

# Continued Multidisciplinary Project-Based Learning (CM-PBL) Frame and Assessment Criteria

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Problem- and project-based learning represent approved methods to train students, graduates and post-graduates in scientific and other professional skills. Project-based learning (PBL) is a promising education method especially in the case of Health Informatics, due to the inherently multidisciplinary approach to research and development projects in this field. PBL is generally tailored to one or two term schedules. The students are trained on realistic scenarios in a broader context. Continued Multidisciplinary Project-Based Learning (CM-PBL) was developed and implemented to afford the continued training of students of computer science and medicine during their theses both on scientific working and on professional skills. A long-term research project on a web-based information system on hospitals built the scenario for the realistic context. This short paper describes the CM-PBL Frame and the assessment criteria for the students' performance and outcome.

Keywords: H/MI education, Learning models, Cognitive Learning, Project-based Learning, Problem-Based Learning, Medical Informatics

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The author developed and implemented CM-PBL at the Department of Medical Informatics at Aachen University during the period 2002-2007. The development has been based upon personal experiences with and training in project work in an international consulting company, literature work, training-courses in Problem-Based Learning at Maastricht University (NL) and last not least the continued cooperation, support and feedback of the students and the co-teacher Dr. Cord Spreckelsen [[We07](#)], [[WS07](#)].

The following describes the CM-PBL frame in short and lists the assessment criteria the author and her colleague used for the formative assessment of the students on their scientific work and their professional skills. As they are not part of [[We07](#)] and may be of use for other teachers, the author decided to publish them separately.

## **CM-PBL Frame**

### ***Integration in a Research Project***

In a CM-PBL environment the students work on their theses as full-value team members of a long-term research project. The student's sub-project constitutes the topic of his or her thesis. Each student is obligated to present his or her ongoing work regularly to the team and to participate in the discussions of the team mates' progresses and questions. This takes place during the weekly meetings of the research team.

The training of the students in scientific work consists of three parts:

- A workflow for the thesis describes the "Milestones of a Thesis".
- The team acts as peer group.
- The teachers perform formative and summative assessments of the students' scientific work and professional skills and intervene if necessary.

In addition to these three parts the teachers intermediately give short lectures on scientific work, such as literature research, in one of the weekly meetings.

### ***Training in Scientific Work***

#### **Part A: Milestones of a Thesis**

The guidance during the thesis follows a workflow, called "Milestones of a Thesis" (see Table 1). The workflow is communicated during the first individual meeting of the teacher with the student. It is described in the project documentation, which is accessible on a research server for every team member. If necessary the teacher introduces the student to scientific work during the individual meetings. The workflow describes the structured conversation of the teacher with the student (Laurillard 1998, see [[HPO6](#)]), and the familiarization of the student with the IT environment of CM-PBL.

**Table 1:** Milestones of a Thesis

<b>Period</b>	<b>Milestone</b>	<b>What</b>	<b>Who</b>
Orientation	o Request for a thesis topic	1 <sup>st</sup> contact (Email or call)	Student to teacher
	o Becoming acquainted with each other and the project	1 <sup>st</sup> individual meeting	Student and teacher
	o Announcement of participation	Email	Student to teacher
Planning	o Study design o Draft of the project plan	2 <sup>nd</sup> individual meeting	Student and teacher
	o Becoming a team member	1 <sup>st</sup> participation in a team meeting	Student and team
	o Access to the research server	Email	Student to project assistant
Performing	o Proposal	Working paper	Student to teacher
	o Research question o Study design o Project plan	1 <sup>st</sup> presentation	Student to team
	o Conduct of the project, e.g. o Requirements analysis o Design o Implementation o Evaluation	Further presentations	Student to team
	o Acceptance	Final presentation	Team to student
	o Basis for further research and development (R+D)	Provision of the developed application and research data on the research server	Student to team
	o Closure o Final evaluation of the CM-PBL approach (*) o Discussion of future R+D ideas and professional plans	Final individual meeting	Student and teacher

(\*) The formative evaluation of the CM-PBL approach takes place as single interviews with the students at the beginning, in the middle and at the end of their thesis projects. Furthermore the teachers perform group interviews during the weekly team meetings approximately every three months, to explore the students' satisfaction, ideas and recommendations for further improvement.

## Part B: The Team as Peer Group

The team acts as peer group. During the weekly meetings one or two students present their work on certain milestones of their project and get feedback from their team mates and from their teachers. This fosters social interactions, which are regarded as a crucial part of a good learning environment [HP06], [SD95].

## Part C: Assessment and Intervention

The two teachers assess formatively the students' work and skills. This is done every four weeks: For every student assessment criteria on scientific work [DLLS02] and professional skills [DL98], [Se02] are evaluated:

The **criteria on scientific work** are

- knowledge and competency,
- methodical and scientific work,
- determination, commitment and autonomy,
- quality of performance,
- quality of presentation.

**Table 2:** Assessment Criteria for the Scientific Work, based upon [DLLS02]

	<b>Knowledge and Competency</b>	<b>Methodical and Scientific Work</b>	<b>Determination, Commitment and Autonomy</b>	<b>Quality of Performance</b>	<b>Quality of Presentation</b>
<b>A</b>	Profound knowledge and willingness to learn	The thesis is performed methodologically and based on scientific standards	Based upon own ideas and determination, all goals are attained or exceeded	Outstanding and new results are achieved	Exemplary representation of results
	12...15	12...15	16...20	26...30	16...20
<b>B</b>	Profound knowledge, is interested	The thesis considers scientific standards	The theses is performed independently, own ideas were introduced	All required results are achieved	Competent and carefully reasoned
	8...11	8...11	11...15	18...25	11...15
<b>C</b>	Moderate knowledge, gains knowledge if necessary	The thesis is performed partly methodologically	Certain determination, goals partly achieved	Satisfactory results	No more accuracy than what is absolutely necessary
	4...7	4...7	6...10	11...17	6...10
<b>D</b>	Lacking knowledge, little interest to learn	Lhe thesis is performed barely methodologically	Low determination	Minimal result	Sloppy presentation
	0...3	0...3	0...5	0...10	0...5

The **criteria on professional skills** are

- dependability,
- open to criticism,
- purposefulness,
- time management,
- capacity for team work.

**Table 3:** Assessment Criteria for the Professional Skills, based upon [DL98], [Se02]

	<b>Depend-ability</b>	<b>Open to Criticism</b>	<b>Purpose-fulness</b>	<b>Time Management</b>	<b>Capacity for Team Work</b>
<b>A</b>	Consistent	Consistent	Sets him- or herself a target and shows high purposefulness	Allocates his or her spaces of time for studies, jobs and social life (family etc.) methodically and goal-oriented	Meets all criteria listed below (*)
	26...30	16...20	12...15	16...20	12...15
<b>B</b>	Sometimes not	Sometimes not	Strives for a given goal	Good if getting intermediate feedback	One sub-criterion of level A is not met
	18...25	11...15	8...11	11...15	8...11
<b>C</b>	Often not	Often not	Tends to digress	Has to do some troubleshooting intermediately	Does not participate or is unmastered
	11...17	6...10	4...7	6...10	4...7
<b>D</b>	Never	Immune to feedback	Unoriented	Nonexistent	Disturbs the team work
	0...10	0...5	0...3	0...5	0...3

(\*) Capacity for team work is characterized by [DL98], [Se02]

- respectful towards the team mates and externs,
- differentiates content and relationship aspect,
- listens actively,
- gives feedback,
- offers own ideas,
- undertakes the task of doing something for the research project or his / her team mates.

The teachers start an **intervention**, if a criterion is rated as C or D during their monthly assessment of the students.

The intervention measures include

- A Laud
- B Laud & hints how to improve further
- C Encouragement and advices where and how to improve
- D Close monitoring and advices where improvement is necessary and how it should be done

Additionally the teachers decide on the fly during the weekly team meetings after a student's presentation, whether an intervention is necessary: Either a student is asked to perform a second presentation of the work one or two weeks later, or the teachers decide to discuss the student's work with him or her in a supplementary conversation. This applies especially for the professional skills, as the teacher and the student have to discuss to a certain extent the student's characteristics. Furthermore the student can ask the teachers for additional support.

The thesis report and a final presentation are evaluated for the final marks. The assessment is based upon the assessment criteria for the scientific work (see Table 2). Table 4 shows the correlation of final marks and assessment points.

**Table 4:** Final marks (at Aachen University, Germany, 2002) and assessment points for the scientific work [[DLLS02](#)]

Final Marks	Assessment Points
1.0	93-100
1.3	86-92
1.7	80-85
2.0	74-79
2.3	68-73
2.7	62-67
3.0	56-61
3.3	50-55
3.7	44-49
4.0	38-43

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