Problem-Based Learning Unit

Musical Pads

PART 1.0: THE PROBLEM

OBJECTIVES:

By completing the PBL, students are expected to learn how:

1. To solve problems in an organised manner using brainstorming and resource investigation techniques,

2. To build on prior knowledge and acquire new knowledge throughout the case study,

3. To use basic computer packages (Word, Excel, and PowerPoint) and engineering simulation packages (MultiSim),

4. To work in groups by managing group meetings and recording them using formal minutes to note all actions and decisions.

DISCUSSION OF PROBLEM

You are all in 2H.3 studying for DC circuits (what good students you are), when you notice a frantic, crazy haired guy at the door. He seems to be trying to get into the lab. One of you gets up and opens the door. He bolts in like a lunatic, "Dudes, you've got to help me. Our teacher's gone insane. He has us doing this PBL thing. We have to do a recording, but the mics he gave us are garbage, and we're getting too much clipping. He said we "might" need 10dB attenuator pads. What the h@$$ are attenuator pads? What the h@$$ is 10dB? Someone told me you guys from Electrotech could help! Please! Please! Help me. This PBL is like worth 50% of our mark!"

(Aren't you glad yours is only worth 5% ☺)

You tell him, sure, not to worry, and that you'll call him when you're done. As he leaves, you all look at each other and say, "What the h@$$ are attenuator pads?"

PART 2.0: THE SOLUTION

You must use equipment and components you have used all semester long... that's a hint.

Some extra information you will need:

● The microphone is a 150 Ω device

● The pre-amp, which the microphone connects to is a 1.5 kΩ device.

● Audio equipment also requires a balanced load

You need to design and build the attenuator pads, one for each team member. You should test them to ensure that you have the right input resistance and output resistance, include test measurements in the team report. Now, go list all the terms and ideas you do not know and understand, and figure them out! Good luck.

PART 3.0: ASSESSMENT

The assessment for this exercise will be based on the following:

1. the solution,

2. notes taken during team meetings,

3. meeting minutes (there is a difference),

4. Self-Assessment (to be given later),

5. Peer Evaluations (to be given later).

All these components should be bound into one report with a title page, each members name and ID, and all other pertenant info that goes on a title page.

PART 4.0: REFERENCES

The following is taken from various sources, but particularly from http://www.materials.ac.uk/guides/pbl.asp

The 7-step Project plan of PBL

The following stepped plan approach is essential in order to ensure a systematic method of working is used for all the case studies. Thus group meetings should be structured to conform to the following 7-Step Project Plan of PBL:

1. Explain unknown wording, statements and concepts

2. Define the problem(s)

3. Brainstorm - analyse/try to explain the problem(s)

4. Make a systematic inventory of explanations

5. Formulate self-study assignments

6. Perform self-study assignments

7. Report and evaluate on self-study. After each group meeting, the group formulates the next stage of the self-study assignments

Step 1: Explain unknown wording, statements and concepts:

First, students will read the problem outline, and then they should identify any words, terms or concepts whose meaning they are unclear about. Other student members of the group may be able to provide definitions. It is important that students feel safe to be frank about what they do and do not understand.

Output: Words on which the group cannot agree a meaning should be listed as learning questions.

Step 2: Define the problem(s)

Students are encouraged to contribute their views concerning the nature of the problem. The tutor may need to encourage them all to contribute in a broad discussion. It is quite possible for different group members to have a different perspective of the problem. Comparing these views helps to define the task ahead.

Output: List of problems.

Step 3: Brainstorm

This is the most crucial step in the problem solving process. Here students test out a wide variety of possible explanations or solutions for the problem using information from memory. With brainstorming, each member of the group makes suitable suggestions, until no more ideas are forthcoming. Initially, no priority is set for the suggestions and all ideas are viewed as being equally valid no matter how strange they may appear at first. The scribe writes down all possible ideas that contribute towards understanding, explaining and solving the problem on a white-board or a large sheet of white paper. Only after all the ideas are written down can they be discussed in more detail and priorities can be set. The tutor should discourage students from going into too much detail during the brainstorming phase. This step is essential as it encourages students to come up with different solutions to the same problem.

Output: List of possible explanations or solutions.

Step 4: Make a systematic inventory

Here the group re-examines the ideas raised in the brainstorming in more detail and compares their ideas against the problem outline to see how well they match, which solutions are linked and where further exploration is needed. This step will help define the self-study assignments of Step 5, as the group needs to organise the different explanations and solutions to form a limited number of tentative solutions.

Output: Ordering or linking of possible solutions from brainstorming.

Step 5: Formulate self-study assignments

The group agrees on a core set of learning objectives, often in the form of questions, which form the basis of students' self-study. These learning objectives should be specific and achievable within the time available between two group meetings. At the beginning of a case study (after the first meeting) it is important that all students share the self-study assignments, whereas in a later stage of the case study some students may have assignments that are not shared by the whole group.

Output: The written objectives are the main output of the group after each group meeting. These are circulated to all students and the tutor immediately after the meeting.

Step 6: Perform self-study assignments

In this step, the students will individually seek out any available learning resources to obtain the information that will contribute towards understanding, explaining and solving the problem. It should be emphasised that each student is responsible for their assignment and must be prepared to contribute to solving the problem. After each group meeting, the group will formulate the next stage of the self-study assignments. For some PBL problems, students (as a group) will be requested to undertake experimental investigations to support their case studies. In these instances, it is essential that students liase with appropriate lab staff identified by the case study champion prior to booking a time slot to use lab facilities relevant to their case study.

Output: Students' individual notes.

Step 7: Report and evaluate on self-study

In the second meeting, the group returns to discuss the self-study assignments. Each student reports on the output of their study, shares information about sources, helps each other understand, and identifies problem areas that need further study or expert help.

Output: Students' individual notes.

Whenever a case is completed with a written group report and/or a presentation, then the draft version of the report or presentation needs to be discussed during the last group meeting of that case.

PBL Group Roles

In the first year, the initial group selection for the first two case studies is determined by merging two tutor groups. For at least one of the two case studies, a student's individual tutor will also act as their case group tutor. After this, the groups will change on a random basis. This ensures that any effect of group selection is evened out over the first two academic years. Average group size is approximately five or six members.

By rotation at each meeting, students play four specific roles within the group. These are chair, minutes-secretary, scribe and general group members. Rotation ensures that students are exposed to all of these roles.

During a group meeting, the chair has the task of maintaining the agenda and steering the conversation. In order to have information available to the entire group, it is useful to keep a record as part of the work on a case study. The scribe does so by taking down important matters on a white board, flip chart or large sheet of paper. The information addressed in a student group must be incorporated in minutes of the group meeting. This facilitates the recording of a case study, and is part of the process of ensuring that the case study functions well. During each group meeting, one of the students therefore acts as secretary.

Role of Chair

  * To lead the group through the 7 steps of PBL

  * To ensure equal participation of all group members

  * To maintain good group dynamics

  * To keep time

  * To ensure the group sticks to the task at hand

  * To check if the scribe records the points raised in the discussion

Role of Minutes-Secretary

  * To make minutes of meetings by structuring points written down by the scribe

  * To distribute the minutes of the meeting to all group members and the tutor

  * To participate in the group discussion

Role of Scribe

  * To record points raised by the group

  * To help the group order their thoughts

  * To participate in the group discussion

Role of Group Member

  * To follow the 7 steps of PBL

  * To actively participate in the group discussion

  * To listen to each other's contribution

  * To ask open questions

  * To research all the learning objectives independently

  * To share information with each other

Model Meeting Format in PBL

Prior to each group meeting, an agenda is made. After every meeting is held, minutes are written and circulated. During the meeting the agenda should be followed systematically.

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The standard agenda for the first group meeting is given below:

* Meeting commences (assign meeting roles)

* Apologies for absence (only in very exceptional circumstances)

* Step 1: Explain unknown wording, statements and concepts

* Step 2: Define the problem(s)

* Step 3: Brainstorm

* Step 4: Make a systematic inventory

* Step 5: Formulate self-study assignments

* Close the meeting

The model agenda will be changed or altered depending on the progress of the case study. The following agenda is suitable for most of the subsequent meetings; (during the meeting the agenda should be followed step by step):

* Meeting commences (assign meeting roles)

* Apologies for absence (only in very exceptional circumstances)

* Review the minutes of the last meeting to remind what should have been done

* Step 1: Report on self-study activities assigned at the last meeting

* Step 2: Review the definition of the problem(s)

* Step 3: Brainstorm for new ideas

* Step 4: Make a systematic inventory

* Step 5: Formulate further self-study assignments

* Close the meeting

Other items might have to be added at certain specific meetings. For example, the tutor should conduct a mid-project review on each of the group members' individual performance before the close of one of the meetings. Also, in the final meeting, an item should be included where the tutor can review the group's draft PBL submission, to ensure that no factual errors are contained and to give advice on presentation and style.

Writing Up Minutes of Group Meetings

After every meeting, minutes are written by the minutes-secretary (using the format given below), and then typed up and circulated before the end of the day to all participants in the group including the case group tutor. The minutes are a record of how the PBL case study progressed, and will be submitted with the other submissions at the end of the PBL activity for assessment.

Below is a model for writing up meeting minutes for a normal meeting. The format will change depending on the progress of the case study. For example, for the first and last meeting during a case study the agenda will need special issues for those meetings.

Minutes of Meeting:

* Context PBL group number; Date and time of meeting; Title of case study; Number of meeting

* Opening List of attendees; Agreement on different roles of group members (change at each meeting)

* Announcements of group members or tutor

* Minutes of previous meeting Discuss issues arising from the minutes of the previous group meeting

* Step 1: Report on self-study activities assigned at the last meeting Outline the self-study report from the group members

* Step 2: Review the definition of the problem Write down any changes that may have been agreed since the last meeting

* Step 3: Brainstorm for new ideas Write out all the main ideas that came up in the meeting

* Step 4: Make a systematic inventory Prioritise the ideas raised during the brainstorming

* Step 5: Formulate further self-study assignments Assign individuals to specific study assignments for group members

* Close the meeting Record time of closure; Plan time and location of next meeting

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