

Introduction to PBL: workshop
Donald R. Woods
McMaster University, Hamilton, Canada
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George Brown College

1. What is PBL?

Activity 1:

The most enjoyable activity at university is.... _____

The time I really learn a subject is when I _____

Problem posed first (before the students have learned anything)

Students empowered with selecting learning goals, resources, assessment.

Work cooperatively in small groups (with or without a tutor present in each group).

Teacher? maintain standards, "Guide on the side not sage on the stage," monitors the process, (like a design project).

2. See small group, self-directed, self assessed, interdependent PBL in action

Activity 2:

Reflections: what have you discovered about PBL? about an approach? might it work for you?

Questions?

Answers:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

3. Why select PBL? The claims

M Improved learning (active, coop, freedom to select, ownership, prompt feedback, learning styles)	Should but No published evidence to my knowledge; principles are supported by educational research
M Prefer deep learning	Yes. Proven: PBL promotes deep; lectures promote rote and surface approach
M Better learning environment	Yes, Ramsden/ Entwistle CPQ PBL 35 to 45 lecture: 15 to 22 mix: 22 to 35
M Easier for recall of knowledge in professional practice:	Should but No published evidence other than the “diver” experiment. Divers memorized nonsense lists of words under water and on land; then tested under water and on land. Recall best where memorized.
M Don’t learn as much subject knowledge	NBME I: Slightly less but using wrong measures; need to consider outcomes you value from a program.; 80% “time” to cover material because 20% on process activities.
- Don’t learn as much fundamentals	No. Not a problem from ChE recruiters or alumni; indeed say they are better prepared
M Learn lifelong learning skills	Yes, Perry, resources used, alumni
M Learn problem solving, team skills etc.	No, opportunity to develop. Evidence of more empathetic and whole person MDs

4. Options for PBL

Activity 3: Might an option work for you?

Individual, self directed PBL

	already do	might	no
research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PBEE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Socratic (class directed discussion)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Small group, self-directed, self assessed PBL

modify cooperative learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Guided design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Socratic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tutorless groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tutor in each group	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. Setting up small group, self-directed PBL

Start where you are

6. Getting started: Goals

Feedback about the group work. Form 2802

Task: Problem defined, many issues and hypotheses explored, criteria listed and the issues prioritized. Refrained from early closure. Task carried out and looked back at the result to assess it. Group agreement as to goals. Process was active with monitoring. Completed task on time. Group applied successive approximation and optimum sloppiness. Group avoided contributing excessive information.

None of these behaviours	Few of these behaviours but major omissions	Most features demonstrated	All of these behaviours
G 1	G 2	G 3	G 4

Morale: Group relaxed; enjoyed working together. They gave emotional support to each other and were able to express disagreement or disappointment directly. Seven fundamental rights preserved. Members are enthusiastic and involved.

None of these behaviours	Few of these behaviours but major omissions	Most features demonstrated	All of these behaviours
G 1	G 2	G 3	G 4

Individual Contribution to Task and Morale

Group Strengths

Group Areas to work on

M Case 2: Letter to the Dean:

Context: education in PBL

Target learning objectives:

student-teacher mismatch:

- learning style MBTI
- Piaget: theory vs

concrete

- Perry: student vs teacher expectation

lack of clear goals and criteria

teacher attitude

student's reaction to change

lack of mentor for teacher

criteria for tenure:

- solely on student evaluations
- 3 peer reviews of course outline
- teaching dossier
- evidence of 1/3 course revision
- evidence of scholarship vs diddlin' around

need to inform others: dean, students, chair, peers.

The letter to the Dean.

You have been five years in a tenure-track position. You have 15 refereed publications with 4 others in the mill. You have 2 Master's students and 2 PhD students plus a large series of grants to keep your research program viable.

Your teaching has received "fair" ratings from the students in the past. last year the Chair suggested that you might devote a little time to improving your teaching. Indeed, the Department sent you on two workshops: one on cooperative learning and the other on PBL. These were very motivating. You saw that you could introduce PBL to part of your course 393. You added cooperative learning to each tutorial and you took a four week section of the course and converted it to PBL. It is now six weeks into the term. The Dean invites you to see him and gives you a copy of the following letter:

Oct 15

Dear Dean Habizz

We the undersigned represent 82% of the students in Course 393. The professor is incompetent! The professor is not doing the job. The professor should be fired. We are paying big bucks to come to this university. We demand that you replace this teacher with one who knows how to teach.

H. Andre
 A. Sabina
 R. Gottz
 F. Goamm
 R. Jones
 K. Sigvaler
 K. Armstrong
 A. Siggs
 P. Scripps
 B. Carruthers
 Z. Gafter
 H. Dominik
 P. Sellers
 S. Havaman
 G. Dykkno
 D. Chang
 43 more Signatures

M Case 3: Letter **from** the Dean:

Context: education

Target learning objectives:

What is PBL?

advantages vs disadvantages:

time: can I gradually move toward

form of PBL for my situation:

how many instructors?

how many students?

mine the only course & all others

lecture?

What resources do I need?

am I ready? new role for me

students ready? how to help

process skills: group skills, problem solving,

stress

assessment of students

evaluation of the program

! Case 4: Advice to students

Context: teacher training

Target learning objectives:

learning styles

role of teacher vs student in learning

definition of learning

are test results consistent with learning

can predict how well students will do?

how to communicate advice so that it will be accepted

student preparation prior to course

remedial strategies

student development

grades & rewards

Letter from the Dean

Your Director has just returned from a conference on PBL. The Director asks you to convert your course to the PBL format.

Advice to students: (from Dale Roy, McMaster, with permission)

You are teaching a large enrollment first year course for the second time in a row. Last year it was a matter of getting the bugs worked out but this year you are determined to make the course more effective.

One thing that you found peculiar last year was that you were not really able to say who would do well in the course. Some students that you thought were doing well, had a tough time by the end of the year; the final work of several others was a pleasant surprise. It seems that different students learned quite different things and in quite different ways.

The first month of term is over. you have decided to set aside your lecture for next week and to talk instead to your students about learning.

! Case 5 They just don't pull their weight!

Context: third year, week 6, second cycle of the PBL process;

Target learning objectives

Assertiveness
 Dealing with conflict
 Individual accountability in groups
 Teacher anticipating problems and setting up rules for coping ahead of time
 How the teacher can hold individuals accountable to each other
 Contracting
 "Norms" meetings to establish acceptable conduct
 Learning styles
 Effectiveness of prep. workshops

They just don't pull their weight!

You are using PBL in a third year course. This is the first time the students have experienced this approach in an otherwise conventional curriculum. You assigned students to groups of five or six and tried to ensure that you had a mix of abilities. Indeed, the grade average for all eight groups that you set up was about 76%. Before introducing PBL you ran two hour workshops on "group skills", "being assertive", "how to teach in the teach meetings" and "managing conflict". For the first case problem all of the groups seem to be working OK and the individual reports about the group work didn't show any anomalies. We have just had the second teach meeting. Michelle knocks on your door. After talking briefly about the weather Michelle complains "The other members in my hroup don't pull their weight especially in the teach meeting! In the goals meeting each contracts with the group that they will "teach" a topic. Then when we have the teach meeting the others don't come prepared. They have no notes to hand out. They don't teach me anything. They tell me that I do a good job of teaching them. But they just don't pull their weight! I want to leave this group and join Andre's group. Andre says it's OK."

! Case 6 Paul's decision

Context: Lifelong learning course to first year students at City University of Hong Kong

Target Objectives:

Setting priorities
 Managing time
 Budgeting time
 Clearer understanding of the expectations in university for time to study
 Long and short term planning
 Procrastination
 Learning to say No!

Paul's decision (Ed Ko, City University of Hong Kong)

Paul has been persuaded by his friends to run for a position on the Departmental Society. He really would like to, but he is afraid that doing so might take time away from his other activities. He is already on the university swimming team and has to work five hours a week in order to earn some money to pay back his credit card loans. With six courses that he is taking this semester, he feels that he is constantly behind in his work.

! Case 7 Mary's group

Context: Lifelong learning course to first year students at City University of Hong Kong

Target Objectives:

Responsible attitude
 Communication among group members
 Group work/ meeting skills
 Discussion skills
 Interpersonal relationships

Mary's group (Ed Ko, City University of Hong Kong)

Mary has been frustrated over the progress of her group on their project. It has always been difficult to schedule meetings. In the first meeting, two of the five group members arrived late. In the second meeting, one member did not show up at all. Even though each meeting lasted several hours, they could never agree on what needed to be done and who should do it. Now they are faced with a deadline for a progress report. Mary is charged with the responsibility of editing each member's contribution into a single report but she can't even locate one of the group members let alone get their work.

! Case 8: Bitter Cherries

Context: Clinical clerkship; hybrid program

Target objectives:

Biochemical: electron transport system and oxidation redox reactions.
 Enzyme binding
 Fever and temperature regulation
 Consciousness and different states of alertness, dizziness
 Pharmacodynamic and drug metabolism
 Interviewing patients to clarify symptoms
 Delivery of emergency health care in remote areas.

Bitter cherries (Luis Branda and Barbara Ferrier, Biochemistry, McMaster University)

It's cottage closing time. The last evening of their weekend at their cottage in the outskirts of the small community of Bancroft, Ontario, the family is relaxing. They remember that early in the season they collected choke cherries and put them in a bottle with vodka with the intention of making sort of cherry brandy. The bottle is brought to the table; the vodka has now a strong red color and smells like Amaretto. Two members of the family drink some of it and find it very palatable. After the short time they feel hot and dizzy; they say they don't feel well and want to be taken to the local hospital. Their breath has the odour of bitter almonds.

This is handled in two scenarios with 3 h of student research-prep work between Goals and teach.

Situation II

They are rushed to the emergency clinic in the town hospital where they are given amyl nitrite to inhale and an intravenous injection of 3% sodium nitrite, followed by 25% sodium thiosulfate. Oxygen is administered.

! Case 9: Tony LoPresti

Context: Level III, Adult oncology program, tutored group; Hybrid program

Target Objectives

Hodgkin's diseases,
 Peripheral stem cell transplant
 Hodgkin's versus non-Hodgkin's lymphoma, staging, investigations; diagnosis of Hodgkin's disease; short term and long term complications therapy, infertility
 Cancer therapies
 Young adulthood, sexuality, role change
 Chronic illness
 Crisis and coping
 Uncertainty and anxiety
 Family assessment
 Survivorship issues
 Advocacy issues related to clinical trials, patient decision making, quality of care issues such as delay in diagnosis
 Ethics
 Epidemiology: etiology, incidence, prevalence, prognosis and treatment

This case will be handled over four weeks as essentially three sequential aspects of the case. Students are expected to spend 3 to 5 h each week on this case. Concurrently they have other courses.

Tony LoPresti (Barb Love, Oncology, McMaster with permission)

Situation I

Tony LoPresti is a 22 year old man with a history of newly diagnosed Hodgkin's Disease. He is being seen in the outpatient Oncology clinic today, Dec 15, for further staging of his disease and treatment. He has had a six month history of fever, night sweats and weight loss of 5 kg. He has back pain that is made worse with alcohol consumption. He was initially diagnosed to have chronic prostatitis and was treated with high dose septa in October and November. However, his symptoms did not resolve. Two weeks ago he found a lump in his left groin; lymph node excision and biopsy last week revealed a diagnosis of Hodgkin's disease. His mother has come with him to this appointment. You are the primary care nurse assigned to care for Tony throughout the course of his treatment.

Situation II:

Mr. LoPresti was admitted to hospital yesterday because of altered mental status. Over the past week he has been jittery and last night had one episode of paranoia. He has been admitted for further assessment and observation.

As this patient's primary care nurse from the clinic, how can you participate in his care during this period of hospitalization?

Situation III

Tony is being seen in the clinic today for recurrence of Hodgkin's approximately 6 months following the completion of 8 cycles of MOPP/ABV chemotherapy. He is being considered for a peripheral stem cell transplant.

As his primary care nurse, how will you assist Tony and his family in preparing for this intensive therapy?

Situation IV

Tony is now 1 month following a peripheral stem cell transplant and consolidation radiotherapy for relapsed Hodgkin's Disease. Physically he is recovering fairly well and appears to be in remission. He will require monthly follow up in the clinic for the next 3 months and then will be seen every 3 months for the next 2 years.

As his primary care nurse in the clinic, what needs and issues may arise during Tony's process of recovery and long term follow up?

! Case 10: Process safety

Context: Chemical process analysis. For the past three weeks we have been analysing the process to make maleic anhydride from butane. The students have the detailed Process & Information Flow Diagram.

Target learning objectives:

Given the name of a chemical, you will be able to identify whether the chemical is on the HON list, the HON Section F list.

Given various sources and data for the hazardous nature of chemicals, you will be able to define the terms and interpret the degree of hazard and the implications.

Given a process, you will be able to use HAZOP (or equivalent procedures) to identify the conditions for unsafe operation and recommend corrective actions.

Ideal but not critical learning objectives:
You will be able to describe the Natural Step approach and apply it to this process.

! Case 11: Heat exchanger

Context: Engineering course in heat transfer

Target objectives:

Size a double pipe heat exchanger.

Upcoming visit from Occupational Health & Safety

You are the process engineer for the maleic anhydride process. Recently, a process in the US, similar to ours exploded. Fortunately no one was injured but the ensuing fire caused ½ million dollars US damage. Furthermore, new environment legislation is being proposed that really clamps down on emissions and water discharge. We also are having a visit, in four months, from the occupational health and safety branch of the government. Your supervisor requests that you systematically look over your process.

Will the Heat exchanger work?

300,000 lb/h of crude oil, (heat capacity = 0.475 BTU/lb F; viscosity 2.9 mPa.s; thermal conductivity = 0.0789 BTU/ft.h.F; density = 51.5 lb/ft³) are to be heated from 70 to 136 F by heat exchange with the bottom product from a distillation column. The product (heat capacity = 0.525 BTU/lb F; viscosity 5.2 mPa.s; thermal conductivity = 0.069 BTU/ft.h.F; density = 54.1 lb/ft³) at 257,000 lb/h is to be cooled from 295 to 225 F. Available is a tubular exchanger with an inside shell diameter of 23 1/4 in having one pass on the shell side and two passes on the tube side. It has 324 tubes 3/4 in OD of 14 BWG and 12 ft long arranged on a 1 in square pitch and supported by baffles with a 25% cut spaced at 9 in intervals. Will this exchanger do the job?

Criteria for effective cases or scenarios:

About the goals:

1. the chosen learning goals achievable. For single courses (for example in hybrid or conventional programs) about 3 to 5 hours of study for an individual student; about 6 to 10 objectives for a group of 6 students so that each will

research/teach the others.

2. the learning outcomes are consistent with the stage of development and builds on and activates prior knowledge.

3. goals integrate knowledge, skills and attitudes across subjects and disciplines.

About the scenario created. (can be a single scenario, or you could build a sequence of scenarios but each would expect the same 3 to 5 hours of student study)

4. the scenario contains “cues” that will trigger the desired search for learning objectives; the learning outcomes expected by the teacher are identified correctly by the students.

5. the scenario includes an appropriate level of complexity.

6. the scenario allows an openness.

7. the scenario is motivational and relevant.

8. the scenario is similar to one we might encounter in professional practice; (for example, in Engineering this might include rating, debottlenecking, design, trouble shooting, labour relationships, team work, public, monitoring compliance with legislative regulations).

9. promotes student activity.

10. any data given should be raw data (like we encounter in practice).

11. the scenario identifies the context, gives a concrete scenario and clearly identifies the expected task without spelling out specifics.

Criteria	1	2	3	4	5	6	7	8	9	10	11
1. learning goals reasonable?											
2. learning goals right level & activate past knowledge?											
3. learning goals integrate?											
4. cues to identify goals											
5. appropriate complexity											
6. openness											
7. motivational, relevant											
8. similar professional practice											
9.promotes student activity											
10. raw data											
11. concrete											

Comments:

Creating a scenario:

Some options for assessment of knowledge learned.

M Student summary of the quality of knowledge learned.

M Group solution to the problem.

M Individual concept maps of the knowledge.

M Individual Test and Exams of the knowledge, TETK. created by teacher, peers, groups, individuals, self.

M Individual teach notes and learning contract.

M Peer assessment of the quality of the knowledge brought to the teaching task.

Assessment of process skills: see series of papers in Chemical Engineering Education “Assessing problem solving skills”, “Assessing team skills”, “Assessing lifelong learning skills.”

8. Prep. work: process skills see <http://www.chemeng.mcmaster.ca/innov1.htm> and click on PBL for overview and click on MPS for details. see also paper PBL: Decisions for Planning and Action: why? when? who? where? what? how? see also the workshops given in Woods “PBL” Resources to gain the most from PBL” and “Large Class” workshop.

9. Prep. work: students ready? teachers ready? see Woods, “PBL: how to gain the most from PBL” Chapt 1 and PBL: Decisions with Perry inventory and My Role Is questionnaire.

10. Practical downsides and how to solve them

Student data pages 18 ff.

Both students and teachers must value the “process skills” and “lifelong learning skills”. PBL must be seen as being more than learning subject knowledge! Structure is needed on your part and careful preparation of the students and their attitudes is important; not all students will embrace this approach nor gain the same amount from the experience students self report that the goals meeting is the most difficult.

Reflections:

Example of resources: **Resources for Case 10. Process safety**

MPS Unit **22** Broadening Perspectives

example, p. 2215 MEK from D.G. Austin and G.V. Jeffreys (1979) "The Manufacture of methyl Ethyl Ketone from 2-Butanol," Institution of Chemical Engineers, London. p. 167-178 for the reactor section only.

Handout re TLV

W.F. Kenney (1993) "Process Risk Management Systems," VCH Publishers, New York.

p. 4-18, *** reading for introduction.
 Hazard Identification p. 47-59, 64-74; **
 Hazard necessary? p 75-113. ***
 Risk Identification. p 115-150 ****
 Risk Assessment, p. 151-165; 175-184; ***

T.A. Kletz (1992) "HAZOP and HAZAN: Notes on the Identification and Assessment of Hazards," Institution of Chemical Engineers, UK, Rugby, Warwickshire, UK Defines HAZOP, p. 7 as the process of considering none, more of, less of, part of, more than and other than. ** [In MPS **22** we consider "start up," "shut down," "switch over," "power failure," "barrier failure." plus No, Add, +/-, Part, unexpected, p. 2211]

example, p. 14, ***
 fault trees, p 49 **

T.A. Kletz (1985) "What Went Wrong?" Gulf Publishing Co., Houston TX. Examples, not much theory. *

G.L. Wells and L.M. Rose (1986) "The Art of Chemical Process design," Elsevier, Amsterdam

- Chapter 13 Safety and Loss Prevention. Very similar to Wells (1987).
 - options: p. 464-467 ***
 - HAZOP. p. 469-475 **
 - HAZAN fault tree, 475-483 **
 - example, p. 496-505. ***

G.L. Wells (1987) "Safety in Process and Plant Design," Chapter 9 in "Recent Developments in Chemical Process and Plant Design, Y.A. Liu, H.A. McGee, Jr., and W.R. Epperly, John Wiley and Sons, New York, NY

- very similar to Wells and Rose
 - options, p. 333-335. ***
 - HAZOP, p. 338-339 **
 - HAZAN p. 341 **
 - example, p. 348-355 ***

Woods, D.R., transparencies for "lecture notes" **

Feedback for interdependent, self-directed learning Form 3601

Feedback to _____ for Unit ____ Date _____
 Present & on time: G Present but late by ____ min. Absent G

Quality of Knowledge: good intellectual understanding of the topic, the material supplied was complete and appropriate.

None of these.	A few but major omissions.		Most of these.		All of these.
O _____	O _____ O _____		O _____	O _____	O _____ O _____
1	2 3		4	5	6 7

Quality of Instruction: he/she was here on time, the presentation was focused on the new knowledge; good choice of material and medium with effective communication and resource material supplied.

None of these.	A few but major omissions.		Most of these.		All of these.
O _____	O _____ O _____		O _____	O _____	O _____ O _____

Followup: from this presentation I will have to:

Must study subject on my own; I learned nothing from your presentation.	Major self-study needed. I have some starting references from your presentation.	Some self-study of the basics.	No self-study of the basics. I want to reflect about the ideas.
O _____	O _____	O _____	O _____

Strengths

Areas to Improve on

from D.R. Woods, "How to Gain the Most from PBL," (1994)

Feedback for PBL/SDL a120

Situation\$1

Issues

Number identified: 1 2 3 4 5 6 7 >7

Agreement with tutor <50% 50% 60% 70% 80% 90% 100%

Knowledge/skills to be learned

Consensus among group little some a lot complete

Agreement with tutor's list little some a lot complete

Learning objectives

Quality poor fair OK good excellent

Learning

Quality of questions asked during the teach session none some astute excellent

Willingness to continue to contribute <50% 50% 60% 70% 80% 90% 100%

Your Attitude

Perry shift 2 3 3.5 4 4.5 5

MPS 36

Learning preferences and attitudes a120

Name	Attitude: Perry scale		Learn style			Jungian			
	before	now	strategic	rote	meaning	S value and implications for learning		T value: combine with S and implications on test questions	
						value	implication	value	implication
You									

Assessment of SDL 4n4 1997 a 120
individual reports: consistency among individuals

Group A

Name	Perry start	Perry end	Comments about teaching in teach meetings	Comments about process of SDL
A.A	4.5	4.5	6.75, 6.8, 7.5 6.75, 6.75, 7.25 6.25, 6.33, 7.25	Learning objectives hardest to create; Frustration with meeting C6 because others didn't prepare Enjoyed this type of learning environment "SDL is not as time saving as I thought." "I'm glad that I don't have to listen to lectures on this topic. I was stimulated by working with others to solve a problem under time constraints."
A.B	3.5	4.	6.5, 6.4, 7.2 6.5, 6.6, 7.2 6.25, 6.2, 7.2	"What I like best is the small group atmosphere that is relaxed and where questions can be asked during the lessons without apprehension." "at the end of three problems, I still do not find this the best way to learn." After the second problem: "I think the group has a better outlook on SDL now that we realize that we can do this."
A.C	2.5		6.75, 6.14, 6.14 5.75, 6.3, 6.3 6.75, 6.14, 6.14	"SDL showed me my strengths and weaknesses in communication and expressing myself."
A.D			6.4, 6.7, 7.3 6.4, 6.9, 7.3 6.6, 6.8, 7.5	
A.E	3.5	5	6, 6.5, 7.5 6, 6, 7.5 6.25, 6.5, 7.5	"By the third cycle, every member has become very efficient in presenting their research material. The group understands the styles of learning for each of the members and, as a result, materials were presented without ambiguities or misunderstanding." "As the learning progression increased, the morale of the group also increased."

General:

Third meeting, C6, was the tough one with not all doing their fair share. The group did not confront this directly. Wide range of Perry attitude. Although learning style information was given to everyone about all the group members, these data were not formally reported or used by group. Group too generous in ratings.

Overall estimate: 2 shifted to PBL out of 5;

B tried but preferred lecture; D and C didn't try. QLI=40%

Group B

Name	Perry start	Perry end	Comments about meetings			Comments about process of SDL
B.A	4	5	7.5 7.7 8	7.5 7.7 7.75	7.25 7.3 7.5	"In the past I have always learned on my own. Now I see the benefit in teaching each other. I learn material best when I need to teach it to someone else. This approach also facilitates the learning process. Overall, SDL has really showed me that other people are great knowledge and planning resources." She did not include comments about how they resolved conflict in the group.
B.B	4	?	6.6 6.4 6.375		6.8 6.8 6.8	"Members who previously seemed disinterested did gradually become involved." "Probably the most enjoyable part of SDL was designing the test questions during the feedback session. This gave us an opportunity to explore the interrelationships among different topics."
B.C	3.5	4.	6.5 7.25 6.75	6.75 7.5 7.25	6.75 7.25 6.5	"Even though I do much of my learning on my own, sometimes it is necessary to gain knowledge from a fellow peer"
B.D			5.8 6.4 6.4	6 6.3 5.8	6.6 6.6 6.6	"By the end of the third cycle the group was quite comfortable with the process of SDL. We all got to understand what was expected from each member and each person tried hard not to let the other group members down." Hence, despite the large amount of work we had to do in this and other classes, all group members put in a lot of effort to make it work."
B.E	3.25	4	4.5 6.5 6.63	5 6.2 6.9	4 6.2 6.4	"I am more open minded about SDL now and I understand that it is a good learning technique and that SDL makes one have independent thoughts and try to analyze what is important and what is not." During the first SDL I asked "Why do we have to do this? But I am more comfortable with it after three cycles. L also found that I learned more stuff when I was researching and teaching."

General: Group got off to a tough start with about 3 members uncertain if this would work; somewhere between C5 and C6 they seemed to get their act together. However, D and E really couldn't get their teach skills in place. QLI=

Group C

Name	Perry start	Perry end	Comments about meetings			Comments about process of SDL
C.A	4.7	4.8	6.8 6.6 6.7	7 6.7 6.7	7.2 7.1 6.5	"I was frustrated by the constant pressure associated with this type of learning. I tended to include material which is interesting but not necessary for the topic at hand."
C.B	3.9	4.5	6.36 6.4 6.3	6.7 6.36 6.56	6.5 6.2 5.95	"SDL has built my self-confidence in group skills and made me aware of different teaching and leaning styles through being chairperson and teacher."
C.C	3.75	4.2	6.7 6.9 7.4	7.3 7.0 6.7	7.04 6.9 7.04	"This type of interdependent learning developed trust among the members." "I began asking questions in the second cycle to clarify the pertinent information."
C.D		4	7 5.9 6.4	7.1 6.9 6.9	7.2 6.6 6.6	
C.E	4.3	4.8	6.9 6.75 6.75	6.5 6 6.7	6.3 6.3 6.9	"Morale started dwindling in the third cycle because this method takes considerable time and effort to be effective. Students have become so overloaded with this SDL approach along with their other courses that enthusiasm is decreasing."
C.F	4.5	5	6.5 6.75 6.5	6.9 6.7 6.7	7.2 7 6.5	"The attitude toward PBL has improved through a greater understanding of the process."

General: This is a strong group with all shifted with the possible exception of B. Sensitive to needs of the others; trying hard to make this method effective. QLI= 84%

Group D

Name	Perry start	Perry end	Comments about meetings			Comments about process of SDL
D.A	3.5	4.75		7.2 7.2 7.0	7.4 7.7 7.4	"I have found the self-directed interdependent learning sessions very useful."
D.B	4.5		6.75 6.5 6	7 6.95 6.1	7.5 7.4 7.4	"After the first cycle, we prepared a learning contract which helped to ensure that people knew what was expected of them. Unfortunately, we never actually re-examined these contracts after the teach meeting to verify that our objectives had been met." "Our group was struggling to adapt to the SDL process during the first cycle, but I feel that we have made significant progress over the second and third cycles."
D.C	4	4.8	6.8 6.4 6.8	7.3 6.92 6.75	7.6 7.4 7.5	"After the third cycle, I still find that I am learning tremendously through the SDL method. I hope that the rest of the group is learning greatly as well. I found that it was getting easier to work together as a group, to be more open to the rest of the group and to be sensitive of their needs as time progressed."
D.D	3	3.5		6.45 6.3 6.25	5.9 6 5.8	
D.E	3.5	3.9	6.5 7.1 6.1	7 7.3 6.9	7.2 7.2 7.4	"I initially thought that the material presented by each member would not be taken seriously by the other members. This attitude changed after I realized how much effort each individual put into their research and presentation after the first cycle."
D.F.	3			6 6.5 5.7	6.8 6.6 6.6	Poor documentation supplied on all elements of the activities. I even had to calculate the totals for each group.

General: This group had major problems. One member's idea of teach is to give duplicated stuff from texts with little explanation. Another is habitually late and doesn't inform the group if he is going to miss the meetings. A few want just the rote memory minimum! Three have shifted to PBL; two (and maybe three) provide ineffective contributions to the group learning. QLI= 50%

Group E.

Name	Perry start	Perry end	Comments about meetings			Comments about process of SDL
E.A	4		6.8 6.6 6.8	7 7.2 7	7.6 7.4 7.2	
E.B	3.7	4.5	6.4 6 6.25	6.4 6.2 6.1	7.2 7.1 6.9	
E.C	2.9	3.5	6.5 6.4 6.4	6.6 6.5 6.6	6.8 6.8 6.8	"I felt the PBL format was a refreshing change. This year I was with a group with whom I normally do not work. I now realize that this diversity within the group may be just what is needed to effectively meet the objectives of any task." In the beginning, most members were unsure of this new learning approach. This quickly changed as each meeting progressed. All members including myself found themselves to be more and more comfortable with the new approach." "I personally felt that the SDL technique is very effective and beneficial in terms of setting goals, defining criteria and communication."
E.D	3.7	4.2	6.16 5.86 6.16	7.24 6.54 6.62	7.26 6.96 6.96	"I think I learned a lot about SDL and about group work. Group work is not always a smooth operation but one has to work very hard to keep the group together functioning as a team. That can be stressful."
E.E.	3.5	4	6.4 6.2 6.4	5.9 5.7 5.5	6.6 6.6 6.2	"At first I found this format of learning difficult to adjust to, but I have grown to like it. Although it is more time consuming than the lecture format, I found it forced me to learn the material as well as possible so I could teach it to my group and answer any questions they had. I also liked how easy it is to ask questions in this environment. I also have a tendency to cram information in order to do the assignment or test but with SDL I was forced to learn ahead of time." "Before the first teach meeting I was pretty nervous about teaching my group. I was worried about screwing up and making a fool of myself. Over the last three weeks of SDL I have gained confidence in myself and my ability to teach others."

General: Seems to have made the shift for all five members. QLI= 100%

F

Name	Perry start	Perry end	Comments about meetings			Comments about process of SDL
F.1	4	4.5	6.7 6.4 6.5	6.9 6.8 6.8	7.5 7.2 7	"Everyone in the group showed they were well prepared and able to answer questions."
F.2	3.6	4.5	7.5 6.6 7.3	7.1 7 6.9	7.7 7.5 7.3	"Each group gave their best effort and was always willing to participate. Identifying the goals is the most challenging part of it." "We implemented a specific learning contract for each cycle; this helped." "My teaching skills improved given the encouragement and constructive criticism."
F.3			6.7 7.3 7.2	7.3 7.3 7.2	7.2 7.2 6.9	"By the third cycle our group is becoming more relaxed and confident in our abilities." "Our Perry attitude shifted. At the start we just accepted the input from each; by the third cycle we were asking questions and seeking clarification and challenging each other to help each get a better understanding. Our Perry shift was to about 4.5"
F.4	3.5	4	6.9 6.9 6.6	7.3 7.2 7	7.1 7.1 6.8	"I talked to the tutor to get clarification before each teach meeting. I feel this helped improve my teach meetings." "Creating a separate contract for each cycle helped." "I found that SDL was a great way of creating strong group dynamics. SDL confirmed that everyone must fulfil their commitment to the group."
F.5	3.6	4	6.67 6.7 6.7	6.83 6.98 7	7.3 6.82 6.85	"I think SDL is beneficial since we do not have to learn everything and that some members of the group learn and teach the material in a way that everyone can understand. I think that when one has to learn and teach a topic, it is better understood."

General: This group applauded each other after each teach contribution! All committed to the process. All shifted.. even the sceptics (F.2) QLI= 100%

Group G

Name	Perry start	Perry end	Comments about meetings			Comments about process of SDL
G.1	3.3	3.9	7 7 7	6.7 6.8 6.5	6.8 7.2 7	"We are still struggling to make the most of the sessions and to excel in our learning; this entire process is a team effort." "Some members still do not participate as much as is needed."
G.2	3.5		7.25 7 7.25	7.2 7 6.2	7.2 7.4 6.9	
G.3	3.5	4	6 5.6 5.8	6.4 5.6 6	5.6 5.3 5.9	"I am still sceptical of these SDL units." "I prefer to learn from lectures but these SDL units are necessary to help me learn the various learning preferences I may come across in the working world."
G.4	3.5			7.4 7.5 7	7.4 7.4 7.6	"For the teach meetings, the Perry levels seemed to shift from 3.3-3.8 down to 2.5-3. Each saw their role as to receive information and to expect their peer teacher to be all knowing." "For SDL to be effective, ALL group members must be committed."
G.5	3.75	4		6.4 6.5 6.2	6.9 7.25 7.13	"I didn't learn the material taught near the end of the meeting as well as I could have, the pacing was fast and I had trouble retaining it. It was difficult to present my topic in the short time allotted. It takes a lot of time to research and present a topic; Although I have been learning the material well through SDL, it takes much more time than I expected to spend in one course. For example, if topic "x" was something I learned by copying it from the blackboard, I would not have had the confidence to use that knowledge in a real situation. Because I have been active in my learning, I have been retaining what I learn in class and learning how to apply it to real situations." "I am glad that my speaking came across clearly; I often tend to speak monotonously and mumble. I made a concerted effort to speak clearly and it paid off."

General: no learning contract used; the group suffered because of this. Not all members committed, Tried hard for those who did. QLI=20%

Group H

Name	Perry start	Perry end	Comments about meetings			Comments about process of SDL
H.1			7.1 7.15 7.125	3.6 5.5 5.3	4.7 6.125 5.875	"Morale is a key element in the success of this approach." "Learning contracts were introduced after the first cycle."
H.2			7.4 6.6 6.6	6.2 6.3 6.4	6.3 6.6 6.5	"Most of the teach notes are based on the author's approach to learning with little emphasis on the group member's approaches." "Creating the test questions is difficult." "Personally I find it difficult to learn by this method."
H.3	3.75	3.9	6.6 5.6 5.3	7 7 6.9	6.9 6.8 6.5	"The group needs to put the group work as a priority; the effectiveness is reduced when group members are not enthusiastic about SDL." "Some seemed to give up and not spend the time needed."
H.4			6.7 6.6 6.7	7.4 7.1 7.3	7.4 7.5 7.4	
H.5						missing report

General: A frustrated group. Two seem to have tried hard; one gave up (1) and another just wasn't ready for it (2) and the other's participation was sporadic (5). Didn't share their learning style information; started contracts after the first cycle and this may have helped some. Morale was key issue. Some disagreement between the students as to what is really important disrupted the second meeting (although this was not reported by any of the students).

QLI= 33%