LESSONS IN GROUPS ("LIG")
An original active way to study lessons

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Abstract

We present here research for deriving a collaborative learning situation which is not based on a project or problem. The method mainly consists in working in small teams (4 or 5 students) in order to debate on a lesson which has been previously studied individually (as homework) by each student. Coupled with a motivation problem worked out in the team as a "brain storming", and with quite classical exercises usually solved within the team, this method appears to be very efficient, motivating for the students and well adapted to any subject, including those often considered as difficult to be studied in active PBL, such as mathematics.

Workshop Topics

Autonomous learning; Beyond active learning.

More details (in French) in *http://enseignants.insa-toulouse.fr/fr/ameliorer_mon_cours/PEG.html*

I INTRODUCTION

The starting point of the proposed method is to take the benefit of active learning while getting more efficiency in the global work of the students. The work to be done is precisely defined, so we can guarantee that all the important points are properly studied. To do so, lessons are first studied as homework, with documents, then teams try to solve the difficulties of each team member.

The size of the groups (that we call here "teams") is small (4 or 5 students), so we do not need group working techniques (leader, secretary…); this small size also better develops the strength of solidarity and help between students, and gives more speaking time to each student.

Contrary to many active methods, the students know precisely what they have to do (study a precise chapter of a course book, solve a given exercise…). The group gives a motivation for the students to do the homework (since it is a prerequisite for the work in the team), and the discussion clarifies points which were not clear for each student individually.

II METHODOLOGY

Four important (new ?) ideas give a global consistency of this active process:

1. **Working the lessons in a team;** contrary to most active methods, the students' work is not based on a project or a problem. We require the students study the course for itself. The students work on the course in a team.

   This is usually done in a two-stage process: First the students know that they have to study a precise part of a book or of some document, which has to be done (individually) as homework. Then the students discuss in the team and compare their difficulties, questions, misunderstanding, as well as the points which seem clear to them. Students having understood a difficult point give an explanation to those who did not understand that point, and the students of the team try to solve together the difficulties they may all have encountered. If they do not succeed, they have to express where the problem occurs and then they may ask the professor to help them, which is done under the explicit condition that this is a question arising from the whole team, not from a part (for example from a single student) of the team.

   As we see, the role of the team is to compare and collect the problems the students may have encountered during their personal work (usually as homework), and to find the necessary explanation or to solve the remaining points, while the role of the professor is not to present some new material, but to help the teams solve the difficulties they may have encountered when studying the new material.

2. Positioning and motivation problem: We need to pay special attention to motivate the students (working on a subject alone will not be performed with sufficient attention if the motivation is not there!). This is done in a first step by a so-called "positioning and motivation problem": the professor gives the teams a problem and asks them "what would you do to solve this problem" (or 'How would you solve the problem'). Note that the students are not asked to give a complete solution to the problem, but to find a way they think it could be solved. In fact, the students do not yet have all the material to solve the problem as the aim of the course is to assimilate the new material necessary to solve it. The main hints may be suggested in the wording of the problem.

This problem has three positive points: first the students have their first contact with the interest of working in a team (here in a "brain storming"), and begin to know the students of their team; second this gives a strong motivation for working on the lessons (as requested!), and finally, the problem may be used as a common thread all along the course.

3. Restructuring lectures: The so-called restructuring lectures are survey lectures given by the professor to give consistency to the general lines of the course, after it has been studied by the teams. As research survey lectures, they can also point out some consequences and other possible uses of the lessons studied. Note that the aim of these lessons is NOT to answer the questions of the students (this has been done previously, during teamwork).

4. Exercises and problems solved in teams: As usual, some exercises or problems are given to the students to assimilate the notions and to get the necessary practise and use of them. Usually we do not ask for previous homework for them, but we prefer the team to catch the problem. In this case, it is done in three steps:

- First, teamwork to define a strategy of resolution,
- Then individual work in order to bring the calculations to a successful conclusion and for each student to have his own practice.
- Finally comparison, synthesis and comments of the results by the group.

We can use any kind of exercise, but we preferably use thorough exercises, requiring initiative or in-depth understanding of the lesson (a kind of brain storming to define the strategy of resolution).These exercises include the know-how.

Of course practical work can also be scheduled to complete the learning process (this is usually done alone, so that students can evaluate their actual assimilation of the subject)..

Remarks:

Contrary to some active methods (such as, often, in PBL), the professor answers questions from the group; the important point is that the question is formulated by the group, not by one student of the group. The actual way to answer (re-questioning, giving only a small help or giving the answer, giving quite complete and long explanation, even sometimes showing illustrations or consequences) depends of course on the pedagogical a propos of the professor.

III WAY OF WORKING

Course progression and role of the team:

This is an important difference with most active methods: the matter is studied in a precise order and rhythm, naturally similar for all the teams. All teams are supposed to learn the same material in the same order (that of the document they have to study). Far less initiative (than PBL for example) is given to the students. The role of the team is not to define what the students will learn, nor to give any kind of production, but to help the students to understand and assimilate the notions they have to study.

Working in a team:

Depending on what is required, teams may work either as a “brain storming” (find a way to solve the problem or an exercise), or in a “helping” way

(compare what has been learned, the difficulties or the questions on the personal work previously done). These two ways of working are very different and do not give any room to work sharing. Each student really knows that working in a team is a better way for him to understand and assimilate the subject matter of the course.

Positioning and motivation problem:

Let us emphasize here that the students are not asked to "solve the problem", but only to say "what they would do to solve the problem". This has many advantages: first this is true modelling, which is essential (and not sufficiently taught) in Engineering Education. Second, in this way students work on complex situations without wasting time on completely solving the problem in details, have more distance from the problem and the main choices they make. Depending on the possibilities, the problem will be completely solved (practical work) or left in a state of solving strategy at the end of the sequence. Students say that it is quite surprising for them to have a problem which they are not supposed to solve. They also say that having difficulties to go on stimulates their curiosity and their will to learn and to get new tools for solving problems.

Course learning:

This is a two-step process: first individual homework, second teamwork. Do students work the first step properly? Usually yes, since each student knows that his work is essential for the team to be able to go on properly. The second step (team work) is very useful for all students, since all have to speak, either to ask, or to explain where and why they have a difficulty, or what they (think they) have understood... and when the explanations of the professor are needed, they are really well listened to and usually understood. Asking the group the question is a must to oblige the students to clarify what is clear and what is not. And, as we already know, identifying a difficulty is already a good step to solving it. In a small team, all students speak and progress.

Restructuring lectures:

Usually these lectures are not based on live questions of the students (usually this has already been done during the team phase), but consist in a lecture telling the main lines of the course in order to be sure the students understand the structure of the course (naturally a student stays in the details, and does not see properly the course as a whole). The lectures are done at a quite quick rhythm, which is OK since students already know most of the notions, and only need to give more structure to them.

Exercises and practicals:

They are more classical and aim to complete the comprehension of the notions and to develop the know-how of the students. Usually this is done in the team, which defines how to solve the problem, and then each student does the process (computation), and they compare their results. This seems to be a really good way to do exercises in a class.

For practicals, my experience is to define the work to be done precisely, and to propose the students work alone so that each one finally knows precisely what he is able to do by himself.

Role of the professor:

We could say that the professor plays a much better role since this way of working evacuates the points solvable by students themselves, leaving to the professor to focus only on key points.

Except for the preparation of the course, and that there is much less lecturing (only for restructuring lectures) the role of the professor may seem quite classical, since his main role is to answer the question of the teams, and to do the restructuring lectures. However two points are very different from a classical way to teach: first most interventions on the questions are on the course (in a classical way questions mainly arise during exercises), and second a class has four or five less teams than students, and so the time to answer questions is, in some way four or five times greater than in a classical teaching situation.

Besides difficulties easily solved are completely solved in the team, and so the points to be discussed by the professor are more fundamental. These two points give much more interest and a much better quality of contact between the professor and the students. Besides restructuring lectures are far less technical than lectures introducing new notions (for example proofs are usually not presented in the restructuring lectures), and much more interesting since we can much better explain motivation and consequences. Of course, when necessary, the professor questions the team so that special attention can be focused on some point.

Exams:

We use the same type of exams as the traditional teaching methods, which is well understood by the students. Actually this method is not considered as an aim in itself, but as a better way to learn. Besides, by testing the individual level of students, we also test their capacity to learn in a collaborative way, since this is the way that learning has been organised .

IV APPRAISAL

Most students, as well as the professor are pleased with this method, which is perfectly usable for mathematics, but also, obviously for most subjects, be they theoretical or applied, scientific but probably also non scientific ones.

The students think that this way of learning is more efficient (for the quality of learning), and more pleasant than a traditional way, and the total amount of work is considered as close to that necessary with a traditional method. Quite all students consider that the preliminary homework is done seriously, and that the team discussion is useful and efficient, and gives a good idea (or confirmation) if they have understood the difficult points well. They consider that they learn to localise the points for which they have difficulties and to express questions about them properly.

“Happy consequences”:

This method clearly develops both autonomy and solidarity between students. Students know that other students have same (the same or some?) difficulties and are encouraged to ask other students (and the professor) to explain a point which could be difficult for them. They understand that explaining some point to fellow students, as well as searching together, is a must to better understand the subject matter.

Students say that they enjoy working with this method more than with any other method they used before (including PBL).

The professor is clearly felt as someone who helps them to work, whereas in a classical method he is felt as an authority giving them his knowledge, and in PBL he is often felt as someone looking at the groups more than helping them. Anyway, for my own part, I felt a much closer and friendlier contact with the students... and this gives more pleasure to work, both to the students and to the professor.

Technical consequences:

This method obliges students to work more regularly, and to study all along the course (instead of doing homework mainly before the exams...). The new notions are understood, and better assimilated, all along the course, which is of course of interest to properly understand the coming new notions.

Since the professor can spend more time with each team than with each student, and since simple points are solved inside the team, the professor can better identify the key points which present more difficulty to students, and can spend more time on these precise points.

Can a team (or some students of a team) have mis-understood (or mis-assimilated) a point without being aware of that? Of course this can happen. However the strength of a group lies precisely in the difference of approach of the students of the team, and it seems obvious that this happens far less often than in a traditional way of teaching. Anyway, we have to be aware of this point, which can be partly solved by a careful observation of the work done by the teams, and by questions asked to the team by the professor, when necessary.

The work to be done by the students (homework, teamwork) is well defined since it is based on a specific part of some document (book, or specific document given to the students), and the different teams progress in a quite similar way. As it is known, and detailed for example in (1), (2) or (3), we tend to remember about 70% of what we say in a discussion, while only 10% of what we read and 20% of what we hear. This "collaborative learning", gives a maximum of number of occasions to students to participate to discussions on precisely defined topics. This is why students assimilate and remember the studied topics much better with this method.

Comparison with PBL:

This method is not PBL (the subject matter studied by the students is not based on a problem, nor on a project), however it is active learning, and is based on collaboration between students and on working in teams.

Since the points that the students have to study and discuss about are precisely defined, the sequence of the studied topics are in a logical and consistent order (they do not study "aside topics" as it may happen in PBL) and the method guarantees that all the students have worked (or are supposed to have worked) on the points defined by the professor. This is why this method has a better efficiency than in many active learning methods, such as PBL.

In order to encourage active collaboration and to concentrate the attention on the scientific subject, not on the way a group is working (leader, secretary,...), the size of the groups is smaller, which seems to give more responsibility and dynamism to the students. In this method the students do not learn how to find some required information, but they learn to localise and express their difficulties, to explain to other students what they have understood. Obviously the fact that students speak together on the precise and technical subject is very important for them to understand and memorise the subject.

Finally, for abstract subjects, the theoretical approach is well ordered, and so there is no inconvenience to using this method for abstract or theoretical subjects, as it is presently done. My personal conviction is that it can be used for any kind of subject, including abstract mathematics or physics, or for humanities.

V MORE DETAILS

Some additional comments and more details are given in (4) and in the web page (5). Examples of motivation and positioning problems (mathematics, mechanics) are given in (5). Finally, as an aside topic, we mention contribution (6) which presents reflexions on PBL in mathematics and the way to build PBL problems for mathematics, and more generally for abstract subjects.

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