Problem-based learning

Guglielmo Volpe
Reader in Economics Education
Associate of the Economics Network
School of Economics and Finance
Queen Mary University of London
Email: g.volpe@qmul.ac.uk

The origins of PBL

Health Professions Education
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Fifty Years on: A Retrospective on the World's First Problem-based Learning Programme at McMaster University Medical School

Virginie F.C. Servant-Miklos [a, b]

(1) PBL was founded by five disgruntled doctors in a time of global change;
(2) McMaster did not pioneer the integrated systems approach, but it made it an integral part of problem-based learning;
(3) The early PBL curriculum was fluid and variable;
(4) McMaster offered a loose educational structure dominated by small group learning;
(5) The distinctive feature of problem-based learning, compared with all other progressive education methods, was the use of realistic problems at the start of the learning process;
(6) Lectures and other top-down modes of knowledge transfer were conclusively not welcome at McMaster;
(7) Summative assessment was absent from the first problem-based learning programme.

PBL: an institutional approach

Maastricht University

Maastricht University

Higher Education (2005) 50: 665–683
DOI 10.1007/s10734-004-6371-z

Signs of erosion: Reflections on three decades of problem-based learning at Maastricht University

J.H.C. MOUST[1,*], H.J.M. VAN BERKEL[1] & H.G. SCHMIDT[2]

[1] *Department of Educational Development and Research, Maastricht University, P.O. Box 616, 6200 MD Maastricht, The Netherlands;* [2] *Department of Psychology, Erasmus University, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands*

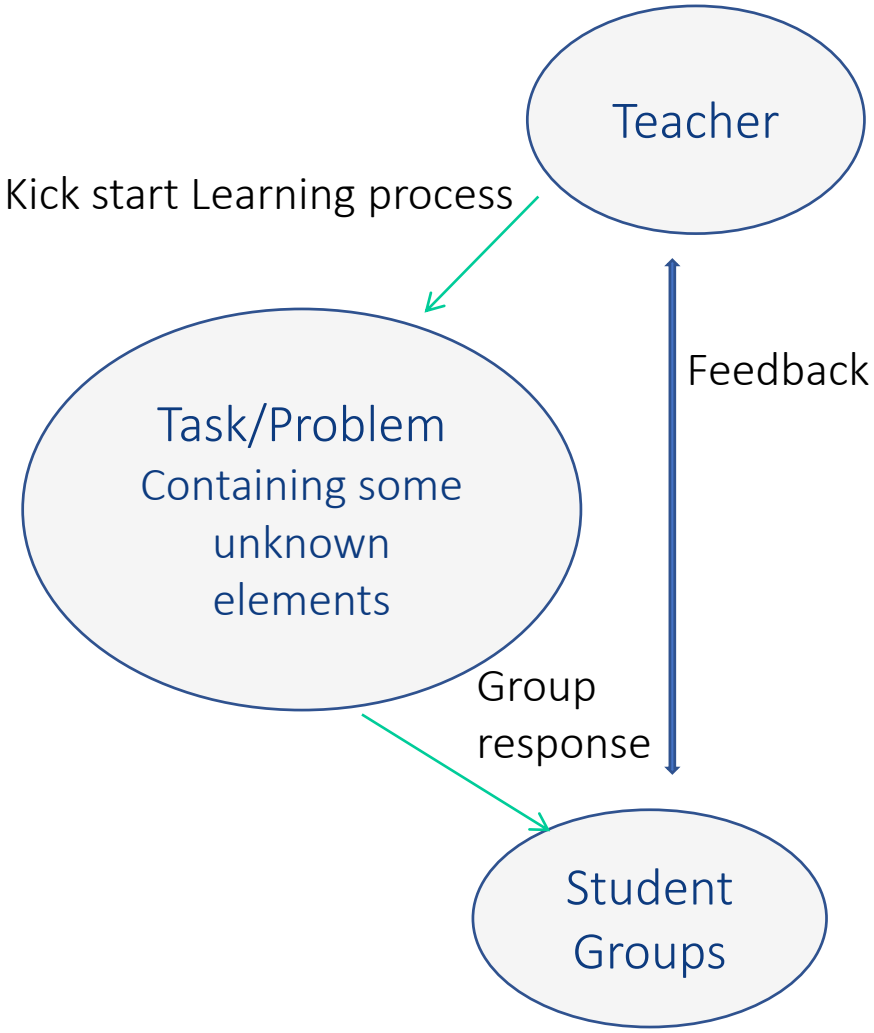
So, what is PBL?

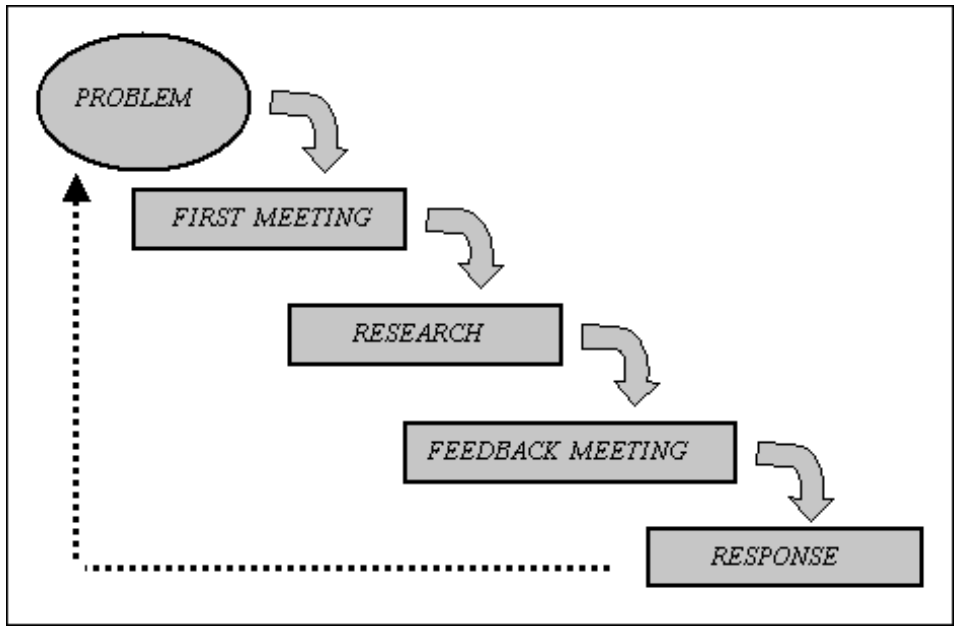
Process and pedagogy

Key features of PBL

- PBL involves learning through tackling problems
- It is a student-centred system whereby students, working within small groups, generate the information necessary to respond to, or solve, a specific problem or task
- The problems are used as a tool to achieve both the required knowledge base and the skills to ‘solve’ them. The basis of PBL is that students learn by ***doing***
- A particular feature of PBL is that it helps develop in students both subject-specific and transferable skills
    - Subject-specific skills are developed directly through problem design, while transferable skills are developed indirectly via the PBL process itself

PBL: the process

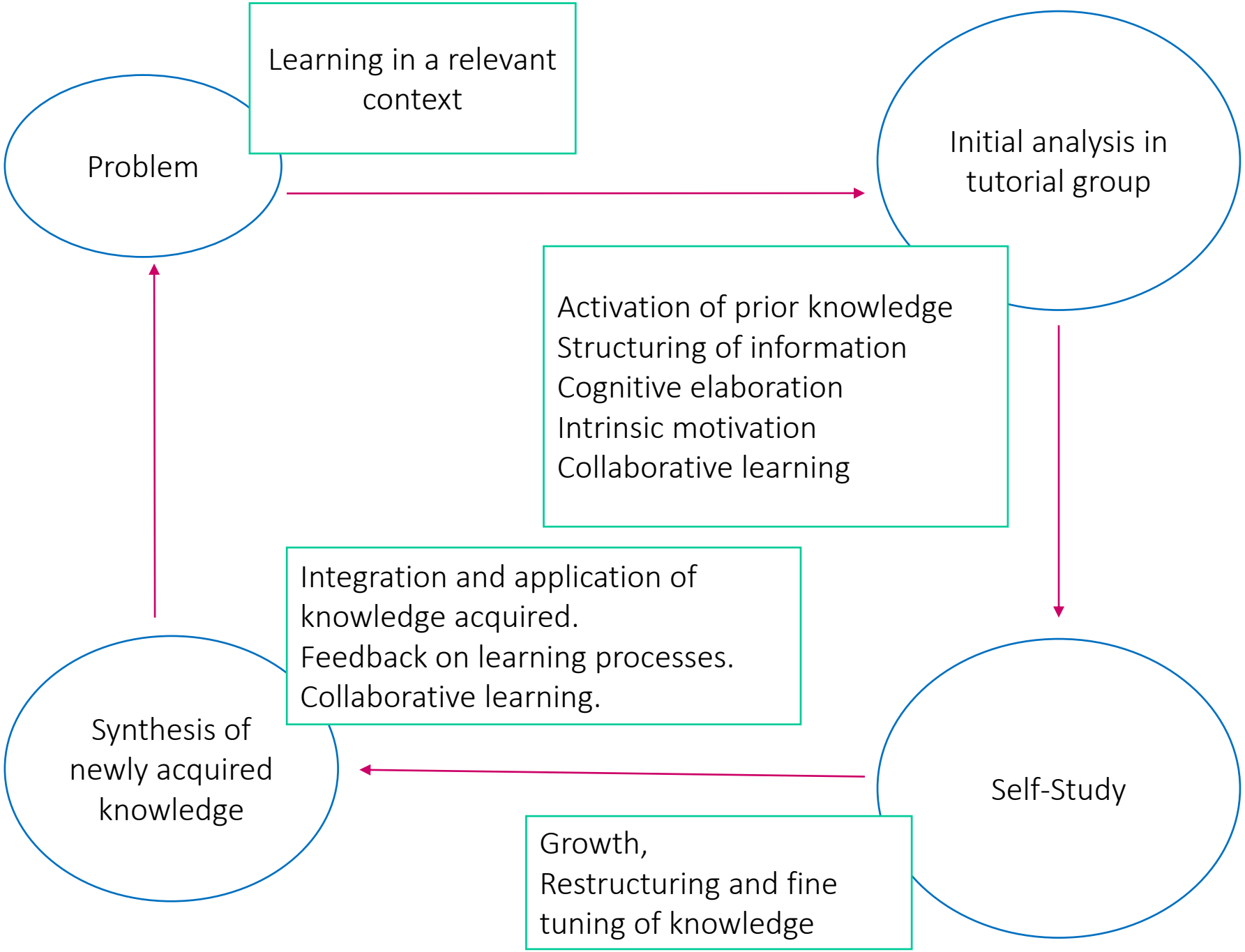




Some more details…?

PBL: the pedagogy

1. Clarify unclear phrases and concepts in the description of the problem.
2. Define the problem; which means: Describe exactly which phenomena have to be explained or understood.
3. Brainstorm: Using your prior knowledge and common sense, try to produce as many different explanations as possible.
4. Elaborate on the proposed explanations: try to construct a detailed coherent personal ‘theory’ of the processes underlying the phenomena.
5. Formulate learning issues for self-directed learning.
6. Try to fill gaps in your knowledge through self-study.
7. Share your findings in the group and try to integrate the acquired knowledge in a suitable explanation for the phenomena. Check whether you know enough. Evaluate the process of knowledge acquisition.


Learning in a relevant context
Problem
Initial analysis in tutorial group
Activation of prior knowledge
Structuring of information
Cognitive elaboration
Intrinsic motivation
Collaborative learning
Integration and application of knowledge acquired.
Feedback on learning processes.
Collaborative learning.
Synthesis of newly acquired knowledge
Self-Study
Growth,
Restructuring and fine tuning of knowledge

Approaches to PBL

- When implementing a PBL environment, one may adopt a ‘partial’ or ‘full-format’ model
  - In a ‘partial’ PBL environment, formal lectures are retained and PBL is used to organise the weekly tutorial sessions in support of lectures
  - In a ‘full-format’ PBL environment, there are no lectures and the learning environment is driven entirely by PBL methodology

The role of the lecturer

The role of the lecturer

- Module design: key to the effectiveness of PBL is a careful design of the learning activities
- Facilitator: stimulate discussion without providing answers
- Feedback: provides regular feedback throughout the year
- Groups management: intervenes in issues concerning the working of groups

Designing the task/problem

Designing a task/problem

- When designing a task, one should first be aware of the learning activities that students will perform when tackling the task and, secondly, try and visualise (and thus eliminate) possible difficulties that may arise in the process
  - Design tasks that are consistent with the learning outcomes specified for the module and to ensure that the learning outcomes *intended* are actually realised
  - A number of difficulties may arise that prevent students from realising intended learning outcomes (availability of resources, adequate supply of material etc.)
- Steps in designing the task/problem
  - Determine the form of the PBL environment
  - Focus on target learning outcomes
  - Determine the learning activities associated with the task
  - Presenting the task to students

Group management

Group management

- Avoid groups that are too large: 4-6 students is ideal number
- Formal structure
  - Group leader and referent for lecturer
  - Note taker to take minutes of meetings that identify roles and tasks for group members
- Regular meeting with group and group leader
- Consider creating group working space on VLE
- Consider using peer-evaluation

Assessment

Assessment

- Tasks provide the opportunity for both formative and formative assessment
  - All responses by PBL groups must, at the very least, receive formative feedback
  - Students could be asked to perform various types of tasks: report, presentation, poster, competition (University Challenge), project management etc.
- Link between tasks and assessment creates incentives for work
- Problems in group work can be limited with a clear reward and punishment system and peer evaluation
- If final examination is held, it should be structured around the principles of PBL (research, independent work etc.)

Challenges

Challenges

- More demanding (in terms of time and energy) than traditional teaching
- Students' resistance / Fee paying students?
  - Among final year students in particular
- Pressure from colleagues: ability to progress to next level
- Isolated approach in the curriculum?
- Learners characteristics
  - Free riders
  - Poor commitment
  - Mixed abilities
- Assessment issues
  - Group vs individual
  - Examination performance

Examples of PBL application in Economics modules

Introduction to Microeconomics

Microeconomics: Frank Forsythe

Weeks 1–6	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
1st hour	Form		Feedback 1	Feedback 2	Feedback 3	Feedback 4
2nd hour	groups	Task 1	Task 2	Task 3	Task 4	Task 5
				S-report 1	S-report 2	S-report 3
					Assess-T1	Assess-T2
						Assess-P1
						↓
						Record 1

Weeks 7–12	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
1st hour	Feedback 5	Feedback 6	Feedback 7			
2nd hour	Task 6	Task 7				
	S-report 4	S-report 5	S-report 6	S-report 7		
	Assess-T3	Assess-T4	Assess-T5	Assess-T6	Assess-T7	
	Assess-P2	Assess-P3	Assess-P4	Assess-P5	Assess-P6	Assess-P7
	↓	↓	↓	↓	↓	↓
	Record 2	Record 3	Record 4	Record 5	Record 6	Record 7

Economic Growth

Economic Growth Module

- Link to resources on EN website

- Final year undergraduate module
- Taken by about 40-50 students
- Mainly economics students but also taken by business students with required prerequisites
- Assessment: 50% coursework, 50% unseen exam
- 3 hours of weekly contact time (2 hours whole class teaching; 1 hour IT workshop)

Module's structure

- Traditional lecture and seminar approach only in first two weeks of semester
- From week 3 onwards students work in small groups of 4-6 people
  - Each group appoints a group leader and a minute taker. Notes of meetings are recorded and supplied to lecturer
- 4 tasks to be completed during the semester drive the learning process
  - 3 tasks make up the final coursework while the fourth task feeds into the final exam
- Groups are required to work about three weeks on each task

Structure of learning

Week	Activity
Week 1	• Lecture on Fundamentals of Economic Growth • IT Workshops
Week 2	• Lecture on Solow Model • IT Worshops
Week 3	• Groups start working on Task n. 1 • IT Workshop
Week 4	• Groupwork on Task n. 1 • IT Workshop
Week 5	• Groups 1, 3 an 5 present results of Task n. 1
	• Groups start working on Task n. 2 • IT Workshop
Week 6	• Groupwork on Task n.2 • IT Workshop
Week 7	• Groups 2, 4 and 6 present results of Task n. 2
	• Groups start working on Task n. 3 • IT Workshop
Week 8	• Groupwork on Task n. 3 • IT Workshop
Week 9	• Groups 7, 8, 9 and 10 present results of Task n. 3
	• Groups start working on Task n. 4 • IT Workshop
Week 10	• Groupwork on Task n. 4 • IT Workshop
Week 11	• Groupwork on Task n. 4 • Submission of Coursework (Tasks n.1, n. 2 and n. 3)

Assessment

- Coursework includes 3 tasks
  - Grade determined through a combination of tutor and peer evaluation
- Final examination
  - Based on task 4. This task is research based and in the exam, the students are asked to report on the research results
  - For example, exam based on article ‘Growth Diagnostics’ by Hausmann et al. and students were asked to replicate analysis with respect to a given country

Economics in Action

Module's learning outcome

- Learn how to compute and interpret key descriptive statistics such as measures of central tendency, measures of dispersion, measures of ranking etc.
- Learn about index numbers, measures of inequality, contingency tables, introduction to probability
- Develop analytical and critical skills in interpreting and making sense of descriptive statistics
- Be able to effectively communicate the analysis in both written and oral form
- Understand structure of economic reports, importance of referencing, ability to conduct research
- Learn how to use Excel to handle and manipulate data and produce relevant statistics

Module's structure

- No lecture – no teaching
- Two hours of small group class activity (20 students)
  - 1 hour in IT lab (Excel learning)
  - 1 hour class activities
- Learning resources available on VLE: references to textbooks, teaching notes, links to useful resources
- Assessment organised around three tasks
  - Individual project
  - Group presentation
  - Group project

Projects


THE CORE ESPP TEAM
ECONOMY, SOCIETY, AND PUBLIC POLICY
Read now
coreecon

Projects

The QM Consumer Price Index

PBL resources and readings

Journal of Economics and Finance
October 2010, Volume 34, Issue 4, pp 477–483 | Cite as

Problem-based learning: merging of economics and mathematics

Authors | Authors and affiliations

Rae Jean B. Goodman

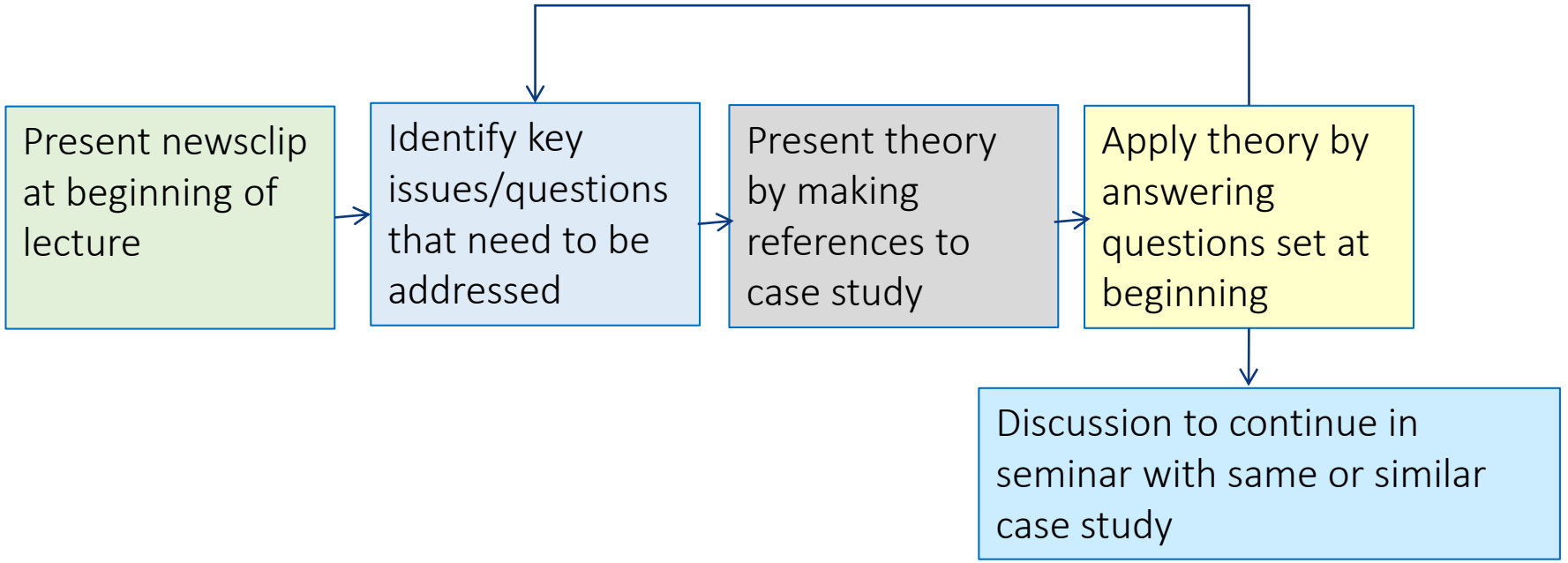
PBL@UD

Institute for Transforming University Education

Problem-Based Learning at University of Delaware

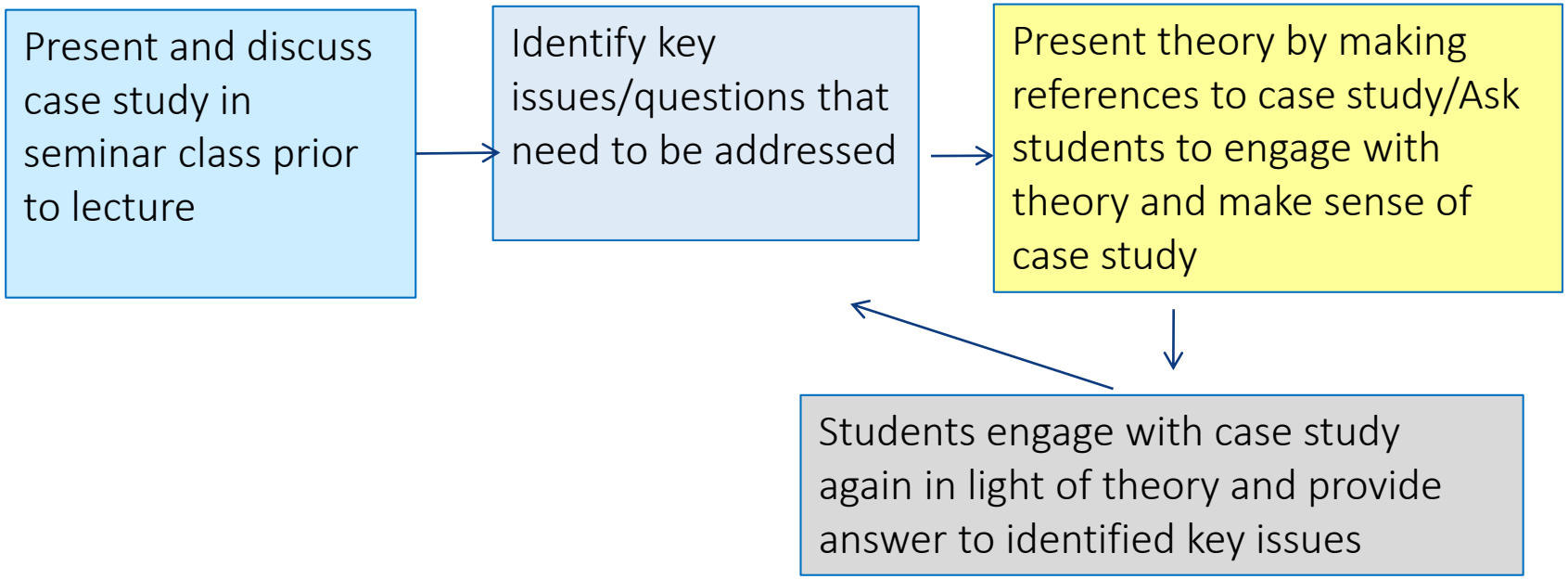
Case studies

Case studies: use of newsclips in lecture & seminar



- Contextualise theory
- Help students develop analysis and evaluation skills
- Show relevance of theory in real world applications

Larger case studies: (lecture) & seminar



- Lecture could be eliminated and discussion takes place in seminar class
- Case study analysis can then be used for both coursework and final exam
- Importance of providing a sense of closure to student
- More information on case studies analysis on Economics Network website

Thanks for listening!

Any questions?