



MODULE

PROBLEM-BASED LEARNING

TRAINING MANUAL



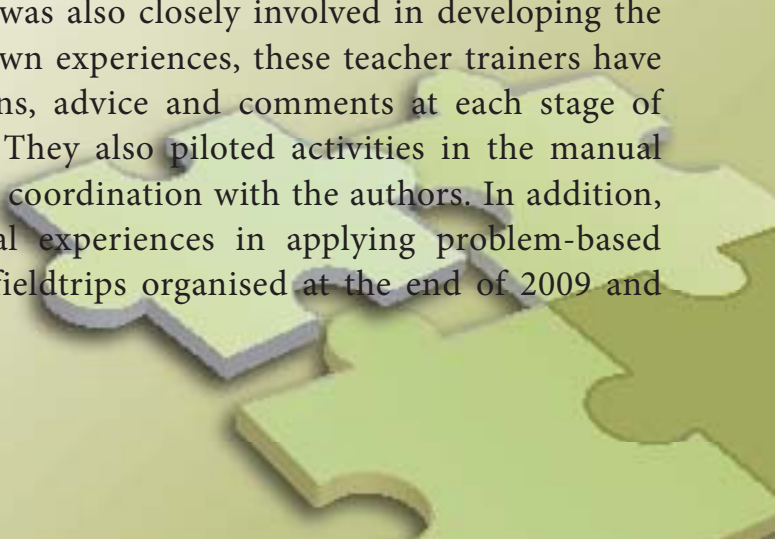
Dear teachers and educators,

This book is a training manual on problem-based learning, especially dedicated to TTI teacher trainers, teacher trainees at colleges and universities, teachers of lower secondary schools and anyone who is interested in teaching methodologies at school. It is the first book in the training package for teachers on active teaching and learning (ATL). Pham Van Dong University – Quang Ngai, Quang Nam University, Nghe An TTI, Quang Ninh TTI, Thai Nguyen TTI and VVOB have been and will be cooperating in developing and finalising this training manual.

The training manual is developed in a highly practical way alongside a theoretical review that is academic, concise and easy-to-understand. Hence, whether you are working for pre- or in-service training, this book and others in the training package will help you organise a two-day training session for your peers or students on how to apply a specific teaching method and organise follow-up activities.

The chief author of this problem-based learning manual is Le Huy Hoang, Ph.D., the Vice Dean of the Technical Pedagogy of Hanoi University of Education, working in cooperation with Assoc. Prof. Nguyen Van Khoi, Ph.D., Head of Personnel and Organization Department, Hanoi University of Education and Vu Thi Mai Anh, M.A., of Hanoi National University.

A group of enthusiastic teacher trainers from these universities/colleges, specializing in pedagogy, was also closely involved in developing the package. Based on their own experiences, these teacher trainers have supplied useful suggestions, advice and comments at each stage of developing this material. They also piloted activities in the manual through daily teaching, in coordination with the authors. In addition, the manual uses practical experiences in applying problem-based learning locally through fieldtrips organised at the end of 2009 and beginning of 2010.



We hope to bring you useful and practical material for teaching about problem-based learning and using problem-based learning methods.

We look forward to receiving your comments and suggestions for further improvement of the manual.

Hanoi, 30 July 2010



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FOREWORD

Article 39 (the objectives of tertiary education) of the Education Law issued in 2005 stipulates that:

“College education provides students with basic professional knowledge and practical skills to solve regular problems within their speciality.

University education helps students master professional knowledge and proficient skills, be able to work independently, creatively and solve problems within their speciality”.

Developing “*problem-solving*” competences for students is one of the training objectives of tertiary education and the foundation for post-graduate education (Masters, Ph.D.).

Many different terminologies are used in Vietnam (and former Socialist countries) to describe problem-solving skills. These include problems, situations, problem-based situations, problem-raising teaching, problem-based teaching and learning, etc. and recently terminology such as problem-based learning (PBL), situation-based learning, etc. Much research on problem-based learning has also been conducted.

Many people believe that to implement problem-based learning, we must find a problem and develop it into a “problem-based situation”. This causes difficulties in application because there are few issues in teaching that meet the criteria of a “problem-based situation” (i.e. contain conflicts, are appropriate to the students’ level of learning etc). Hence, problem raising is interesting in theory but not widely applicable in practice and at low levels.

The concept of problem-based learning (PBL) used in this manual means teaching and learning based on real problems relevant to learners or relevant to the “knowledge and skill standards” of different subjects at secondary schools in accordance with the basic education curriculum in 2006.

PBL implies a learning process where outcomes are attained from the process of solving problems. Therefore, problems are both in context and a motivation for learning; the problem-solving process is the tool for obtaining the learning outcome.

In PBL, knowledge and skills are not usually presented in a rigid format, but embedded in the “problems”. When they are solved, these problems will be revealed; through solving problems, learners will achieve knowledge and skills. Thus, the key issue in PBL is finding and developing problems and conducting problem-solving activities.

In PBL, the traditional teaching techniques of rote learning and memorizing knowledge are replaced by techniques in which learners are actively involved in exploring, finding problems, situations and contexts, proposing assumptions and predictions of future phenomena and explaining their causes and principles through observation, experiments and discussions.

The basic nature of PBL involves acquiring new knowledge and skills through creative-thinking activities. Its main aim is to build crucial competencies for individuals, families and communities, i.e. the competence to quickly and properly detect and solve problems they encounter.

This approach helps learners adapt and integrate into the society and community, an issue of great concern in education nowadays.



INTRODUCTION

The main objective in *problem-based learning* is to help trainees “be able to develop PBL lesson plans on their subject’s topic”.

The training program includes the nine main activities below, divided into two groups:

1. Overview of PBL with the following activities:

- (1) Getting acquainted activity
- (2) Orientation and basic concepts of PBL
- (3) Strengths and weaknesses of PBL
- (4) Essential skills in PBL
- (5) The PBL process in teaching

2. Applying PBL with the following activities:

- (6) Understanding different levels of application of PBL
- (7) Developing PBL lesson plans
- (8) Practicing PBL in topics
- (9) Training summary and evaluation

Each activity is organised into five sections:

- **Time:** Time duration for the activity (according to trainers and organisers)
- **Objectives:** The overall objective of the activity and the knowledge, skills and attitude trainees must achieve after the activity.
- **Materials:** Essential teaching aids needed to support trainees, based on the content of each activity (worksheets, resource information, etc.) and training equipment.
- **Steps:** A detailed tentative plan of the training process and output of each activity. The number of tasks in each activity may vary according to the objective and content, as regulated in the “training content”.

Each activity includes one or more tasks; each task has a clear name, training organization, process and is presented in the trainer’s activity, trainees’ activity and teaching aids (focusing on sharing real-life experiences).

The activities often include resource/supporting information which provide *brief information* in line with the activity’s objective (i.e. the content that learners must attain after participating). This information is presented in the Appendices.

- *Assessment*: Focuses on whether the objectives were achieved.
- This part may also include notices for trainers and explain and emphasise the main objectives of the activity.

In order to apply PBL, we must:

- Review, analyse and synthesise the teaching curriculum and content based on systematic thinking from the perspective of learners, to make it meaningful and close to their real-life experiences.
- Relate knowledge and skills of different subjects and educational activities to learners' real-life experiences to solve complex and practical learning problems in accordance with the learning objectives of the grade and level.

PBL is not solely a teaching method, but also requires adaptation of the learning content, tools and organization as well as changing assessment of the learning outcomes in a holistic way.

As a teaching method, PBL can be integrated in most other teaching methods (e.g. problem-raising presentations, problem-raising dialogues, and research experiment demonstration) to make them more active.

This manual is developed in cooperation with:

Assoc. Prof. Nguyen Van Khoi, who developed Activities 2, 6, 7 and 9;

Le Huy Hoang, Ph.D., who developed Activities 1, 3, 4 and 5;

Vu Thi Mai Anh, M.A., who developed Activities 4 and 8;

This training manual is dedicated to TTI teacher trainers who participated in the training for “Problem-based learning” and sponsored by VVOB Vietnam. Trainers will also use the manual during peer and dissemination training for other TTIs.



ACTIVITIES

Activity 1 – Get acquainted

Time: 30 mins

Objectives: After completing this activity, trainees will be able to:

- Get acquainted and learn more about other participants.
- Share personal information, hobbies and abilities with others. Initiate and agree upon rules during training.
- Propose training objectives in cooperation with the trainers.

Materials: Coloured A4 paper.
Preparation of a class-seating chart, each seat shown in a blank box large enough to write the name of a class member.

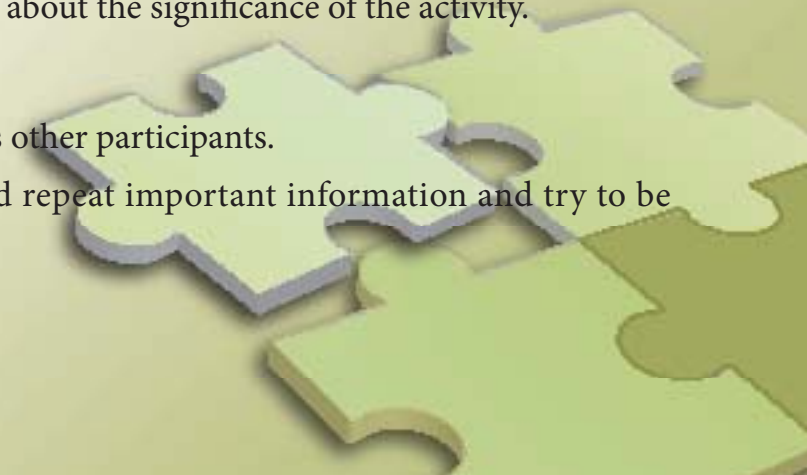
Steps:

1. Provide coloured paper and ask trainees to write their names (in CAPITAL letters) on it, fold it and put it in front of them.
2. In pairs, exchange personal information and expectations about the training and initiate rules to be observed during training.
3. Introduce their partner to others, using information gathered during the discussion.
4. Participants are asked to cover their names on the card and provided with class seating charts. They have to fill names of as many class members in the chart as possible (whoever fills in the most correct names will receive a prize).
5. Agree upon the training objectives and rules.

Assessment: Ask participants about the significance of the activity.

Notes: Facilitators:

- Do the same as other participants.
- Emphasise and repeat important information and try to be humorous.



Activity 2 – Orientation and basic concepts of PBL

Time: 60 mins

Objectives: After completing this activity, trainees will be able to:

- Present and agree upon some related concepts and terminologies (problem, situation, problem-based situation, problem-raising teaching and problem-solving teaching methods, etc.);
- Know how to use resource materials (hand-outs, internet, etc.);

Materials: Worksheet for Activity 2 (Appendix 1)
A1 paper, markers.

Steps:

1. Divide the class into groups and allocate tasks for each group (each group studies one concept).
2. Ask trainees to discuss and write on the A1 paper their own definition of the given concept.
3. Groups make their presentation on each definition; trainers discuss and agree upon core content of each concept.
4. Guide groups to read carefully the resource material for Activity 2 (Appendix 1).
5. Deliver worksheets and ask groups to complete them.
6. Sum up the concepts. Focus on the core characteristics of PBL.

Assessment: Ask trainees about the core characteristics and features of PBL. Trainers can then evaluate the attainment level of the training objectives.

Notes: There are many ways to define each concept, which need to be compared and distinguished from each other.



Activity 3 – Strengths and weaknesses of PBL

Time: 90 mins

Objectives: After completing this activity, trainees will be able to:

- Present strengths and weaknesses of PBL.
- Be aware of advantages, disadvantages and solutions when applying PBL.

Materials: A0 paper, markers, flipcharts.
Worksheets (Appendix 2).
Information on strengths and weaknesses (Appendix 2).
Resource information on the solar system and seasons in a year (with videos, if available).

- Steps:**
1. Divide the class into groups of four (including a leader and a secretary to record all group activities).
 2. Assign groups to solve the first problem in the worksheet (buying pizza).
 3. Guide trainees to solve the problem by themselves (this is quite an easy problem).
 4. Give the more difficult second problem to the groups (most trainees are unlikely to solve this problem immediately).
 5. Guide trainees to solve the problem with suggestions closely related to the PBL process. Provide them with resource materials on the solar system and seasons.
 6. Using the new knowledge, ask groups to give conclusions and solve the problem.
 7. Discuss the cognitive process using the problem-solving approach and compare it to traditional approaches.
 8. Ask groups to reflect on the strengths and weaknesses of the learning approach they have just experienced. Ask them to present and share their findings on A0 paper.
 9. Deliver resource information sheets and ask groups to complete the sheets.
 10. Analyse key strengths and weaknesses of PBL, discuss needed solutions where necessary, and make notes.

Assessment: Consider all the information presented by each group, as well as answers to the resource information sheets and their proposals.

Notes: Promote participants' self-confidence and emphasise the strengths of PBL. In addition, discuss international experiences and trends.

Activity 4 – Essential skills

Time: 180 mins

Objectives: After completing this activity, trainees will be able to:

- Describe requirements and different levels of a problem.
- Present some essential skills in PBL, focusing on the problem-finding skills.
- Apply these skills using specific examples.

Materials: 7 worksheets.
A0 papers, markers.
Resource information in Appendix 3.

Steps:

1. Divide the class into groups of four.
2. Read resource information in Appendix 3, discuss different levels of the problem and give one example for each level.
3. Report and discuss the results.
4. Deliver worksheets and ask trainees to study the worksheets in order to describe and give examples for the following skills:
 - a. Problem finding
 - b. Problem solving, giving examples (solve the problem presented in the problem-finding skill)
 - c. Mindmapping
 - d. Identifying assumptions – conclusions
 - e. Systematic thinking
 - f. Using problem trees
 - g. Using logical frameworks
5. Groups complete the worksheet on their assigned skill, present the application example, discuss, and give conclusions after each skill is presented.
6. Summarise groups of skills and make notes about their application.

Assessment: Evaluate performance of groups while studying worksheets. Ask them about possible applications and the meaning of each skill introduced in the activity.

Notes: Trainees may have difficulties doing the worksheets. Facilitators need to monitor and support them in a timely manner while they are working.

Activity 5 – Teaching process

Time: 60 mins

Objectives: After completing this activity, trainees will be able to:

- Analyse the PBL process
- Specify each step in the process

Materials: A sheet listing all the steps in the process (out of order).
A0 paper, markers

Steps:

1. Divide the class into small groups (5 trainees/group).
2. Deliver worksheets (Appendix 4 – Resource material for Activity 5) and ask them to draw a mindmap based on the terminologies in the worksheet.
3. Groups start to draw the mindmap.
4. Groups present their final results, give comments and feedback.
5. Ask the groups to continue their discussion and write an analysis of each step in the process. Each group is responsible for one step.
6. Groups present their final results. Sum-up, introduce resource materials for reference and answer trainees' questions.

Assessment: Assess the results, arguments and feedback made by each group, Consult trainees on the feasibility and level of detail used in the process.

Notes: Some trainees have already learnt about the problem-posing process from Russian educators. It may be necessary to adjust content when trainees' experiences are inconsistent.



Activity 6 – Understanding different levels of application

Time: 30 mins

Objectives: After completing this activity, trainees will be able to:

- Identify four different levels of PBL.
- Present the classification rationale and conditions for applying different PBL levels.

Materials: Worksheet for Activity 6 (Appendix 5).
Application level framework (presented on A1 paper, one for each group).

Steps:

1. Organise the class into groups and allocate tasks for each group (each group can study one application level of PBL).
2. Guide them to carefully read the related information according to the task allocated (Appendix 5).
3. Deliver worksheets.
4. Ask trainees to complete the worksheets.
5. Ask the groups to discuss and agree upon the levels, classification rationale and application conditions for different PBL levels. Finalise the application level framework.
6. Sum up the levels, classification rationale and conditions of different PBL application levels.

Assessment: Ask trainees about PBL levels, using a specific example.

Notes: There may be many ways to identify different PBL levels. For example, based on different levels of difficulty, synthesis, generalization, etc.



Activity 7 – Developing lesson plans

Time: 60 mins

Objectives: After completing this activity, trainees will be able to:

- Apply knowledge and skills of five activities in the training program in order to develop PBL lesson plans.
- Develop a PBL lesson plan for a specific topic within their field of expertise.

Materials: Worksheet for Activity 7 (Appendix 6).
Material for trainers and trainees (worksheets and resource materials).

Steps:

1. Organise the class into groups and allocate tasks for each group.
2. Guide groups to carefully read relevant information (Resource material for Activity 7, Appendix 6).
3. Ask trainees to write on the worksheet a summary of their own attainment of essential knowledge and skills in PBL; the main points in developing PBL lesson plans; PBL lesson plans through examples in the resource material; and develop a PBL lesson plan for a specific topic within their expertise.
4. Propose a sample PBL lesson plan.
5. Ask groups to discuss and agree upon the above issues.
6. Group representatives present their discussion results; other groups discuss and add more input.
7. Sum-up main content in developing a PBL lesson plan.

Assessment: Evaluate trainees' level of mastering content of PBL lesson plans through their examples.

Notes: PBL lesson plans may be very diverse.



Activity 8 – Practice

Time: 180 mins

Objectives: After completing this activity, trainees will be able to:

- Develop a complete PBL lesson plan in their field of expertise.
- Be aware of challenges in the planning process.

Materials: Computers and printers (if available).

Projectors.

Lower Secondary textbooks (depending on each class, groups can be divided according to subjects, with each group preparing a Lower Secondary textbook for their subject).

Steps:

1. Divide the class into subject groups.
2. Allocate tasks for groups.
3. Discuss and develop a lesson plan in groups.
4. Present and share lesson plans for each group.
5. Discuss and give suggestions. Share related problems occurring during group work.
6. Propose amendments for each group's lesson plan.

Assessment: Check the lesson plan

Notes: Make sure groups complete their tasks in a timely manner and that they are of a high quality.



Activity 9 – Summary

Time: 30 mins

Objectives: After completing this activity, trainees will be able to:

- Summarise the main points they have learned during training (objective, content and results of each activity).
- Self-evaluate their attainment level against the training objective.
- Develop a personal plan to study further and apply PBL in their own field of expertise.

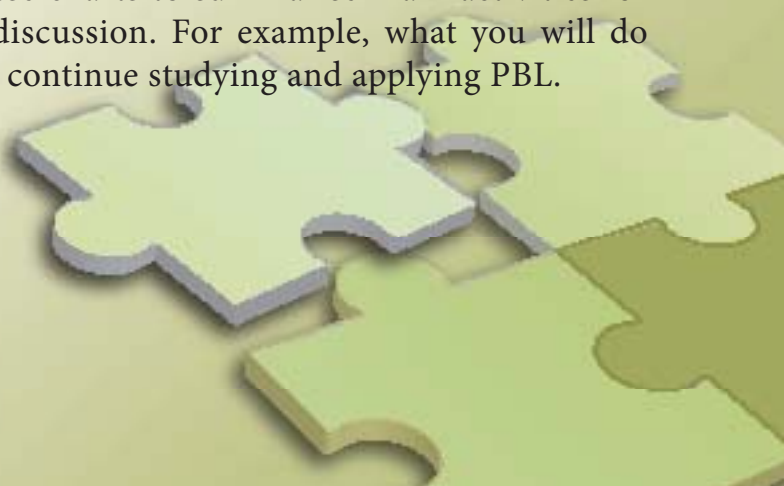
Materials: Worksheet for Activity 9, self-evaluation form, specific plan for applying PBL (Appendix 7).
Materials for trainers and trainees (worksheets, resource material in the training manual).

Steps:

1. Organise class into groups and allocate tasks (each group to complete one part of the worksheet).
2. Discuss and fill in the worksheet.
3. Group representatives present their discussion results; other groups discuss and add input.
4. Ask trainees to write their own thoughts and feelings in the “self-evaluation form”.
5. Summarise main activities of the PBL training.
6. Discuss the detailed action plan with participants (Appendix 7).

Assessment: Evaluate whether training objectives were achieved, by reviewing trainees’ worksheets and self-evaluation forms.

Notes: It is possible to use charts to summarise main activities for illustration and discussion. For example, what you will do and how you will continue studying and applying PBL.



APPENDICES

Appendix 1 – Resource material for Activity 2

Problem-raising or Problem-posing methods (PPM) were introduced more than 100 years ago. In the mid-20th century, many international research publications on PPM or related to PPM were introduced into Vietnam through specific Vietnamese versions, such as: I. Ia. Lecne, *Problem-posing methods*, Education Publishing House, HN (1977); V. Okon, *Background to Problem-posing methods*, Education Publishing House, HN (1976); I. F. Kharlamov, *How to promote students' activeness in learning*, Education Publishing House, HN (1978); etc.

Modern education theories and teaching practices all over the world have proved the importance of PPM with the cognitive process and development of students. Modern teaching methodology systems are not complete without PPM (see also *Problem-solving methods in modern education*, <http://tamgiang.net/diendan/showthread.php?t=3574>).

Although research on PPM still uses a variety of terminologies (style, trend or method; problem-posing or problem-solving) and different ways of classifying and ranking specific content, all of them emphasise the strength and importance of PPM in teaching and learning at school. “It is impossible not to apply such a teaching style or methodology at school if we want to promote students' activeness and creativity in learning”¹.

Due to different translations, the English terminology “Problem-based learning” may be translated differently in Vietnamese. It is necessary to distinguish them in Vietnamese: problem-raising teachingmethod, problem-based learning, and problem-based situations.

1. Concepts

1.1 Some key concepts

A *problem* is “what needs to be considered, researched and solved; for example: posing a problem, solving a problem, having a problem (conflict or something that needs to be solved)”².

¹ Nguyễn Như An, 1996,

² Hoàng Phê, 1998, p. 1066

To conclude, the word ‘problem’ refers to any question or matter involving doubt, uncertainty or difficulty that needs to be discussed to reach a solution.

A *situation* means “something happening (overview of related events and phenomena which happen in a certain space and time, showing a state or development trend of an object), in the aspect which needs to be coped with”¹.

According to Phan Trọng Ngọ: “Originally, a situation was a real event in society with physical, philosophical, psychological or social features”².

In education (and teaching in particular), it is possible to simulate and develop a real-life situation for the sake of pedagogic functions in teaching.

To sum up, a situation is objective; only when it is linked with a person can it become a problem or problem-free situation.

Problem-based situations:

There are many definitions of a problem-based situation. This is Phan Trọng Ngọ’s definition: “A problem-based situation is one which occurs when there is a conflict between what a person needs to solve the situation and when their knowledge, skills and methods are not sufficient to solve it. Hence, to solve it, he/she has to explore the situation in order to understand it and know how to solve it”³.

Using this definition, he proposes three conditions of problem-based situations:

- (i) Events in the situation exist as a problem; i.e. it must consist of two elements: data (what is known) and requirements (what needs to be found).
- (ii) The situation must be related to the person; i.e. the subject must have a demand to tackle the situation, and data and requirements of the situation must be related to the subject.
- (iii) The situation must motivate the person to be engaged in solving the problem.

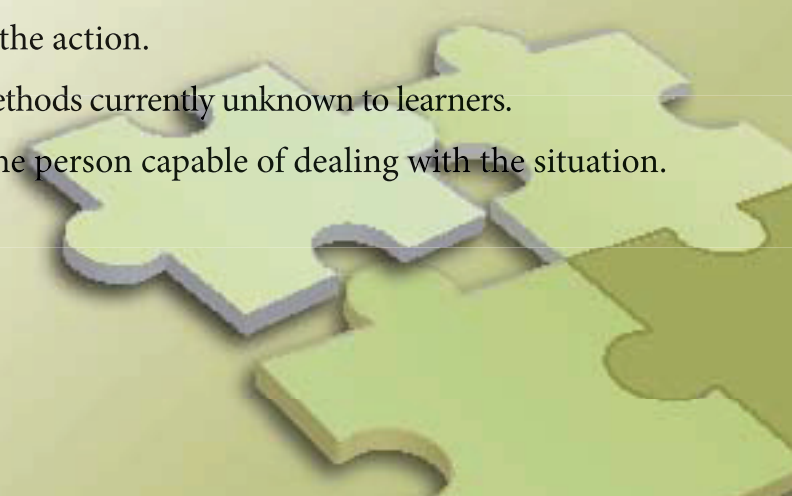
Based on the findings of M.A. Machiuskin (1950), Trần Bá Hoàng (2003) suggests paying attention to three main areas of a problem-based situation:

- (i) Learners’ need for cognition of the action.
- (ii) The search for knowledge and methods currently unknown to learners.
- (iii) Knowledge and experience of the person capable of dealing with the situation.

¹ Hoàng Phê, 1998, p. 962

² Phan Trọng Ngọ, 2005, p. 216

³ Phan Trọng Ngọ, 2005, p. 262



1.2 Some similar concepts

Problem posing or problem raising: “Problem posing is a learning method in which students systematically engage in the process of solving problems and mathematic problems developed from the curriculum”¹.

Using the terminology “problem posing” may be misleading, as solving the problem is the teacher’s main purpose.

Problem solving: emphasises the problem-solving stage and considers it as the main stage. If students are involved in this stage, they will both master the knowledge and learn ways of leading to that knowledge.

Problem-based situation: “A problem-based situation is a teaching method in which the teacher creates a problem-based situation to stimulate learners to discover the problem and proactively try to tackle the situation, through which they attain knowledge, develop skills and obtain other learning purposes”².

Problem posing and solving (Trần Bá Hoàn)³: takes into account both of the above stages.

2. Problem-based learning - PBL

The modern history of PBL started in 1970 at the Medical School of McMaster University, Canada.

a) Characteristics of PBL

The terminology *Problem-based learning* is “a strategy used as a tool/guideline in which students cope with problems (often unclearly structured) in a particular context and try to find significant solutions”⁴.

In order to apply this strategy, teaching activities must be designed on the basis of researching respective learning activities in a specific context/situation. This can be understood as a *problem solving method* (in terms of teaching method).

In this sense, PBL can internally motivate learners and stimulate independent, creative and critical thinking, cooperation and communication skills.

In this booklet, PBL means ***teaching and learning by solving real problems related to learners using the learning content within the “knowledge and skill standards”***,

¹ Nguyễn Văn Lê, 1998, p. 5

² Phan Trọng Ngọ, 2005, p. 261

³ Trần Bá Hoàn, 2007, p. 90-91

⁴ James Rhem, http://www.ntlf.com/html/pi/9812/pbl_1.htm

through which learners attain knowledge and build up skills independently, such as planning, self-orientation, cooperation, high-level thinking and life skills.

This approach helps learners adapt and integrate into society and the community, an issue of high concern and importance in education nowadays.

PBL implies a learning process where outcomes are attained from the problem-solving process. Therefore, problems are both the context and motivation for learning; while the problem-solving process is the tool for obtaining the learning outcomes.

b) Features of PBL:

- Uses practical and relevant problems in a particular situation. The problem is the central situation and learners can approach it right at the beginning of the lesson/curriculum.
- There may be many different solutions for a problem. When new information is collected and reviewed, awareness of the problem will change, leading to changing solution.
- The training curriculum is developed on the basis of systematically analysing the problems; teaching methodologies focus on learners and group work in combination with individual work; the teacher plays the role of facilitator and supporter for learners.

c) Why study and apply PBL?

Modern education is highly interested in *methodologies focusing on mental activities* of learners:

Firstly, learners must be put in a real-life situation that is continuously changing and is interesting to them.

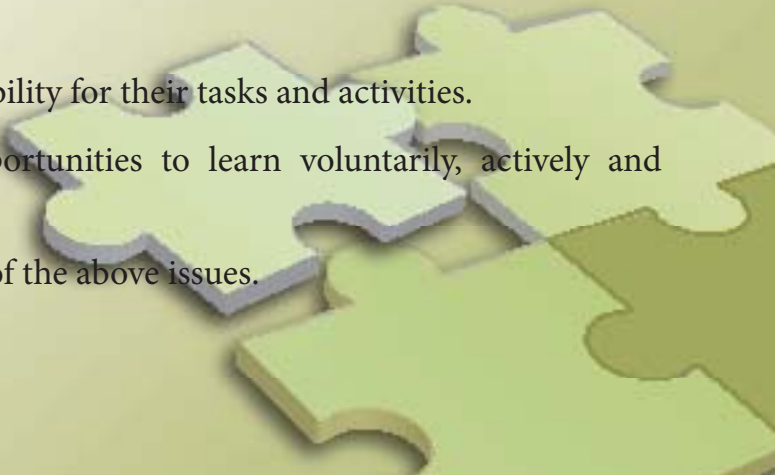
Secondly, a real problem arising from the situation will stimulate them to explore and reflect.

Thirdly, learners must have necessary information (what is known, figures and data) to solve the problem.

Fourthly, students must take responsibility for their tasks and activities.

Fifthly, students must be given opportunities to learn voluntarily, actively and creatively.

Problem-based learning can meet all of the above issues.



WORKSHEET FOR ACTIVITY 2

Name:; **Group:**

Tasks:

(1) Study resource materials for Activity 2

(2) Answer the following questions:

a) Meanings/definitions of concepts (as assigned for the group)

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b) Characteristics of problem-based learning

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c) Comparison between traditional problem posing methods and PBL

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d) Trainees' comments (each group should give at least 2 comments on the content or ways of organizing the activity)

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Appendix 2 – Resource material for Activity 3

A. Advantages and disadvantages of PBL¹

No	CONTENT	ASSESSMENT	
		Advantages	Disadvantages
1	Learners obtain knowledge related to the subject through giving proper solutions to the problem		
2	Learners explore new knowledge through solving the problem		
3	Learners may not do exactly what the teacher wants them to do		
4	Learners work quite independently from their teacher. Therefore, they may not be able to explore everything their teacher wants them to during problem-solving time.		
5	Promotes active teaching and learning		
6	Helps learners develop abilities independently		
7	It is easy for weak or unconfident learners to let other members of the group do all the tasks.		
8	Sets up the relationship between knowledge and real life		
9	Learners can be wrong in their conclusions unless the teacher gives strict supervision		
10	Some learners do not get used to this learning method		
11	PBL helps learners understand the meaningfulness of the subject		
12	Develops critical thinking, independent learning and flexibility/adaptation		
13	Revives curiosity for older students or teachers		
14	It takes time to plan and implement PBL		

¹ Jonh, 2002.

No	CONTENT	ASSESSMENT	
		Advantages	Disadvantages
15	Helps teachers understand better the competence and special abilities of learners		
16	Helps learners be able to solve real-life problems in various ways		
17	Encourages cooperation and discussion – the basis for developing life skills		
18	It is difficult to choose proper problems to solve		
19	It is necessary for both teacher and learners to have PBL skills and other related skills		
20	Makes learners confident when facing various situations/problems in the real world		

B. SAMPLE OF SITUATIONS/PROBLEMS

1. “Five students decided to have a party. Each contributed 100,000 VND. They gave 500,000 VND to a mother to buy food from the supermarket. The bill was 430,000 VND. The mother gave back 10,000 VND to each and kept back 20,000 VND. So each student paid 90,000 VND for the party and the mother kept 20,000 VND. So $5 \text{ students} \times 90,000 \text{ VND} = 450,000 \text{ VND}$ and $450,000 + 20,000 \text{ VND} = 470,000 \text{ VND}$. Where is the lost 30,000 VND?
2. Nam wants to buy a pizza on the occasion of his brother’s birthday. There are two kinds: a small one (10 c.m. in diameter): 20,000 VND; and a big one (20 c.m. in diameter): 75,000 VND. Nam is wondering: Which one is cheaper?
3. It is cold in winter and hot in summer in the North of Vietnam. Why?



Appendix 3 – Resource material for Activity 4

ESSENTIAL SKILLS FOR PROBLEM-BASED LEARNING

A. DEFINITION AND TYPES OF PROBLEM

1. What is a problem?

A problem refers to any question or matter involving doubt, uncertainty or difficulty that needs to be discussed to come to a solution¹.

2. Types of problem²

There are three types of problems depending on learners' abilities:

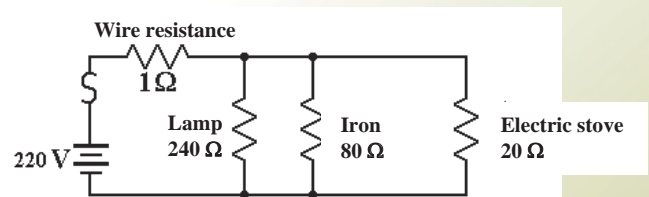
Type 1: Application tasks (level 1)

Application tasks are given at the end of a lesson or a chapter and found in the textbook or workbook. At this level, a problem is given to develop the level of knowledge and comprehension of learners. The solution is found in the learning program (normally the textbook).

Example 1:

A simple circuit as shown in the diagram

Task: Calculate the electric current going through the fuse, lamp, iron and electric stove.



Example 2:

After learning the law of Independent Assortment (Mendelian genetics), learners may be given the following task:

When cross-breeding pure-bred smooth and wrinkled peas, will the skin of the resulting next generation (F1) pea be smooth or wrinkled?

Or, put another way, when cross-breeding smooth and wrinkled peas, F1 peas are 100% smooth. Explain why.



¹ Source: <http://dictionary.reference.com/browse/problem>.

² Barbara Duch, "A Key Factor in PBL", Center for Teaching Effectiveness, University of Delaware.

Type 2: Fact-based story assignment (Level 2)

This means using stories to transform an application task (level 1) into a real-life situation. At this level, it helps develop comprehension and application skills. Learners are even required to make decision at times. This type promotes links to real life, so learners have a thorough understanding of the subject and are active in problem solving.

Example 1:

Tuan came to Nam's house for group-study and stayed overnight. The next morning, Tuan got up early and turned on the 100w. lamp. He wanted to surprise Nam by making coffee and warming it up on the 1000w. electric stove. He wanted to iron his clothes at the same time using the 1500w iron. However, the electrical circuit at Nam's house has only a 20-ampere fuse. Did Tuan have to warm the coffee first then iron his clothes?

Example 2¹:

At a hospital, 2 women gave birth to 2 boys. Due to a nurse's mistake, no-one knew which mother was which. Tests showed that one boy had A type blood and the other had O type. The mother (number 1) whose blood type was A thought that the boy with blood type A was her son. The mother (number 2) whose blood type was B thought that the boy with blood type O was her son. However, they were not sure so they asked the hospital to test the fathers' blood types. Results showed that the father (number 1) had blood type O and the other father (number 2) had blood type A. This was the opposite of what the mothers' had believed.

- a) Use scientific evidence to explain the results to the two families
- b) Is it possible to confirm which boy belongs to which family using only the blood type test?

Note: Heredity of human blood type A, B, AB, O is controlled by gene I^A , I^B , I^O (I^A , I^B are dominant)

Type 3: Real-life situations (level 3)

This is the most difficult level of "problem" and the desirable level for PBL. At this level, while solving the problem, learners develop higher-thinking skills such as analysis, synthesis, and comparison through exploring, researching and problem solving.

In these situations, the lessons contain knowledge that is previously unknown by the learners. To solve, learners need to have knowledge of various subjects (not just one), and practical as well as theoretical knowledge.

¹ Adapted from the Test for the 9th grade gifted students- Ho Chi Minh City, 2007.

Type 1 assignments can be adapted to Type 3 if the given problem contains knowledge unfamiliar to learners.

Example 1¹:

Part 1:

Your teacher has his house built. You are a good student with sound knowledge of electrical systems in houses. You asked to help design the electric system for his house and he agreed. The house has 4 bedrooms, 1 living room, 1 dining room and toilets. Your teacher is a Literature teacher. He does not even know how the fusebox operates, how much electric equipment will be needed, How many fuses will be needed; how electric wire will be installed, etc.

Answer your teacher's questions about domestic house electrical systems. If you do not have the answers, please search for further information. You need to ask your teachers for further information to complete the task.

{You will be given Part 2 when you finish Part 1}

Part 2:

Your teacher will tell you about electric equipment used in the house including a micro-wave, fridge, oven, electric frying pan, dishwasher in the kitchen; computer, printer, iron, television in the bedroom; hair dryer, water heater; a neon lamp and a wall lamp in each room (except the bathroom).

The room areas are as follows:

Kitchen: 3m. x 4m.; living room 4m. x 5m.; bedroom 3m. x 3m.; bathroom: 1.5m. x 2m.

How many electric sockets will be needed? Design the circuit for the kitchen. Is it necessary to have fuses for the kitchen's circuit? Design the whole circuit for the house.

{Ask your teacher for comments when you finish your tasks}

Example 2:

A situation where lower secondary children are smoking.

3. Requirements for "problems" used for teaching and learning²

A "problem" is a tool, context and situation for learners to obtain subject knowledge. Therefore, a "problem" is the most important factor to be defined. The effectiveness of PBL depends on the quality of the problems given to learners. Research results show that a good "problem" should:

¹ Barbara Duch, "A Key Factor in PBL", Center for Teaching Effectiveness, University of Delaware

² Barbara Duch, "A Key Factor in PBL", Center for Teaching Effectiveness, University of Delaware, U.S.

- Imply a conflict and that current knowledge is not enough to solve it
- Be based on the learning content
- Be related to real life
- Help develop higher thinking skills
- Draw attention and motivate learners
- Encourage cooperation

4. Problem-defining methods

Not many teachers use this method due to difficulties in defining problems for learning. In fact, there are not many materials about problem-defining methods or techniques. Here are a few, however:

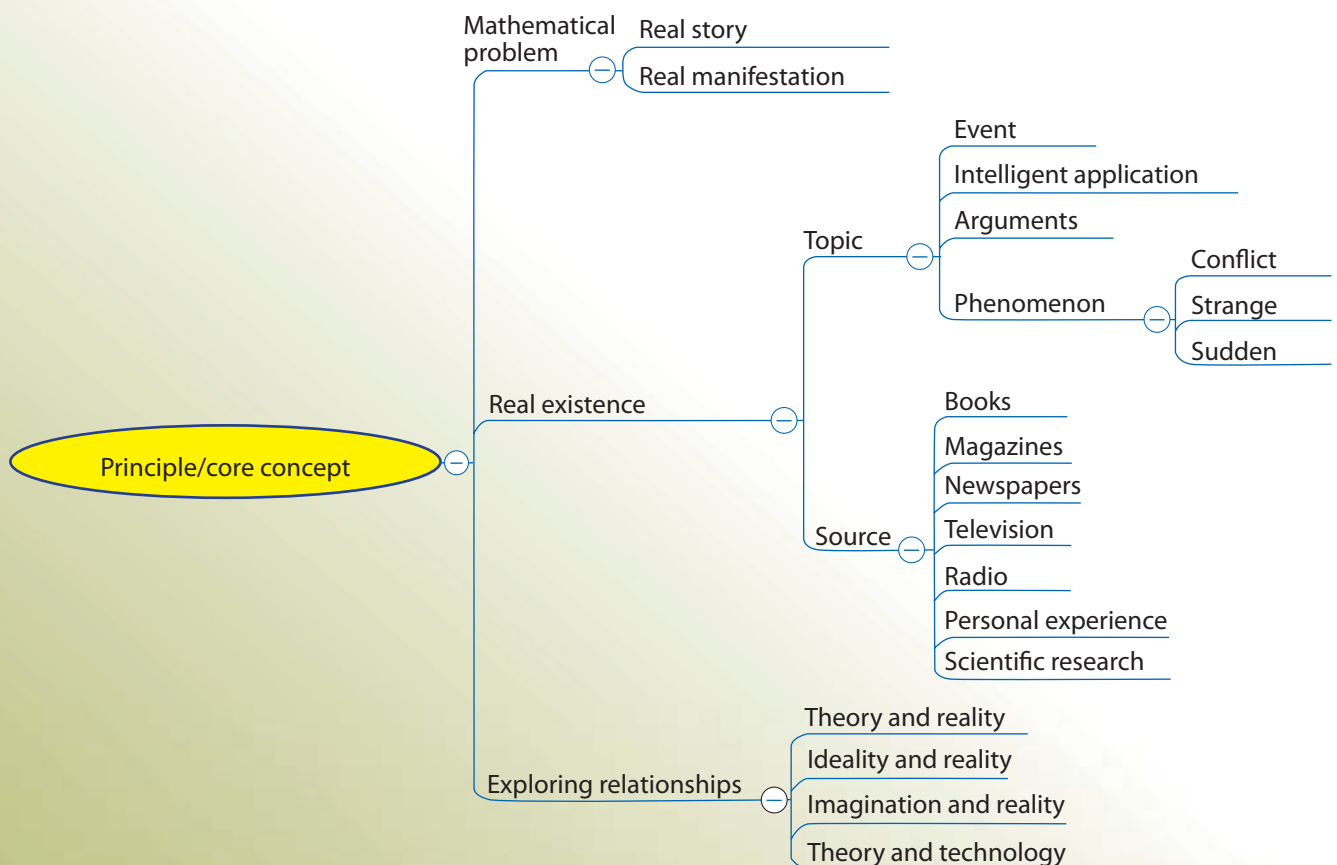


Diagram 5.1: Problem-defining methods

Based on this, there are two ways to define the problem:

Option No. 1: Set up the task using concepts/principles

Based on objectives, content of the lesson/subject, teacher selects core concepts/principles (unknown to the learners). The teacher then constructs 3 levels of “problem”: Application tasks (level 1), stories related to real life (level 2), and showing the existence of concepts/principles in real life (level 3).

Option No. 2: Find out the existence of concepts/principles in real life

Learners examine and discover problems in real-life events; technology advancements in daily life, controversial discussions, other things which are changing, controversial, etc.

Resources containing the “problem” include books, magazines, newspapers, television and radio programs, personal experiences, research, etc.

Option No. 3: Exploring contrary factors

is a way to explore problems in various aspects in real life, when there is a contradiction between what should happen and what does happen in reality. For example:

Between theory and real life: a man’s cholesterol levels should increase if he eats lots of eggs. However, some people who eat 20 eggs over tens of years still have normal rates of cholesterol in their blood.

Example 2: According to Mendel’s Segregation Law, if pure-bred flowers with two contrasting characteristics (red flower and white flower) are cross-fertilised, the F₂ (next) generation will receive a 3:1 ratio (3 dominant, 1 recessive: 3 red flowers and 1 white one). However, in fact, the F₂ generation produces the ratio: 1 red flower, 2 pink ones and 1 white one.

Between an ideal situation and reality: Ideally we should be able to produce lifelong motor engines, but in reality we can’t.

Between imagination and experiences based on wrong assumptions: People often think that acrobats should be able to walk a tightrope easier without a cane (because they do not have to carry one). But in reality, it is much easier to carry a cane as it helps them balance.

Between theory and technology: For plants to grow, we should only need to maintain good conditions of water, light, and fertilizer. However, some plants still die despite having all these conditions.

However, defining the problem can be subjective: some problems classified in Option 1 may also satisfy some criteria in Options 2 & 3.

An important question to bear in mind when selecting the problem is: “What would learners gain by solving this problem?” The problem should help learners consolidate

knowledge and obtain new knowledge, make use of some prior knowledge to obtain new knowledge, identify the presence of knowledge/theory in reality, or learn how to relate things and find solutions to problems. To sum up, defining problems and using them for teaching and learning purposes are very important phases. This is crucial to teachers' successful PBL applications.

B. PROBLEM-SOLVING SKILLS

In order to grasp skills for problem solving, it is first necessary to understand the problem-solving process.

Problem-solving steps

For PBL in schools, there are 4 steps, as follows:

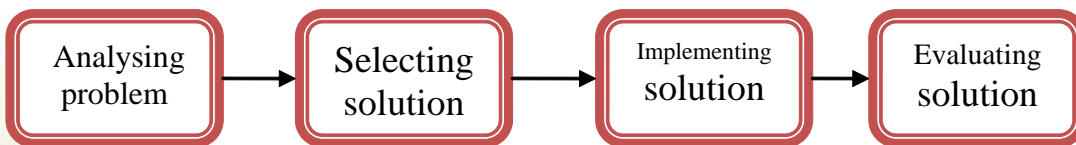


Diagram 5.2. Problem solving steps

Steps	Description
Analysing the problem	<p>Objectives:</p> <p>Thoroughly understand a particular problem and try to find solutions.</p> <p>Content:</p> <p>Based on given information:</p> <ul style="list-style-type: none"> - Find out causes of the problem. These can be either external or internal ones (inherent ones). - Study effects of the problem. <p>Required skills (terms below explained in following section):</p> <ul style="list-style-type: none"> - Mindmapping; - Identifying known data/knowledge and questions that need to be answered; - Systems thinking; - Using supporting tools such as mindmaps, problem trees.

Selecting solution	<p>Objectives: Select the best solution</p> <p>Content: Selection is based on knowledge gained in step 1: Proper solutions are those stemming from internal/inherent causes of the problem.</p> <p>Required skills:</p> <ul style="list-style-type: none"> - Cause/effect thinking - Systems thinking - Using logframes
Implementing a solution	<p>Objectives: Based on the problem, find answers/lists of activities which need to be done to solve the problem</p> <p>Content: Application of theories/concepts to find out answers/activities to solve the problem.</p>
Evaluating the problem	<p>Objectives: Test/evaluate the effectiveness of the solution</p> <p>Content: If it is a mathematic problem, this step is a cross-check. If the problem is related to real life and solutions are assumptions/hypothesis, omit this step. If the problem is related to real life and solved after research, assignments or fieldtrips, this step is carried out after completing step 3.</p> <p>* This is an important step when solving real-life problems, because it helps to give immediate information about whether the selected solution is effective and if not, alternative suggestions can be made.</p>

In real-life, the first step of problem solving is usually to define and express the problem. But in schools, this first step is mainly done by the teacher. Therefore, PBL in schools starts with analyzing the problem. However, it is necessary for the teacher to encourage learners to gradually practice finding the problem themselves when they get acquainted with this method.

C. OTHER SKILLS

1. Mindmapping:

Mindmapping refers to a way of organising thinking. A mindmap is a diagram including a main topic and subtopics. The main topic is connected to subtopics, and subtopics connected to one another by lines. Some subtopics are not connected directly but are related to each other.

A mindmap shows consecutive development from vertical (one way) to horizontal (two way) and to multi-aspect thinking.

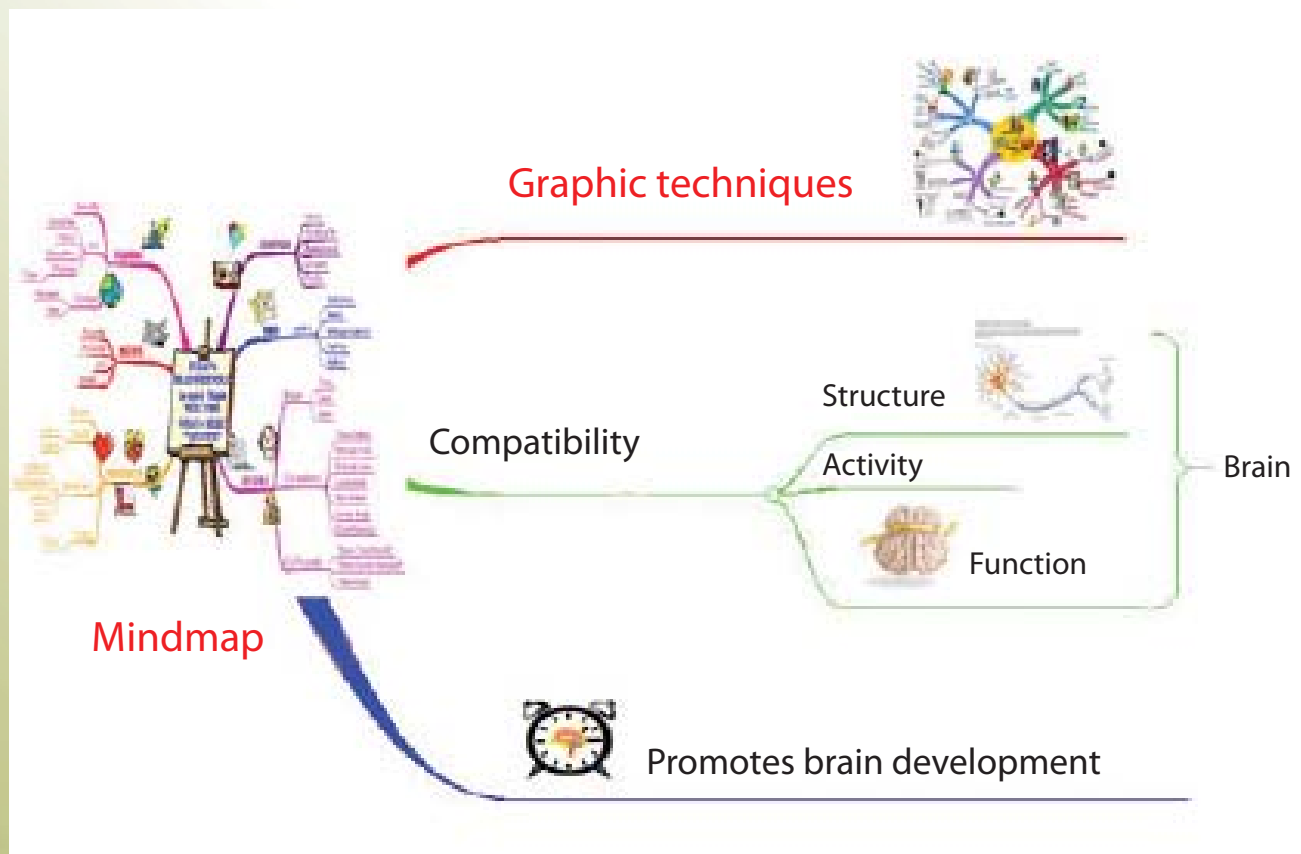


Diagram 5.3. Example of a mindmap¹

¹ Source: <http://tolamvienkhoa.wordpress.com/2008/09/05/whatismindmap/attachment/2/>

Mindmapping helps to show close links between ideas. It develops the creativity needed in various subjects.

The inventor of mapping, Tony Buzan, suggested mindmapping should be used to:

- Plan for a presentation or a report
- Plan exceptional creative ideas
- Persuade or negotiate
- Help remember
- Plan for personal objectives
- Take the initiative.

Pen, papers, board, or chalk may be used for mindmapping. However, by doing so, it may be quite difficult to add, extend, change or re-arrange ideas, and attractive mindmaps may not be produced.

Nowadays, with ICT development, software can be used to produce attractive mindmaps. Another advantage is that they are easy to change, revise or extend. In addition, in some software you can attach comments, evidence or presentations to produce a more detailed mindmap. Software for mindmapping includes FreeMind, Mind Manager, etc.

2. Skills for identifying assumptions and conclusions:

These skills are applied to problems of levels 1, 2 and those of level 3 that are described in concrete situations or use prior knowledge.

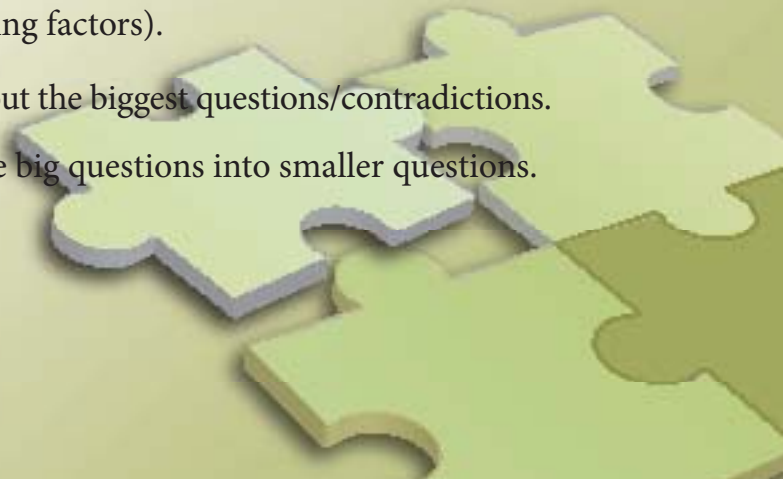
There are two consecutive steps: 1. Identifying assumptions 2. Identifying conclusions

Identifying assumptions

1. Find and list assumptions (hypothesis), known factors and clues to the problem.
2. Select clues useful for analysing or finding solutions in the following steps. Ignore unhelpful or useless facts (disturbing factors).

Identifying conclusions

1. Find out the biggest questions/contradictions.
2. Divide big questions into smaller questions.



3. System-thinking skills:

In reality, any thing or phenomenon is considered a system if it is formed with different components. These components have interactive relationships that create their typical characteristics and ways of working. The system can be studied in various ways, looking at all the components individually. However, it is impossible to see the whole system this way without seeing all of the components/parts and their interaction. This systematic way of observing things/phenomenon is called a system-thinking skill.

Applying this skill in problem solving involves addressing the problem as a whole¹. These can include contradiction, cause, effect, solutions and results, as in the following example of a logical relationship:

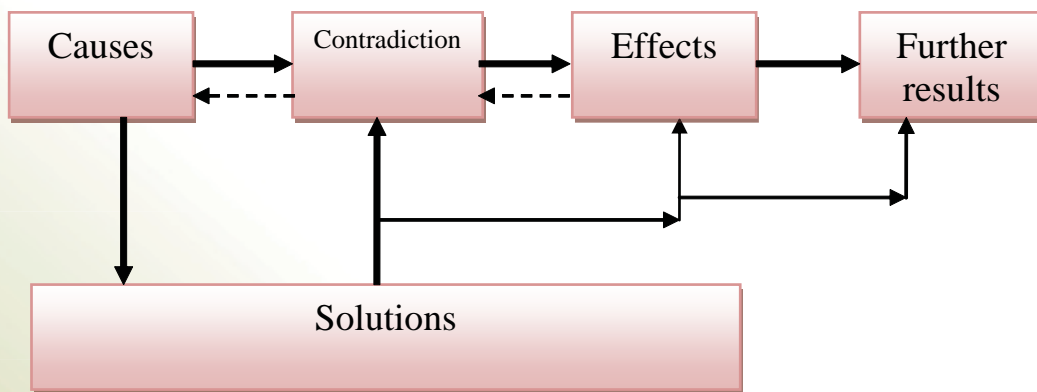


Diagram 5.4: Systematic diagram of a problem

Everything has contradictions, every contradiction has causes, contradiction happens and causes effects. These should be based on causes to propose solutions; if the contradictions are solved by particular solutions, effects are eliminated, leading to future results. Clearly, if the solutions do not come from causes, the contradictions would not be solved.

In Diagram 5.4, according the logic of the problem (illustrated by bold arrows), causes lead to contradiction, unsolved contradiction leads to effects which leads to the result. However, in reality, the logic of the problem is found and solved as per dash lines: problems rise with the presence of contradictions or effects. By analysing these contradictions/effects, causes are identified.

System thinking is very useful for analysing problems, because sometimes it is easy to find direct causes but the inherent causes can only be found when the problem is looked at systematically. For example, in the past when a person had a chronic

¹

problem with skin sores, his blood was tested. The result might show that he was HIV positive. Dermatitis is a direct cause of the sores, but the inherent cause is his broken immune system, as HIV viruses are causing failure to fight against the disease. If he has treatment for dermatitis only, the underlying disease would not be treated.

4. Problem-tree analysis::

A problem tree¹ is a tool for analysing problems using a system-thinking approach. Here, the content of the problem is visualised as parts of a tree. It is a creative and effective tool for analysing problems. Normally the problem includes contradiction – seen as part of the problem, causes and effects. The contradiction is the part that needs to be solved. Causes can be found only with analysis. The visible parts of a tree are the trunk and leaves represent contradictions. The roots represent unseen or invisible causes.

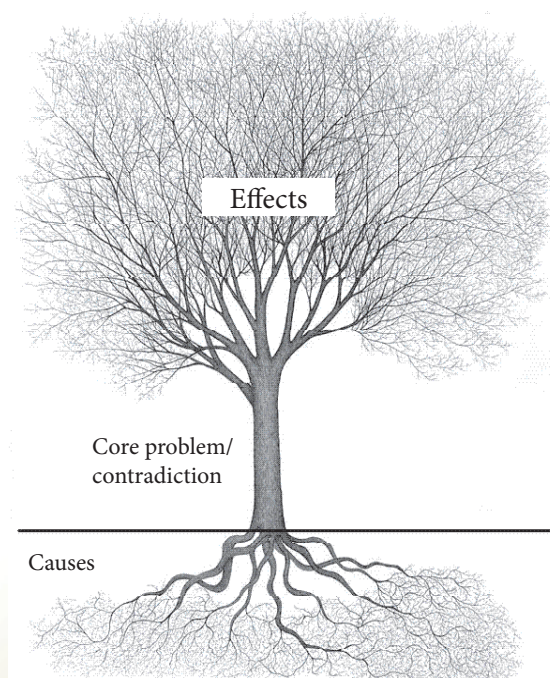


Diagram 5.5a: A problem tree

(Source of photo: www.4perspectives.com/treeoflife2.htm)

In problem-tree analysis, a three-layered diagram (root, trunk, leaves) of a tree is visualized. The name of the problem is written on the trunk, while effects are written on the leaves. To solve the problem, it is necessary to find the unseen

¹ A problem tree is a mathematical application introduced in the middle of the 19th century by Jacop Steiner, a Swiss mathematician.

parts under the ground (main roots, subordinate ones). In other words, causes are of two types: external and internal ones. Roots are internal ones that are difficult to see.

The problem is analysed as a whole so that solutions are logical, proper and feasible. A problem tree is similar to a mindmap, but it is easier to visualize using parts of a tree.

However, mindmapping uses a list of things to analyse independent content, while a problem tree both lists and structurally sorts them. Therefore, a problem tree is used most effectively to see the problem as a whole.

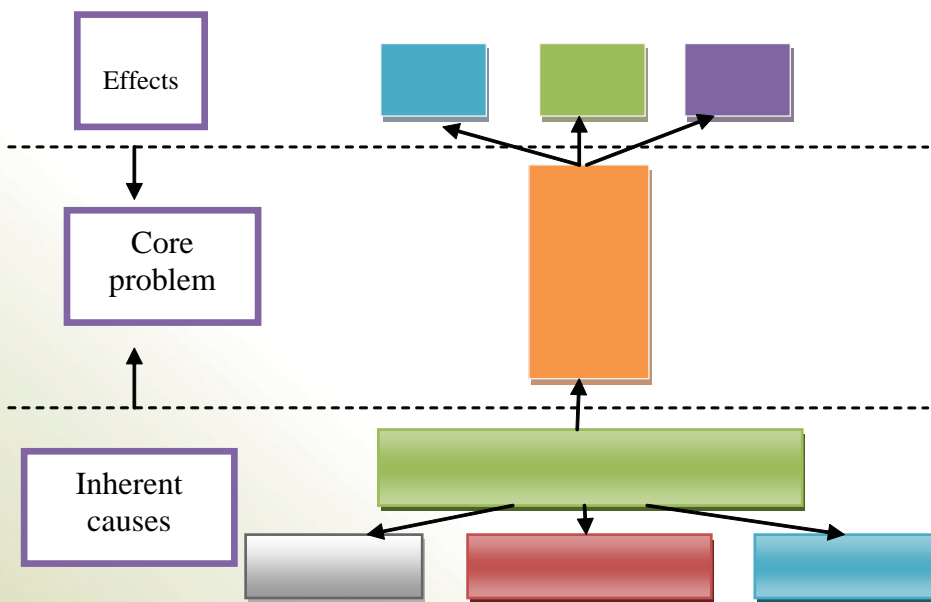


Diagram 5.5b: A problem tree in diagrammatic format

5. Logical frameworks (logframes):

A logical framework or logframe is a tool to manage projects, used in the project-planning phase. The term Logframe was first introduced in the U.S. in the 1960s, and is now widely used in international development projects in Europe, Australia and Canada¹, etc. Project planning, implementing, supervising and evaluating work have now become much easier, thanks to logframes.

In teaching and learning, logframes are used for planning lessons or the whole academic year activities, etc. In PBL, logframes are used to find solutions once causes have been found. Thanks to the logic of its matrix, it is easy to find

¹ International Service for Agricultural Research- “Engendering the Logical Framework- Helen Hambly Odame, Research Pffocer. ISNAR, August 2001.

proper solutions. A logframe is normally a matrix including columns and rows. Normally the content of columns includes the core problem (name of problem/contradiction), causes, solutions, and effects. The content of rows is content related to the respective columns. For example, Problem A has causes A1, A2, etc, Solution A1.1, and A1.2, etc (based on causes A1, A2, etc) Thus, solutions are rational, stemming directly from the causes of a problem.

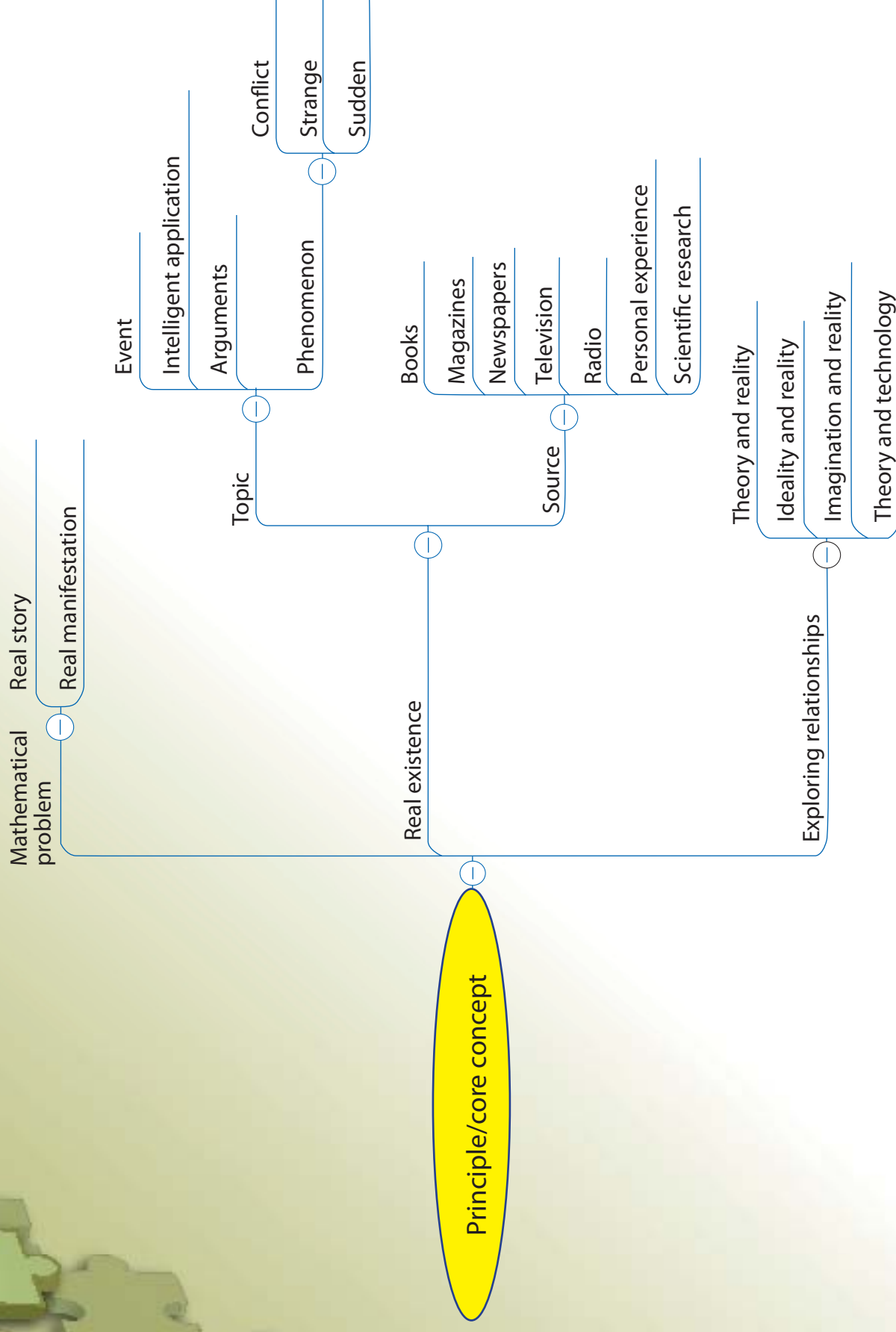
Problem	Causes	Solutions	Note/ Future results
A	A1	A1.1	
		A1.2	
		...	
	A2	A2.1	
		A2.2	
		...	
	...		

In addition, learners use logframes to present their PBL processes. Logframes help develop logical thinking and improve learning outcomes. They also help teachers to assess their students' learning outcomes.

However, it is not advisable to use a logframe for simple problems (level 1). Logframes should only be used for complicated problems with lots of direct and indirect causes and especially problems found in reality.



GUIDELINES FOR IDENTIFYING PROBLEMS



GUIDELINES FOR PROBLEM-SOLVING SKILLS



Analysing a Problem

- Mindmapping skills;
- Skills for identifying known data/knowledge and questions which need to be answered
- System-thinking skills
- Skills for using supporting tools such as mindmaps, problem trees.




Selecting a Solution

- Cause/effect thinking skills
- System-thinking skills
- Skills for using logframes



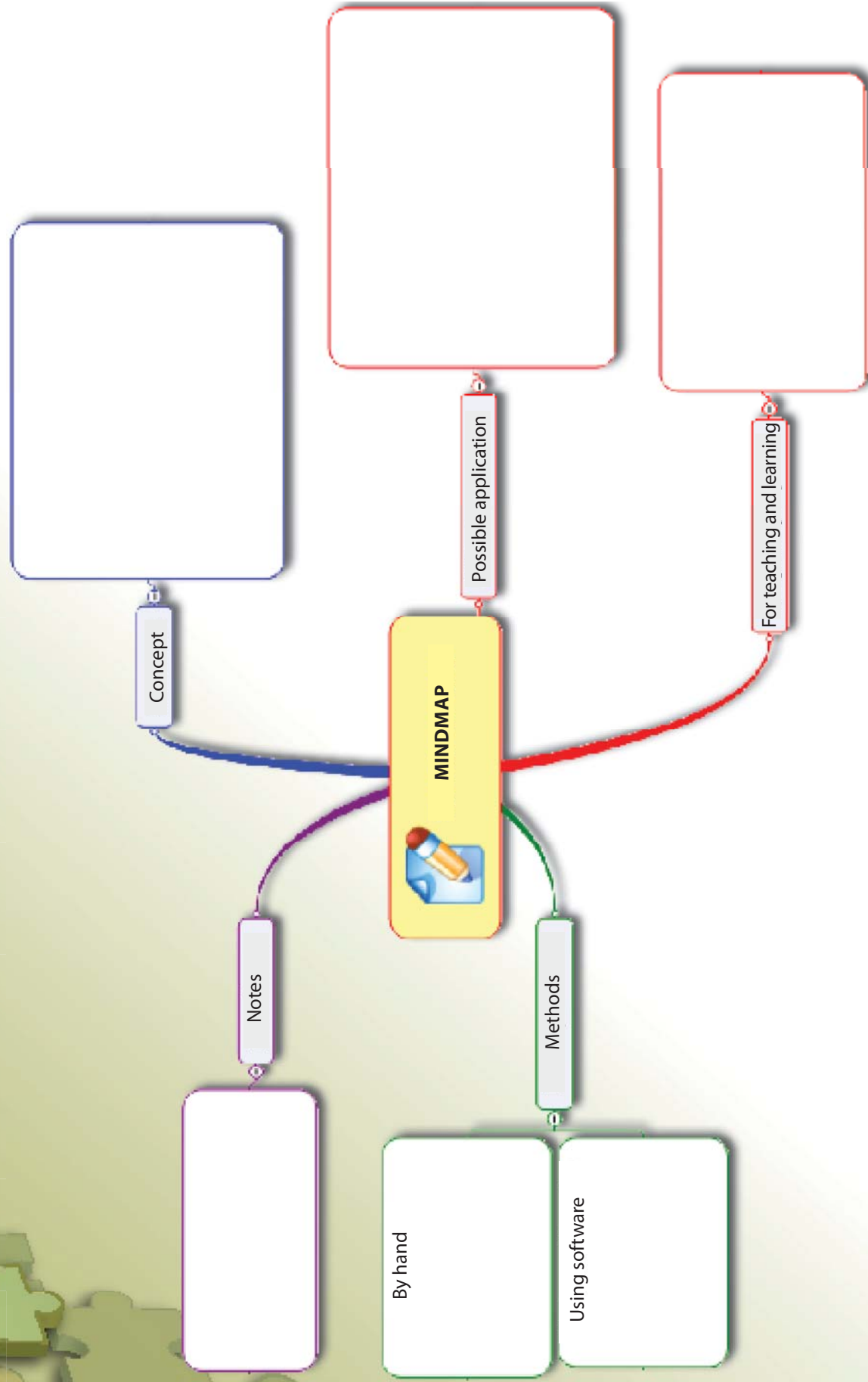
Implementing a Solution

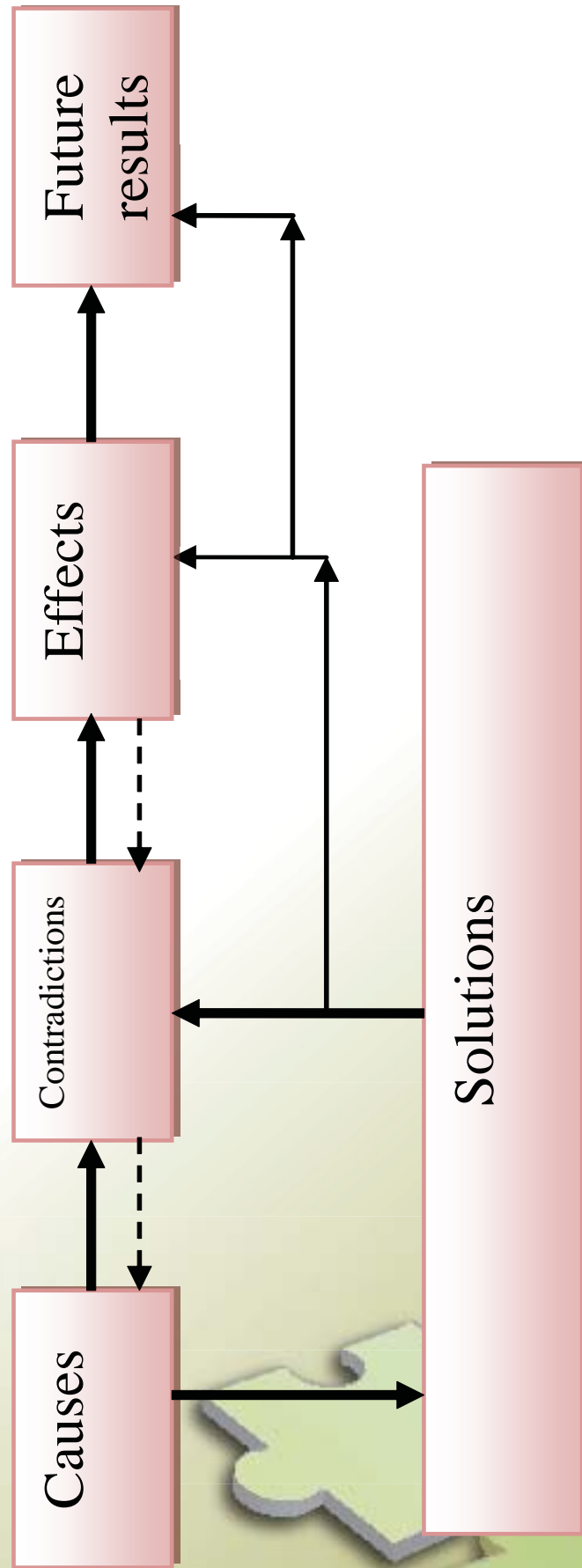
Flexible depending on the problem



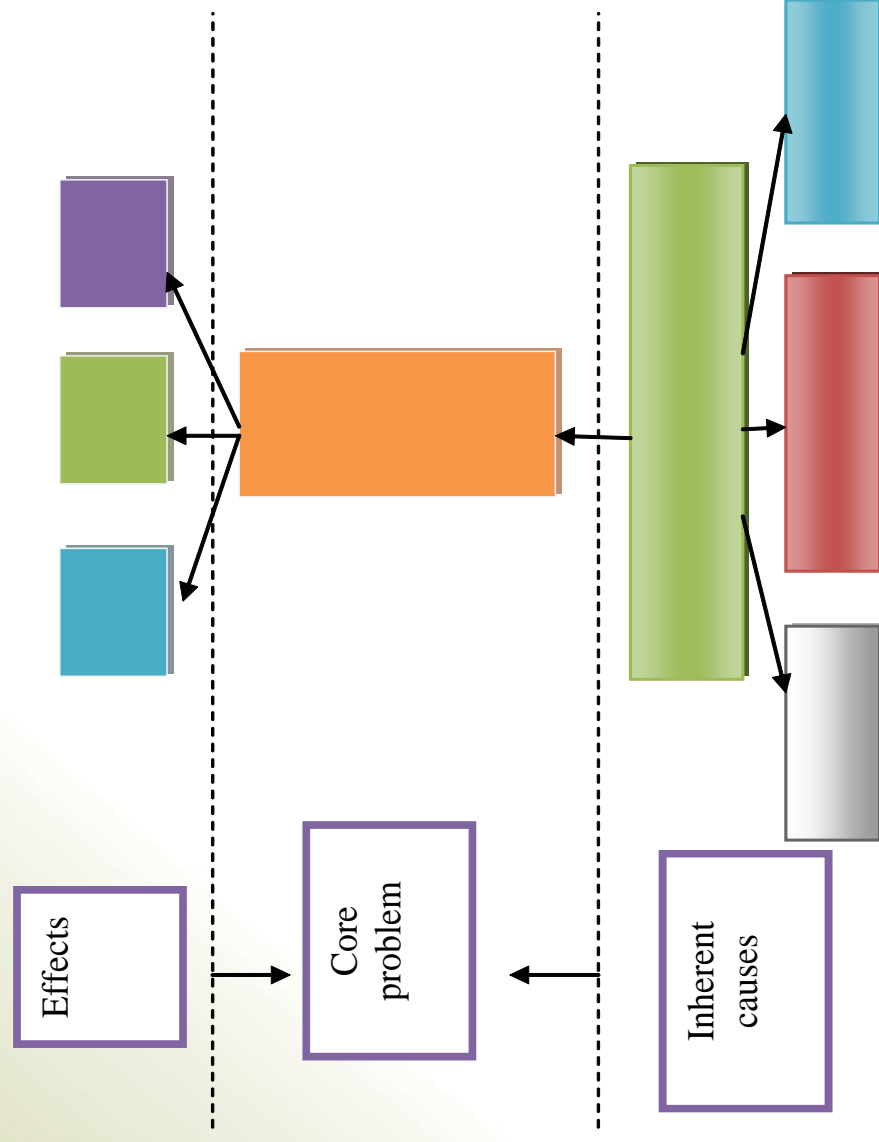
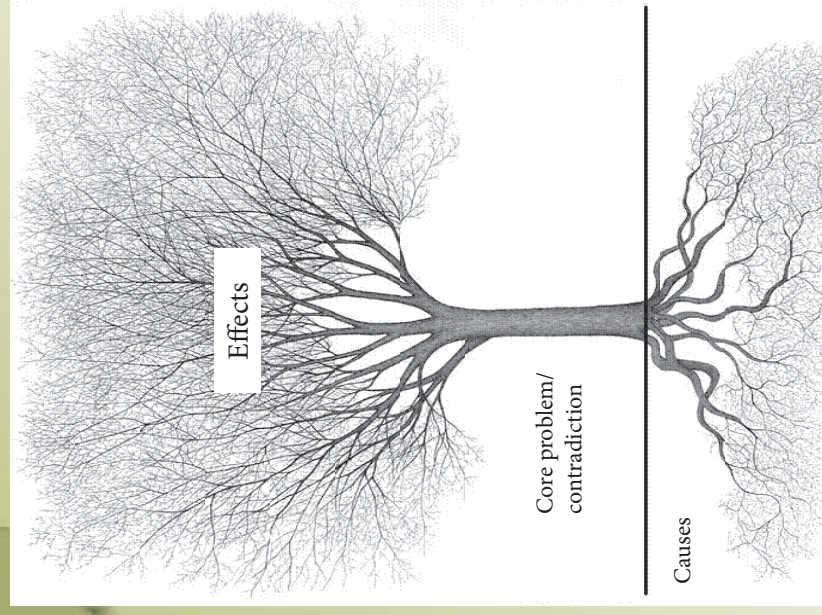
Evaluating a Solution

EXAMPLES OF A MINDMAP



GUIDELINES FOR SYSTEM-THINKING

GUIDELINES FOR PROBLEM TREE ANALYSIS



GUIDELINES FOR USING LOGFRAMES

Problem	Causes	Solutions	Notes/ Future results
A	A1	A1.1	
		A1.2	
		...	
	A2	A2.1	
		A2.2	
		...	
	...		

Appendix 4 – Resource material for Activity 5

PROBLEM-BASED LEARNING PROCESS

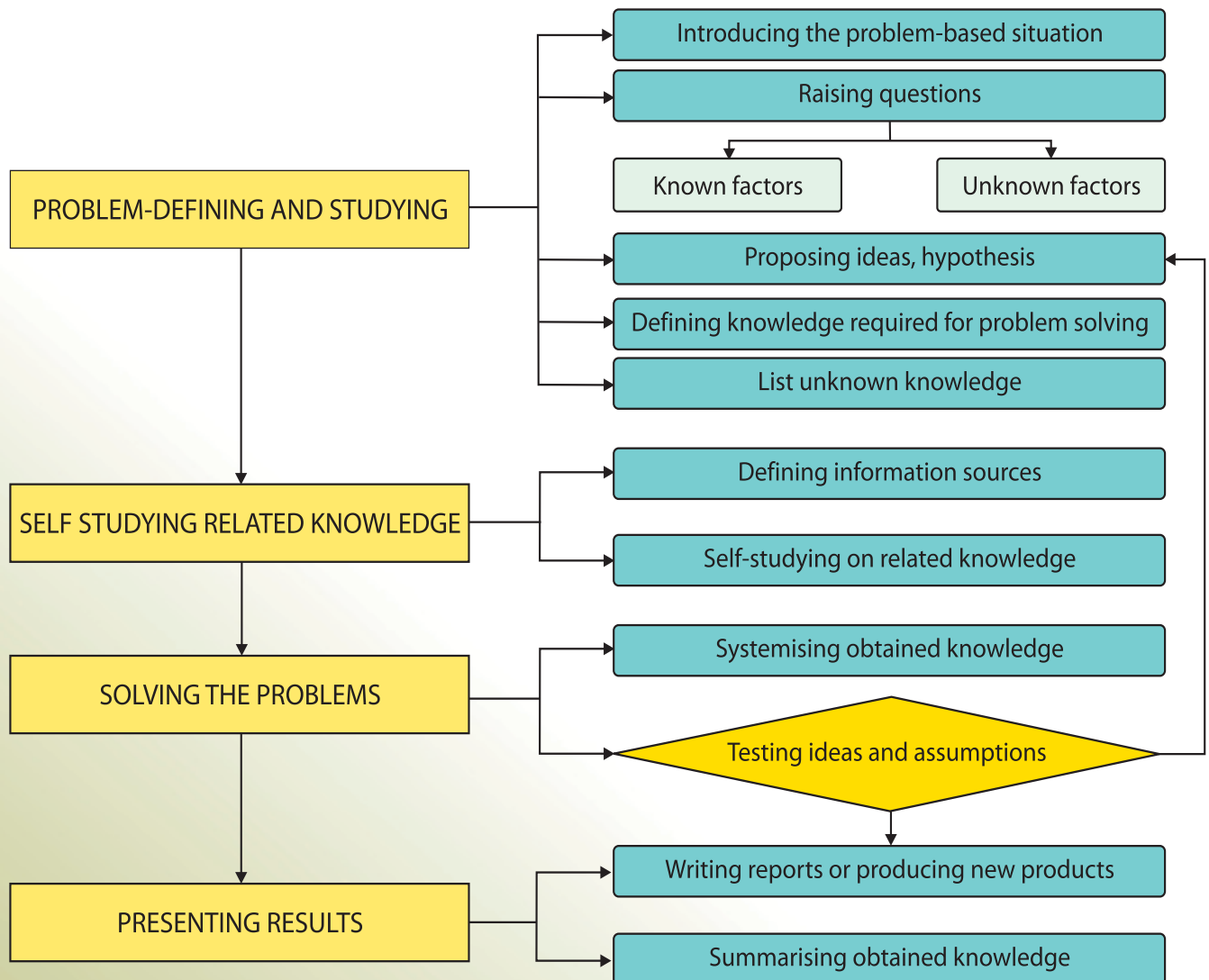


Diagram 6.1: The PBL process

Phase 1: Defining and studying problems

This phase introduces the situation containing a problem for learners and find a solution. It includes 5 steps, all with the teacher's guidance:

Step 1: Introduce the situation

There are various ways to do this, such as telling a story, an event, showing a video clip or giving out a mathematical problem already identified by the teacher.

Step 2: Clarify problems

This is done using two types of questions related to the problems, as introduced in Step 1: what is known and what extra information is needed. Learners can then identify the problems in a given situation.

Step 3: Propose ideas, hypothesis

By discussing in groups, (with the teacher's support if necessary), learners develop ideas and hypotheses for the problems. At this stage, they have not been proved.

Step 4: Define knowledge required for problem solving

List knowledge needed, based on ideas and hypotheses developed in Step 3.

Step 5: List unknown knowledge

Study the list of knowledge (made in Step 4) and add new knowledge required. In this step, the teacher's suggestions play an important role in guiding learners to proper selection of content.

Phase 2: Self-studying related knowledge

In this phase, learners study topics defined in Step 5 of Phase 1 individually. This is done in 2 steps:

Step 1: Define information sources

Sources for information should be mainly textbooks. Other sources can be found on the Internet, or advice from experts and relevant persons (if necessary).

Step 2: Self study

Contents for studying are divided into small topics assigned to group members. When self-studying, members can discuss their parts with others if necessary.

Phase 3: Solving the problems

Based on information collected in Phase 2, learners return to the problems by checking ideas and hypotheses given in Phase 1. For good results, this phase should be done in two steps:

Step 1: Discuss obtained knowledge

Topics studied in Phase 2 should be presented and discussed so that all group members understand the topics and their roles in checking ideas and assumptions.

Step 2: Evaluate ideas and assumptions

Each idea and assumption should be checked for its validity. Based on the checking, the problems should be solved by studying new knowledge and logical reasons. If no

assumption is accepted, return to the initial problems, propose another hypothesis and do the checking again.

Phase 4: Presenting results

This can be done in two steps:

Step 1: Write reports or make new artifacts

Normally this step is structured into three parts: Part 1: Raising the problems, Part 2: Solving the problems, Part 3: Conclusion. In addition, products or solutions to the problems can be made.

Step 2: Summarise obtained knowledge

This is an important step. You must summarise knowledge obtained by solving the problems, so as to achieve the learning objectives.



Appendix 5 – Resource material for Activity 6

1. 4 Levels of applying PBL

In their studies, Trần Bá Hoàn (2003) and Phan Trọng Ngọ (2005) introduced four levels of applying PBL, of increasing difficulty, implemented in five key areas: problem finding, assumption raising, planning, problem solving and conclusions. See below:

Level	Problem finding	Assumption raising	Planning	Problem solving	Conclusion
1	Teacher	Teacher	Teacher	Learners	Teacher
2	Teacher	Teacher	Learners	Learners	Teacher + Learners
3	Learners + Teacher	Learners	Learners	Learners	Learners + Teacher
4	Learners	Learners	Learners	Learners	Learners + Teacher

2. Comments on the levels of activity:

- Level 1

- + Teacher raises the problems and possible ways to solve them
- + Learners solve the problems with teacher's guidance
- + Teacher concludes, assesses students' work

- Level 2

- + Teacher raises the problems and encourages learners to find ways to solve them
- + Learners solve the problems
- + Both teachers and learners make conclusions and assessments

- Level 3

- + Teacher provides information containing the problems
- + Learners find/define the problems, propose assumption and solutions
- + Learners solve the problems, assess their learning and give conclusions. Teacher supplements and corrects learners' conclusions if necessary.

- Level 4

+ Learners actively complete all the tasks;

+ Teacher is only involved when necessary

→ At level 1, teachers do almost all the tasks; learners just do the problem solving. The higher the level, the more learners participate. At level 4 (research), learners' activities dominate, they actively do all the tasks, and the teacher only corrects their conclusions when necessary. This is the ideal complete inquiry-based learning.

3. Conclusions

- The above levels show how much learners participate in PBL tasks. The higher the level, the more learners participate in the activities.
- To decide the level, it is necessary first to clearly decide on basic content for PBL.
- Selection of PBL levels can be based on:
 - + Subject objectives (required knowledge, skills, level 1, 2, 3, 4 of objectives) at secondary schools. It is easy for teachers to do cross-subject connections in PBL because secondary teachers can teach more than one subject.
 - + Teacher's knowledge and skills of PBL.
 - + Learners' familiarity with various levels of PBL.
 - + Learners' qualifications (for good students, it is easy to apply levels 2 and 3, and then level 4).



WORKSHEET FOR ACTIVITY 6

Name:; **Group:**

Task:

(1) Study information provided in resources for Activity 3

(2) Answer the following questions:

a) Key characteristics of level..... in various PBL levels:

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b) On what basis is PBL divided into different levels?

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c) On what basis is the correct PBL level selected?

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d) Give an example for a level of PBL application (assigned by the group)

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.....

e) Learners' recommendations

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.....

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Appendix 6 – Resource material for Activity 7

1. Some background information about PBL (see previous activities)

- Some knowledge related to PBL;
- Various levels of PBL application
- Skills required for PBL
- The PBL process

2. PBL planning

2.1. Background for PBL planning

PBL planning is based on various logical steps of scientific research. Vũ Cao Đàm (2007, p. 47) proposed the following steps: (1) Select research topic (2) Define research objectives (3) Define research questions (4) Define research hypothesis (5) Present evidence (6) Select methods for checking hypothesis.¹

PBL planning is “activity-based teaching and learning”. According to Nguyễn Bá Kim (1998), all such teaching and learning content relates to a particular activity. By defining these activities, we can cement teaching and learning objectives, explain how to check implementation, and help learners obtain knowledge or other objectives. It is necessary to explore hidden activities to achieve objectives.²

As a result, teachers should:

- (a) Create chances for learners to participate in activities aligned with teaching objectives and contents
- (b) Promote motivation for learning activities
- (c) Help learners obtain knowledge, especially on methods and tools, and successfully complete all activities.

¹ Vũ Cao Đàm, 2007, page. 47.

² Nguyễn Bá Kim, 1998.

2.2. Approaches to PBL planning

PBL planning can be approached in several different ways. For example:

a) According to a logical process

This includes the 5 following steps:

- (1) Define the problems
- (2) Set a hypothesis
- (3) Make an action plan (for solving the problems)
- (4) Solve the problem
- (5) Make a conclusion.

b) According to teaching and learning activity orders

Researcher Nguyễn Hoàng Trí (2009, p.26) described this method:

- (1) Teacher defines the problem, key questions and resources
- (2) Teacher instructs learners to study the problems: divides learners into groups, defines the problems, sets up time limits, and organises job assignment, presentation and assessment
- (3) Group studies and discusses problem to find answers to research questions
- (4) Group presentation and teacher assessment: groups make presentation, while teacher organises an assessment activity.

c) Shortened method

According to Trần Bá Hoàng (2003, p. 12), PBL can be done using 3 steps:

- (1) Define the problems
- (2) Solve the problems
- (3) Make a conclusion

Question: How do you use the above approach in making your lesson plan?



2.3. PBL planning

2.3.1. Ideas

Learners at teacher training institutes will use PBL planning in their future teaching careers. Therefore, it is necessary to base PBL on related teaching and learning curriculum and content.

2.3.2. Content for PBL planning

The three shortened steps mentioned beforehand can be used as follows:

- a) Define the problem: select topic, define teaching objectives, analyse implementation conditions, select PBL levels and resources, estimate time required for activities, and define detailed topic contents.
 - Suggestions for selecting topics: analysing curriculum and subject textbooks; identifying contradictions, controversial discussions, difficulties in real-life, listening to opinions of people who are not experts in the topic area, finding out advantages/disadvantages in peer research; unpredictable questions.
 - Select meaningful problems that are complex, realistic and practical.
 - Analyse the problems to define teaching objectives: Which knowledge/skills are the problems related to? What knowledge and skills do learners have?. What subjects/topics do these knowledge and skills belong to? What unknown knowledge and skills are required to solve the problems? What are subject objectives and cross – subject combinations?

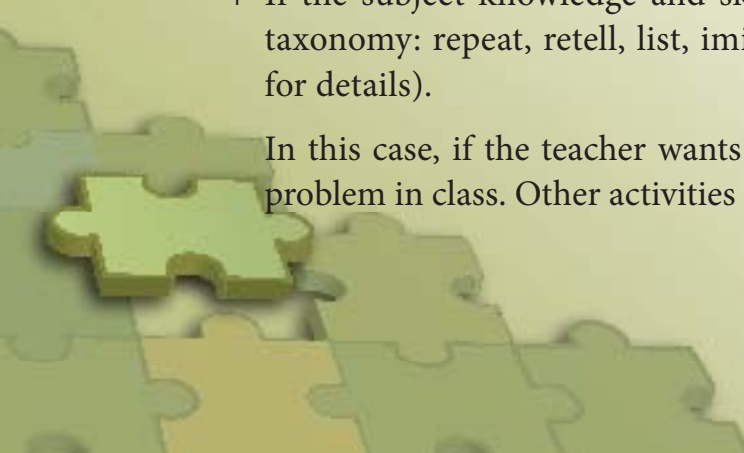
How should the problems be solved? Possibilities include using theories to prove/reject hypothesis; experimenting/practising to prove/reject; or using both theories and experiments to prove/reject. Attention should be paid to teaching conditions (at schools or at universities/teacher training colleges, etc.)

- Selecting PBL levels:

Select the levels depending on teaching objectives regulated in subject knowledge and skills standards, subject skills and teaching conditions. For example:

- + If the subject knowledge and skills standards are regulated as level 1 (Bloom taxonomy: repeat, retell, list, imitate, etc.), choose level 1 (see previous section for details).

In this case, if the teacher wants to choose level 2, he/she should solve the core problem in class. Other activities can be done by learners at home.



- + If the subject knowledge and skills standards are regulated as level 2 (Bloom taxonomy: explain, present or implement, etc), choose Level 2.

For higher standards and better school conditions, higher levels of PBL can be chosen.

- b)** Solve the problem: Instruct learners to study the problems. Teacher divides learners into groups, defines the problems, sets up time limits, assigns tasks, and organises them for presentation and assessment. Groups study and discuss to find answers to research questions. Then, groups make presentations and self assessments.
- c)** Make a conclusion: discuss and draw conclusions; make assessment based on topic objectives; and finally, make recommendations.



WORKSHEET FOR ACTIVITY 7

Name:; **Group:**

Tasks:

(1) Study information provided in resource material for Activity 7

(2) Complete the following:

a) Summarise the basic knowledge and skills that you gained

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b) Write about the main steps in making the PBL lesson plan

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c) Write about the insights for the PBL lesson plan

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d) Make the PBL lesson plan for your own subject (See Lesson Plan below)

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e) Trainee's recommendations:

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LESSON PLAN

I. GENERAL INFORMATION

Prepared by:

School:

Preparation Date:

Subject:

Grade/class:

Time:

II. OBJECTIVES

1. Knowledge
2. Skills
3. Attitude

III. PROBLEMS TO BE DISCUSSED

1. Problem introduction
2. Design of core questions
3. Known knowledge, skills
4. Unknown knowledge, skills
5. Guiding questions
6. PBL methods
7. Required skills
8. Related subjects (if any)
9. Related resources
10. Evaluation of problem-solving results

IV. FACILITIES AND PREPARATION

1. Preparation made by teacher
2. Preparation made by learners

V. IMPLEMENTATION

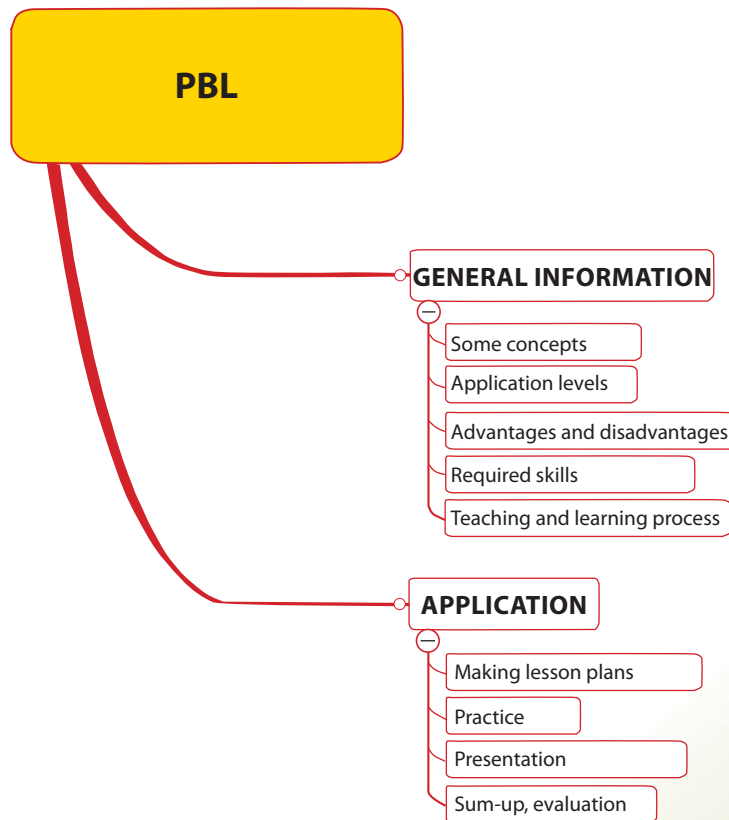
PHASES	Content	Activities		Location	Time
		Teacher	Learners		
Problem defining and studying					
Searching for related information					
Problem solving					
Presenting results					

Appendix 7 – Resource material for Activity 9

1. Summary of completed activities

No	Activity	Objective	Main content
(1)	(2)	(3)	(4)
1.	Introduction and getting acquainted		
2.	Search for basic concepts related to PBL		
3.	Study of different levels of PBL application		
4.	Exploration of advantages and disadvantages of PBL		
5.	Study of required skills for PBL		
6.	Exploration of PBL process		
7.	Planning for applying PBL		
8.	Practice of PBL per topics		
9.	Sum up and evaluate the training course		

2. PBL Summary



PBL content and activities

3. Plan for detailed PBL application

a. Tasks

- Define 2 problems (one at level 2 and one at level 3) in your subject content.
- Make lesson plans for the above content based on selected problems.
- Teach based on the prepared lesson plans.

b. Notes

- Evaluate how is easy or difficult it is to find problems for identification in your subject.
- List difficulties when preparing lesson plans, and your solutions.
- List difficulties when applying PBL, and your solutions.
- Share lesson learned when applying PBL.
- Send your lesson plans and all of the above information to VVOB.

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