GAMES: Virtual Worlds and Reality

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A Problem-Based Task becoming a Simulation

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Abstract

This paper describes the procedure followed to turn a problem-based task into a simulation carried out by several groups of students of engineering from different nationalities, as well as the steps chased to pursue its goal: the students' presentation of a new instrument or service developed by every group that will facilitate, in their opinion, the Technical Engineer in Topography's task enormously.

The relevance of this paper consists in the way a pedagogical strategy of active learning such as problem-based learning, in which learners are encouraged to take responsibility for their group and organize and direct the learning process with support from a tutor or teacher, becomes a simulation as both strategies are used to enhance content knowledge and foster the development of communication, self-directed learning skills and problem-solving.

Keywords: simulation, problem-based learning, socioconstructivism, cooperative learning, active learning.

What is Problem-Based Learning?

It is a pedagogical strategy for posing contextualized, real world situations, and providing resources, instruction, and guidance to learners as they develop content knowledge and problem-solving skills (Mayo, Donnelly, Nash, & Schwartz ,1993). The ability to solve problems is more than just accumulating knowledge; it is the development of cognitive strategies that help students analyze ill-structured situations to produce meaningful solutions.

According to the Central Queensland University of Australia (2002:2) Problem-Based Learning (PBL) encourages students to take responsibility for their own learning. On their webpage, dedicated to provide their students information on this learning methodology, they point out that "the PBL process follows the following format:

1. A PBL activity would involve students meeting as small groups to discuss a particular problem situation that has no easy or straight forward answer.
2. The problem situations they face will be messy, authentic and are likely to occur in real life.
3. The group would use their own knowledge and experience when discussing the problem and treat it as if they were personally asked to solve it.
4. From here the group would come up with a number of hypotheses that are likely to explain and solve the problem situation.
5. Once these hypotheses have been established the group then negotiates an area of exploration for each member and retires independently to carry out the research.
6. After sufficient time has elapsed to allow the research to be completed the group will meet again to discuss the problem in light of the information discovered by the group members.
7. Now the group will draw conclusions as to nature of the problem and the best fit solution, given the information known.
8. Finally, the group makes a professional presentation as to the solution and its consequences."

The historical origins of Problem-Based Learning date back to the early 1970s at the Medical School of McMaster University in Canada though its intellectual beginnings are far older (Rhem, 1998). This approach has flourished in medical schools; nevertheless, sciences in general and humanities have started to take it up. John Cavanaugh, vice-provost for Academic Programs and Planning at Delaware (Rhem, 1998:2) sorts out the place of PBL among the learning strategies as follows:

> "Imagine a family tree: Active Learning would be at the top. Cooperative/Collaborative would be a subset of that, […] PBL [would be] a subset of Coop/Collab based on cases [as] all forms of group work don't center on cases; problem-based groups do".

PBL and Simulation: Similarities and Differences

In PBL the main focus is the problem, a messy and ill-defined one as real problems are. It should be authentic or at least based on reality that does not necessarily have a right answer; the problem comes first instead of the concepts, which requires information-gathering by the student besides reflection on the process and on the content. The learners, not the teachers, choose which path to follow to solve it, meanwhile teachers become tutors and coachers for them (Merrill, 2005).

Both PBL and Simulation are active learning/teaching strategies that involve learners in *doing* rather than just learning about something which is crucial for any higher level learning and a notable trend in engineering education. If we admit that lecturing focuses on the teacher, active learning strategies (PBL and Simulation, in our case) underline the importance of the learners' activities in such a way that students are mentally active, according to Cameron (1999), and their learning is most effective as they are involved in the learning experience rather than being passive recipients of the information (Pfeiffer, 1994).

Thanks to both strategies, our students interact, work out problems together by collaborating in a proposal based on the socioconstructivism (Vygostky, 1978) since group interdependency is a key to share learning and knowledge at the individual and the group level (see tables 1 and 2). Hall (2007) points out that this is primarily a constructivist approach that conceptualizes learning as a private process within an individual and then includes aspects of sociocultural theories in recognition of the value of others in the learning process: socioconstructivism proposes that the meaningful construction of knowledge occurs when a learner interacts with other learners.

The framework that guides the creation of authentic learning is the experimental learning cycle (ELC) and at the heart of it is the challenge or problem to solve from which we want students to acquire knowledge, skills and attitudes. Simulation and PBL belong to it but perhaps the main difference between these two active learning strategies lies in the fact that Simulation provides experiential learning while PBL also offers a self-directed learning process in which learners decide what to study based on a problem case, question or scenario that drives their learning.

Whereas in PBL students —working together in groups with the help of a facilitator and using 'problems' or scenarios as a basis for study— share their existing knowledge and understanding of the scenario, agree what they need to learn to solve the problem, discuss their progress, evaluate their work and decide next steps, Simulation structures the information students receive to focus their learning on the intended curriculum and increases the strategy's effectiveness in a wider variety of ways, in accordance with Maxwell, Mergendoller and Bellisimo (2004).

Describing the Problem-Based Task: towards the Simulation

The Problem-Based Task (PBT) was carried out by five groups of four students of engineering —from different nationalities studying English at the Universidad Politécnica of Valencia, Spain— who benefited by using a simulation-structured information at the time the simulation —in which the PBT situation turned into— made use of a PBL framework to promote student-directed learning and problem-solving skills to explain a simulated scenario with several possible solutions.

Understanding a Simulation as a replica of actual events presented in a manner with a specific purpose (Dumblekar, 2004), students were introduced to the scenario as shown in table 1.

Table 1: *Scenario*

Your Problem-Based Learning Task becoming a Simulation

1) *In a few days an important prospect customer is meeting you to attend your presentation on a new instrument or service your company has developed that will facilitate the Technical Engineer in Topography's tasks enormously. Your team's presentation will sum up, in a few minutes, your instrument or service characteristics and advantages and will probably determine the future of your company as millions of euros have been invested on the design and development of the instrument or service your team presents.*
2) *You and your team are responsible for the project.*
3) ***Problem**: you are not sure what a good presentation is. You do not know what the important customer is going to focus his/her attention on during the presentation of your project.*
4) *As the situation is so important for you and your company's future **you have to**:*

    a. *Decide and design what super instrument or service you are going to present the prospect customer.*
    b. *Search and decide what a good oral presentation is.*
    c. *Prepare a rubric or grid that allows you to assess the presentations of the super products or services of the rest of the teams and, therefore, any future oral presentation.*
    d. *Deadline: Your important customer will show up on _____.*

Briefing Phase

As mentioned above, each team was formed by four students from different language backgrounds (Spanish, French, German, Polish, Turkish and Czech) and an heterogeneous competence in English by using a PBL framework to promote student-directed learning and problem-solving but providing them with basic information and instruction during the briefing phase as shown in table 2.

Table 2: *Information and decision phase*

Besides the information dealing with your instrument or service and oral presentations that you can search in the library and on the Internet, the following files are available on PoliformaT(*)-Ingsup-Resources*:*

1. *Link to the video Professional Presentations (scenes 14:00 to 20:26 minutes).*
2. *File on Designing Visual Aids.*
3. *File on Getting Started. Some tips. Communication Skills.*
4. *File on Guidelines for Oral Presentations.*
5. *File on Oral Presentation Advice and How to give a Bad Talk.*
6. *File on Presentations Vocabulary.*

(*) Our university online platform

Teams worked on the task in class sessions for eight hours before the deadline (simulation proper), starting by thinking back the best speeches, lectures or presentations they have ever attended, and designing their product or service. Each team devoted the time and effort they considered necessary outside class sessions to reach their goal. The teacher observed and facilitated the students' task during class sessions and by electronic mail and office hours.
Before the simulation started, every team provided the facilitator (their teacher) their grid to assess a good oral presentation, according to the information gathered, their experience on the topic and every team member's agreement. The facilitator studied all the proposals and merged them in one under the consensus among students. This final grid was used by team members to assess their peers during the simulation.

Simulation Proper

Following the patterns that students considered make an oral presentation successful (delivery, body language, tone of voice, structure and organization, visual aids, etc.), every team presented the features and advantages of their products or services to the rest of their classmates that acted as prospect customers and asked for particular details of their interest.
During the simulation students assessed their peers' presentation according to the agreed grid which allowed students to vote for the best product or service. Comments and suggestions from the learners let presenters reflect on their performance and learn from it.

Debriefing

After the simulation, participants answered an open questionnaire on:

- The activity;
- Their feelings and reactions;
- Their learning;
- The activity and learning application, either academically or professionally;
- Proposals of improvement.

Their answers, attitude and behavior guide the facilitator to improve the activity the following courses.

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