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*Evening meeting on teaching and pedagogy*

# Have students debate: Why ? How ?

## Team Learning: another way to teach

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*To know more (in French!) :*
http://enseignants.insa-toulouse.fr/fr/ameliorer_mon_cours/peg.html
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Don’t walk in front of me, I may not follow,

Don’t walk behind me, I may not lead,

Just walk beside me and be my friend

often attributed to *Albert Camus (?)*

# Preliminary

**1. « Knowledge is no more spread during lectures**

« Information is quite everywhere: at home, on the computer…

Institutions are no more the unique places for knowledge transmission. They have to become the preferred place for understanding and exchange. »

*Xavier Prats Monne, Commission européenne*

**2. A challenge:**

Due to various factors, a more and more important disparity of the scientific level of students.

In order to face that:

Preliminary homework… but how to achieve this ?

Only possible if strong motivation, and so if interest, visible efficiency…

# Have students debate: why ?

- **Better memorization:**

  Studies say we tend to remember

  10% of what we read

  20% of what we hear

  70% of what about we debate…

- **Better motivation:**

  More friendly, more pleasant.

  The student can better see his own progress,

  and so improves his motivation and his efficiency.

- **It encourages homework:**

  To measure up to other students, not to penalise them.

  Thanks to the better motivation

# Have students debate: how ?

- By forming (small) teams (ideally 4 students)

  who work mainly self-sufficiently
- AND by giving them activities to be solved in teams:

  Including a difficulty, an « obstacle », a challenge

  Requiring a (or various) decision, some initiatives

  Possibly involving controversy:

  Many ways to solve

  Paradoxal result…

# A team, that's magic !

**Thanks to the teams:**

Students can debate, express themselves.
Students can listen each others.

Students are encouraged to work.

But, above all, here is the « brain storming » effect:

The (partial) idea of one guy of the team can be taken over, supplemented, transformed, corrected by others teammates.

Ideas affrontments enable advances.

A team is much more than the union of teammates' ability.

So we can submit to teams problems that we could not submit to isolated students (« obstacle »).

# Have students debate on lecture material (1)

- **Homework:**

  No initial lecture, but

  Students have to learn a precise part of some document (book…)

  They have to identify difficulties and key points

- **Teamwork:**

  Students debate on this homework:

  Compare their difficulties, try to solve them alltogether

  Talk on the consequences of the important points

  The professor do help the teams when requested

  (questions clearly expressed by the whole team)

- **Remark:**

  Important to have proper motivation

  for the students do the homework

  Important to have a good document for students to work on (ouch!)

# Have students debate on lecture material (2)

**Turn the lecture material into a problem:**

Instead of lecturing, we turn the lecture into a problem

(questions to solve, leading to results usually presented during the lectur

=> Problem team solving, difficulties confronting,

the teams tries to solve these difficulties

When requested the professor helps the teams

(for questions coming fro

the team)

**… with highlighting main results**

**and consequences of important points**

**Remarks :**

Can be done with previous homework, or direct teamwork.

Important to have a good document for students to work on (ouch!)

Teamwork is necessary to overcome the obstacles due to new notions, situations.

# Lectures based on students' questions

*(Eric Mazur, Harvard)*

**Homework:**

No initial lecture, but

Students have to learn a precise part of some document (book…)

They have to identify difficulties

and ask questions to the professor via internet

**Lecture:**

The lecture is based on questions to the professor, who can see which points have to be lightened, which ones have to be highlighted…

Never for doing a quite classical lecture on the subject already studied as a homework.

**Remark:**

« No question, no lecture »

Lecture useless for a student not having done the previous homework

# Lectures based on students' answers

*(Eric Mazur, Harvard)*

## 1. A marvelous tool: questions to all students, then discussions:

A question is asked to all students, who answer via an electronic mean or hanging hands, or color papers.

If the number or right answers is between 30% and 70%,

the students have to argue with their neighbours (2-3 minutes),

then « re-vote ».

The lecture is adapted to students' understanding.

## 2. « Lecturing using students answers »:

A « quite classical » lecture (without preliminary homework) is interrupted by questions/discussions

## 3. Even better: homework, then questions/discussions/explanations:

Preliminary homework (« study a precise part of a document »)

Lecture is made of questions/discussions/explanations

# Have the students debate: exercices and problems

- Assimilation exercices or of immediate application of the lecture material:

  To be done as a homework, and to be checked or corrected in the team (comparing results, the used method, various mutual checking and explanations)

- Exercices and in-depth problems, problems which need thinking: Three steps:

  Defining a solving strategy (teamwork)

  « Technical solving » (individual work)

  Comparing and interpreting results, synthesis (teamwork)

- Usually no complete exercices correction

  No computational details, but mention key points

  This can be done during exercices classes,

  or during « structuration lectures »

# Synthesis and structuring lectures

- **They are fundamental!**

  WE NEED GIVE STRUCTURE to the knowledge acquired during homework and teamwork

  Otherwise knowledge is ill-assorted, unorganized in students' brain, lack of hierarchy… and so not really efficient !

- **The so-called « synthesis and structuring lecture » :**

  To give consistancy, structure, to the already studied notions.

  To give insight to students, about their work and the acquired knowledge
  Sometimes to supplement what they have already seen, alone or in team.
  (show some consequences of the acquired notions)

  Never (or quite never) for re-doing what has already been studied,

  nor for answering students'questions.

- **Remark:**

  These lectures are based on what students already know, have worked on
  We call out to students on what they know

  => This does interest them. They remember what we say here.

  Much more efficient than to show them « the beauty of science »!

# What for the students' motivation ?

## Idea: a « positionning and motivation problem »

When starting a sequence, give the students (groups) a problem…
asking them not to solve the problem,
but to say how they would do to solve it

(modelisation, concrete problem… math problem)

## Remarks:

- A good way to solve the problem uses the tools to be later studied…
- This problem may then be used as a « red line » along the course
- The problem is also good for showing the interest of working in group, for giving strength to the group, for learning to work in a group

# Some remarks (1/2)

- **Students study the totality of the course**

  in the order (and the logic) defined by the professor

- **Students work more regularly** (not only at the end of the course, for the exams), key points are known all along the course

- **Prefer quite small teams** (4 students, possibly 3 or 5) :

  Easier work than in bigger groups

  All students are involved in the totality of the group work

  Strong motivation et participation of the students

- **No work sharing** since group production is required

# Some remarks (2/2)

- **Easy to implement**, to mix with a traditional method
- **Suitable for any subject**, well suited for theoretical subjects, as maths, quantum physics…
- **Some difficulties :**

  Order of type sessions délicate,

  An appropriate document is necessary

  (students must be autonomous on the document).
- **The method is interesting and motivating**

  (students… but also professors)

# Some side effects

- More critical thinking
  and more need of agreeing to what the other says
  than in professor's explanations.
- True discussions and real solidarity between students… and better contacts students-professors!
- Students ask for explanations more easily and spontaneously, they do not hesitate to ask again.
- Students' autoevaluation easy thanks to the group reactions. Easier qualitative evaluation by the professor.

# Dialog, confidence, autonomy

- Learning to talk together,

  to listen to the other one, and to answer him (in his register!),

  to respect him.
- Acquire self-confidence:

  Students see that they can learn by themselves,

  that they can give explanations to others, progress in groups.
- Confidence in the professor:

  whose main role is no more knowledge transmission,

  but assitance to knowledge construction.
- Acquire autonomy:

  learning to use a document, to express and ask for aid.

# Facing the level differences of students

How ? Suggestion :

Systematic guided previous homework,

Team learning: Students arguing together during lectures and exercises

Why? Because each student can go at his own rythm,

Because we better understand and memorise

when we have argued on a matter,

and the lectures are adapted to students level.

Irrealistic? No, if students understand that this is their interest to do it, ie if so they prepare the teamwork.

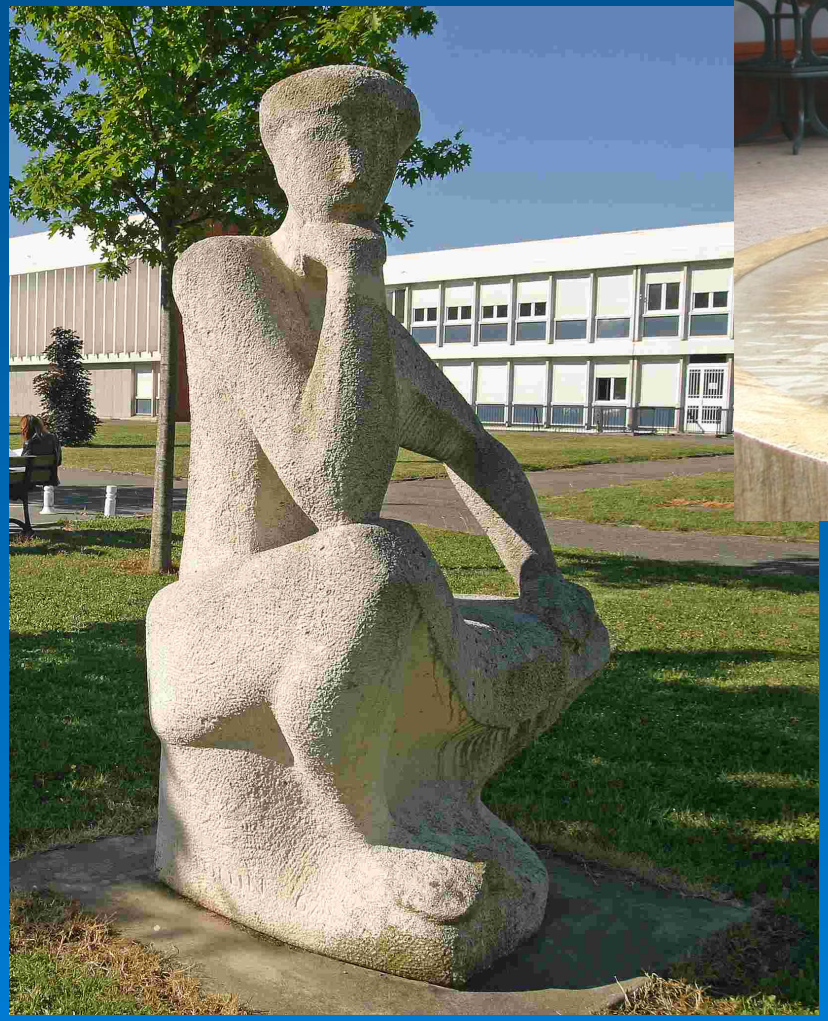
# The challenge: some hints to take it up

- Preiminary homework on lecture material,
  followed by consolidation in teamwork
- Exercices of immediate application of lecture material
  … corrected in teamwork !
- Auto-evaluation exercices done in homework…
  … commented in teamwork !
- Lecture turned out into a problem,
  so better willing to work again on it,
  and better memorized since worked in team
- Avoid too « technical » lectures

(too slow for some students, to speedy for some others, never interesting!)

**We have to guide homework**

Insa, Toulouse (France)




IPL, Louvain La Neuve (Belgique)

Just choose the one you prefer!

# “Lecturing via a problem”, an example: Existence, unicity and construction of the circle around a triangle (1/3)

The mayor of a city wants to have a circular cycling road going through three different points of a sport area. The aim of the problem is to determine whether it is always possible or not, whether there are many solutions or not, and to give a way to derive the desired circle.

Choose three points on your sheet of paper, and call them A, B, C. Draw the triangle ABC. If the center of the desired triangle, compare OA and OB.
On which straight line must O be in order to meet this property? Draw this line.

Now draw the bisection of the segment BC. If it crosses the bisection of segment AB, let us call D the intersection point of these two straight lines.

Would we have DA=DB=DC? Clearly explain your position and why (use words, and then formulae). Does the circle with center in D and radius DA go through the three points A, B, and C? Are you sure? Explain why. Draw this circle. Does it “work” properly?

# Existence, unicity and construction of the circle around a triangle (2/3)

So you now have drawn the desired circle, and O is precisely the point D. Congratulations! We usually call this circle "**circumscribed circle of the triangle ABC".**

What do you think: would the center of this circle be also on the bisection of the segment AC? Give precise justification of your answer, and check in your graph by drawing this bisection.

Here we have a surprising property: **the three bisections of the sides of a triangle intersect in a single point!** This point is called "center of the circumscribed circle of the triangle". Of course, don't resist, just draw the bisection! Right, if the graph is done properly it contains the point O!

Can we always do so? Can the mayor build his cycling road whatever may be the three points A, B, C? Yes, at least quite always: there is a configuration of the three points for which the bisections cannot cross… Which one? In this case do the three points form a triangle?

# Existence, unicity and construction of the circle around a triangle (3/3)

So we now have proved another important property: **we always can get a circle going through the three vertices of a triangle!**

For the mayor, it will also be necessary that the circle is not “too big” (nor “too small”!), does not go through houses, nor even private properties… but this is another story!

Are there many possible circles? Let think: the center of the circle must be on the dissection of AB since OA=OB… I leave you finishing the argument, but there is one and only one solution (or no solution when the points A, B, C are aligned).

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*December 2015*

*(the text may be shorten or on the opposite more explicit, depending on the level of learners and on the amount of teamwork we expect for solving the problem)*