TINTIN IN THE LAND OF PBL

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Abstract

In PBL, the quality of the problem-situation has the greatest impact on group work and the investment and motivation of the students in the group. A very important aspect of the situation is that it comforts one’s own misconception. It is only when one runs up against one’s own misconception that one can hope to truly internalize a new concept. Tintin is a bottomless source of situations that can be used to confront students with their misconceptions.

Workshop Topics

The role of emotions in learning; Beyond active learning

I. INTRODUCTION

Active learning and in particular problem based learning are pedagogical approaches which motivate students in their acquisition of knowledge and competences. In a survey carried out in the University of Maastricht, Schmidt and Moust (2000) showed that amongst the factors affecting students’ learning in PBL, it is the quality of the problem-situation that has the greatest impact, even more that the quality of the tutoring. The quality of the problem-situation has a positive effect on group work and the investment and motivation of the students in the group.

The starting point for an active learning activity is therefore the choice of a good problem-situation. But what exactly makes a problem-situation good? What are the ingredients that will make this situation interesting to students and conducive to learning? To reply to this question we proposed a hands-on session to search for problem-situations drawn from a resource with a strong cultural nature: comic books, in particular Tintin albums.

The objective of the hands-on session was to place the participants in the position where they had to find a motivating problem-situation from Hergé’s works and thereby come to identify the principal characteristics of a good problem-situation. In this paper, we will present the ingredients identified by the participants and
examples of the problem-situations formulated. Finally we will present some of the characteristics that have been identified in the literature and discuss the interest of working from Tintin.

II WORKSHOP

II.1 Phase 1 – Analysis of problem-situations

During the first phase of the workshop, the participants, divided into two groups, were asked to analyse a series of problem-situations and to discuss what makes (or does not make) them suitable for stimulating students in their learning. Three different problems were presented from the fields of electricity, food poisoning, cholesterol and for each problem two examples, worded differently, were given.

The major characteristics identified by comparing these problems were:

- Open vs closed problems
- Questions vs answers
- More structured vs less structured
- Relevant context for students involved
- Correspondence with student expectations

It was felt that at freshman level, it would be more appropriate to use closed problems, problems which are well defined and structured as they need more guidance in how they should approach the topic. In a closed problem, attention is drawn to the particular points that much be studied, frequently via direct questions. As students progress and have more experience in PBL, then open problems can be introduced as students will be better able to tackle the problem, identify what they need to learn for themselves. Moreover, open problems give the opportunity for more creativity.

Both context and expectations are seen to be important factors. If the students do not feel concerned by the problem, if it does not correspond to what they want to learn about, then motivation will be low.

One of the problems was presented in the form of a letter. It was felt by some that could make the problem reach the student on an emotional level. By wording the problem in this way, it became more personal: the student would be more inclined to see it as ‘his/her problem’ than if it is presented in a more neutral way.

II.2 Phase 2 - Problem-situations from Tintin

Each group was given four Tintin albums and asked to look for a problem-situation suitable for a first year physics course for engineering students and arguments to support their choice. This means the situation should introduce basic physics concepts in mechanics, electricity, optics.

Finding situations which do not correspond to scientific fact was relatively easy. Some of the examples found are presented below:
Destination Moon

- The one stage rocket
- The absence of oxygen in the space suits, especially when Snowy walks around the Sprodj Atomic Research Centre
- The X-ray machine showing the skeletons directly
- The missing fin and tail rotor on the helicopter

Explorers on the Moon

- The problem of gravity in the rocket when the engine stops
- The position of the characters when they look at the earth through the optical lens
- Captain Haddock being pulled towards Adonis
- The way the rocket lands on the moon

King Ottokar’s Sceptre

- The spring in the camera and its use to propel an object in wood and an object in gold.

The participants were then asked to word the problem-situation for students and produced the following examples:

Problem 1

*In Explorers on the Moon*, explain the situation on page 5.

What is gravity? Why does it exist? How does gravity act?
When does gravity stop?

Problem 2

I’ve been reading “Explorers on the Moon”. On page 5, I see that the engine has stopped and the people are weightless. I wonder what happens with gravity between the Earth and the Moon. Please explain this situation.
Is it possible to create artificial gravity?
How can you create a rocket/device that escapes Earth’s gravity?

Problem 3

Dear Anne,

In Destination Moon, Mr Thomson and Mr Thompson are trying to solve a mystery and suddenly they have the impression they have seen a skeleton. Trying to find the skeleton, they end up going through an X-ray machine. The X-ray machine displays the picture of their skeletons (page 24).
Is this situation really possible? What are the risks involved in having your body exposed to an X-ray machine like that?
Do you think you can help me answer these questions?

Love as always,

Val
Problem 4

In King Ottokar’s Sceptre, Tintin suggests that the spectre was taken out of the castle by the use of a camera equipped with a spring. He made a convincing test by shooting a piece of wood out over the moat. But, the sceptre is made of gold which is quite heavier than a piece of wood. Do you think the camera can send the golden spectre out of the moat?

Problem 5

The flying objects

In Destination Moon, different flying objects are present. Tintin and Captain Haddock travel to Sylvania by plane. They have nice seats and wonderful first class service, not to mention the view they can enjoy.

The patrol of the place where the rocket is going to be launched flies in a ‘charming’ helicopter.

The rocket in the story, the monoplane, the parachute – all these flying objects are important for humanity.

Can you discuss something about them in the context of the pictures?

II.3 Discussion on the problem-situations

Problems 1, 2, 3 and 4 were considered to be closed problems and therefore suitable for first year students. It was also pointed out that although problems 1 and 2 deal with the same subject matter, problem 2 is nevertheless more open: “I wonder what happens…” is a formulation which is less directive and leaves some latitude to students in how they go about finding the solution.

Problem 5 is very open and immediately gave rise to the concern about how students would deal with it. Is it too open? It can incur different reactions. A student who is really interested in flying could go into great detail about every aspect of the different ‘flying objects’. Another may just be content to state what he/she can observe in the pictures. An objection was raised that this situation implies another instruction: ‘Please guess what the teacher is thinking’! The interest here is the possible danger of a problem-situation which is too open. The role of the tutor becomes all the more important as the problem-situation is open. In this case the learning objectives must be very clear to the tutors involved so that they can guide the students and avoid any time wasting on inessential aspects.
III  SOME CHARACTERISTICS FROM THE LITERATURE

There are many papers on the characteristics of good problem-situations. To establish the list below, we have been especially inspired by the criteria proposed by the University of Delaware (Duch, 1996) and those identified during the setting up of the new curriculum in the Ecole Polytechnique de Louvain (Milgrom et Jacqmot 2001), (Neyrinck et Jacqmot 2000), (Bédard 2006), (Mauffette 2006).

III.1 Some components of a good problem-situation

A good problem-situation has the following characteristics:

1. The situation problem is concrete and/or realistic. For example, it represents a situation that the learners may experience in their everyday life.
2. The situation is new for the learner, its resolution represents a challenge.
3. Its formulation arouses the interest of the learner, the scenario is evocative, arresting, stimulates questioning and research.
4. The situation calls upon the learners’ current knowledge or competences. They are able to express an opinion, an idea on the problem.
5. The problem is open and will lead to debate. This means that several solutions are possible, that several approaches to the problem may be adopted or, finally, that there is an inherent controversy implying several different opinions.
6. The solution is not immediate. The problem is formulated in such a way that it can be understood but it is necessary to reformulate it, to make hypotheses, to look for information…
7. The solution requires both collaborative and individual work. The complexity and length of the problem are such that its solution cannot be found by an individual learner in the time allotted.
8. The problem is relevant; its resolution will lead to the acquisition of the competences and/or knowledge targeted.

III.2 Why use Tintin?

Working from the adventures of Tintin has the following advantages:

1. It takes the participant/problem designer outside his/her usual field which generally favours inventiveness (characteristic 2)
2. These albums have a strong, general positive cultural content, everyone, or almost everyone, knows and loves Tintin, (characteristics 1, 4)
3. The albums are a rich source of cognitive conflicts and misconceptions (characteristics 3, 5, 6, 7, 8)

This last point deserves explanation: Tintin is generally taken to be « serious», the scenarios are constructed, structured and the reader (child) therefore has the impression of a very « realistic» Tintin. Yet Hergé made a large number of scientific
errors. Given that these comic books are generally perceived to be realistic, these errors are not really obvious, they do not jump out at the reader. However, on close reflection, it becomes obvious that something is not quite right: a cognitive conflict is born…

IV CONCLUSIONS

Over decades, physics teachers have developed an arsenal of overly stylized scenarios involving projectile motion, weights on pulleys, or oscillating masses and springs. The situations seem so artificial that students inevitably lament, “When am I ever going to use this stuff in my real life?” Kalali (2005) On the other hand, student never complain when starting a lecture with comics, cartoon or movies. In this hands-on, participants very rapidly found attractive problem-situations in Tintin. Such situations are very interesting because they motivate students and bring them in front of some misconceptions. In fact, we (and students) are surrounded by artificial situations in which we know something is wrong but, at the same time, it is not completely wrong. This is the case of superheroes, cartoons, science fiction movies, and of course Tintin. We have seen, on television, astronauts travelling weightless in space, even when the engine of their rocket is off, but at the same time we are puzzled when the engine of Tintin’s rocket stops and the people are weightless. What might be the action of the engine on the gravity? Is it possible to create artificial gravity? Such are very important questions that can lead to deeper understanding of physics concepts.

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REFERENCES


