

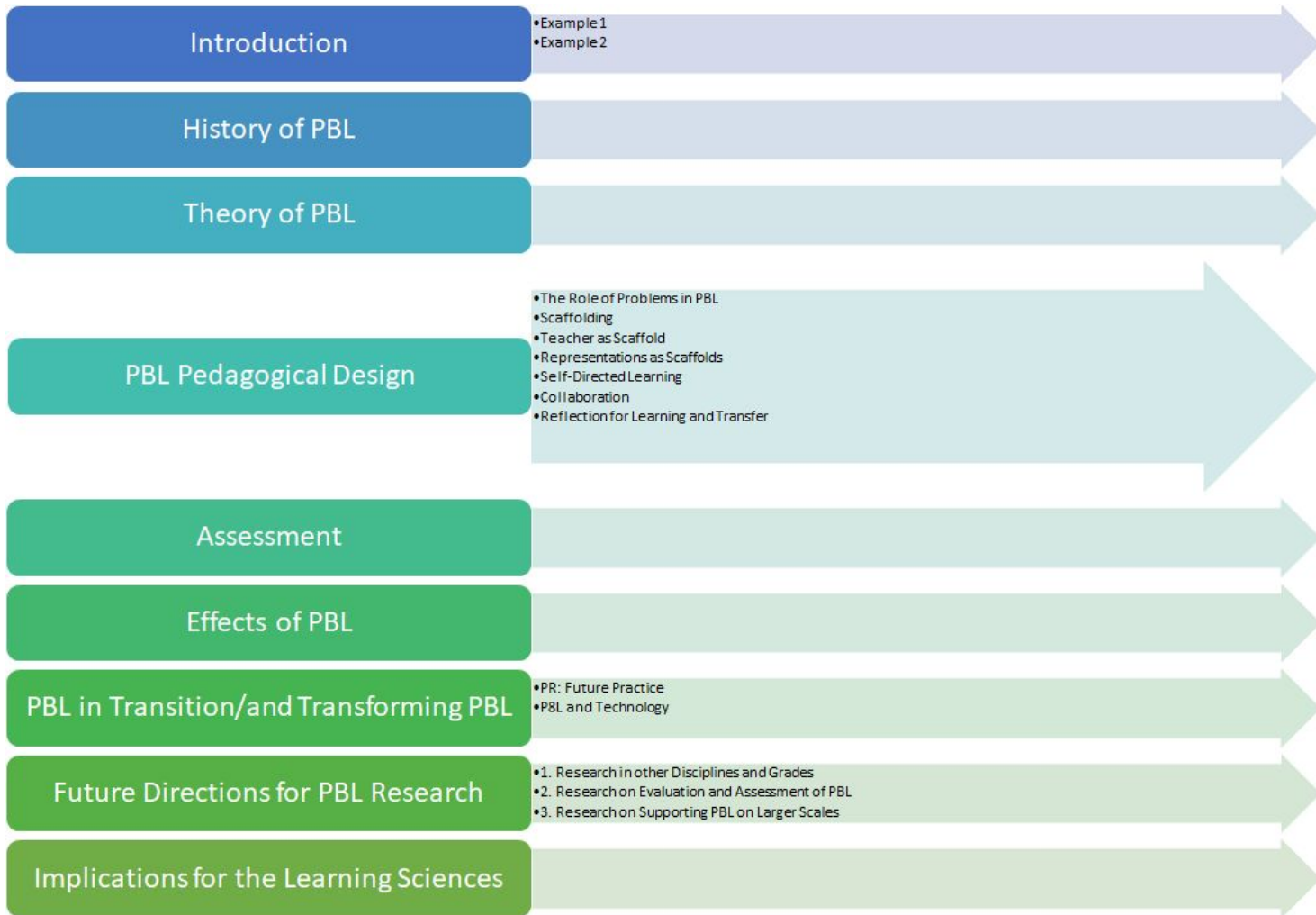
Problem Based Learning

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Outline of Presentation on

Problem-Based Learning



Introduction

- **Definition-** Problem-based learning (PBL) is an active approach to learning in which learners collaborate in understanding and solving complex, ill-structured problems.
- As students engage with ill-structured problems, they develop skills in reasoning and self-directed learning and construct flexible knowledge
- **Requirement-** Because of their complex and ill structured nature, these problems require learners to share their current knowledge, negotiate among alternative ideas, search for information, and construct principled arguments to support their proposed solutions.
- **Goal of PBL-** To address a large range of cognitive and affective dimensions

PBL in comparison with traditional approach

Compared to traditional forms of instruction, PBL enhances students' ability to transfer knowledge to new problems and to achieve more coherent understandings

Examples of PBL - The University of Hong Kong

- To provide an idea of how PBL looks, we present two examples from clinical disciplines.
 1. Example 1- How a typical diagnostic PBL problem works in a medical context.
 2. Example 2- Illustrates the role of educational technologies in PBL.

Features of PBL

Characteristics of successful PBL environments include (Saven. 2006):

1. content integration across a range of disciplines;
2. collaboration and teamwork;
3. application and synthesis of new knowledge toward greater understanding of the dimensions of the problem at hand;
4. reflection on the learning process with self and peer assessment;
5. engagement with real-world problems and issues; and
6. examination processes measuring progress toward the goals of PBL

These goals can be achieved

at a macro level– through full imple. mentation of an overarching, integrated curriculum design-- and

at a micro level– in the complex interactions that occur in small group, student-led, and educator-facilitated discussions.

PBL Tutorial Cycle

-(adapted from Hmelo-Silver, 2004)

Step 1- Problem Scenario

Step 2- Identify Facts

Step 3- Generate Hypotheses

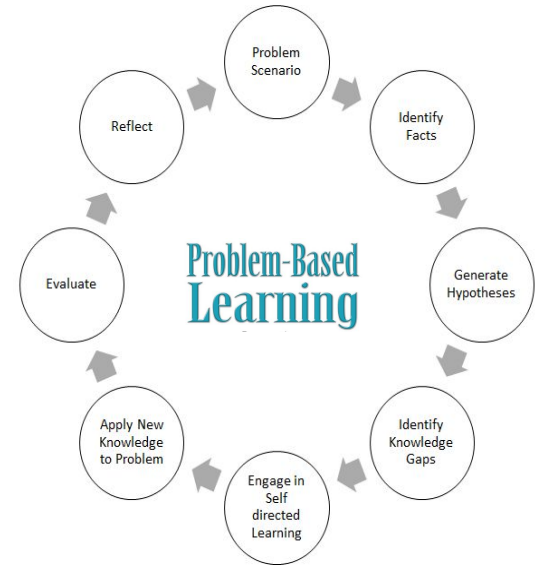
Step 4- Identify Knowledge Gaps (Learning Issue)

Step 5- Engage in Self directed Learning

Step 6- Apply New Knowledge to Problem

Step 7- Evaluate

Step 8- Reflect



Example 1- How a Typical Diagnostic PBL Problem Works

Medical Case-

Mr. Ho was a 60 year old machine operator in a garment factory who had enjoyed good health previously. He has married and had a son and a 4 year old grandson. The family had lived for 15 years on the 4th floor of a public housing estate with no elevators. Mr. Ho visited his family physician and complained of discomfort in both knees, worse on the right side. Each morning, he had to walk to the bus stop to get to work. In the past few months, he had found this increasingly difficult, particularly when he was walking down the stairs. Additionally, he was not spending as much time playing with his grandson as he used to.

PBL Tutorial Cycle

-(adapted from Hmelo-Silver, 2004)

During the first two-hour session

Step 1- Problem Scenario

Step 2- Identify Facts

Step 3- Generate Hypotheses

Step 4- Identify Knowledge Gaps

(Learning Issues)

Step 5- Engage in Self directed Learning

During the second two-hour session

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Example 1- How a Typical Diagnostic PBL Problem Works

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Scaffold

During both two-hour sessions, the tutor asked many questions to scaffold students' problem solving including the

- causes of symptoms,
 - diagnosis and differential diagnoses,
 - indicators from the physical exam and laboratory tests,
 - treatment plans,
 - side effects of the surgery,
- and so forth.

Tool- Whiteboard

important tool for representing key case information (often listed in a column labeled "Facts" and hypotheses), sometimes labeled "Ideas," and for recording the "learning issues" that will drive self-directed learning, discussion, evaluation, and reflection.

Example 2- Role of Educational Technologies in PBL- Moodle

First Tutorial T1 - Affordances of Moodle

- video-based problem accompanied with inquiry materials in the form of 3-D anatomical images.
- Interactive whiteboard - large-screen visualization and digital object manipulation
- Moodle resources- recordings, supporting materials
- Discussion forum

Second Tutorial T2

- generating a collaborative document
- concept mapping software consolidates learning as a post-problem assignment

History of PBL

Began in medical education, where students were not learning to apply their basic science knowledge to clinical care

Slowly blossomed into other professional higher education areas such as engineering, architecture, education and gifted education

Getting extended from west to Asia-Pacific region rapidly

A movement from inert fragmented knowledge to a notion of knowledge as tool for thinking and acting

From teaching dynamics to learning dynamics

From Individualistic learner model to learning communities

From focus on content and presentation to focus on student activities through the design of learning tasks and environments, providing tools for individual and collaborative work

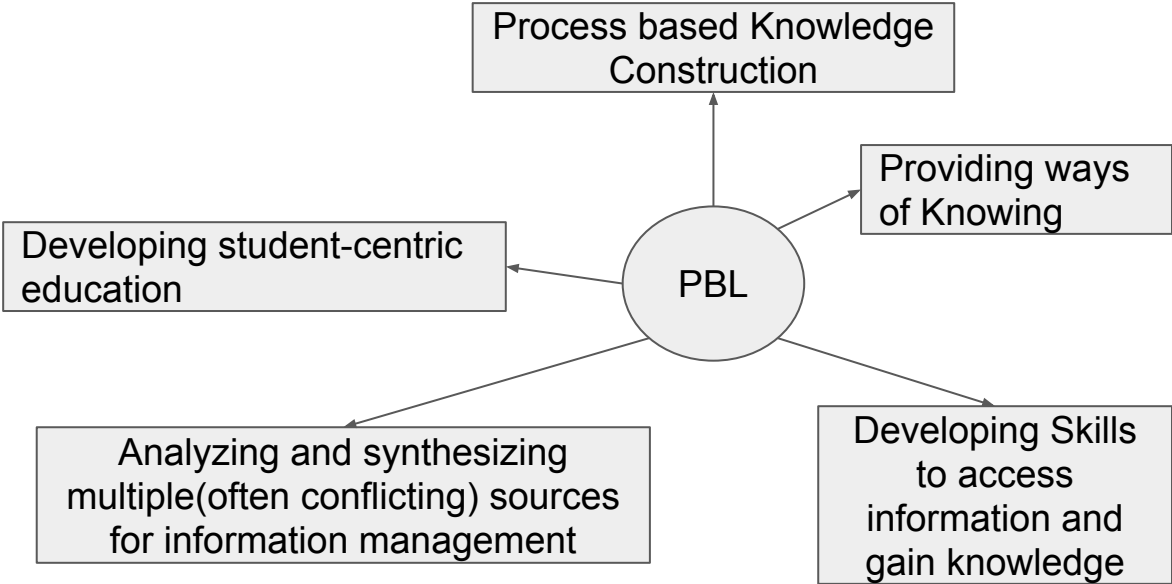
Theory of PBL

PBL is grounded in constructivist and sociocultural theories

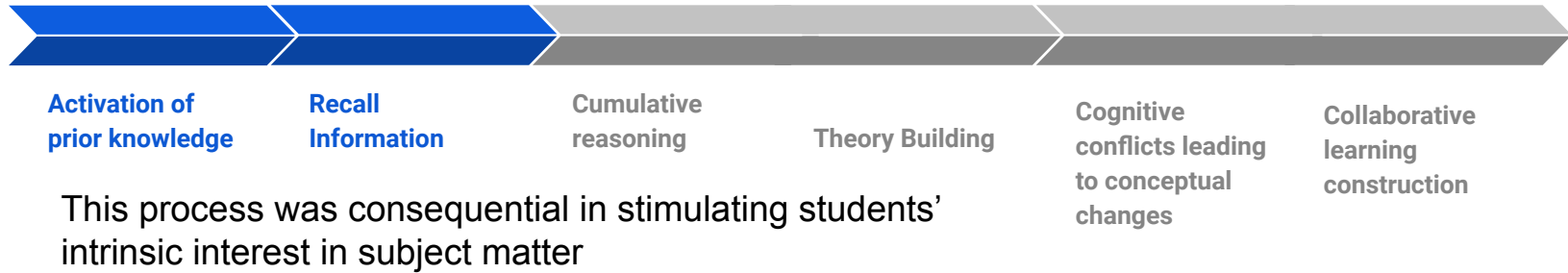
Designed to situate learning in real world contexts

In PBL group following socially negotiated and constructed processes occur-

- Identification of problem
- Integration of knowledge
- Internalization of knowledge



Theory of PBL continued



Activation-Collaboration Hypothesis

1. Activate prior knowledge
2. Refine mental model
3. Discuss the problem in the group
4. Identify knowledge gaps with peers

Later part of tutorial is based on earlier discussions and self- directed learning

Situational Interest Hypothesis

1. The real world and applied nature of PBL arouses students' interest
2. Leads to ongoing engagement and a desire to seek new information

Effects of PBL

Collaborative enquiry to solve complex real word problems-> Social construction of knowledge

Cognitive perspective -> Organize learning experience for better understanding of concepts through problem solving activities

Situated perspective -> Knowledge construction related to disciplinary knowledge and problem solving through social interaction

This aligns with Vygotskian perspective that “knowledge begins in the external world and it is later internalized by the individual”

These perspectives also connect the PBL to the notion of ‘Cognitive apprenticeship’, highlighting role of expert.

Role of Facilitator

Make expertise visible through questions that scaffold learning through modeling, coaching and eventually fading their support

Rather than teaching the content knowledge facilitator models learning strategies

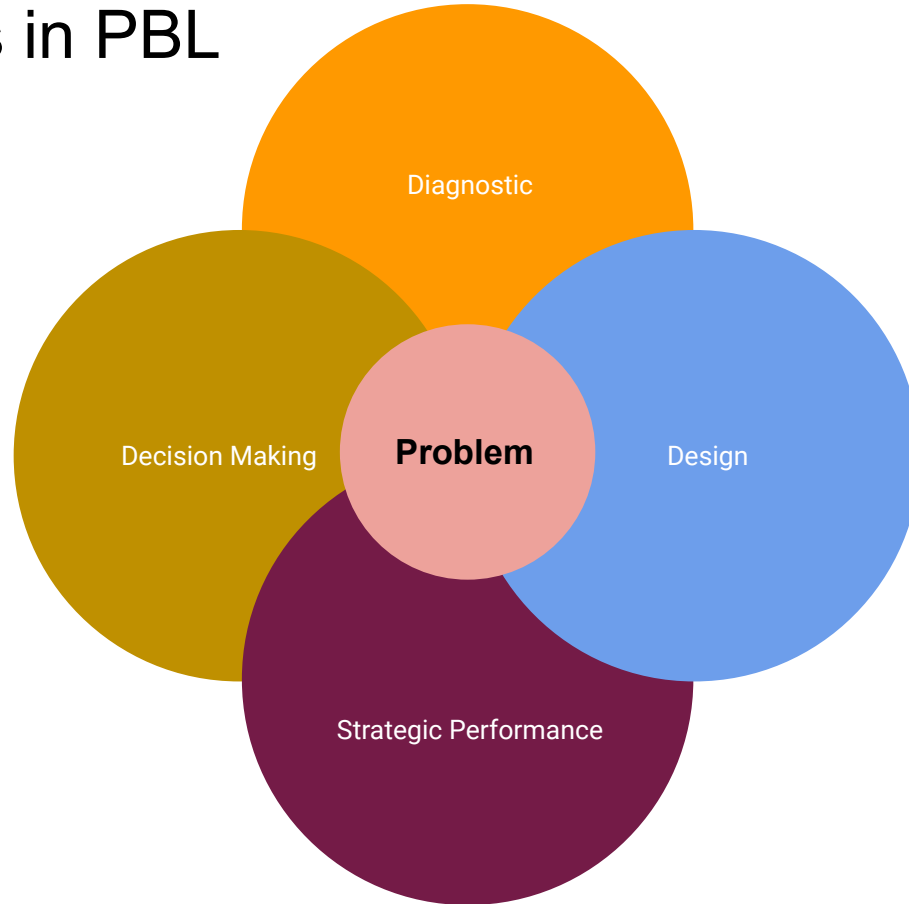
They continuously monitor the discussion, selection and implantation of appropriate strategies as and when needed

They pose questions to guide student teams' enquiry process

They help student team members to realize the limits of their understanding and identify the learning issues or misconceptions by pushing them to justify their thinking and explaining their ideas

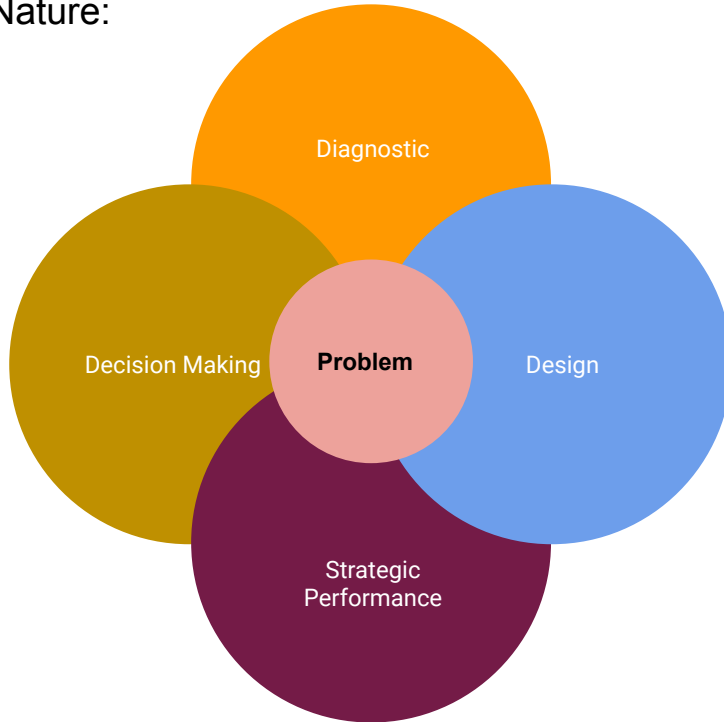
Role of Problems in PBL

Nature of Problems:

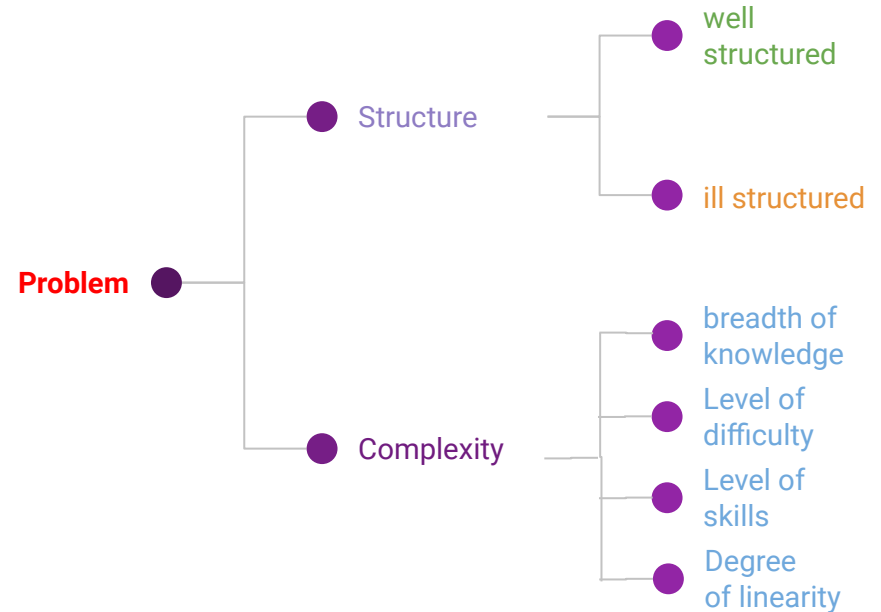


Role of Problems in PBL

Nature:



Characteristic:



Scaffolding in PBL

Communicating process

Presenting/simplifying the process involved in solving the problem to students

Coaching

Providing guidance to learners by highlighting critical steps of the process

Eliciting articulation

Asking the student to articulate and explain their thinking and make thinking visible

Facilitating scaffolding

Teacher:

- Guide active learning
- Prompting open ended questions
- Deploying strategies

Example strategies:

Revoicing, Summarizing, Pushing for explanation, etc.

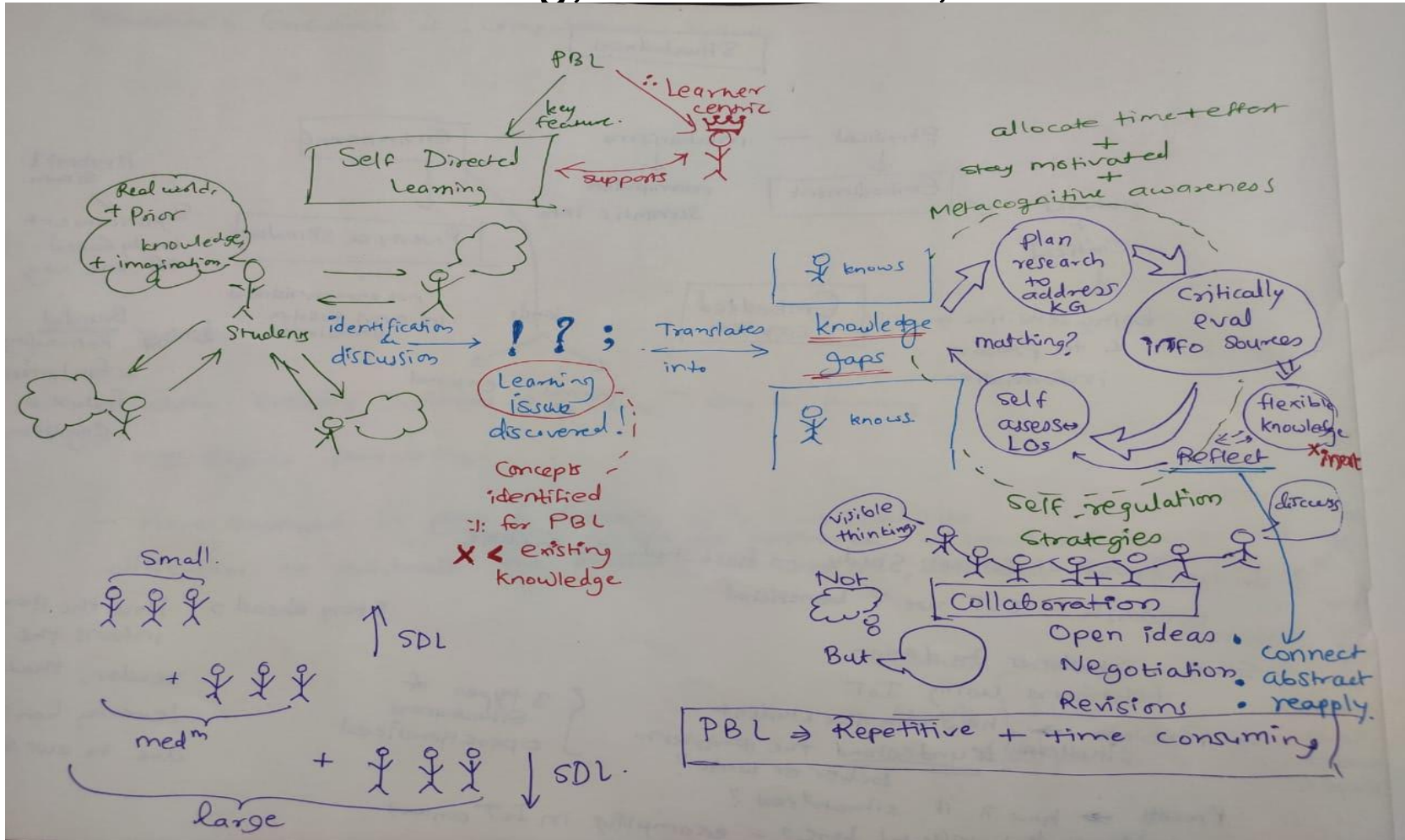
Representation:

- Collective knowledge construction
- Shared referential objects
- Structure of the representation as guide

Example strategies:

Use of tools such as white board (digital boards), techniques such as checking consensus, cleaning up board, etc.

Self Directed Learning, Collaboration, Reflection



Assessments

How would you assess PBL?

Think of apply+
Levels

Mastery of knowledge and skills

Mastery of problem solving process

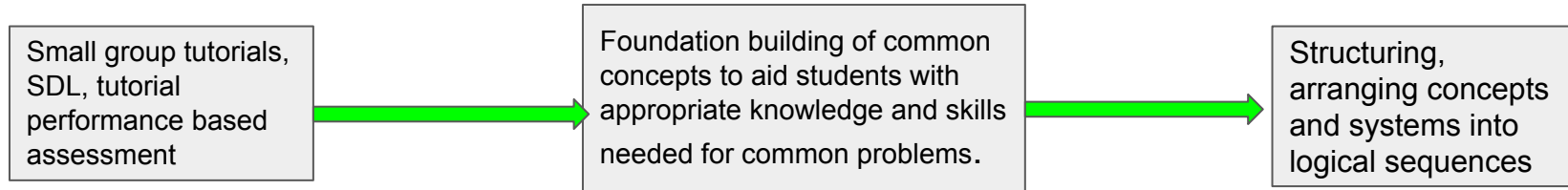
Aim : Knowledge → Practice

Effects of PBL

PBL	Non-PBL
Strong Procedural knowledge	Solid Factual Knowledge
Better at linking and applying declarative and procedural knowledge to situations	
Metacognitive skills -> planning and monitoring	
Positive attitudes towards PBL - interesting, relevant, engaging but more difficult!	
social and emotional connections	
SDL	
self-chosen learning resources, more diverse and meaningful study techniques	lecture notes

PBL : Future practise

A number of transformations and revisions has been made on PBL. Many more to come.



Greatest issue : faculty commitment, how type of professional development programs be integrated, skills and knowledge of facilitators

Overcome by : Course based approach, facilitator guides shared at regular briefings, introducing PBL at discipline specific course level.

PBL and Technology

Building on traditional PBL techniques, technology plays an important role.

- Accessing of visual tools and learning objects
- Rich contexts, communication spaces, scaffolds, video cases as visual triggers, interactive whiteboards.
- Promotes social interaction and collaboration amidst students.
- Enables facilitator to guide and direct the negotiation of meaning and construct of knowledge

RESEARCH

Can PBL be used in other disciplines?

- PBL primarily derives its conjectures from **medical education**
- Can it be implemented in disciplines like engineering, history, geography and economics?
- Research should focus on
 - Kinds of **scaffolding** that might be needed as PBL is used in different settings (different environments)
 - **Tailoring** scaffolds according to prior knowledge

Evaluation and Assessment

- Effectiveness of PBL: assessed by measuring **components** of PBL settings
- PBL programs may emphasise on structure of blocks or technology
- PBL skills: reasoning, problem solving, decision making and soft skills (collaboration, self directed learning)
- Assessment of ***process rather than product***; quality of contributions to the group rather than written assessments or exams
- How do we create assessments that are consistent with the values of PBL but also psychometrically measures of student learning?

PBL on Larger scales

- How to **distribute** scaffolding among facilitators, technology and other contextual features?
- Designing technology for distributing expertise to facilitators
- Distributing PBL cases to **large audiences** via online technology
- Digitalizing PBL tutorials by expert teachers and distributing them to schools
- Digitalized PBL tutorials as **teacher development** tools

Implications for Learning Sciences

- Facilitation in PBL \subseteq Supporting student agency in student centred learning environments
- Understanding how different scaffolds mediate student learning in PBL
- Roles for technology in creating contexts, scaffolding and discursive spaces in PBL supports other forms of inquiry and guided discovery
- Understanding the nature of generative principles in PBL \subseteq discussion of design principles