

## The Engineering Problem Based Learning Spaces at Victoria University

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### WHAT IS IT?

A precinct designed to support transition from traditional lecture-based teaching of engineering to problem-based learning (PBL) approach

#### Primary Infrastructure

- multiple PBL studios for small group work
- PBL multifunction room or common room
- soldering and experimentation laboratory

#### Secondary Support Infrastructure

- technical store
- small lecture theatre
- printing services
- campus library

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### PBL PRECINCT ORGANIZATION



Source: Dane, J. 2008. Data collected for doctoral thesis entitled: 'New Generation Learning Environments in Higher Education', Monash University. Thesis in progress.

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### FEATURES OF PBL STUDIOS

- Controlled fob key access between 8 am and 10 pm
- Each team "owns" a 3 x 3 m studio for entire semester
- Partitions 1600 mm high for restricted privacy
- Table setting and chairs for 6 – 7 people
- One locker per student
- Whiteboard, pin board
- Desktop computer, wireless network
- Team supervisors meet students 1 to 2 h/wk in studios
- Team supervisors meets students in laboratory
- Other communication possible any time via WebCT/Blackboard

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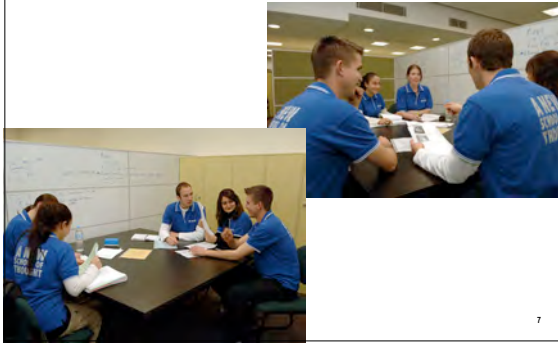
### A place to THINK!



### PBL ACTIVITIES



## PBL ACTIVITIES



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## FEATURES OF MULTIFUNCTION SPACE

- Informal space
- Kitchen facilities – microwave oven, refrigerator
- Used for presentations
- Team discussions
- Computer facilities

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## A place to COMMUNICATE!



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## FEATURES OF PBL LABORATORIES

- Controlled fob key access between 8 am and 10 pm
- Enable students to construct and test electronic and mechanical projects without continuous supervision
- Meet strict OH&S guidelines (Victorian OH&S Act 2004)
  - safe working numbers
  - fume hoods for soldering
- Contain appropriate technical equipment, general-purpose hand tools and assembling apparatus

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## A place to DESIGN & TEST!



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## PBL EXPERIMENTATION LAB



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## PBL EXPERIMENTATION LAB



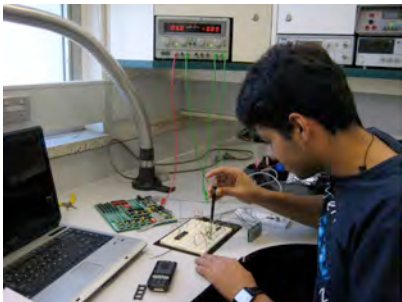
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## PBL ACTIVITIES



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## TEAM WORKSTATION



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## PBL & LABS



## WHY IS IT?

- Modern engineers need to be more than technically competent [1]
- If designed well, PBL promotes technical skills which engages students in the learning process
- In addition, PBL promotes:
  - team based learning
  - communication skills
  - analytical thinking
  - self-directed learning
  - multidisciplinary learning

[1] Engineers Australia. 2006. Engineers Australia Policy on Accreditation of Professional Engineering Programs, Document No. P02, Engineers Australia, Barton, ACT.

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## WHY IS IT?

- Change curriculum to improve retention rates in engineering.
- Recognised that success of PBL is critically dependent on:
  - learning principles
  - academic structure of programs
  - design of appropriate learning spaces and support infrastructure.

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## WHAT HAPPENS HERE?

- Teamwork, small and large group work, individual work
- Teams meet in PBL studios to:
  - identify learning issues
  - allocate specific issues to members
  - reflect on progress
  - produce technical reports
- Larger groups may use multifunction/common space to conduct "tutorial" sessions with technical and language supervisors
- Teams, sub-groups or individuals work in PBL laboratories to design, build and/or test components for a final product

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## HOW IS THE SPACE USED?

- PBL precinct used extensively during day; some use it in evenings
- Initial pattern of use different to what was expected:
  - fewer unsupervised student meeting than expected
  - more work by individuals or groups of two or three
  - studios sometimes used by individuals for work on non-PBL units
  - students found it challenging to work in teams
- Challenges to teams:
  - part-time employment of team members
  - family commitments
  - students unwilling to cooperate

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## HOW IS THE SPACE USED? (cont'd)

- Students made PBL multifunction space their "home" on campus
- In that (non-timetabled) space they:
  - meet informally
  - use computer facilities, kitchen facilities, etc
  - conduct presentations
  - attend occasional lectures and workshops
  - meet with staff for PBL planning and coordination
- Activities that are not discouraged leading to a sense of community:
  - watching and making movies
  - playing computer games
  - other such social activities

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## HOW IS THE TECHNOLOGY USED?

- Original assumption that students would use their own laptop computers in preference to installed PC's was incorrect
- In absence of installed PC's students chose to work in library or open-access computer laboratories
- Student use of studios immediately increased after desktop PC's were installed
- Use of WebCT/Blackboard in first instance was variable – students prefer to communicate electronically via other on-line tools such as Hotmail and Messenger

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## FACILITY EVALUATION

- Student PBL experience evaluated annually via questionnaires and focus groups
- In relation to PBL approach students:
  - enjoy "hands-on" style of PBL
  - understand the principles and goals of PBL
  - appreciate how PBL can prepare them for the workplace
  - consistently valued the importance of teamworks
- In relation to PBL facilities, students:
  - liked new PBL spaces and having individual team suites
  - initially requested access to computers in PBL studios rather than multifunctional space

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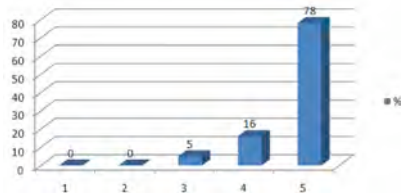
## FACILITY EVALUATION (cont'd)

- Stojcevski administered a short questionnaire in 2007:
  - How would you rate the PBL studios in terms of a teaching facility?
  - How would you rate the facilities within the PBL studios?
  - Please also provide your comments in terms of the benefits and difficulties, in terms of the PBL studios used as a teaching facility?
- Response scale for first two items:

1 Very Poor	2 Poor	3 Good	4 Very Good	5 Excellent
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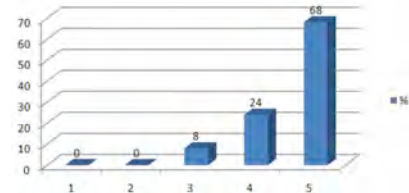
## STUDENTS RESPONSE



Students' response to the question: "How would you rate the PBL studios in terms of a teaching facility?" expressed as a percentage of the 37 responses in total.

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## STUDENTS RESPONSE



Students' response to the question: "How would you rate the facilities within the PBL studios?" expressed as a percentage of the 37 responses in total.

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## FACILITY EVALUATION (cont'd)

- Content analysis of responses to open-ended question identified the following themes:

### Benefits

- dedicated space for each team for entire semester
- supervisors know where to find students
- high-quality technology
- physical environment enables collaboration
- students have access to appropriate and relevant resources

### Difficulties

- initial access problems (electronic key allocation)
- no microwave and refrigerator supplied at first

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## LESSONS LEARNED

- PBL contention is that students learn to become independent learners in a supportive environment that brings them into contact with practice-related problems
- Thus design of PBL spaces is critical in meeting the required goals
- Design of PBL spaces:
  - influenced both student and staff behaviour
  - reinforced shift in staff role from instructor (*sage on stage*) to facilitator (*guide on side*)
- Studios encouraged collaboration amongst students in their teams
- Multifunctional space encouraged cross-team activities

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## LESSONS LEARNED (cont'd)

- Students value having their own place
- Providing facilities for "hands-on" work is important; both academic and technical staff should be consulted in this
- Open access, desktop computers appear not to be relics of the past
- PBL precinct develops a sense of community and student ownership of studios; this leads to use of the spaces for activities outside PBL
- Proximity of studios to each other also contributes to the sense of community

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## LESSONS LEARNED (cont'd)

- Student retention is enhanced by PBL as it emphasizes:
  - academic and social integration
  - collaborative learning
  - informal interaction
- The PBL precinct provides spaces that support and encourage these important functions.

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## A place to be RECOGNISED!



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