

APPLYING PROBLEM-BASED LEARNING AND ACTIVE LEARNING IN TEACHING IT COURSES AT HANOI UNIVERSITY

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Abstract—This paper introduces problem-based learning and active learning and detailed steps to build problems and activities for specific courses in the faculty of information technology, Hanoi University.

Keywords— Active learning, problem-based learning.

I. WHAT IS PROBLEM-BASED LEARNING

Problem-Based Learning (PBL) is a teaching method in which practical problems are used as a mean to motivate students to learn concepts and principles. This method of learning contrasts with the direct presentation of knowledge in the traditional way. Moreover, this method helps students enhance different skills such as critical thinking, problem-solving, and communication. It also brings more chances to work in teams, searching and analyzing research items, and life-long learning [1]. By using real-world problems, students are given more opportunities to transfer their knowledge and skills from previous activities or projects into a practical setting. Problem-based learning is an educational approach that focuses on learners, in which learners, by acquiring self-direction and applying skills and knowledge, solve unstructured problems.

In a PBL class, the role of teachers and learners differs from the role of them in traditional classes. The role of teachers is to facilitate learning. In this context, “facilitate” means that the responsible teacher creates an effective educational environment for learning [2]. This will require teachers to design a series of instructional and assessment strategies to guide and manage students when they participate in learning events. First, teachers must have a solid foundation in relevant content so they can explain concepts in many ways. However, the role of teachers is not to disseminate contents but to guide students to learn by encouraging students to participate in learning activities that are connected to reality and reflect professional activities.

Teachers should provide guidance by applying effective teaching strategies in a given situation and continuously adjusting those strategies to reflect student needs. Although direct instruction is sometimes useful, teachers should generally limit direct instruction and data entry while students solve problems or perform practical activities to promote learning and effectiveness [3]. Good questioning skills, listening skills, and process evaluation strategies are particularly important to maximize student achievement

II. RULES TO CREATE PROBLEMS AND ACTIVITIES IN PBL CLASS

There is a variety of sources to create problems such as newspapers, magazines, books, textbooks and television, movies. Some can be used with little editing; However, some others need to be changed for use. The following guidelines are from the University of Illinois website [4] written to create PBL problems for a class centered around methods; however, general ideas can be applied in using PBL more simply:

A. Choose a central idea, concept, or principle

Selecting a target idea, concept or principle which is always taught in a course and then think of key point review, exercises, or homework which need to be assigned to students to help them learn the concept. Clearly define the learning goals that need to be accomplished when students solve problems.

B. Real-world context

When considering one concept, teachers should think of a real-world context related to that concept. After that, a realistic case that can be adjusted is developed. Teachers will add some motivation for students to solve the problem. More complex problems will challenge students to deepen their knowledge to solve. Look at magazines, newspapers, and articles for ideas about storylines.

C. Introduce problems in stages

The problem should be introduced in stages so that students can identify learning issues that will lead them to study target concepts. Here are some questions that may help guide this process:

1. What will the first page (or stage) look like? What open-ended questions can be asked? What learning issues will be identified?
2. How will the problem be structured?
3. How long will the problem be? How many class periods will it take to complete?
4. Will students be given information in subsequent pages (or stages) as they work through the problem?
5. What resources will the students need?
6. What end product will the students produce at the completion of the problem?

D. Detailed instructional plan and teacher's guide

Make a teaching description which details the instruction plan on using the problem in the course. If the course is a medium or large class, there should be a combination of small lectures, class discussion and small group work with regular reporting. The teachers can alternately use PBL and other teaching methods.

E. Identify key resources

Last but not least is to identify key resources for students. It is the fact that students need to know how to find and take advantages of learning resources on their own, but it can be useful if the instructor indicates a few good sources to help them start. Many students only limit their research to the Internet, so it will be important to guide them toward the library as well.

III. DETAILED ACTIVITIES FOR IT CLASSES

To overcome these issues, more activities are designed to engage students. Instead of using computers all the time in class, students are allowed to work in groups, play games, and activities

which promote learning. The second challenge is when working in groups, there are only some students work hard and do all for the other team members. To make all students take part in work, some special activities like compare notes or context experts is applied. The details of each activity are described in the table below:

After teaching at the Faculty of Information Technology, Hanoi University, I faced a number of challenges. The first thing is that many students don't pay much attention in class. In most IT classes, students have to work with computers all the time and some people prefer to surf the Internet playing computer games rather than learning. To overcome this problem, many activities are designed to engage students. Instead of using computers all the time in classes, students will work in groups, play games, and activities that promote learning. Teachers can utilize different applications to design games such as kahoot (<https://kahoot.com/b/>), quizlet (<https://quizlet.com/latest>) or head up! The second challenge is when working in a team, only a few students work hard and do everything for the other members of the group. To make all students participate in the work, some special activities such as comparative notes or context experts are applied. Details of each activity are described in the following table:

Strategies	Old ways	New ways
Case study	Give a list of required software for students to choose build	Give some real problems and students will identify their own soft systems which can help then build those systems
Critical analysis, games	To teach a unit on the GUI designing principals, teachers list each principle, give an explanation and some examples	Show pictures of good/bad interface and require students to analyze the good/bad things then teachers will generalize the principles. Play quizlet or heads up at the end
Think, pair, share	To teach a unit on requirement collection for a soft system, teachers give a list of techniques and give quizzes to test	Students work in a group of 2, 1 acts as a customer, 1 acts as a developer. The developer prepares an intake form and tries different ways to get requirements from the customer.

Table 1: Activities in IT course

There are more activities and tools suggested by Mike Truong [6] which teachers can apply to make their class more active in table 2

#	Strategy	Description	Suggested Tools
1	Think, pair, share	Think about this, get with your neighbor, and share your thoughts...	Timer
2	Concept expert	One of you is responsible for reading [this], one for [that], and then get together and share/compare	Timer

		what you've learned	
3	Compare notes	Compare notes with your neighbor for clarity	Timer
4	Brainstorm a solution	With a partner write down two different ways this problem could be fixed...	Slides, handout, etc.
5	Deconstruct an argument	What are the flaws or holes in this argument...	Slides, handout, etc.
6	Fill in the blank quote	Example: "Life is incomplete without _____"	Slides, handout, etc.
7	Multiple choice question	Which answer would you pick and why...	Slides, handout, etc.
8	Summarize a concept in 10 words or less	Distill concept down to a few words to capture the most important elements.	AnswerGarden
9	Recite something together	Recite something together out loud or from memory	Slides, handout, etc.
10	Show a video clip	Recite something together out loud or from memory	Laptop, speakers, etc.
11	Analyze a picture	What does this picture make you think/feel/remember...?	Slides, handout, etc.
12	Make a metaphor	Think of a metaphor for this concept or something to compare it with...	Discussion
13	Give a case scenario	Which one of the following three scenarios is most likely to..."	Handouts
14	Personalize/modernize it	Write/discuss how you would react to this and why...?	Slides, handout, etc.
15	Create a test question	Take a minute and create a test question for this concept...	Google Slides Q&A
16	Poll the class	Poll the class by raising hands, using an app, texting, or other student engagement tools	Tricider
17	Paraphrase the idea	Students put idea - a definition, theory, procedure, etc. - in their own words	AnswerGarden
18	Shared Document	Use Google doc questions/comments (all can type in thoughts/questions comments)	Google Doc
19	Exit Ticket	At the end of class, write 3 things you learned, 2 questions you still have, and 1 application.	AnswerGarden
20	Biggest takeaway	At the end of class tell your neighbor the #1 takeaway from today.	Google Slides Q&A

Table 2. General activities for an active learning class

IV. CONCLUSION

The value of active learning is clear. When students are motivated to reflect, analyze, process and discuss course concepts, they report increased motivation, learning, critical thinking, and engagement. Despite embracing the pedagogical value of active learning, creating a classroom environment that supports and fosters active learning is a challenge. Students frequently approach classroom activities with a passive stance that leaves instructors struggling to pique their attention, foster interaction, or promote participation.

REFERENCES

- [1] Duch, B. J., Groh, S. E., & Allen, D. E. (Eds.). (2001). *The power of problem-based learning*. Sterling, VA: Stylus.
- [2] A. Walker and B. E. Shelton, "Problem-based education games: Connections, Prescriptions and Assessment", *Journal of Interactive Learning Research*, 19(4), 663-684
- [3] R. Streveler and M. Menekse, "Taking a Closer Look at Active Learning", *Journal of Engineering Education*, vol. 106, no. 2, pp. 186-190, 2017. Available: 10.1002/jee.20160.
- [4] "Problem-Based Learning (PBL)", *Citl.illinois.edu*, 2019. [Online]. Available: [https://citl.illinois.edu/citl-101/teaching-learning/resources/teaching-strategies/problem-based-learning-\(pbl\)](https://citl.illinois.edu/citl-101/teaching-learning/resources/teaching-strategies/problem-based-learning-(pbl)). [Accessed: 01- Mar- 2019].
- [5] Busfield and T. Peijs, "Learning Materials in a Problem Based Course • Guides for Lecturers • UK Centre for Materials Education", *Materials.ac.uk*. [Online]. Available: <http://www.materials.ac.uk/guides/pbl.asp>. [Accessed: 08- Mar- 2019].
- [6] M. Truong, "HANU Fulbright Project - Presentations", *Sites.google.com*, 2019. [Online]. Available: <https://sites.google.com/apu.edu/hanufulbright/presentations?authuser=0>. [Accessed: 21- Mar- 2019].
- [7] A. Salem, "developing an active learning experience for active learning courses.", *Journal of Al-Azhar University Engineering Sector*, vol. 12, no. 45, pp. 1311-1320, 2017. Available: 10.21608/aej.2017.19139.