

Discussion as media and tool in PBL project-groups: constructing learning and managing

Claus Monrad Spliid^{a*}

^aUNESCO Chair in PBL in Engineering Education - Aalborg University, Vestre Havnepromenade 5, 1., DK-9000 Aalborg, Denmark

Abstract

The Aalborg PBL Model encourages project-management as a way for students to achieve efficiency and effectiveness in their study-projects. This paper looks into how the development of conversation skills relates to project-management as well as other factors. Through analysis of interviews focusing on the discussions which groups undertake in their pursuit of problem-solutions fulfilling assessed real-world needs as well as meeting the requirements of the educational program, it is concluded that discussions serve as a media for achieving learning and as a tool for developing skills essential for professional engineering practice.

Keywords: PBL, process competences, project management, peer learning, discussion;

1. Introduction

We know that the Aalborg Model of PBL works – yet we don't know exactly why and how it works. Students go through up to 10 projects over 5 years, then they (usually) graduate and most are immediately employed in industry and being valued for their knowledge, skills and competences – not least skills and competences in handling collaborative projects. However, before acquiring an appropriate level of project-management competences, student-groups struggle with inadequate process efficiency and inadequate project effectiveness. Some of the causes of this (as perceived by students) can be detected through reading the process-analyses that groups report in connection with project reports for first and second semester. Apart from a general lack of similar project-collaboration experience (tools are provided through a course on PBL, Mosgaard & Spliid (2011)) the groups confess to inadequate management and unfinished or undecided *discussions* – by many students (although not all) labelled “idle time”.

In extension to previous research into students' logic behind their project management (Spliid 2011), the objective of this research is twofold (1) find ways of facilitating students' handling of *discussions* in early semesters, and (2) find ways of motivating students for approaching *discussions* as a professional skill used by professional engineers. Henriksen (2011) reports how professional engineers (production-management and -design) engage in “coordination” activities during the implementation process – a process of “negotiating” with the implementing staff. As this management process was estimated by the engineers to constitute app. 50% of their time spend clearly there is a need for engineering students to prepare and qualify for this type of professional performance.

Students most often use the term *discussion*, however in this paper the term “conversation” will be used as a more neutral synonym when there is no direct reference to students' statements. Merriam-Webster (2013) describes conversation as originating from Latin with the meanings “to associate with” or “to turn around”, while *discuss* means “to discourse about in order to reach conclusions or to convince”, and “implies a sifting of possibilities especially by presenting considerations pro and con.” Clearly there are other intentions embedded in students' use of *discussion* as any project group has many conversations concerning simple clarifications and verifications without attempting to *discuss* neither preconditions nor implications.

An illustration of the diagnostic potential embedded in group conversations can be made through a simple communication exercise called “Murder at the Black Horse”: 28 pieces of information (relevant + irrelevant) distributed among 15-25 students; at least 2 observers; 5 simple questions – and the scene is set for an often predictable and sometimes dramatic conversation before the group (often reluctantly) offers its first guess attempting to answer the 5 questions (Who done it? When? Where? How? Why?). After an average of 45 minutes simulating the communication that dominates a semester long project a long list of “pitfalls and dangers” can be produced (see Table 1), and unfortunately only few examples of “best performance” can be extracted. Students' attempts to structure and manage the conversation systematically are hampered by personal issues (role preferences; emotions; lack of trust, competitiveness etc.) as well as lack of professional competences – thus unveiling the “monster” threatening students and groups which do not handle conversations with the necessary rigor.

* Corresponding: Claus Monrad Spliid. Tel.: +45-9940-2564
E-mail address: clauss@plan.aau.dk

Table 1. Group conversations: “Pitfalls and dangers” and “Best performance”

| Pitfalls and dangers | Best performance |
|---|-------------------------------|
| Hair-splitting/Quarrels | Organizing the process |
| Parallel conversations | Formulating helpful questions |
| Repeated conversations | Focusing on evidence/facts |
| Perfection/Fear of failure | Involving participants |
| Complexity/Ambiguity | Structuring information |
| Lacking insight/expertise | Summing up information |
| Speculation/Opinions | Evaluating process |
| Implicit assumptions | |
| Uncertainty/Doubt | |
| Uncritical/Overly critical | |
| Anarchy/Fragmentation | |
| Mistrust/Opposition | |
| Indecisiveness | |
| Ignoring evaluative info from observers | |

The scope of this paper is to explore further into the groups’ process of acquiring and constructing the knowledge, skills and competences required for handling complex projects – specifically regarding the groups’ handling of conversations aimed at securing a sound progression with the process as well as the project. The aim is to gain a deeper understanding of the groups’ own perceptions of handling the conversations paving the road to project success. The initial research-question was:

“Which factors do the groups identify as significant for their discussions?”

Answering this question should provide evidence of groups’ own perception of significant factors – factors which influence outcomes related to intra-group relations, factual learning, competence achievement and resource management. These outcomes are perceived by supervisors to play an important role in achieving success whether it is success for the students or success for the Aalborg Model of PBL.

2. Conceptual framework

In order to create an overview of students’ perceptions of the circumstances surrounding their *discussions* an analytical tool was needed to distinguish among the approaches applied by the students, and for understanding the reasoning behind students’ efforts. The analytical tool should assist in providing a clearer picture of factors underpinning best performance as well as poor performance.

Spliid (2011) bases his categorization on the project-management logic emerging during the text analysis and he sets up a two-dimensional matrix. The managerial categories (vertical dimension) “goals”, “activities”, “tools” and “personal issues” seem valid and useful also for this analysis as they correspond with students’ writings and therefore correspond with their reasoning. The assumed group project-goals (horizontal dimension) “structure”, “efficiency”, “learning” and “familiarity” are however found less precise and less useful for this analysis as they originally emerged during a search for factors significant for an efficient and effective project overall. Therefore, in order to perform an in-depth analysis of the data generated from students’ statements, a second dimension must be added allowing a possibly unequivocal distinction between learning-related factors and management-related factors.

Barrett & Moore (2011) presents three interdependent principles derived from research into PBL-tutoring of study-groups (being part of a Diploma in Teaching and Learning in Higher Education), principles proposed as facilitators of the dialogic knowing which essentially is central for any PBL- and project-group:

- democratic social relations;
- co-constructing knowledge through co-elaboration;
- shared control.

Barrett & Moore (2011) thus relates their categorization to the learning process to be secured by the tutor in collaboration with the group – a situation distinctively different from the Aalborg Model.

Dixon (1999) has added the organizational dimension to Kolb’s learning-cycle which allows for an analysis based on a theoretical framework of cognitive abilities within the student-groups. The associated competences focus on “knowledge acquisition”, “knowledge integration”, “knowledge interpretation” and “knowledge implementation” – all of which are well known challenges for first-year engineering students. However, the management perspective does not appear explicitly out of this model.

While the “coordination” and “negotiations” carried out by the professional engineers (Henriksen, 2011) were rooted in knowledge implementation alone, student-groups’ conversations are assumed to cover the full learning-circle – although further analysis may bring evidence of any predominance. An assumption is that students do not distinguish among Dixon’s cognitive abilities, but rather focus on usefulness and usability in pursuit of completing the project (e.g. solving the problem – the typical focus of an engineer).

In light of the present focus on the communicative processes only, and assuming the principles proposed by Barrett & Moore (2011) will not provide a completely adequate picture of engineering students’ attempted accomplishments, a complimentary set of concepts for the horizontal dimension is therefore sought, leading to the following research question:

“What are purposes and contents of the group-discussions?”

Answering this question should provide evidence of groups’ own perception of the nature of the *discussions* taking place in the groups within the scope of the project. Extracting such “nature” should reveal insight into attitudes and circumstances essentially underpinning academic success for an engineering project-group within the Aalborg Model of PBL.

3. Methodology

The initial research was based on reading process-analyses from 1st and 2nd semester groups. The 2nd semester groups (Global Business Engineering spring 2011, 7 groups) had reported group as well as individual reflections, while the 1st semester groups (Energy Technology fall 2012, 10 groups) solely reported group reflections. Although the paramount intention for engineering students is producing a solution (practical or procedural) to a project-problem, the *discussions* in focus appear at any stage of the process, and in the process-analyses they are issues dealt with as part of project-management, group-collaboration as well as learning process – meaning that these *discussions* have a life of their own as project-constituents with a major impact on process and product.

To answer this question, semi-structured interviews of app. one hour were performed with two 4th semester groups, one 6th semester group and one 8th semester group (all studying Global Business Engineering). Developing these interviews as an open conversation (initiated by the questions “What do you do when you *discuss*?” and “Can you give me an example of a recent *discussion* you had?”) while simultaneously documenting students’ statements in writing on the black-boards in the group-room, the conceptual frameworks of Barrett & Moore (2011) and Dixon (1999) were presented in relation to issues emerging as the interview progressed. Also Henriksen’s (2011) findings from industry were presented as a reference to the professional practice the students are aiming for. At the end of the interviews the blackboards were photographed as documentation and support for the following analysis. Immediately after each interview an analysis was performed in order to maintain the evidence collected.

The interviews were employed as a means to clarify and verify the data obtained through the process-analyses as well as a means to identify skills and competences acquired during the extended project-experience. As the author has acted as lecturer and/or project-facilitator to all groups (during their first two semesters) it was possible to refer to the intended learning outcomes of these semesters – learning outcomes specifically dealing with process-competences related to project-management, group-collaboration as well as learning process.

During the interview students addressed just as much one another as the interviewer, and in-between they questioned the interviewer about the terminology used as well as the context, the background and the practical implications – exemplifying the acquired process-skills and –competences.

4. Analysis

4.1 Analysis of process-analyses

Making use of the principles proposed by Barrett & Moore (2011) provides an overview of the factors identified – see table 2. Despite the intention to perform an unequivocal distinction between learning-related factors and management-related factors, the interdependency shines through and indicates that group *discussions* are vital for developing the knowledge, skills and competences aimed for – as two groups formulate it in their process-analysis: “share the talking – share the thinking”.

Table 2. Factors significant for group discussions

| | Goals | Activities | Tools | Personal issues |
|------------------------------------|---------------|------------|--|-----------------|
| Democratic social relations | Participation | Share | Moderator | Emotions |
| | Influence | Listen | Agenda | Trust |
| | Ownership | Initiate | Breaks Procedures and rules for group | |

| | | | collaboration | |
|---|-----------------------|--------------------------|---|---------------------|
| Co-constructing knowledge through co-elaboration | Understanding | Preparation | Coordinator | Positioning |
| | Documentation | Presentation | Board | |
| | Variety of viewpoints | Argue | Google docs | |
| | | Question | Agreements on terminology | |
| | | Think-talk-share | Facts | |
| Shared control | Procedures | Feedback | Production schedule | Self-critical Trust |
| | Content | Decisions | Top-Tail | |
| | Main thread | Estimation | Agreements on content, grammar and layout | |
| | Disposition | Evaluation | | |
| | Consensus | Sparring as verification | | |
| | Follow-up | | | |

Table 3. Factors in focus during group discussions

| Goals | Focus |
|-----------------------------------|--|
| Clarification and learning | Terminology; concepts; theories; models; |
| Shared understanding | Project-objectives and –goals; problem and problem-formulation; methodology; |
| Implementation | Functionality; procedures; solution; |
| Project planning | Scheduling; sequencing; resource allocation; |

Based in the context of the factors identified in the process-analyses a new set of horizontal dimensions is proposed to be “project structuring and planning”, “shared understanding”, “learning and clarification” and “implementation” as these represent and reflect the interviewed project-groups’ understanding of their process. The original intention of applying the same vertical categories as in Table 2 is found to add no significant information not already available in Table 2. Table 3 is therefore reflecting loyally the focus as expressed by students in process-analyses as well as interviews.

4.2 Analysis of interviews

According to the groups, *discussions* that repeat themselves are more frequent in the early semesters due to lacking establishment of shared understanding of goals and due to lacking communication skills making group-members unable to handle (manage) the uncertainties of ill-defined projects. But most of all due to a more individualized approach and lack of adequate knowledge:

“Having read the textbook doesn’t provide adequate understanding of a concept nor terminology.” [D]

Someone opens a conversation and others join (sometimes just to position themselves) and an unfocused, unstructured *discussion* develops – until someone (who has capacity to observe the conversation) calls for a summary in order to secure consistency, or until someone (who may see no point in continuing the *discussion* or may be outright upset and exhausted) calls for a vote, or until someone (who may have other pressing activities scheduled) calls for a suspension of the group-meeting as such. Groups may also differentiate between “open modus” and “closed modus”: open modus defined as a divergent process predominantly characterized by a variety of viewpoints, while closed modus is defined as a convergent process predominantly characterized by aligning positions, verifying information and making decisions. In order to differentiate the group must call for a pause between the modes and thus enabling a focus on the aims and needs.

Exemplifying this group [A] explained how some *discussions* were allowed to continue as the outcome would be learning, whereas other *discussions* would be closed earlier in order to make a management related decision. Although fewer *discussions* were reported in this group – purportedly due to the fact that the group-members were quite familiar with each other after having collaborated through 2-3 projects – focusing the conversation still needed attention. Being more familiar with each other actually meant that group-members trusted each other to perform more thorough preparation and perform in-depth research leading to

more precise and correct formulations – as opposed to a more extensive need for interpretation in groups with less common collaborative experience.

The conversations aimed at reaching (or creating or co-constructing) a shared understanding, are more prone to develop into the unfinished or undecided type of *discussions* – which may recur several times until the group has reached a sufficient level of comprehension to be able to settle the uncertainty. The needed comprehension may deal with academia, methodology or structure. Two other factors influencing the closing of *discussions* are time and patience; deadlines can be quite conducive to urge group-members to make a choice, and those with more patience (and words) are more likely to have an impact.

In group [B] a typical *discussion* (within the early project phase) may begin with a request/suggestion for a plan (schedule; overview) for the work to enable the project-progression. A suggested activity may spur a clarification of the activity and a related theoretical model which again leads the conversation towards the problem formulation – followed by comparison of theories/tools – then a detour around the initial problem-statement evaluating its validity before ending up with the requested plan expressing shared project-goals based on the shared understanding achieved through the conversation.

The group characterized this unplanned and unstructured conversation as a necessary “test of agreement” – “something you have to go through at some stage” for achieving shared understanding – as group-members otherwise “assume we agree”. Some group-members had experienced having this type of conversation during the final 1-3 weeks of their earlier semester-projects explaining the late occurrence being due to insufficient familiarity with other group-members’ thinking and a reluctance to open up issues which may disturb the assumed agreement and thus disturb work, progression and emotions.

In group [A] a typical *discussion* may originate in a desire to organize and handle data-collection properly or with an intention to align perceptions of the report-structure. The following comparisons of different approaches may not result in an actual plan or structure, but rather a clarification of “how should we plan” or “why should we structure the report a certain way”.

Students’ responses to Barrett & Moore’s (2011) principles were initially reluctant and marked by uncertainty of the meaning behind the principles, however they quickly defined “co-constructing knowledge through elaboration” as similar to their learning efforts. The “democratic social relations” is seen as a continuum where the focus relates to the development of trusting and helping each other, and similarly the “shared control” comprises issues of responsibility, interest and contribution. Students stressed that an extra principle “shared goal/product” seemingly is missing. Engineering students’ are deeply engaged in systematizing, analyzing, planning and measuring in their efforts to solve the project-problem:

“We are applying theoretical knowledge to a practical problem.” [C]

As groups become more conscious of the project-process and attains a more holistic perception of performing a study-project it also becomes obvious that *discussions* serve as a means to produce output that ultimately becomes input to another part of the project. And while students during early semesters perceive ownership as the right and plight to defend their personal writings and react hotheadedly possessive, students at later semesters will perceive ownership as a group achievement that cuts away any individualistic and possessive claim regarding insignificant project-issues.

5. Findings and discussion

5.1 Origin of group-discussions

Based on the interviews with student-groups it appears that *discussions* originate in a:

- lacking transparency or consensus;
- disagreement or a wish to define/clarify/rectify;
- deliberate intention to attain deeper knowledge;
- deliberate intention to manage the process and/or to structure the project/report;
- deliberate intention to reframe, rethink, restructure and/or innovate.

The reasons listed are apparently all based in a striving to achieve results which in students’ words mean doing “what’s making us engineers”.

5.2 Discussion as media

Like in the communication exercise mentioned in the Introduction, the communication among the participants serves as a means to achieving results – solving the mystery or in engineering terms: solve the problem with a procedural or functional construct. Solutions do not appear out of the blue, only based on solid and verifiable knowledge which (in learning terminology) serves as ingredients in the students’ co-constructing through co-elaboration – which in project-management terminology is equivalent to a coordinating process.

Citing Willert (2011) who in his terms specify “learning mediated through languageing” where students “adopt new language patterns or codes, thereby, hopefully, helping them to gain a richer understanding of the world or to become more adept at

handling it in action.” *Discussions* thus serve as media for coordination of meaning (Pearce, 2007) – the *discussion* results (goals, plans, procedures, activities or tools) being expressed as coordinated management of meaning.

As reported from the interviews unstructured approaches are most common, however it appears that approaches become more and more systematized and professionalized as experience accumulates and skills and competences emerge – ultimately securing conversations from the “pitfalls and dangers” listed in table 1.

5.3 Discussion as engineering tool

For Henriksen (2011) the coordination or negotiation process is clearly a co-construction of a new meaning or a new understanding which as a shared effort dissolves the conflicts that otherwise impede project progression. Awareness and professional competences enables quality conversations – a serious recommendation to students of early semesters that homework actually does pay off immediately and in the long run. However, a significant learning that emerged from the communication exercise mentioned in the Introduction is that posing crucial and critical questions can at times serve as the most effective and efficient approach in problem-solving (learning).

When taking into account the cognitive abilities in Dixon’s (1999) organizational learning cycle students confirm that their *discussions* affects all aspects of the learning cycle. Furthermore, the students appreciated the fact being involved in the full learning cycle and the full project-cycle, although they still find project complexity to be a unifying as well as a separating factor between management and “real engineering performance”.

5.4 Discussion as diagnostic tool

Barrett & Moore (2011) propose their three principles as facilitators of the dialogic knowing central for groups engaged with PBL-tutorials. The principles coupled with a project-management view provide a useable and useful diagnostic tool for:

- assessing strengths and weaknesses in the group’s approach;
- suggesting changes in the group’s approach;
- making supervisory interventions.

6. Conclusion

In conclusion, this paper has sought to (1) find ways of facilitating students’ handling of *discussions* in early semesters, and (2) find ways of motivating students for approaching *discussions* as a professional skill used by professional engineers. As regards (1) the overviews provided in tables 2 and 3 are proposed as diagnostic tools to assess strengths and weaknesses in the project-groups’ approach. How this diagnostic tool may be applied is yet to be explored, but the evidence behind this way of thinking points towards formulating more durable explanations for what is making the Aalborg Model of PBL work.

As regards (2) the evidence provided proposes a stronger focus in the supervision and in the PBL-course raising the awareness of the potential in and the value of conversation competences. Communication exercises (like the “Murder at the Black Horse”) and subsequent thorough analyses and follow-ups seem necessary in providing early-semester students essential eye-openers regarding best performance versus pitfalls and dangers.

Acknowledgements

I appreciate the constructive comments on my initial and developing ideas as well as the fruitful conversations with colleagues Erik de Graff, Lars Bo Henriksen, Alexia Jacobsen, Lars Peter Jensen and Mette Mosgaard – and in particular I appreciate the students’ willingness to be interviewed and engage in deliberate conversations about their own practice.

References

- Barrett, T. & Moore, S. (2011). Students Maximising the Potential of the Problem-based Learning Tutorial: Generating Dialogic Knowing. In: Barrett, T. & Moore, S. (Eds.): *New Approaches to Problem-based Learning: Revitalising Your Practice in Higher Education*. Routledge, New York. (p. 115-129)
- Dixon, N. M. (1999). *The organizational learning cycle: how we can learn collectively*. 2nd ed., Aldershot, Gover.
- Henriksen, L.B. (2011). The engineering project and the concept of “implementation” – on engineers, project management, and “the thing itself”. *Working paper presented at the Proceed seminar – Aalborg 25-26 August 2011*.
- Merriam-Webster (2013). <http://www.merriam-webster.com> (accessed March 3, 2013).
- Mosgaard, M. & Spliid, C.M. (2011). Evaluating the impact of a PBL-course for first-year engineering students learning through PBL-projects. In: 2nd International Conference on Wireless Communication, Vehicular Technology, Information Theory and Aerospace & Electronic Systems Technology (Wireless VITAE). IEEE Press.
- Pearce, W. B. (2007). *Kommunikation og skabelsen af sociale verdener (Communication and the making of social worlds)*. Dansk Psykologisk Forlag.
- Spliid, C.M. (2011). Mastering projects and processes in the Aalborg PBL model. In: Davies, J., E. de Graaff & A. Kolmos (Eds.): *PBL across the disciplines: Research into best practice*. Aalborg: Aalborg Universitetsforlag. (p. 555-568)

Willert, S. (2011) Social construction of meaning and its translation into real world action: the problem of learning transfer and how to circumvent it. In: Horsdal, M. (ed.) *Communication, Collaboration and Creativity. Researching Adult Learning*. Odense: University Press of Southern Denmark.