Chapter 9
Developing Successful Group Processes in Interdisciplinary Projects

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9.1 Introduction

Problem-based learning (PBL) has over the decades been recognised as a popular pedagogical strategy (Hmelo-Silver 2004). In PBL at Aalborg University, students' learning is based on complex, real-world problems that do not have a single correct answer. Students work collaboratively in groups to identify what they need to learn in order to solve a problem. They engage in self-directed learning and integrate new knowledge while solving the problem, defined by them within the framework of the curriculum. They reflect on what they have learned and the relevance and effectiveness of the strategies and research methodologies employed. The teacher acts as a facilitator of the learning process rather than as a knowledge provider (Zhou 2012). Thus, PBL has been considered as a response to the growing challenge of industry practices where high levels of interdisciplinary collaboration and the ability to manage the challenges arising from it are required.

Interdisciplinary learning, which is one aspect of PBL strategy (Savin-Baden 2000; Zhou 2012; Krogh and Jensen 2013a), involves crossing professional discipline borders (Hansson 1999; Zhou 2012; Krogh and Jensen 2013b). Therefore, when developing a measure of interdisciplinary competence development, the relevant dimensions of teaching and learning should be considered. These include awareness of professional and disciplinary perspectives, appreciation of disciplinary perspectives, appreciation of cross-disciplinary perspectives, recognition of disciplinary limitations, interdisciplinary evaluation, ability to find common ground, reflexivity, and integrative transversal competences (Lattuca et al. 2013; Lattuca 2002). In other words, interdisciplinarity

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integrates disciplinary contributions and thus minimises the borders between the separate contributions of individual disciplines. The process of achieving integration requires identifying, evaluating, and rectifying differences between disciplinary insights in order to achieve new understandings at a higher level. Such cognitive achievements are not possible without the synthesis of disciplinary methods, knowledge, or insights into something new (Aram 2004; Wenger 2006).

Recent studies have suggested that interdisciplinary learning brings both benefits and challenges to learners (Zhou 2012; Lattuca et al. 2013). On the one hand, compared with disciplinary learning, interdisciplinary learning provides learners with more opportunities to integrate new knowledge into previously acquired knowledge, which makes learning more effective (Gero 2013). It is also expected that interdisciplinary learning may increase the learner's motivation to learn due to the interest it sparks. On the other hand, the task of interdisciplinary learning is full of complexity (Klein 2004), and creates challenges for learners due to the sometimes poor organisation of group work, insufficient communication from teachers and the institution, the difficulty of innovative thinking and problem solving, and so on (Marquez et al. 2011). Therefore, in PBL settings, issues encountered in group processes in interdisciplinary projects should be given attention (Marquez et al. 2011; Zhou 2012). For example, in Yueh et al. (2015) students reported that their experiences with an interdisciplinary PBL approach had multiple advantages in improving skills, such as group communication, knowledge exchange, and understanding the value of each other's disciplines. However, the study also suggests that further efforts are required, including closer attention to the features of group members, the composition of groups, and the interaction patterns of different groups. This implies the need to rethink how to facilitate learning in groups working on interdisciplinary projects, how to keep the group dynamic, and how to propose appropriate strategies for ensuring that the group makes progress and keeps moving forward.

Subsequently, this chapter aims to respond to the research needs while presenting and discussing a case study, namely the student satellite project AAUSAT3 at Aalborg University (AAU) in Denmark. We will analyse and discuss the experiences from the case and what they have taught us about how to develop successful group processes in an interdisciplinary PBL project. Furthermore, we will explain the implications for how to develop better and more successful group processes for other PBL contexts around the world.

9.2 Research Context: A Student-Built Satellite Project (AAUSAT3)

The overall research context of this case study encompasses the PBL principles and model of Aalborg University. The AAU PBL principles combine problem orientation, whereby problems or questions suited to the educational program serve as the basis for the learning process, with project work, where the project represents both the means through which the students address the problem and the main learning context for students. Figure 9.1 illustrates the elements that generally form part of

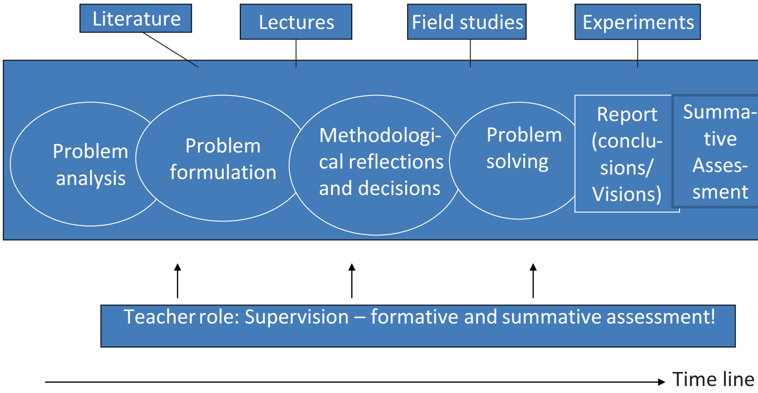

Fig. 9.1 Processes in PBL group and project work at AAU

the problem-oriented project work at AAU. The figure also shows the processes and resources available for the problem-based project work at AAU (Krogh and Jensen 2013b).

The specific research context for this study is the project to develop the third student-built satellite at AAU, AAUSAT3. The mission of this satellite is to operate the Automatic Identification System (AIS) payloads, as proposed by the Danish Maritime Safety Administration, with the aim to be used by ships to inform other ships about their position, course, speed, name, type of cargo, and so forth. It is also an important part of anti-collision systems and the supervision of near-coast traffic today. The signals used by AAUSAT3 are from ships on the open sea, especially in the Arctic regions and around Greenland (Zhou 2012). The project aims to reach the following educational objectives (Zhou 2012):

- Show that students are able to develop working satellites.
- Develop the system engineering skills of the students as a complement to their existing education while giving them experience in project management.
- Show that AIS may be able to replace the LRIT (long range identification and tracking) system as a cheaper and more effective alternative.

The AAUSAT3 is a joint venture of several institutes at AAU, including the Department of Electronic Systems, the Department of Energy, the Department of Mechanical Engineering, and the Department of Computer Science. Students at AAU in their fourth through tenth semesters have opportunities to participate in AAUSAT3, according to different levels of tasks.

9.3 Empirical Work

The empirical work of this study focuses on students' group processes in AAUSAT3. We examine the benefits students gained and the challenges they faced from their experiences working in an interdisciplinary project group. Qualitative methods including interviews and observations were used to collect data. As suggested by Zhou (2012), the qualitative approach focuses on people's life stories and, unlike quantitative research, can often be naturalistic in terms of studying people in everyday, uncontrived settings and situations. Thus, from a qualitative view, research is a human construction, framed and presented within a particular set of discourses and ideologies, and conducted in a social context. Therefore, there will of course be limitations for generalisability.

One of the authors of this chapter followed the group development process in AAUSAT3. As it was a huge interdisciplinary project, participants from nine student groups (three from the sixth semester who are marked student A, B, and C; three from the seventh semester who are marked student D, E and F; and one from the ninth semester who are marked student G) and two supervisors (supervisor A and B) were interviewed and observed. The interviews were organised using open-ended questions that allowed for in-depth follow-up questions in order to examine participants' perceptions of the group learning experience. A total of ten interviews (including eight individual interviews and two group interviews) were carried out, with each interview lasting around 30 min. Data from the interviews were generated from transcripts, which contributed to a response to the research focuses in this study. In addition, the researcher attended a total of 18 group meetings and recorded some discussions on problem-solving processes among group members. The researcher also noted the 15-day observation diaries on the students' project work. The findings from the observations provided evidence of confirmation or contradiction of the interview results, which improved the validity and generalisability of this study.

The data analysis centred on the research focuses of this study and generalised the results from four aspects of group process, namely (1) group establishment, (2) group composition, (3) group management, and (4) supervision. Thus, the analysis encompassed how interaction between facilitation and group learning occurs in interdisciplinary contexts. In other words, through qualitative methods in this study, we connect hidden mental processes of well-known group experiences that are constructed in a setting of interdisciplinary learning and real-life problem solving, as discussed below.

9.4 Experiences Learned from Group Processes in AAUSAT3

In this section, the results of the data analysis lead us to discuss four aspects of lessons learned regarding developing successful group processes from the case of AAUSAT3: (1) peer-arranged group formation, (2) task-related group diversity, (3) shared responsibility of group management, and (4) supervisors as learning experts and facilitators.

9.4.1 Peer-Arranged Group Formation

According to the observations, all participants in group work on AAUSAT3 come from programs of study in Department of Electronic Systems. The two supervisors assigned to work with students on the project also come from the Department of Electronic Systems (one a professor and the other an associate professor). In AAUSAT3, students have opportunities to develop their groups by themselves. At the beginning of each semester, students obtain the project proposals from the AAUSAT3 website. Gathering according to common interests, they discuss the possibility of group establishment.

This method of group formation has been described as a ‘peer-arranged process’, according to data from interviews. Before group establishment, some of the students knew each other well, and some had experience from project work in previous semesters and felt comfortable working together. Even students in the sixth semester have already gained rich experience in how to initiate, participate in, and manage group work. The following quote comes from a student interview (Zhou 2012):

> When we started, actually, we formed the groups on Monday, before that we had already decided to do this project [AAUSAT3]. It [the group formation] also had a peer-arranged process. The other groups also said they wanted to do this so we sat down to discuss [how to collaborate and work together]. Because you also need people with different skills in different groups, it was the way it was decided (Student B).

In other words, most group members come from a community where they have had good experiences and share common interests. As Wenger (2006) suggests, a community of practice is not merely a club of friends or a network of connections. It has an identity defined by a shared domain of interests. Mutual engagement requires the ability to take part in meaningful activities and interactions in the production of sharable artefacts, in community-building conversations, and in the negotiation of new situations. Membership therefore implies a commitment to the domain, and therefore a shared competence that distinguishes members from other people. They build relationships that enable them to learn from each other (Zhou 2012). This further indicates the importance of group diversity, as discussed below.

9.4.2 Task-Related Group Diversity

Collaborators are not a homogeneous group, but rather individuals with different perspectives, expertise, conceptualisations, working methods, temperaments, resources, needs, and talents (Zhou 2012). With this perspective, a principle of task-related diversity in developing groups in AAUSAT3 becomes another lesson learned in this study. In order to complete the tasks, students require input from multiple fields of knowledge: electronics, communications, computer science, mechanics, astronomy, physics, oceanography, industrial design, materials, energy, etc. One of the supervisors reflected on the breadth of knowledge required in an interview:

> To solve a problem or work on a project always requires a lot of knowledge, but this project is much more complex. This not only means complex knowledge, but also requires our students to be strongly confident to solve those complex problems and have good collaboration skills. We are happy to see most of us are mostly positively working on this project (Supervisor B).

Tasks are full of challenges for student groups. From observing group meetings, we found that supervisors do not assign the individual members' tasks; instead they assign the tasks agreed upon through group discussions. Normally, students have group meetings once a week to discuss milestones. In these meetings, members present their progress, share knowledge and experiences, plan the milestones for the next week, and assign tasks. If the group is experiencing challenges or difficulties, members will spend more time discussing solutions and which milestones might remain flexible for modification along the way. The principle of task-related group diversity is followed consciously when the groups are formulated and developed. This places focus on the complementarity of expertise, knowledge, and skills in the groups, which is also a consideration when introducing new group members. For example, students expressed the following view in interviews:

> We have to have a very good programmer at least […] So actually one of us started the group and tried to make the group. Though there was one guy who was also interested, but he was not really relevant to what we needed to do. So we had no ideas to introduce him as one of our members (Student E).

> We have to know each other. I am responsible for mechanical design and hardware design, but I need to have discussions with two members all the time. One works on software and one works on hardware, too. Mechanical design can't be finished without some parameters from hardware […] (Student D).

Previous studies (Amabile 1996; Choi and Thompson 2006; Zhou 2012) have indicated that group composition and choices concerning task engagement may impact group performance, and that task-related diversity in fact enhances group performance (Nijstad and Stroebe 2006). The right level of diversity seems to be essential to avoid cognitive uniformity and conformity: group members who have different approaches to the same problem are less likely to get stuck in a rut. Also, group members should perform the tasks they are good at. Meanwhile, people who are given a choice in certain aspects of task engagement will produce more creative work than people for whom the choice is made by someone else (Amabile 1996). In addition, relationships among group members, such as whether they are engaged in cooperation or competition, whether they are friendly or not, and the extent to which they have different working habits or thinking styles, etc., are also key to creative collaboration. As has been discussed regarding peer-arranged group formation, most students know each other well and have very good relationships, which also motivates collaboration.

9.4.3 Self-Managed Groups and Shared Responsibility

In order to ensure task accomplishment and stimulate group dynamics, well-organised project management is essential for learning activities. The social theory of learning indicates that project groups work as communities, needing multiple forms of leadership: leaders, networks, people who document the practice, pioneers, etc. These forms of leadership may be concentrated in one or two members of the group or widely distributed, and may change over time (Wenger 2006; Zhou 2012). This phenomenon has been found in student groups in AAUSAT3. According to the data from observations, students share the responsibility of project management. As mentioned above, students plan milestones, organise group discussions, and supervise meetings by themselves. Members make different contributions to the leadership of the group and everyone is responsible for the task's progress and success, as noted in the following quote.

> We have different kinds of responsibilities. It was easier for our supervisor, he only needs to email me, so I was appointed to contact him. And we have one guy who is responsible for contacting the company of sponsors who we have cooperated with (Student A).

> It is not like we have fixed roles, but we tried to make everyone have some specific parts… in the group meeting on Monday, if someone says 'I can't do this now', the group says 'ok, you don't have to do that' (Student F).

As discussed by Frame (2002), we can see that student groups function as self-managed teams. Team members define the approaches they will take to get the job done. This kind of self-managed team can be seen as a mechanism to empower members to do the best job they can: when people make their own decisions, they have a greater commitment to executing them effectively. Furthermore, people who are closer to the work have a better sense of what is needed to do a good job than managers far away from the day-to-day action (Frame 2002). In self-managed teams, students choose individual jobs and negotiate with each other about progress and strategies for moving projects forward. The interviews also indicate that project tasks are the core topics in both students' formal and informal discussions, and even in their social lives after study time. Through working together, students become not only professional collaborators, but often good friends, too; thus, they share their experiences and emotions with each other now and then.

Because this is a long-term project, documentation management is essential for successful work. Every Wednesday afternoon, all the participating students come together for a project meeting to foster discussion and cooperation, which allows them to move forward with the project. The agenda, points of discussion, problems, new solutions, reflections, decisions, deadlines, and task assignments are documented in Tracwiki, which is a web-based software approach to project management. Thus, groups that join the project later can easily become familiar with what has been done and how specific tasks have been handled in the past (Zhou 2012). In addition, during their daily work, students like to mark their milestones on the blackboard with a reminder of their individual roles. Usually, they update the group schedule plan each week (Fig. 9.2) based on their discussions (Fig. 9.3).

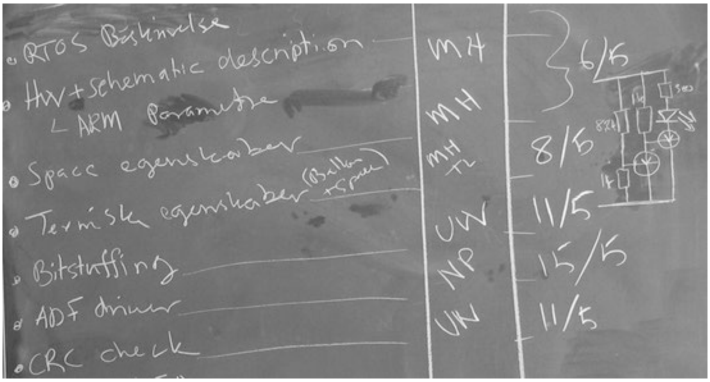

Fig. 9.2 Timetable on blackboard

Fig. 9.3 Students in discussion

> We have had milestones, which are always the plan of the whole project. So we know when we should turn in the report. OK, then we divide it into small tasks – what do we need to do this week, and what will go on to next week. Then we take out the blackboard and put the tasks and our names down on the right (Student D).

However, self-managed teams also have their limitations. In AAUSAT3 there have been some complaints, according to interviews. Students expressed that they needed more effective leadership. Although students select group coordinators who are in charge of initiating group meetings and cooperating with other groups, sometimes the lack of leadership puts students in a situation of uncertainty, as the following notes express:

> There are so many details in the project work. One person is needed to use a list to check what we have done, what we need to do, who is doing what, and when it is going to be done. This person keeps track of what someone is doing now and then to delete this or that from the list. He may also delegate assignments by saying, 'we need someone to do this now' and the other will say, 'OK, I can handle that'.

As previously mentioned, complexity is embedded in the practice of interdisciplinary projects and is often associated with difficulties (Frame 2002). These difficulties necessitate effective leadership in order to help project groups deal with task-related challenges. This also implies that there is a dilemma between intellectual freedom and the challenges of the task, which requires more help from supervisors; this will be discussed in the following section.

9.4.4 Supervisors as Expert Learners and Challenges

In AAUSAT3, both interviews and observation data indicate that there is a good relationship between supervisors and students. When student groups encounter technical problems they cannot handle or have group disagreements, they request help from their supervisors. Usually, they have supervisor meetings once every 1 or 2 weeks. The group makes an agenda and informs the supervisor before the meeting. From the interviews, we know that the supervisors tend to enjoy the students' problem-solving processes and to address some critical questions in the discussions. They tend to encourage students to explore answers instead of transferring experience and knowledge directly. The students tell us that the supervisors play an 'inspirational role' in the group work:

> He is a kind man, I think. But he didn't like to tell us answers directly. He often gave some suggestions: 'Your ideas are very good, but if you do it like this, what will happen?' or 'Can you prove your ideas in practice?' (Student C).

In other words, the supervisors act as learning experts within student groups and share learning experiences with them, using inspirational ways of addressing them instead of teaching knowledge directly. When students do not feel emotionally safe they are less likely to engage in the behavioural hallmarks of creativity: members are less likely to speak up and suggest novel ideas, criticise others' ideas, challenge the status quo, ask questions, or admit mistakes for fear of ridicule or more subtle forms of interpersonal rejection (Edmondson and Mogelof 2006). However, in AAUSAT3, with a narrow power distance between students and their supervisors, the students feel emotionally safe in a friendly learning environment. The supervisors work from the assumption that their role is to help every student to reach their inner potential in the learning processes, and they encourage and reward creative behaviour in learning that further supports successful problem-solving processes.

However, the interviews also revealed the challenges of facilitation in AAUSAT3. Supervision in interdisciplinary projects places high demands on supervisory experience and teaching skills in order to ensure that cooperative learning in and between groups breaks through disciplinary boundaries. This undoubtedly brings challenges for supervisors, i.e. when they encounter task difficulties together with students, as expressed by one supervisor in the interviews:

> Sometimes we are supposed to know much more than them [students], but we disappointed them. We are also gaining new learning experience as we are solving the new problems.

> This is exciting, but sometimes also frustrating. Our pressure comes not only from the deadline of the project, but also the quality of students' learning. Some knowledge is outside our fields, so how to motivate the groups to make progress and develop learning dynamics is really a technique that we learn, in addition to the knowledge itself (Supervisor A).

Ideally, in AAUSAT3, the supervisors and students work together, integrate several disciplines related to the central topics, identify the weaknesses and strengths of the perspectives that stem from the different disciplines and, as a result, develop critical thinking skills. Thus, they acquire high-level meta-cognitive skills, and are expected to transfer the interdisciplinary knowledge and learning experiences gained from AAUSAT3 to other projects in the future.

To summarise, students have had both good and bad experiences in the four aspects of group processes listed above. Briefly, peer-organised group formation is often based on trust and a well-known network of students that is supportive in developing a long-term learning community; task-related group diversity motivates students intrinsically for problem-solving and learning; self-managed groups with shared responsibility among group members reflect the core principle of PBL, namely 'student-centred learning', but cause management issues due to a lack of effective leadership. When the supervisors play their roles as learning experts, they may face challenges in relation to students' difficulties with interdisciplinary project tasks. All the findings contribute to implications for developing better interdisciplinary PBL models in the future.

9.5 Implications for Developing Students' Interdisciplinary Projects

This section will focus on implications stemming from the above discussions for better developing and facilitating students' interdisciplinary projects based on studies in AAUSAT3. These fall into two categories of improvements: (1) developing more effective self-managed student groups and (2) developing interdisciplinary supervision groups. The implications are also helpful for developing interdisciplinary PBL models in other contexts.

9.5.1 Developing More Effective Self-Managed Student Groups

In the overall context of the AAU PBL educational model, student project work is combined with lectures, seminars, or laboratory work on relevant subject matter. University teachers supervising student projects facilitate the students' group work. It is generally expected that students work in groups of six to eight during their first year of study; later in their studies group sizes may shrink to just two or three students. Individual project work is accepted, but students are told that this minimises the possibility of peer learning. Each group is assigned a supervisor, who helps, challenges, supervises, advises, and discusses the work with the students throughout the process and finally assesses them (Krogh and Jensen 2013b). Supervisors play an important role in modelling the problem-solving and self-directed learning skills needed for students to self-assess their reasoning and understanding. They also support the learning and collaboration processes, which make students better at acquiring flexible and relevant knowledge within the subject area (Hmelo-Silver 2004; Zhou 2012).

In the case of AAUSAT3, while the students enjoyed self-directed learning experiences in their self-managed groups, they also needed methods for more effective group management. This also indicates that shared responsibility in the group can motivate members' mutual engagement but simultaneously cause problems of losing ways. Furthermore, supervision in AAUSAT3 lacks awareness and experience for helping student groups manage the issues that stem from the dilemma between 'equal leadership' and 'clear common goals'. According to Frame (2002), to a large extent, the potential problems of self-managed teams are hardwired due to their structure. The principal components of this structure are group decision-making, lack of a clearly defined leader and roles, and diffuse accountability. Slow decision-making, the need for compromise, and aimlessness are all potential consequences of this structure. As Gregory and his colleagues (1972) suggested, the ability of a manager will be tested to the utmost when complex technical changes demand a high level of corporate activity. A premium is placed upon fixing clear objectives, setting up high-response decision-making, and communication and control systems to enable a wide range of resources and disparate talents to be harnessed to the full.

Undoubtedly, this requires more effort from supervisors in guiding students through methods for more effective group management. As suggested by Amabile (1996), group project management requires creative ideas and other related qualities, such as freedom in deciding what to do or how to accomplish the task, a sense of control over one's own work and ideas, management enthusiasm for new ideas and ability to create an atmosphere free of threatening evaluation, sufficient resources and time, pressure, and so on (Amabile 1996). When they function properly, self-managed teams can be very impressive, as the team assumes total responsibility for the work effort with individual shared responsibility (Frame 2002). As mentioned above, the peer-arranged group formation meets requirements regarding the development of an effective project community both professionally and emotionally and fits the core philosophy of student-centred learning in PBL; however, it also requires students to develop effective methods of self-directed learning and group management, which should be integrated into daily supervision.

9.5.2 Developing Interdisciplinary Supervision Groups

In addition to the issues of facilitating more effective self-managed student groups, supervising students' interdisciplinary projects also poses challenges due to the complexity of the task. It should be noted that facilitation is the skill of knowing precisely when a question needs to be asked, when the students are going off-track, and when the PBL process is stalled. In the context of interdisciplinary projects, in particular, teaching strategies need to pay more attention to interactions between learners and their project tasks.

However, the fact is that teachers who teach and supervise interdisciplinary subjects must contend with teaching a discipline (or disciplines) that are not part of their original background (Gero 2013; Zhou 2012). In the case of AAUSAT3, an interdisciplinary supervision group needed to be developed in order to help students deal with the challenges more effectively. As AAUSAT3 was initiated by several departments, including Department of Electronic Systems, Department of Mechanical Engineering, Department of Computer Science, and Department of Energy Technology, a list of experts required by the tasks of AAUSAT3 was made. The experts came from the initiating organisations, supplemented by a broader network within and from outside AAU. The expert network can provide more knowledge resources to the student groups. In other words, the boundaries of participant groups should be broadened; as when the students formed their groups through the principle of task-related group diversity, a supervision group should be formed according to the same principles.

If an interdisciplinary supervision group is developed, this will positively influence the effective interaction between teaching and learning. When we encourage students to learn from an interdisciplinary project and to have successful group learning processes, an interdisciplinary supervision resource should be a necessary precondition. As mentioned above, in group composition, a series of fundamental factors concerning group formation are often conceptualised as representing member diversity in such dimensions as demographic characteristics, personality traits, opinions, tenure in the group, and disciplinary educational and functional background (Zhou 2012). In this sense, we argue that a group's creative potential first and foremost depends on the degree of diversity in groups. Functional, informational, and cognitive diversity are associated with higher levels of group innovation. To enjoy the task itself and the process of searching for new solutions, intrinsically motivated individuals are more likely to spend energy exploring the problem and to find creative solutions (Cooper and Jayatilaka 2006).

In addition, although task-relevant cognitive skills and personality traits are important, intrinsic motivation is a key to group processes and solving problems creatively since it reflects members' drive and determines what they will do. Thus, as when we encourage positive negotiation among student group members, it is obvious that members of interdisciplinary supervision groups must also communicate their ideas to one another and learn to support the emotional dynamics of collaboration, especially belief in a partner's capabilities (Cooper and Jayatilaka 2006).

We are calling for a broader interdisciplinary learning community helping both student groups and supervision groups reach their inner potential in learning processes.

9.6 Conclusions

In this chapter, the case of the interdisciplinary project AAUSAT3 has been discussed by focusing on group processes in a PBL environment at Aalborg University in Denmark. It argues that interdisciplinary projects can be viewed as two sides of the same coin for student groups and supervisors in PBL. On the one hand, it stimulates the dynamic of group processes in student groups and motivates learners (both students and supervisors) to engage in solving complex problems; on the other hand, it leads to difficulties for both students and supervisors due to task-related challenges. The case study and the discussion both provide a clearer understanding of PBL at Aalborg University as a learning community and of an interdisciplinary project that provides conditions calling for learner engagement in such a community of practice while exploring meaningful group processes that involve both good and bad experiences. These points underpin the previous arguments, such as interdisciplinarity being associated with complexity, which influences group processes and project supervision in PBL. However, it also leads to challenges for learning and teaching. In order to overcome some of these challenges, we suggest that AAUSAT3 first take a step towards more effective project management by strengthening group leadership, and second develop interdisciplinary supervision groups for more effective project facilitation. In a general sense, it is necessary to re-think how to deal with the issues of group processes in interdisciplinary PBL projects that are caused by the tensions in 'student-centred learning', effective learning, and effective teaching/supervision. Further re-thinking on how to improve the design of a PBL curriculum in interdisciplinary projects and how to improve interdisciplinary supervision are also needed.

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