involved in the group's project work, i.e. to gain in-depth knowledge about a specific area selected by the group within the specific knowledge domain determined by the curriculum. The Instruments or Tools for the learning activity are the problem-oriented project-work understood as a particular pedagogical model for learning, which on the one hand is the basis for the Rules regulating the activity, and on the other hand influences and is influenced by the activity and interpretations of the Community. The Community consisting

of the study groups and the supervisors interprets the Rules of the activity, and represents and embodies the local traditions of how to understand, explicate and carry out problem-oriented project work with the roles and tacit knowledge. In this respect the Community will influence the Division of Labour within the project group. The actual Division of Labour within the project-group, however, will be created by the group-members through interaction and negotiation with focus on the object. The group will – in concert with their supervisor – discuss and determine the courses of action regarding the Object of the activity.

The activity regarded as a learning activity should ideally result in two types of outcome: the change of the Subject (the students) as a consequence of the learning processes of being involved in knowledge-gathering, knowledge-management, and knowledge-creation, i.e. 'operations'. Through such concrete actions they will have gained routines in carrying out these procedures. Changes of the Subject will in turn influence the entire activity system. The second type of outcome consists of the products produced (the project report), and a grade expressing the wider activity system's assessment of the activity in relation with the dominating norm: to assess the outcome. Due to this activity system the students define the problem to investigate and their methods through conversation with their supervisor, which implies discussing and negotiating about object, method and division of labour.

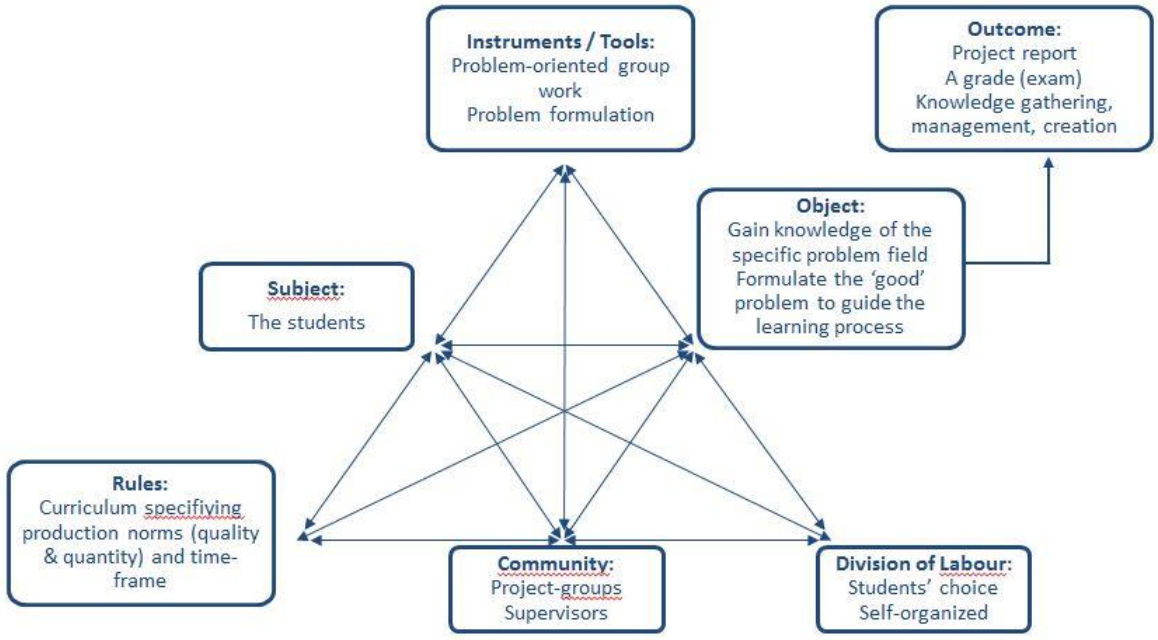


Fig. 3

As described, many options are open in this phase and it may be experienced as a period of uncertainty where only the supervisors may offer some facilitation.

## FINDINGS AND PERSPECTIVES FROM THE IMPLEMENTATION OF KUBUS

We introduced three cohorts of students at the Master's programme in "Learning and Innovative Change" to Kubus to support the initial phase of their project work. Students in this programme study innovation and were at the same time objects of pedagogical innovation through this experiment. Kubus in a light version was introduced in the "preject phase" of the project, i.e. the problem formulation phase, but we underestimated the significance of the problem formulation aspect, and the fact that this aspect is not part of Kubus. It was introduced by means of literature studies and presentations of the concept and with the (naïve) expectation that the students would welcome this intervention and renewal of the problem oriented learning concept. But we learned that our students responded differently to changes in their learning environment.

Some groups devoted their time and effort to learning to use the Kubus tools and techniques, and they were generally positive regarding the usefulness of the method referring to the challenging emotional aspects of the learning process in project work:

> *"I have some times felt that it has been a little difficult out here, what with groups and so on, also because it is very touchy-feely. You can't really say what you mean, because you can't hurt the others' feelings, and in this respect I think that this tool is such a really great tool, because it just lifts that out. There are some people who are a little more afraid of saying something and so on, and are very ill at ease and so on, and this is a very cool tool, because it puts people's minds/brains in play, and what they are capable of, because you don't have use so much energy on thinking about the others and that social stuff. I just think that it has been so great. I also believe that that is the reason why it goes so well. It simply functions so well because it is feeding off our ideas and our creativity."*

In this case the feelings of insecurity seems to have been reduced due to the Kubus tools with a positive outcome regarding idea generation.

However, Kubus was in general experienced as a complex and time-consuming concept to understand and to apply. Few groups tried sufficiently to acquire the tools, because they considered it too complicated and it was disturbing their primary object, i.e. to find and solve a self-defined problem, which they focused on. Having to deal with the complexity of the new tools introduced an extra dimension of insecurity into the process by breaking students' habits which was not welcomed in all groups, as this demanded the students to reflect on managerial aspects and the roles of the "born" leaders in project groups. Also, the students may have experienced the supervisors' changed role as adding to the insecurity.

However, some students who were generally critical towards the Kubus-experiment at the same time regarded elements of Kubus as beneficial for their PBL work. They therefore decided to be both critical and constructive and change the forthcoming course. These students were offered additional instruction in Kubus to allow them to develop a course for the next cohort to fit into their context by integrating the aspects of Kubus they found beneficial to support their group-work – i.e. the managerial tool for division of labour but without the transparency element of visualizing work-sharing and individual contributions to the project work. The students thus adjusted and integrated elements from the Kubus into the PBL model, which could scaffold the problem formulation phase and thus help dealing with the insecurity of that phase. Simultaneously, they were making sure that this part of the Kubus activity system would not be in conflict with the PBL activity system and its pedagogical values. In this way they added to the potential learning outcome of the processes.

## DISCUSSION

There are distinct differences in the two pedagogical approaches: Kubus is constructed to create an efficient and regulated framework around self-organized groups to speed up knowledge management and future innovations. The intention of the problem oriented learning approach is to stimulate and motivate learning processes and create scientifically competent students, that are able to research and question established knowledge, and who might be innovative as well.

Kubus delivers a set of rules and guidelines to abide by – whereas PBL leaves much up to the group itself to decide. Due to the strong framework surrounding the Kubus-group it is expected to be self-directed and self-sufficient with very little external support in the process. There are no evaluation criteria of the value of the findings and solutions. Quality assurance is embedded in the structure and carried out by following the rules. In contrast, the PBL-group is expected to work independently on negotiating its own framework for collaboration, but with the support of a supervisor. The role of the supervisor is, amongst other things, to ensure the academic level and subject oriented relevance of the learning processes. There may be elements of apprenticeship, which both introduces students to, and maintains, academic habits and culture. Furthermore, the supervisor should support the group in creating an atmosphere where group members may express doubt and uncertainty (Illeris, 2015 p. 49). The supervisor is therefore an important factor for the learning process, not least during the problem formulation phase, as she/he is confronted with all aspects of students' learning process.

The framework offered by Kubus may to a large extent reduce the insecurity of the initial phase, which the groups have to learn to cope with in the PBL-approach. However, from a learning perspective it could be argued that while the reduction of insecurity is desirable, cf. the above quote, learning to deal with insecurity might on the other hand open to important

learning potentials in the form of transformative learning. In Illeris' understanding transformative learning means a change of the learner's identity through personal development, deeper understanding, tolerance and flexibility (Illeris, 2015 p. 50) and is closely related to processes including discussion, disagreement, compromising and decision making (p. 49) and thus not something to avoid. The ideal learning scenario would consequently balance between 'sufficiently' safe environments to promote creativity and 'sufficient' insecurity to promote transformative learning.

The introduction of Kubus in this context illustrates that the value of a tool is related to established habits and traditions, supported by and framed by the activity system. This shows that new knowledge is shaped by the learner's existing knowledge and experience (Dewey, 1910), and consequently frames what students regard as important. Introduction of Kubus meant that the students had to accept a specific, but implicit, understanding of innovation in a pre-ject phase (dealing with not-knowing) and knowledge management (by shared leadership) in order to use it properly. The students accepted to some extent the managerial benefits of Kubus. This shows how knowledge-use is a part of a knowledge re-conceptualization process, and explains why what works in a particular field is not easily translatable to actual practice if transferred from another context, since the knowledge transformation process is complex. New knowledge is formed by prior understanding, and Kubus may not correspond with the students' conception of project work, so they either dismiss it or transform it.

To expect changes in behavior, leading to more efficient educational processes on the basis of implementing Kubus may then sound a bit naïve, but new concepts can offer insight and ideas and new understandings of established practices. The introduction of Kubus might add value by verbalizing the tacit and given managerial process around problem formulation and hereby pointing at the importance of more efficient group structures and collaboration. The introduction of Kubus shows that educators must be aware of how new pedagogical practices are interpreted in the context of the established culture (the community), and welcome the disturbance it might introduce, as it may visualize implicit values in the existing culture.

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