



Is there an ideal assessment method to evaluate academic knowledge, team work and interpersonnal skills in a PBL process ?

Adrien Barrot, Christine Barrot, Bertrand Doucet, Wissam Karam,
Emmanuel Rodriguez

► To cite this version:

Adrien Barrot, Christine Barrot, Bertrand Doucet, Wissam Karam, Emmanuel Rodriguez. Is there an ideal assessment method to evaluate academic knowledge, team work and interpersonnal skills in a PBL process ?. Active Learning in Engineering Education (ALE 2007), Jun 2007, Toulouse, France. hal-02423349

HAL Id: hal-02423349

<https://hal.science/hal-02423349>

Submitted on 24 Dec 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

IS THERE AN IDEAL ASSESSMENT METHOD TO EVALUATE ACADEMIC KNOWLEDGE, TEAM WORK AND INTERPERSONAL SKILLS IN A PBL PROCESS?

BARROT Adrien¹, BARROT Christine¹, DOUCET Bertrand¹, KARAM Wissam¹, RODRIGUEZ Emmanuel¹

*1 INSA de Toulouse, 135 av. de Rangueil, 31077 Toulouse, France
emmanuel.rodriguez@insa-toulouse.fr*

Abstract

Issues concerning learning assessments are presented, extracted from a PBL experience. Aiming at improving the current PBL second session, proposals of solutions to the risk of too many assessments, the students' disappointment facing the trade-off between daily work and formal evaluation, and interpersonal skills and team work assessments, are explained and proposed for discussion.

Key words:

Assessment, student frustration, team work, interpersonal skills, PBL.

I INTRODUCTION

A Problem Based Learning (PBL) Mechanical Design course for students in second year of an engineering school (around 20-years old), has been run twice between September 2005 and June 2007. Considering all the areas that reflect the quality of a learning experience, the first year (2005-2006) brought many satisfactions (student motivation, respect of objectives, etc.) and some disappointments (excessive time spent for homework, assessment frustration, etc.) (Barrot *et al*, 2007). Among these areas, there are learning assessments which are crucial for the learning success, and also a delicate part to manage for PBL designers and tutors. We encountered indeed some unsatisfying situations of assessment, which may be summarised by four questions:

- i- How can a succession of assessments which blurs their individual meaning for the students be avoided?
- ii- How can the students' frustration linked to the gap between time spent during the project phase and the formal evaluation be limited?
- iii- How can the interpersonal skills be evaluated?
- iv- Should team work be assessed?

Based on this first experiment and publications concerning this topic (Dutch *et al*, 2001), we have looked for improvements to answer these issues, in order to apply

them during the second year (2006-2007). Our solutions are presented and submitted for discussion.

II ISSUES ABOUT THE SUCCESSION OF ASSESSMENTS

Through publications and discussions with other teachers, it is not rare to see that evaluation is a difficult point to implement.

Pesse wanted to put the stress on the evaluations by multiplying them (Pesse *et al*, 2007). Thus knowledge is regularly evaluated four times during the course. However, the significant number of evaluations causes a decrease in the marks standard deviation and finally a good project is not clearly differentiated from a bad one. This problem is recurrent even if the evaluation is not marked. This problem is encountered for know-how as well as for interpersonal skills or teamwork.

Let us show a concrete example. During our first experience in PBL, we wanted to control everything to avoid bad surprises. Thus, in order to check the teamwork progress, many exhaustive grids were elaborated. They include five main points:

- General feelings,
- Communication between team-mates,
- Team organization,
- Knowledge sharing,
- Personal work and commitment in the group.

In practice, students had to complete a grid every two courses. To avoid boredom, the grids were different each time, and their complexity was increased. But the effect was the opposite. The complexity of these grids, the great number of questions and the non-repeatability of the questions produced two consequences. On one hand, the students did not look at them and, on the other hand, the tutor did not use them to see whether the group worked in a suitable way.

Consequently, the intention of guiding the students and diagnosing various problems managed to hide the true goal of these self-assessment grids. At the end of each restructuration lecture based on student questions, we distributed only one exercise on the same topic but related to another study case. The small number of exercises (only one per topic) generated student fear attributable to the false idea of insufficient knowledge acquisition.

This year, to improve the system of self-assessment, we increased the number of exercises per topic and we used only one self-assessment grid which summarises the points presented previously. Always using the same grid facilitates filling it out for the students and the tutor's diagnosis. In addition, using the same grid allows a comparison during the course.

As the course has not yet finished, we cannot say if the feelings of the students will be better. A question remains: "Is it possible to find appropriate evaluations? (a good compromise between type and numbers)"

III STUDENTS' FRUSTRATION

In the first year, one of the main problems we were confronted with was the students' frustration caused by the final examination method. Knowing that sustained frustration impedes students' learning and efficiency in exams (Chaffar and Frasson, 2005), we will present our formal assessment technique and the consequent student reaction. Then we will explain how we intend to minimize complaints and frustrations during the second year.

III.1 Past examination method and its criticism

During the first year of our course, students' grades were composed equally by the project mark and by a formal examination mark. One of the main consequences we were confronted with was the frustration caused by the above ratio. Students did not tolerate that project work – on which they spent more than 60 hours (around 40 hours in the classroom) – could have an equal share in the final grade with a three-hour examination. Moreover, this feeling was strengthened by the type of final examination (classical exam) that they considered not related to the active learning method we tried to use with them during a full semester. The direct effect was that some students who got used to working with diverse references (especially books and internet) without time constraints were destabilized. This led to some emotional breakdowns during the exam: some walkouts one hour after the beginning and a case of crying that required a close attention of the tutors present.

III.2 Present intention of modification

In order to minimise the students' frustration in the second year, we have tried to work conjointly on the emotional and the examination sides. First, thanks to the improvement of our tutoring skills and by increasing the time spent with students, we give the students more rooms to voice their opinions. Frustration is then minimised because they feel understood by the tutors. The latter should also inform the students about the examination method fairly early during the semester so that they take it into consideration during the learning and studying process (self-developing formula sheets, doing exercises). Then, during last year's final examination, many students complained about the amount of time needed to fully read and understand the exam's technical file. In fact, the exam subject was composed of two distinct parts: the technical file and the question sheet. Consequently this year, we intend to hand out the technical file up to two weeks before the examination date so that they find enough time to understand the drawings, the functioning of the mechanism and the French technical words (for foreign students). This should eliminate a part of their fear during the exam session.

By the above, we are trying to minimize frustration caused by an examination technique which does not fit in with the learning methods. But a huge question is still unsolved: “How can we, when a group work is done, evaluate the personal skills and motivation without passing by a formal examination?”

IV INTERPERSONAL SKILLS

Problem Based Learning often takes into consideration the students’ interpersonal skills. In fact, in a labour market where these competences are the most demanded, the PBL method is an effective means to teach students the basics of interpersonal skills.

However, there is not a unique and complete solution for their assessment, since this knowledge is particularly subjective.

According to Dorval, (Dorval *et al*, 2007), a biology teacher, interpersonal skills are often ignored in different assessments, though students must acquire some notions as:

- Identifying, analysing information to solve a problem,
- Communicating an idea, explaining a concept to someone,
- Working in group.

He considers that interpersonal skills should be individually evaluated and should represent twenty per cent of the final mark. This percentage is shared out in ten per cent given by the tutor, five per cent by the laboratory team, and five per cent by the peers. To help the assessment, five criteria are given to tutors and peers:

1. The student’s contribution to the team efficacy. Does the student take part in an active way in the “life of the group”?
2. The student’s autonomy. How does the student manage his working time? Is he creative?
3. The reasoning and scientific responsibility. Does the student take into account the good hypothesis? Is he giving evidence of scientific rigor?
4. Personal development and social implication. Is the student curious? Is he able to work in team?
5. Attendance. Is the student present at the meetings? Is he late?

This article is based on a study done by twelve teachers practising PBL. It highlights the difficulty to obtain homogeneous interpersonal skills marks between teachers.

Moreover, on one hand, according to the students, the part of this knowledge in the final mark is underestimated and on the other hand, some teachers think it is too high, because they consider interpersonal skills useless.

During our first experience, we put the stress on scientific knowledge. That is why interpersonal skills were not identified as a marked item. We considered that PBL

could bring more in the interpersonal skills field but that it was not a good thing to mark them.

In practice, each group was given a global mark covering different aspects of subject knowledge. Nevertheless, tutors could attribute an individual mark in order to take into account motivation or absenteeism. Of course, as Dorval showed, it is only one aspect of the interpersonal skills.

During our second year of experience, we have decided to clarify the interpersonal skills mark. Considering that only what has been learned or acquired should be assessed, the evaluation of these skills is formative. Finally, we just insist on building awareness of interpersonal skills; the students have three more years to improve them before graduating.

Thus, a specific informative document about interpersonal skills is distributed to the students. It is presented as a grid of twenty adjectives which enables students to self assess their behaviour (rigorous, curious, autonomous, creative, etc.). This grid is completed individually at the beginning and at the end of the course.

Finally, in our future work, we wish to improve the interpersonal skills assessment taking it into account officially by the means of evaluation grids. For this, a precise understanding by the teacher is necessary which is not yet the case. A question is raised: "Is PBL appropriate to teach interpersonal skills?"

V TEAMWORK ASSESSMENT

Teamwork is one of the main features of our course. Firstly, as always in PBL, working in a group can help students in many ways (for example by lessening the sense of isolation (Seymour & Hewitt, 1997) and improving academic achievements, persistence (Johnson, Johnson, & Smith, 1991, 1998; Springer, Stane & Donovan, 1999), autonomy and social maturity (Michaelson & Black, 1994)). It can also be a cause of problems (Felder & Brent, 1996) and failure (Feichtner & Davis, 1985) if not carefully monitored. Secondly, mechanical design methods are almost all based on a group of designers. The group has different aims depending on the method:

- value analysis (Chevallier, 1989) and functional analysis (Tassinari, 2003) use it as a way to include different points of view to find all the functions of a product,
- TRIZ (Cavallucci, 1999) and many other creativity methods (Gogu, 2000) use it as a way to improve lateral thinking (de Bono, 1967),
- concurrent engineering (Prudhomme, 1999) uses it to fasten the design phase of a product by doing all its sub-phases in parallel.

Therefore teamwork is not only a way to improve the learning of students but also a way to acquire skills that are used daily by mechanical designers.

V.1 Aims of our PBL course concerning teamwork

Before choosing a specific kind of assessment, the aims of the course, have to be precisely defined (Duch & Groh, 2001). Indeed, the more precise our aims are, the more accurate our assessment will be. This is especially true concerning the acquisition of skills that cannot be easily classified as right or wrong.

In our case, students are almost complete beginners concerning team work skills and methods. They have already worked on a problem based learning course during which they used group roles (Allen, Duch & Groh, 2001): leader, reporter and timekeeper. The fact is that, when asked, the students globally do not think that this team working method is efficient and really used by engineers.

The aims of our PBL course are therefore modest. First, students should experience and analyse the benefit of working in groups when tasks can be done in parallel. This is the most easily demonstrated contribution of team work and therefore a way to stimulate them to get the group organised. Secondly, they should experience the benefit of a team facing a task where everybody can contribute something to the group. This is harder to achieve. Our students have different background knowledge, some of them having already taken mechanical design classes. Finally, the students should experience and discuss whether the use of group roles is an efficient team management tool.

V.2 First assessments

Team working skills are hard to assess due to their non-Boolean nature. Facing an issue, the use of team working methods cannot be easily demonstrated as being right or wrong. Such a situation has to be experienced and analysed so that the students can be convinced by the efficiency of these methods. Therefore, we think that team working is better assessed by a formative peer, team or self-assessment. Assessment is thus a way to analyse the situations students have experienced during the course.

To reach our first aim, we planned to make the students work on a time consuming pre-project that cannot be done without distributing the different tasks composing the pre-project. Last year, we noticed that students understood the benefit of the group facing a problem too long to be done in time by a single person.

Concerning our second and third aims, we used four different self-assessment grids in order to progressively increase their perception of issues and benefits of team working, team working skills and methods (Bourret & Moore, 2005; Marre, Hernandez, Hernandez, & Ferrer, 2005). As explained in §II these grids were underused. Therefore if the groups were efficient because of tutor interventions, students have not clearly analysed the benefits of bringing different ways of thinking together and the need for a group to use organisation tools.

V.3 Assessment modifications

Our first aim being achieved by our first self-assessment method, we decided to keep it.

The assessment of the second and third aim are now simplified in a single grid as explained in §II to help the students to keep track of the evolution of their team working skills. Analysis of the situation is improved by tutor questioning on the answers given by the students on the grid.

To help the students understand the different issues of team work and the benefit of using group roles, we chose to let each student become a tutor for 15 minutes. They first observe a working team with a tutor group analysis tool (Milgrom & Jacqmot, 2000). Then, they analyse what the good behaviours and the problems of the observed group are, and intervene as a tutor by asking questions to the group to help them improve their team behaviour. This peer assessment shows very good results on the observing students: nearly all of them declare to understand that using group roles is important and that they will be more vigilant on their own and their group behaviours.

Nevertheless, formative assessments have a lesser impact than normative ones. In order to lay emphasis on team work, should we grade it? And what means are the best to assess such skills?

VI CONCLUSION

Our first experience in a PBL led us to face four main issues concerning assessment: the possible inefficiency of a succession of assessments, the students' disappointment facing the trade-off between daily work and final evaluation, the assessments of interpersonal skills and team work. For each issue, ideas for solutions have been proposed, such as a unique self-assessment grid, a modification of the final exam, or the occasional students' activity as tutors. But other questions remain in these fields. Our search for improvement in these issues is continuing during this second year, and our ideas are currently being tested in a real and demanding way: by the students' direct reactions.

REFERENCES

- Allen, D. E., Duch, B. J. & Groh, S. E. (2001). Strategies for using groupes *In* Duch, B. J., Groh, S. E. & Allen, D. E. *The power of problem-based learning* (pp.59-68). Sterling Virginia, Stylus Publishing.
- Barrot, A., Barrot, C., Doucet, B., Karam, W. & Rodriguez, E. (2007). *L'APP pour initier à la Conception Mécanique*. Actes du colloque Pédagogie active dans l'enseignement supérieur, Université catholique de Louvain, Louvain-La-Neuve (Belgique), 24-26 janvier 2007 (pp.35-44).

- Cavallucci, D. (1999). TRIZ : l'approche altshullerienne de la créativité. *Techniques de l'Ingénieur*, A5211.
- Chevallier, J. (1989. 1^e ed.). *Produits et Analyse de la Valeur*. Toulouse, Cepadues-Editions.
- Chaffar, S. & Frasson, C. (2005). The Emotional Conditions of Learning. *American Association for Artificial Intellingence*, 6p, (www.aaai.org).
- De Bono, E. (1967). *The use of Lateral Thinking*, ISBN: 0-14-013788-2.
- Dorval, E., Ménard, L. & Maufette, Y. (2007). *La perception des professeurs à l'évaluation du savoir-être dans un baccalauréat en APP*. Actes du colloque Pédagogie active dans l'enseignement supérieur, Université catholique de Louvain, Louvain-La-Neuve (Belgique), 24-26 janvier 2007 (pp.323-334).
- Duch, B. J. & Groh, S. E. (2001). Assessment strategies in a problem-based learning course *In* Duch, B. J., Groh, S. E. & Allen, D. E. *The power of problem-based learning* (pp.59-68). Sterling Virginia, Stylus Publishing.
- Feichtner, S. B., & Davis, E. A. (1985). Why some groups fails : A survey of students' experiences with learning groups. *The Organizational Behaviour Teaching Review, Vol. 9* (pp.58-73).
- Felder, R. M., & Brent, R. (1996). Navigating the bumpy road to student –centered instruction. *College teaching, Vol. 44* (pp.43-47).
- Gogu, G. (2000). Méthodologie d'innovation : la résolution des problèmes créatifs. *Revue Française de Gestion Industrielle, Vol. 19* (pp.35-62).
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (1991). Cooperative learning : Increasing college faculty instructional productivity. ASHE-ERIC *Higher Education Report No. 4*. Washigton, DC : Gearoge Washigton University.
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Maximising instruction throught cooperative learning. *ASEE PRISM*, February (pp.24-29).
- Michaelson, L. K., & Black, R.H. (1994). Building learning teams: The key to harnessing the power of small groups in higher education. In S. Kadel & J. Keener (Eds.) *Collaborative learning: A sourcebook for higher education Vol. 2*. State College, PA: Nationnal Center for teaching and Learning Assessment, (pp.65-81).
- Milgrom, E., & Jacqmot, C. (2000). *Le guide du tuteur en candidature FSA*. Louvain-La-Neuve, Université Catholique de Louvain.
- Pesse, S. & Legrand, X. (2007). *La mise en place de la pédagogie par projet à l'Ecole Nationale Supérieure des Arts et Industries Textiles*. Actes du colloque Pédagogie active dans l'enseignement supérieur, Université catholique de Louvain, Louvain-La-Neuve (Belgique), 24-26 janvier 2007 (pp.229-234).

- Prudhomme, G. (1999). *Le processus de conception de systèmes mécaniques et son enseignement – La transposition didactique comme outil d'analyse épistémologique*. Thesis, Université Joseph Fourier – Grenoble 1.
- Seymour, E. & Hewitt, N. (1997). *Talking about leaving : Factors contributing to high attrition rates among science, mathematics, and engineering undergraduate majors*. Boulder, CO : Westview.
- Springer, L., Stanne, M. E. & Donovan, S. (1999). Effects of cooperative learning on undergrads in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research*, Vol. 69 (pp.21-52).
- Tassinari, R. (2003. 3^e ed.). *Pratique de l'Analyse Fonctionnelle*. Paris, Dunod.