Using a Problem-Based Learning Environment to Engage Students

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To teach is to engage students in learning*

Engaged Students

- Think critically, analyse and solve problems and have the ability to arrive at informed judgements
- Find, evaluate and use appropriate learning resources
- Work co-operatively in teams and small groups
- Are flexible, adaptable, motivated and creative
- Communicate with peers and tutor
- Select and apply content knowledge and intellectual skills to a given situation

* Education for judgment: The artistry of discussion leadership.
Edited by C. Roland Christensen

How do we engage students ?

- We never educate directly, but indirectly by means of the environment
  - John Dewey, 1906
- Learning is a social activity

∴ We need to create a social environment conducive to learning

Why use Problem-Based Learning ?

- PBL is a student-centred approach designed to facilitate co-operative learning and encourage students to engage in deep learning.

Why use Co-operative Learning ?

- Simulates the 'real world'
- Highly motivates students when actively involved
- Learn in context
- Experience negotiation and networking skills

Problem Based Learning (PBL)

" The principal idea behind PBL is that the starting point for learning should be a problem, a query, or a puzzle that the learner wishes to solve."

Boud, D. (1985) PBL in perspective. In "PBL in Education for the Professions," D. J. Boud (ed); p. 13.

Good PBL problems:

Encourage student engagement

- Are realistic

- Have no 'right answer' , are framed as open ended questions which require discussion and challenge the students to make informed judgments.

- They should challenge more able students as well as allowing all students to participate

Require student engagement

- Require a range of resources, including personal resources: skills, knowledge as well as external : e-resources, text, facilitators, other team members

- Be multi-stage and require the students to work on the problem over a period of time.

- Relate to module and course objectives, including both the content and the development of key intellectual, professional and transferable skills.

Strategies for writing problems

- Use of research papers, case studies, newspaper articles, news events, abstracts from grant proposals and others

- Use of handouts, WebCT, internet, PowerPoint presentations, graphs, video clips

- Shared on-line teaching resources

Forming Groups:

- Randomly heterogeneous (based on class list)
- Intentionally heterogeneous
  - (based on student records, experience etc)
- Allow students to form their own groups ?
- Jigsaw format (Stakeholders)

CASE STUDIES: PBL was used to deliver courses to the following students:

Cohort 1: Postgraduate distance learning students

Cohort 2: Undergraduate final year students (on-campus)

CASE STUDY 1:

Rationale

- **The growth in e-learning and widening participation has resulted in students located nationally and internationally with a broad spectrum of ability and diverse backgrounds.**

- **There is a need to develop a student- learning environment with enhanced student motivation, engagement and support with flexibility and accessibility.**

Methodology: Pedagogic elements

- **Students (n=84) were divided into 6 groups, each containing seven students with a range of abilities**

- **PBL exercise consisted of 2 parts and students had 1 week to complete each part**

- **Marks were allocated for relevant participation in group work, and discussions were documented on the boards, and could be easily marked**

Methodology: Pedagogic elements

- **A number of multimedia resources were used and students were encouraged to use literature links**

- **E-tutor peer supported learning was used to encourage students to participate in discussions**

- **Detailed feedback given to students with comments regarding their group participation**

- **Student feedback was achieved by web-based questionnaires, student-staff consultative committee meetings, discussion board postings and emails**

Methodology: Structure of the PBL exercise

Part 1:
An open-ended case study with questions

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Group discussion (1 week) → **Submission of report (part 1)**

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Part 2:
Further information with questions. Students designated a shareholder identity
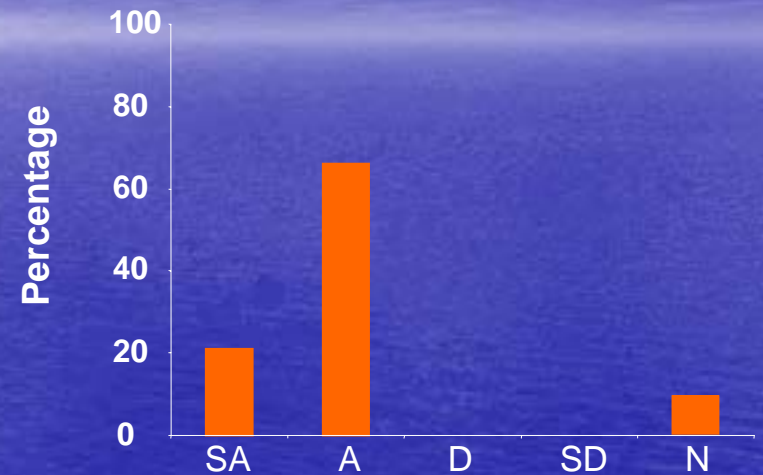
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Group discussion (1 week) → **Submission of report (part 2)**
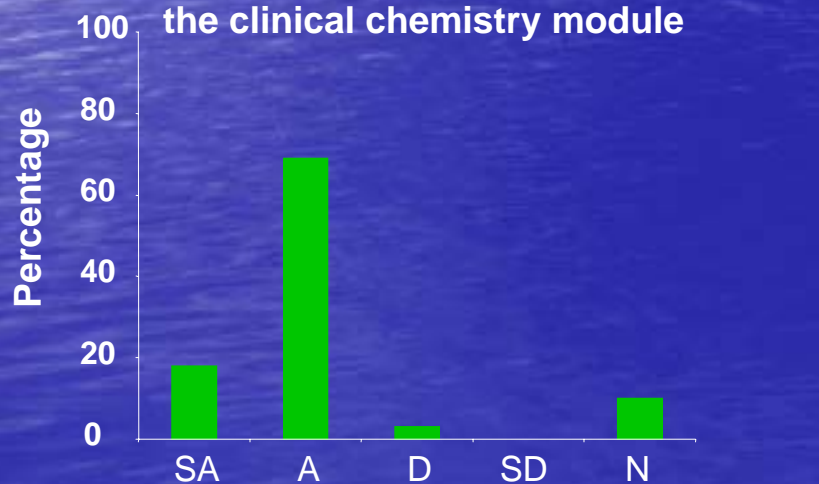
Evidence of student engagement in learning

The PBL problem encouraged study in different areas of endocrinology and metabolic disease
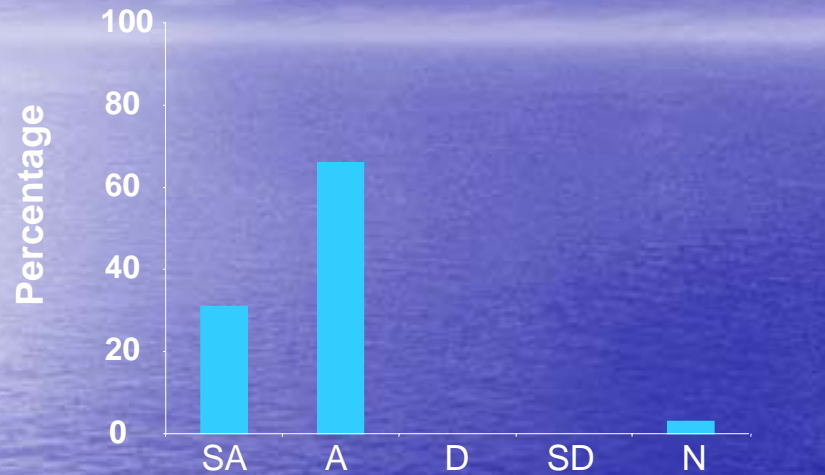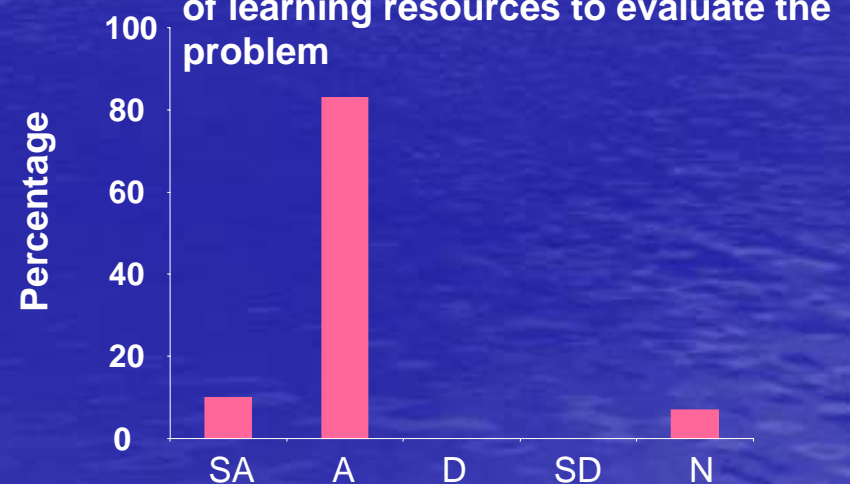
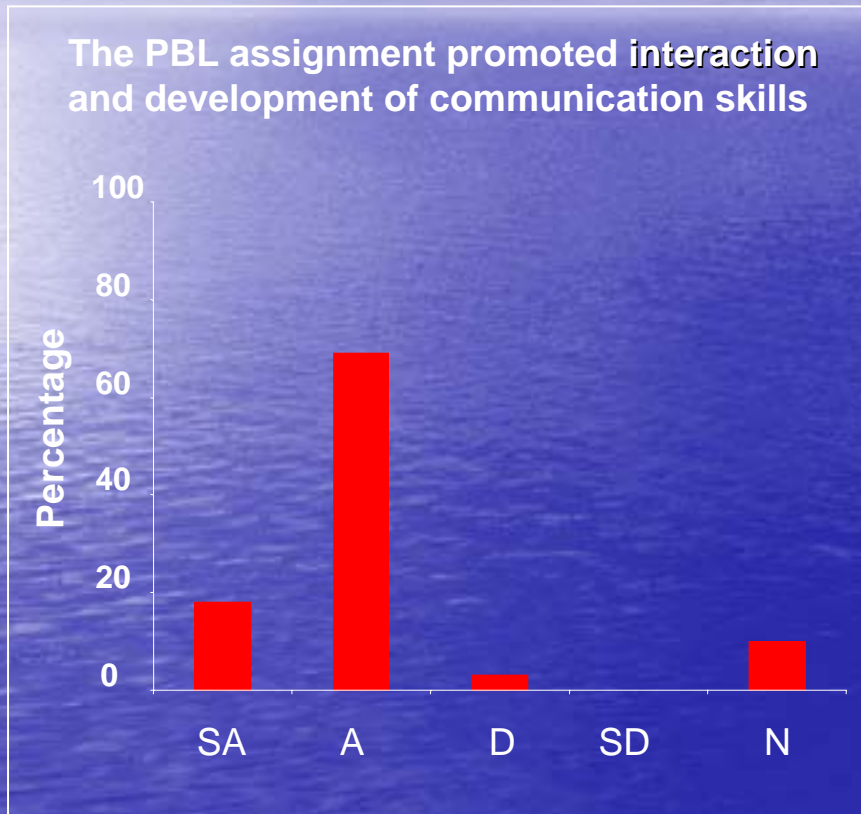**The problem based learning experience was enjoyable**

PBL resulted in increased interest in the clinical chemistry module

PBL encouraged the use of a number of learning resources to evaluate the problem

Enhanced communication skills

The PBL assignment promoted interaction and development of communication skills

CASE STUDY 2: Delivering Bioinformatics to final year students

Rationale

- Using computing tools to allow the management, visualisation, integration and analysis of biological data

- Growing number of tools, databases and other resources

- Avoid creating ' bioinformatics technicians'

Methodology: Pedagogic elements

- **Students (n=59) were assigned to groups of 6 each containing students with a range of abilities**

- **PBL exercise included 2 classroom session and a final role play and review session, students had 3 weeks to complete the task**

- **Marks were allocated for:**
  - **participation in group work (peer assessment),**
  - **role play (peer and tutor assessment)**
  - **supporting material (tutor assessment)**

Methodology: Pedagogic elements

- **A number of multimedia resources were used and students were encouraged to use literature links**
- **Student feedback was achieved by web-based questionnaires**
- **Quantitative analysis of marks from PBL and other coursework marks**

Methodology: Structure of the PBL exercise

Part 1: Team Building
Identify skills of group
Identify skills required for task

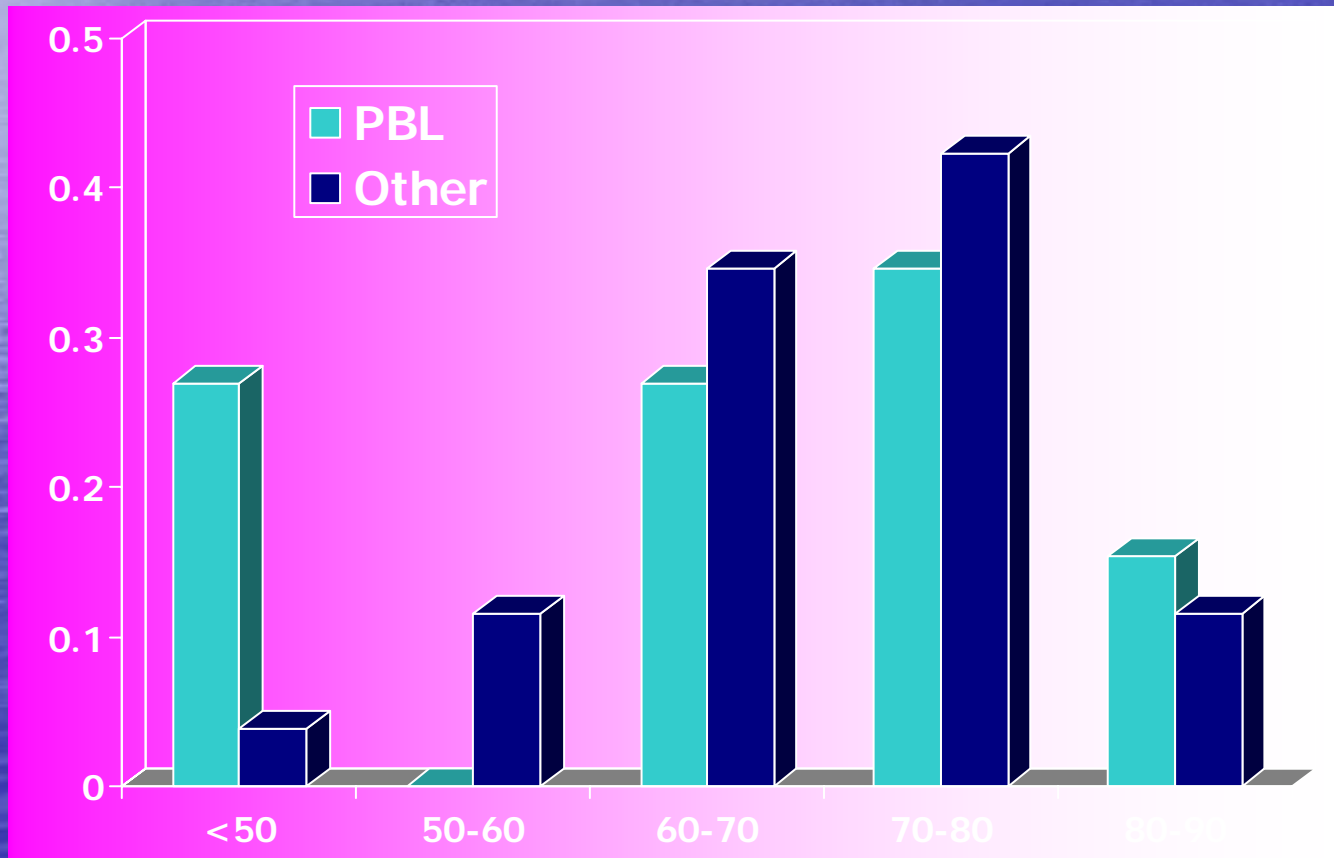**Brief presentation**

Assign tasks to team members

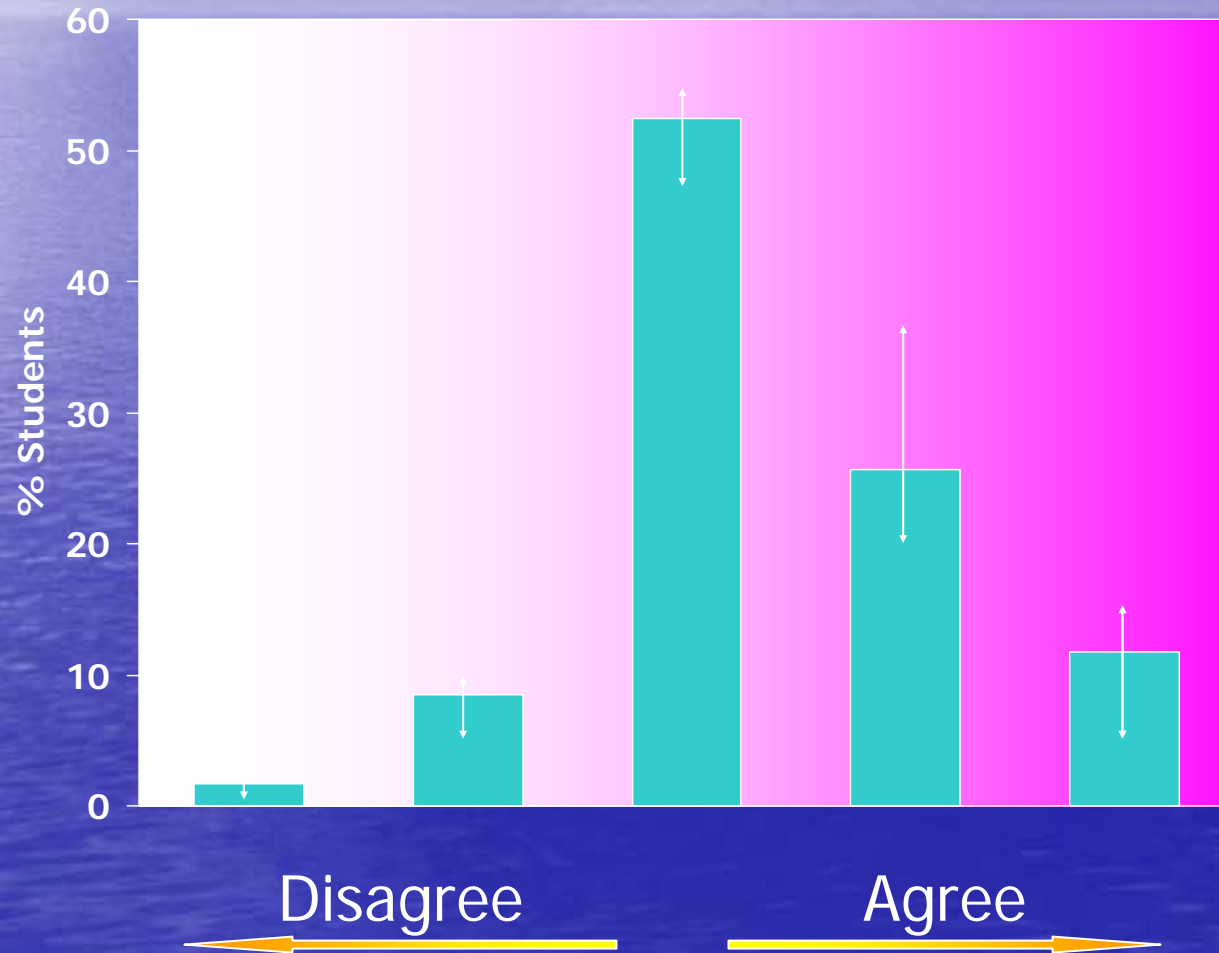**Part 2: Gather information**

Facilitated team discussion

Part 3: Prepare role play and supporting material
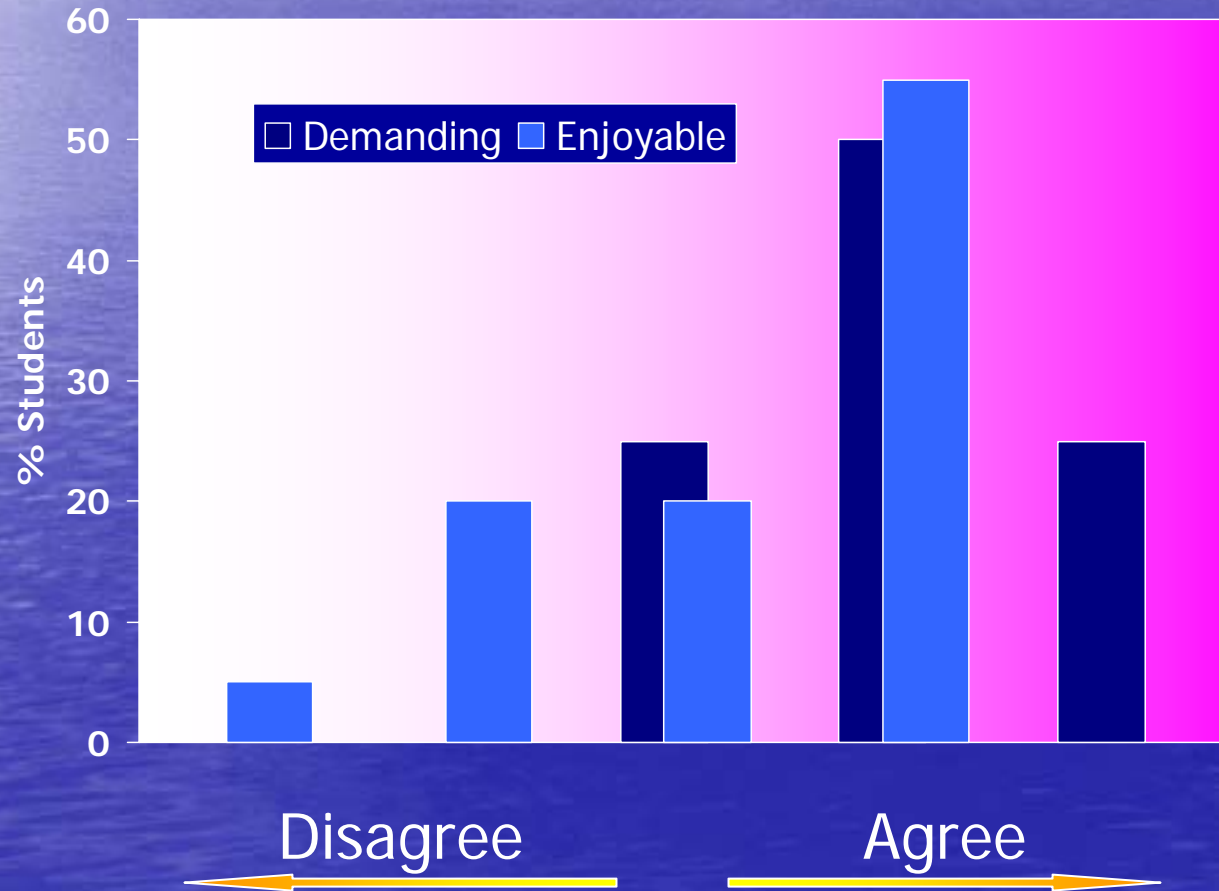
Role play and review

Quantitative Feedback:
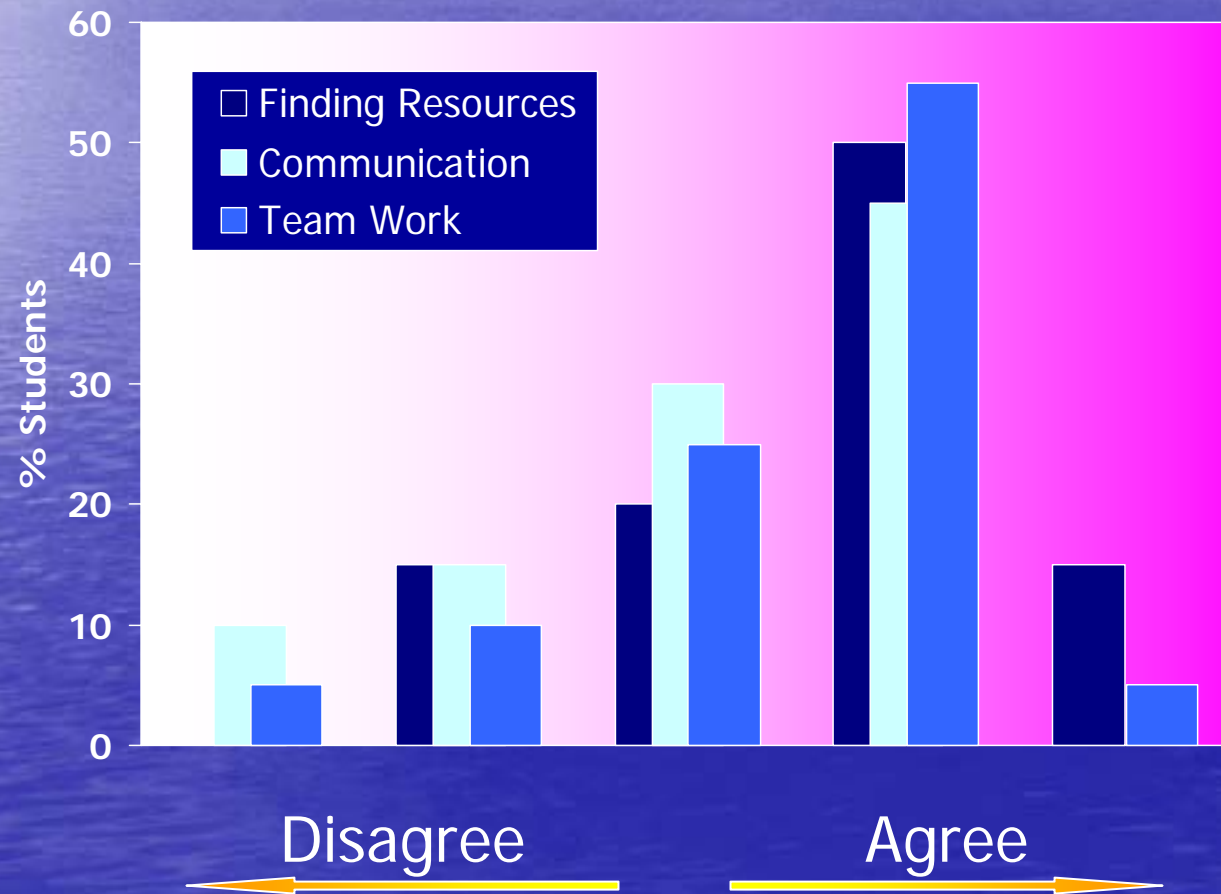# Results for PBL and other coursework

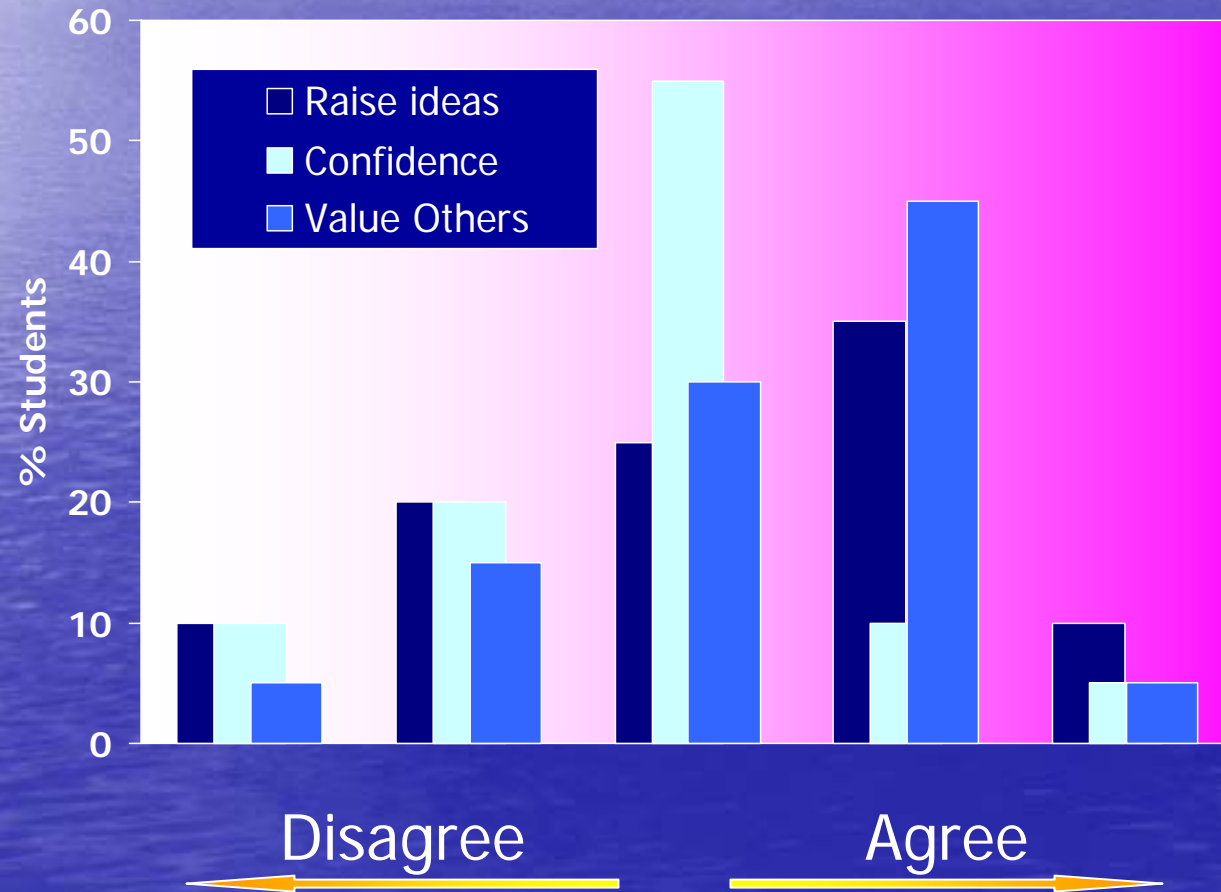# Qualitative Feedback: PBL improved understanding

Qualitative Feedback: Learning Experience

Qualitative Feedback: Generic Skills

Qualitative Feedback: Communication Skills

Summary

- **PBL provided a platform in which educators can foster the development of process skills to complement content knowledge:**

  "I liked this method of assessment because it gives an overview of the relevance of different tests and how they tie together. I think it is as effective at developing a knowledge of clinical chemistry as critical reviews and essays if not more so and is definitely more interesting and relevant.

- **PBL facilitated an environment for researching a number of lecture areas rather than one lecture at a time:**

  "I enjoyed the PBL assignment and found it interesting and a good motivator to study different areas of endocrinology."
  "I believe that analysing a case study was a lot more beneficial in learning chemistry then having to write an essay on the same topic"

- **PBL encouraged collaborative learning in an on-line**

  "I found it interesting and challenging - I'm usually shy about airing my thoughts in a group session like that but I had to work on that skill to get the marks for participation."

Summary

- **PBL is effective as a multistage process. The length of time given for discussion (1 week for each part) was sufficient for effective student engagement:**

> *"A little more time for each part would have been useful, although I understand that to strike while the irons hot is also important."*

- **PBL provided a forum that challenged students to work cooperatively in groups with other students with diverse backgrounds from around the world.**

- **There was increased engagement and interest in the module co**

> *"It was interesting and exceptionally stimulating. It encouraged me a lot to study from different sources of information and basically go out and find the answers myself. It was definitely the highlight of this module"*
> *"More PBL assignments in the future"*

Summary of results

PBL provided a platform that:

- **Encouraged the sourcing of material in different areas of biomedical science.**
- **Encouraged critical thinking, creativity and intellectual skills**
- **Enhanced the student's communication skills and encouraged collaborative learning**
- **Increased their engagement with the subject and discussion boards**

Conclusions:

- PBL provides an environment for engaging students
- Identify 'good' problems
- Group Formation