OLE RAVN

5. CO-CREATION IN PBL PROJECT WORK

When searching among research papers using the terms "co-creation" and "higher education" you are very likely to stumble upon insights about the marketisation of education (see for example Fagerstrøm & Ghinea, 2013) or the "value co-creation" generated by integrating students' assessment feedback on teaching in order to develop better teaching approaches (see for example Díaz-Méndez et al., 2012). These marketing and assessment connotations fill the concept of co-creation with debates about the aim of drawing on students' experiences in higher education teaching and sometimes in the sense of treating students as a special type of customer.

The concept of co-creation is about how students and teachers can co-create and produce value together in different ways. But assessment and marketing – however important they may be – are not the only places where educators can co-create with students. Co-creation between students and teachers for learning and knowledge production goes on all the time as a part of the many types of learning settings in higher education.

Here, the idea is to relate the notion of co-creation to the particular situation in higher education teaching and learning where teaching takes the form of supervision of a group of students, who produce a project report over a fairly long period of time. In this scenario, the teaching process by the supervisor and the learning processes of the students are closely entangled in a co-creative process.

It is characteristic of this type of teaching scenario that the content of the teaching is developed continuously during meetings with the students and as a function of the specific problematics students bring into the teaching and learning situation. And the scenario for the students, at the same time, entails that the students' learning processes and knowledge production are shaped and formed in a co-creative process fuelled by their own and the supervisor's contributions.

Such processes can be imagined to occur under many different types of supervision circumstances but in this chapter the setting is limited to the Problem Based Learning (PBL) model where the teacher takes on the role of a supervisor for a small group of students who have the task of writing a problem-oriented project report together.

In the PBL model a project report is the common end product and the processes undertaken in developing this report as a final outcome have many dimensions. For example, one dimension is the complex cooperation and collaboration among students in the project group and the many aspects of planning, negotiation of ideas etc. As indicated above, we shall limit our focus to the meeting points between the group of students and the supervisor.

T. Chemi & L. Krogh (Eds.), Co-Creation in Higher Education, 67–82.

CO-CREATION IN PBL SUPERVISION

The type of learning activity that goes on in a PBL setting is usually referred to as active learning, collaborative learning, peer learning and so on. The PBL model is a rich and complicated model, which has many aspects and includes many different learning spaces. Here the idea is that co-creation of knowledge between teacher and students is a fairly unexplored area related to the PBL environment but that it is in fact one of the most central to understand and explore for a full conceptualisation of the model.

As a first step towards a conceptualisation it should be highlighted that any productive co-creation between supervisor and students entails the active construction by the supervisor of the necessary learning space. The construction of a co-creative space for students and supervisor is very much a task for the supervisor to accomplish. Even the most motivated, skilled, progressive group of PBL students, fully engaged with their project, cannot establish a co-creative space for learning that includes the supervisor and therefore it becomes highly relevant to look at how a supervisor can nurture this type of learning space.

Based on the above reflections, this chapter takes as its problem formulation: how can a supervisor establish a space for a co-creative process with a group of students working on their PBL project?

The answer to the problem will be the development of a vocabulary about a co-creative learning space. The approach to reach this vocabulary will have four steps. To start working on the interaction between the supervisor and the project group, our first step is to elaborate on the concept of PBL as it is used here and the role of the supervisor in this framework. Secondly, a connection is built between the space for co-creative processes and a theoretical framework related to dialogical processes in education. Thirdly, we take a closer look at a typology of supervisor approaches and discuss how they can be related to the notion of a co-creative space. Finally, the goal is to establish a vocabulary about a co-creative space in four dimensions and see how supervisors can address these dimensions for constructing a fruitful co-creative space with their students.

In the second part, we shall discuss the framework developed by Alrø and Skovsmose in their study of dialogical processes in education. They develop a vocabulary about how we can interpret dialogic learning as a space where certain characteristics of the dialogue between teacher and student are highlighted as the most important. Their work builds, among other things, on the ideas of Paulo Freire's dialogical pedagogy and the language theoretical ideas of speech acts. By choosing this perspective we gain an insight into the type of dialogue needed for dialogic-based learning to build upon in establishing a vocabulary about supervision in a PBL setting.

In the third part, development of different types of supervisor roles is discussed. This will produce another set of highly focused PBL supervision concepts to later build upon. This part will be inspired by Olsen and Pedersen (2015) and their profiles of archetypical supervisors and supervisor approaches in a PBL setting.

Finally, these theoretical inputs will be used to develop a vocabulary on how supervisors can be successful in producing co-creative processes with students in the PBL setting.

PBL – Problem Based Learning

The PBL framework in higher education is a well-established practice in many universities around the world but it comes in all shapes and sizes. The version of the PBL model discussed here will be inspired by the Danish tradition, as it has been practised in the universities in Aalborg and Roskilde since their start-up in the early 1970s.

In this model, some key elements can be considered the basic principles – the projects are student-driven, students work in teams, projects are ideally interdisciplinary in character, project periods are several months long and often a full semester.

For a deeper insight into these principles I will refer to the work of Illeris (1974) and for some discussions on the model today, to Andersen and Heilesen (2015) and Kolmos et al. (2007). See also the official PBL principles of Aalborg University (2015) as an example of an institutional PBL setup or the explanation of the model in the specific disciplinary setting of mathematics in Vital et al. (1995).

Here, to set the scene, let me just give some short interpretations of some of the above principles. Students work in teams of anything from 2 to 8 participants depending on the field of study but the average group has 3 to 5 members in it. Students usually have a lot of course activities at the beginning of the semester and then a "free" schedule for working intensively on their PBL project for the final few months of the semester.

Students working in the PBL model are in control of the project, in the sense that they themselves choose the topic to work on and in principle they have the final say in any matter concerning the direction of the project. The supervisor has the role of supporting the project groups' working and learning processes towards a fully developed project report.

The project report's central elements are (1) the development of a problem formulation within a chosen theme which the group finds interesting to explore, (2) the development of an approach to work scientifically with this clearly formulated problem, and (3) the work on the problem through the developed approach to establish an answer to the problem formulation. Together, these elements typically end up in written form to comprise the project report, which could be anything from 30–100 pages long, depending on the number of students in the group and the requirements of the study programme.

However, the project report is only the end product of a complex process where students and supervisor have normally had many, many discussions about the theme, the problem formulation, the scientific approach and methods, the conclusions, the use of theory and the way to handle empirical data and so on.

In the PBL model considered here, the interest is in these processes and how a framework can be built that optimises and furthers a co-creative process between the group of students and the supervisor.

Supervision in PBL

In the framework of this chapter the educational programme's coordinators choose a supervisor for a specific group of students. Supervisors might supervise many groups in each semester and their possible workload for one particular group of students might be something like 5 well-prepared meetings over a period of a few months.

At first this might not seem to be a lot of contact between group and supervisor, but in practice these meetings are highly condensed and normally well-prepared, often with a clear focus and points of discussion related to working papers and issues the students can see they need to address as the next problematic things. Frequently, the supervisor has read many pages of materials and part of the meeting time with the group will comprise discussions about these materials and how to develop them or go beyond them and make a change of direction.

The meetings often take an hour, or one and a half hours, of intense discussion and debate and this is really the stage for the main co-creative processes going on in PBL supervision. The supervisor can take on different types of roles in these encounters, as we shall explore later, but here it will suffice to say that the different stages of the project process and the different types of content of the focus in the meetings obviously greatly influence which type of role the supervisor will adopt in the co-operation with the group.

Above, we divided the process of constructing the project into three elements – developing a problem, developing a scientific approach and the work with this approach. These different elements call for slightly different supervision approaches. The formulation of the problem can be a troublesome affair with many proposals and questions in the melting pot and is often accompanied by quite a lot of frustration from students who just like to get on with a clear-cut task. However, the idea, in a PBL setting, is precisely that this type of difficult and frustrating period is a rich source for learning processes and the supervisor will need to know this and act accordingly. This period calls for patience in the co-operation and the supervisor can focus on helping out with suggestions for improving provisional problem formulations or explaining procedures for researching deeper into the broader theme to find the right problem to work on.

In the later phases of the project, the working papers discussed in meetings could be about techniques of doing interviews or experiments, or about the presentation of a specific theoretical framework and so on, where the supervisor has a completely different role as an expert in the field or an expert in how to work scientifically in this or that respect.

This way, the type of content of the discussions and the stage in the project process clearly influences the character of the meetings between supervisor and group. We can begin to think of several types of co-creative spaces between students and supervisor.

DIALOGUE IN THE CO-CREATIVE SPACE

In the following pages, we set out to develop some ideas on the importance of dialogue for constructing a co-creative space in a PBL supervision setting. As indicated, we will discuss the work of Helle Alrø and Ole Skovsmose and their concept of dialogic learning in collaborative investigation. Their approach is among other things inspired by Paulo Freire's dialogical pedagogy and the project of challenging the "banking" model of learning with processes of dialogue in learning.

Alrø and Skovsmose presented the idea of dialogue and learning in the field of mathematics education. In their book *Dialogue and learning in mathematics education: intention, reflection, critique* (2002) they outlined their "inquiry co-operation model" which was developed on the basis of theoretical perspectives about dialogue and empirical work with mathematics pupils in a dialogue-based classroom setting. Below, we consider their later reflections on the key issues at stake in conceptualising dialogic learning.

Dialogue as a pedagogical approach is presented as resting on three key elements. First of all, it is an inquiry process; secondly it entails taking risks, and thirdly, equality must be maintained in the dialogue. Let us address these three points and relate them to the higher education PBL setting.

Dialogue as a process of inquiry emphasises that the learning process is about acquiring knowledge in a new terrain and building on the existing resources that can be related to the particular problem formulation of the project and the sub tasks at hand.

> We understand dialogue as part of an *inquiry process*, its aim being to obtain new insights. During this process, those involved act towards each other and the subject matter with curiosity, wonder and reflective pondering. Dialogue in this sense is different from instruction, order, and persuasion. Dialogue implies a willingness to question one's understandings and pre-understandings and to examine what is new and different but also what is considered knowledge already acquired. Entering into a dialogue means taking ownership of the process of investigation. (Alrø & Skovsmose, 2004, pp. 40–41)

This focus on the inquiry process in dialogic learning resonates well with the ideas of PBL where students need to develop their own research problem to work on. This in itself demands curiosity and the willingness from both students and supervisor to seek out new knowledge and new understandings using what might be a new approach or perspective on the specific topic worked on.

And for the supervisor entering the dialogue, it means taking ownership in the process of investigation. The students clearly maintain the ownership of the project and whatever outcome the process will lead to but, by entering the dialogue, the supervisor connects to the investigation process and thereby engages in the project, taking on a shared responsibility for the project process to become a success.

Going into a dialogical process with a group of students is, however, for supervisors by no means an easy task. It entails supervisors putting themselves at risk by going into explorations of knowledge in areas where they are not the obvious expert. And, on the other side, it can be quite challenging for students, too, as entering into dialogue is also about a loss of control.

> A dialogue *includes risk-taking* in terms of unpredictability. When entering a dialogue you may touch issues that are delicate or unforeseen; there is a risk of losing control or steering into a dead end. But at the same time, it is possible to address one's tacit knowledge or to come to see things in new and different ways. It is possible to learn! (Alrø & Skovsmose, 2004, p. 41)

The unpredictable nature of the course of a PBL project is a well-known feature of PBL settings in the literature (Olsen & Pedersen, 2015). It is actually a prerequisite for establishing the kind of learning environment that is truly problem-oriented and where the driver of learning is the focused endeavour towards an answer to the problem formulation, even though this might lead into different kinds of fields of science, demand the development of a new situated knowledge that has not been discussed directly in research literature and so on. This way, dialogic learning is unpredictable and in the PBL setting it can lead to a lack of control for supervisors in the sense that the project drifts away from the areas of their specialisation or specific expertise. In the case of interdisciplinary projects the content may even be far beyond the point where the supervisor has a privileged position, for example, as being the "knower" about the ups and downs in a specific type of experiment or in the use of a certain type of statistics.

It could be tempting to propose that the supervisor should or could just regain authority and demand the project go in directions that steer clear of the uncontrollable, interdisciplinary and risky parts of tackling the problem in the project report. This, however, goes against the idea of dialogic learning as described above, where the main idea is to enter into an open inquiry, with the risks this entails. Under these less controllable conditions, the authority of the supervisor will shift from the expert in a specific theory or approach, towards a generalised expert role in doing science. The most important role for supervisors is then their skills as researchers and their experience in how to do research.

The final dimension in the notion of dialogic learning relates to the connected point about establishing equality in the dialogue.

> A dialogue *maintains equality* including a respect for diversity. This does not mean that a dialogue presupposes similarity or symmetry. We are speaking of

> interpersonal equality and human respect. In a dialogue there should be no use of power or force, no persuasion of the other, and no winning. The purpose of a dialogue should not be defined or decided by an authority. To be productive, a dialogue develops as a dynamic process between equal communicating partners. (Alrø & Skovsmose, 2004, p. 41)

Equality in the higher education PBL scenario can quite easily fall apart if violated by either students or supervisor. On the supervisor side, the obvious mistake is becoming too strong an authority in the dialogue and show unnecessary power in dialogue about the project choices to be taken or the way to proceed. On the other hand, the group of students can be highly dependant on the authority of the supervisor if they are insecure about what to do, how to go on etc. They can even reach levels of frustration where they demand a straightforward answer about what the right way to proceed looks like. Of course, the authority of the supervisor as a research expert is a constant presence in the relation between supervisor and students, and so it should be. But the supervisor's insights into the importance of maintaining equality in the dialogue and attempts to create the best possible learning space, tone and playing rules of the dialogue will make a huge difference in shifting from situations of authority back to an equal participation in the dialogical inquiry.

From these dimensions of dialogical learning Alrø and Skovsmose build a deeper insight into the different types of dialogical speech acts that dominate in dialogic learning. Speech acts are part of the 20th century language philosophy movement called "the linguistic turn". It can be summarised as a growing interest in the importance of language philosophy for other areas of philosophy or for our understanding of, for example, science or education. Speech act theory was developed by, among others, Searle and Austin and an important source of inspiration behind this development was Wittgenstein's later emphasis on the performative role of language inherent in his concept of language games (see e.g. Searle, 1969; Austin, 1975; Wittgenstein, 1997).

Alrø and Skovsmose identify the following series of dialogic acts as central to dialogic learning: getting in contact, locating, identifying, advocating, thinking aloud, reformulating, challenging and evaluating. (Alrø & Skovsmose, 2004, pp. 47–48). These speech acts are referred to as dialogic acts, that is, speech acts with the qualities of making an inquiry, running a risk and maintaining equality. Other types of speech acts are less imbued with these qualities as, for example, persuading someone, ordering, instructing, correcting etc. (Alrø & Skovsmose, 2004, p. 47). These types of speech acts can also be found in many educational settings but they work against the idea of establishing dialogic learning, which is defined as the learning that takes place where the use of dialogical speech acts are predominant.

We will not go deeper into the reflections on dialogical speech acts here, but just reiterate that overall they relate very well to the general ideas of teaching within a PBL framework – advocating for ideas, thinking aloud in a space of inquiry,

reformulating ideas based on evaluation of previous thoughts, challenging these from new perspectives and so on.

In this way, dialogic learning is a powerful framework for building a vocabulary about co-creation in PBL supervision and we will return to this construction later on and reframe the ideas of dialogic learning in this specific scenario.

SUPERVISING IN THE CO-CREATIVE SPACE

We have discussed how a focus on dialogic learning can be a platform for establishing a co-creative space between students and supervisor. Next we will look into the different types of roles presented in literature for the archetypical PBL supervisor. This will provide us with detailed vocabulary about the roles in play in PBL supervision. Building on these and the ideas of dialogic learning we shall then construct a vocabulary for a supervisor to build a co-creative space with his/her students.

In the Danish PBL tradition one important typology of supervisor roles is presented by Olsen and Pedersen (2015). Below we will follow their vocabulary of supervision and discuss it in the context of establishing a co-creative space between supervisor and students.

Olsen and Pedersen (2015) first outline two different supervision approaches related to the *content* of the supervision (1) problem-oriented supervision and (2) disciplinary supervision. These are in practice closely interrelated but it is possible analytically to make an important distinction between them. Let us first take a closer look at problem-oriented supervision by highlighting three dimensions.

Problem-oriented supervision is focused on the methodological perspectives in the PBL project – that is, being able to make distinctions between the theme of the project, the problem formulation, the design of the project and the methodological approach in the project, the empirical work, the analysis, the conclusion and so on. This part of the problem-oriented supervision relates to developing a strong idea in students about what these elements in a project process and project report mean.

Another dimension relates to the supervisor's efforts to develop the students' work with the methodological perspective in the project by keeping the emphasis on how and why the group would like to proceed in this and that way, theoretically and empirically. This dimension connects to a third dimension presented by Olsen and Pedersen (2015), that the problem-oriented supervisor makes group project work become highly reflexive. The students should understand that what they choose to do eliminates other options and choices and in this way the supervisor strengthens the students' reflections on what knowledge they are about to produce.

In contrast to problem-oriented supervision, disciplinary supervision emphasises the project's connection to the knowledge and approaches in the scientific domain in question. This type of supervision is about helping students to find the important theories in the particular field, guiding students regarding the central position in the scientific debates for the relevant topics of the project. Disciplinary supervision also relates to the way in which theories are developed in a project and to how

empirical work is conducted and corroborated. It deals with the detailed scientific investigations of the problem formulation and all the project's sub-tasks in arriving at a conclusion that is well founded in the scientific theories and methods chosen.

The difference between these two supervision approaches is interesting in relation to this chapter's efforts to develop a vocabulary for co-creation in supervision. Even though the disciplinary supervision approach seems necessary and very important for the students to complete their project report, it none the less has the potential to disrupt a co-creative space of collaboration. The disciplinary supervision approach strongly positions the supervisor as the expert and thereby makes it easy to slide into a "supervisor knows best" supervision where the group of students asks questions about the proper approach, about technique in every detail, about which theory to choose etc. In actual fact, the supervisor in almost all cases does know best but acting as an "answering oracle" might not be the best teaching strategy in supervision of PBL projects and especially not when the emphasis is on building a co-creative space for collaboration.

In contrast, the problem-oriented supervision approach has some advantages in relation to building a co-creative space. Its aim is not explicitly to socialise students into a specific scientific tradition or paradigm – as one might interpret the disciplinary approach – but rather to produce in students a high level of reflexion upon the scientific choices made in the project, to produce transparency in the communication to readers about the scientific choices of the project and so on. In this way, the problem-oriented supervision approach is a more promising line to pursue in building a co-creative space, as it can open the scientific debate with challenging questions like "Why do you want to do it like this?" or "What does this choice entail for your analysis?" There is a difference between focusing on a supervision content about the reproduction of disciplinary tradition and scientific paradigm, and on a content that challenges the students' reflections on the reasons for their choices in, for example, empirical methods, problem formulation or theoretical grounding. This difference is an important building block in constructing a vocabulary about co-creation in supervision.

In addition to these two different approaches to the content of supervision, Olsen and Pedersen also present four types of supervision styles that each reflect a certain attitude or role taken in the *form* of supervising a PBL group. The four styles are called (1) product supervision, (2) process supervision, (3) laissez-faire supervision and (4) control supervision. This typology is inspired by Tofteskov (1996) but here we follow Olsen and Pedersen's outline (2015).

Product supervision is a style where the supervisor is focused on students gaining solid input from the supervision session, for example, clear input regarding their project report's structure or learn about a specific theory. In this type of supervision, the supervisor is very active in developing ideas and suggestions for the project report, to solve the problems of the group. One aspect of this supervision style is also a thorough and continued focus on details and on the norms for producing the final written report.

Product supervision does not hold much promise for producing a co-creative space with students. The supervisor is far too aggressive in producing the right content in the right way and the co-creation process will be unfruitful, in the sense that it is not driving the students' learning process. Instead it is driving the project report forwards, but this is not necessarily the most important task for the supervisor and it is certainly not the main issue for creating a co-creative learning space.

Process supervision represents a focus on the student group's learning processes. This type of supervision, instead of focusing on the final product, will be focused on the insights the group develops during the process of writing the project. The process supervisor will not produce a lot of ready-to-use suggestions but instead ask the group questions for reflection and focus on nurturing the learning and knowledge processes going on in the group. This style of supervision also includes a focus on supervising the group's internal working processes in order to maximise the development of process skills.

Process supervision is a promising approach in the context of supervision for co-creation. The supervisor's agenda is here to increase the students' insights and their working processes as a group. This means that focus is mainly on how to develop the skills of the group towards effective group processes and the ability to reflect about how to proceed.

Laissez-faire supervision comes in two forms – one where the supervisor thinks that students are best not met with too much problematising of their work. Ample amounts of positive feedback are best to help maintain positive motivation in the group, which is considered the most important element in producing the final result.

The other version of the laissez-faire approach involves the supervisor who lacks engagement in the student group's project. Only general suggestions or rules of thumb are given, with a clear distance from any details of the project. This supervision style is presented by Olsen and Pedersen as the supervisor who just wants to get on with his/her own research.

Finally, *control supervision* is the style of PBL supervision that focuses on testing the knowledge of the group of students. Taken to its extreme, the meetings between supervisor and group of students can be a sort of extension of the final examination situation to the entire period of writing the project. Another version of the control supervision style is about a search for the "capacity" of the group for the purpose of finding the right level of abstraction, theory, empirical challenge that the group can muster.

Control supervision might be thought of as detrimental to constructing a co-creative learning space – it emphasises clear boundaries between students and teacher and focuses directly on the exam through tests, thereby developing a clear hierarchy and a closing of open inquiries. Laissez-faire supervision closes any approach to opening a co-creative space of inquiry, either by overuse of appraisal or by non-engagement in the project. Positive feedback is, of course, not detrimental to a co-creative process but it does not necessarily include the required engagement and investment in the project from the supervisor.

The two-times-four categories of supervision outlined above are based on analytical distinctions and there are naturally many overlaps between them in a situated supervision setting. A supervisor might even use several of them during just one supervision meeting. Here, however, they will suffice for reflecting upon the type of supervisor role and approach that is needed to establish a co-creative space of learning and knowledge production.

CONSTRUCTING A CO-CREATIVE SPACE FOR SUPERVISION

This section will be aimed at constructing a vocabulary for establishing a co-creative learning space in PBL supervision. Drawing on the above perspectives and discussions, four dimensions will be suggested as essential elements in a supervisor's vocabulary for constructing a co-creative space with students.

For supervision in the PBL model, many other dimensions than these four are needed, depending on the focus of the supervision. One could think of five essential dimensions for a supervisor vocabulary on developing problem formulations, or four elements for keeping students on a productive timeline. Here our focus is only to construct central dimensions in building a co-creative learning space, as in our original intentions.

It should be noted that co-creation will always occur in the interaction between supervisor and students, no matter which type of supervision is used. The idea here is to produce a vocabulary that will increase the quality of the co-creative learning space by providing some dimensions that can be used to think and reflect about the situated construction of a specific co-creative space.

It should also be noted that all supervision settings are unique. They depend, for example, on the element of the project in focus (see the division into three project phases mentioned above). They are dependent on the module learning goals described in the curriculum. Also, some supervisors have a great deal of experience and some have just started. In addition, and most importantly, no student groups are alike and the dynamics of a supervisor meeting are very much entangled in the persons present, their backgrounds and foregrounds and the mutual understanding of the situation. Given all these complexities, the aim below is to highlight general dimensions for constructing a co-creative learning space.

The four dimensions in combination will define the meaning of a co-creative learning space in PBL supervision as an answer to the chapter's problem formulation and the elements will be called (1) the *atmosphere* of the space, (2) the *approach* of the supervisor in the space, (3) the *involvement* of the supervisor in the space and (4) the *topology* of the space.

Atmosphere – Constructing an Inclusive Dialogue

The atmosphere of the co-creative space relates to the supervisor's active efforts to construct a learning space with the students. The metaphor of *atmosphere* is chosen

in order to highlight that an important dimension in a co-creative space is the ability to work with the feeling and sensation of the space.

Inspired by the concept of dialogic learning, we can borrow some of its key elements for building the right kind of dialogue for joint exploration or inquiry. A first feature relates to the issue of maintaining equality in a co-creative space. This means that unnecessary use of authority by the supervisor should be avoided and instead emphasis should be given to equal participation in the inquiry of all persons involved in the project. An equal communication between all participants rests on the supervisor's ability to create a learning space of interpersonal equality and human respect, with minimum use of power or force by either students or supervisor. This will often demand a quite active role from the supervisor in inviting all students into the discussions, or in holding back one's own good ideas for preserving an equal dialogue to obtain a rich learning space for the students.

PBL projects end with exams, where the supervisor role will change to that of an examiner and this makes it a complicated relationship of power between the supervisor and the group of students. There is no way of escaping the influence of these circumstances and they have to be addressed directly to secure a safe atmosphere by discussing openly what will be the yardstick for the final assessment of the project. However, this need not be in opposition to constructing a co-creative space in the project process, as long as the issue is addressed and the equal and non-authoritarian space is restored with this knowledge.

The construction of an atmosphere promoting imagination and creativity is an important dimension of the co-creative space as defined here and the supervisor will have to work actively for the initial confidence of the students and a relaxed environment to achieve this. Stupid questions must be welcomed and the inclusion of all participants in the dialogue is an important element in forming a positive and safe atmosphere during the supervision meeting.

Approach – Focusing on a Problem-Oriented Supervision Style

The approach of the supervisor in the co-creative space concerns the different roles it is possible to take in PBL supervision. The metaphor of *approach* has been chosen to highlight that an important dimension relates to the way supervisors address and possibly plan the content and form of their supervision.

From the above discussion of the PBL supervisor roles it has already been argued how an emphasis in the supervision towards a problem-oriented, as opposed to a disciplinary approach is preferable. Acknowledging the importance of both approaches, the co-creative space benefits from a supervisor who approaches the subject of the project with an open agenda and in this way does not overly explicate "how things are done around here". A co-creative space for imagination, open inquiry and a joint exploration of the problem worked upon will benefit from the emphasis on constant reflections about the choices made, the phases of the project, the many possible ways to proceed empirically etc.

The supervisor role presented above as process supervision has a connection to this problem-oriented emphasis in the supervision. The process-oriented supervisor is mostly interested in producing strong process skills in the group of students to strengthen their own ability to explore the problem formulation of the project. Process supervision is less occupied with the production of ready-to-use solutions for the group or the final look of the project report and in this way supports an emphasis on building a strong dialogue especially between the members of the group. This will be productive for a co-creative space by focusing on an inclusive dialogue about how to proceed with the project, as opposed to a more supervisor-driven approach like control supervision or product supervision.

However, it also raises the question about the very position of the supervisor in the co-creative space and this leads us to the third dimension.

Involvement – Engaging in a Risky Inquiry

Supervisors' level of involvement in the co-creative space relates to the extent to which they take ownership of the project process.

In the vocabulary presented above on supervision roles and styles, the involvement of the supervisor is not explicitly portrayed from a positive point of view. In product supervision or control supervision, there is a strong involvement in the project, but for specific reasons that do not directly relate to the positive potential for co-creation in the supervisor's engagement. At the same time, several of the archetypical supervision roles are clearly detached from the project processes, trying to avoid too much interaction with the group or the project.

However, there seems to be a space for a productive role of involvement when we are to define a co-creative space in PBL supervision. If we refer back to the key elements of dialogic learning, the argument is raised that unequivocal involvement and engagement in the dialogue is absolutely necessary. Engaging oneself in the project means to enter the unknown together with the group of students. It portrays the entering into the dialogic learning space as engaging in a risky exploration, as opposed to staying detached or being in control of the process of supervision.

Building on this idea, it seems important for a supervisor to be aware of the level of involvement in the explorations and open inquiries of the project. It is obviously a fertile setting for the construction of a co-creative space to throw oneself into the discussions and learning process on equal terms with the students. Hence, on a scale from "being totally detached from the project" to "total involvement in the project", taking a step towards active participation in the inquiries seems to be an important aspect in constructing a co-creative space.

Here, several points require careful thought, as some will suggest the project process is the students' and no one else's. In the exam situation, the supervisor will be examining the final product and thereby potentially has to dramatically shift position during the project period from involvement to detachment. Even though these arguments may have some weight, I would argue that the involvement should

be quite thorough, in the sense that the supervisor should be an active thinker in relation to the project in general and to many of the decisions and choices made. This will serve as the best possible condition for a co-creative space – which is our main concern here – but also for producing the right kind of atmosphere for an open and equal inquiry in the learning space, while directly showing how a trained researcher thinks in this or that open situation or problem scenario.

Having argued in favour of the necessary level of involvement in the project, let us turn to the fourth dimension in the definition of the co-creative space.

Topology – Representing the Complexity of Science

The topology of the co-creative space relates to the character and breadth of the space of inquiry. The metaphor of *topology* has been chosen to highlight the dimension of the co-creative space that relates to the scientific landscape, which will be available for the group of students to explore.

Depending on the supervisor's imagination and concerns about this issue the co-creative space can end up in very different frameworks. Having argued above for the importance of engaging in the project process, a consequence is the risky landscape of science one enters into as a supervisor. No matter how well prepared or senior one may be, there is no chance of one knowing all the possible theories or journal articles or subdomain knowledge that might enter into the thinking about the project if one engages in an open investigation with a project group. The role of expert will – as argued above – be lost. And as the students, too, have time to study new-found theories or case studies or a statistical method unknown to the supervisor, the knowledge gap may even grow during the project period in favour of the students. For strong PBL groups this can be a positive and rewarding outcome of an open co-creative space, but it challenges the supervisor by being risky and going beyond one's professional expert landscape.

The challenge of the supervisor is how to tackle this. The dimension of topology is here meant to underline that the co-creative space between supervisor and students is highly dependent upon the supervisor's attitude to the boundaries of the scientific landscape allowed in the project process.

The space can be thought of as dependent upon the supervisor's level of allegiance with a specific scientific paradigm and her ability to let go of this allegiance if the co-creative process, or the group itself, challenge this or want to enter new and different paths.

Arguing for a productive co-creative space in PBL, there is no question that a too narrow scientific paradigm on how to explore a certain type of question or the handful of few well-known canonical theories will put a brake on the open inquiry that has been argued as a key element of co-creative space. In this line of reasoning the supervisor should be representing the complexity of science – not its canons.

CONCLUSIONS

Above we have defined four dimensions of a co-creative space for supervision in PBL. They relate to the atmosphere of this space, the supervisor's approach in the space, as well as the supervisor's involvement in the project process going on in the space. Finally, the topological dimension highlights how a supervisor directly or indirectly has a big role to play in the breadth and character of the scientific space available for the supervision dialogue.

It was concluded that the active construction of this space by the supervisor will further a co-creative learning process, if the atmosphere of the learning space is constructed as an inclusive dialogue of inquiry between equal participants. The supervision approach should be aimed at strengthening a problem-oriented approach and the level of involvement in the project should be high. Finally, it was argued that the topology of the co-creative space should be constructed to represent the complexity of science, as opposed to specific paradigms of knowledge.

Let me end by underlining that the everyday situated supervision meeting has many parameters for the supervisor to navigate among, as we have touched upon above. In that sense, the arguments for the most open, equal, non-authoritarian, predominantly problem-oriented and process-oriented, engaging, dialogic and non-paradigmatic inquiry construction by the supervisor may meet other challenges that become more important in the specific moment of supervision. However, it could still be important as a supervisor in general to try and reflect upon the best possible co-creative space with each group of students and hopefully make some use of the discussions and vocabulary presented above.

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