Student Design Work through PBL:

Re-engaging Students with Creativity, Design & Professional Development

Kevin Wells
Faculty of Engineering & Physical Sciences
University of Surrey

Background

First year Laboratory Programme

Lab lectures ~1hr

6 hours per week

Experiment Rotation working pairs

Background

Professional Skills Programme

Mandatory component for IET accreditation

Lectures	~1 hr
Workshops	~2 hrs

Motivation

Professional Skills Programme

Mandatory component for IET accreditation

Concerted effort required …. to fail the module.

Motivation

First year Laboratory Programme

….. Teaching materials were very tired

….. allowed students to ‘sleep walk’ and still get good grades

….. Creativity / personal expression

Motivation

Address as a single problem:

Enhance student learning with creativity and design

Laboratory Skills

Professional Skills

Motivation

Address as a single problem:

Enhance student learning with creativity and design

Laboratory Skills

Professional Skills

Planning

Week	Student Preparation		Professional Skills/Design session	Assessment		Lab Session	Assessment
2	**E1**						
3	**E2**		E1	Peer-based assessment			
4	**Project**		E2	Peer-based assessment		E1 - Transistor Amplifier	single mark
5			Project & Criteria Design	Peer-based assessment		E2 - Filter Design	single mark
6						Project	Feedback only
7						Project	Feedback only
8						Project	Feedback only
9						Project Showcase	Peer-based assessment

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Implementation

Web pages replace lab lectures + lab manual

Transistor Amplifier Tender

Design Brief

TPC (The Transist
upcoming electron
requirements stipul

Base Emitter Sl
A circuit to shov
oscilloscope).
Part A: To de
Part B: To de
a voltage to de

Part	
Part	

Table E1-1 -

Bipolar Junction Transistor Basics

Components like resistors
yet do not produce any e
not "passive" are called "
active nature, and given t
circuits. They are primaril
transistors form the basic
with the most common ty
come from the way they
workings of a transistor.

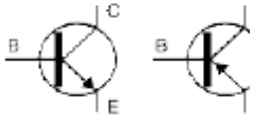


Figure 1 - Schematic sym

The operation of a transis
control the current flowin
workings of the transistor
consider the analogy in fi
the base, the water can fl
analogous to the Base Cu
(analogous to the current

Quantity	Equation	Symbol
DC Current Gain	I_C/I_b	h_{fe}
AC Current Gain	$\Delta I_C/\Delta I_b$	β or h_{fe}
AC Input Resistance	$\Delta V_{be}/\Delta I_b$	R_{in} or h_{ie}

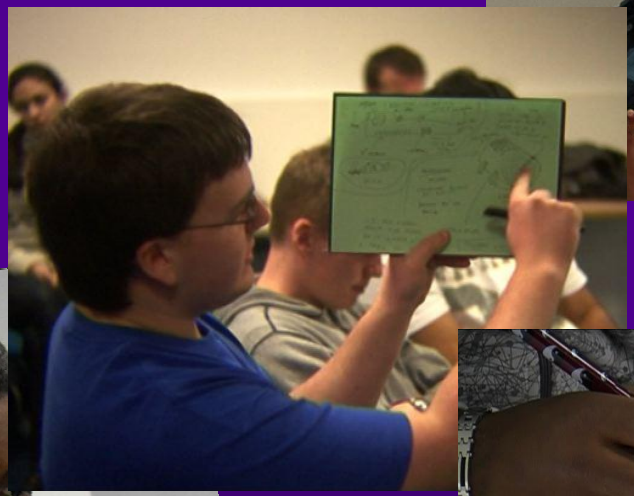
Table 1 - BJT characteristics

Packaging

When using transistors it is important to know which leg of the device is which. The easiest way to do this is to find the data sheet for the transistor you will be using. If you have difficulty finding the datasheet the labs will usually have copies of the datasheets for the transistors they have in stock of they will be able to tell you where to get them.

Implementation

Design session & PA



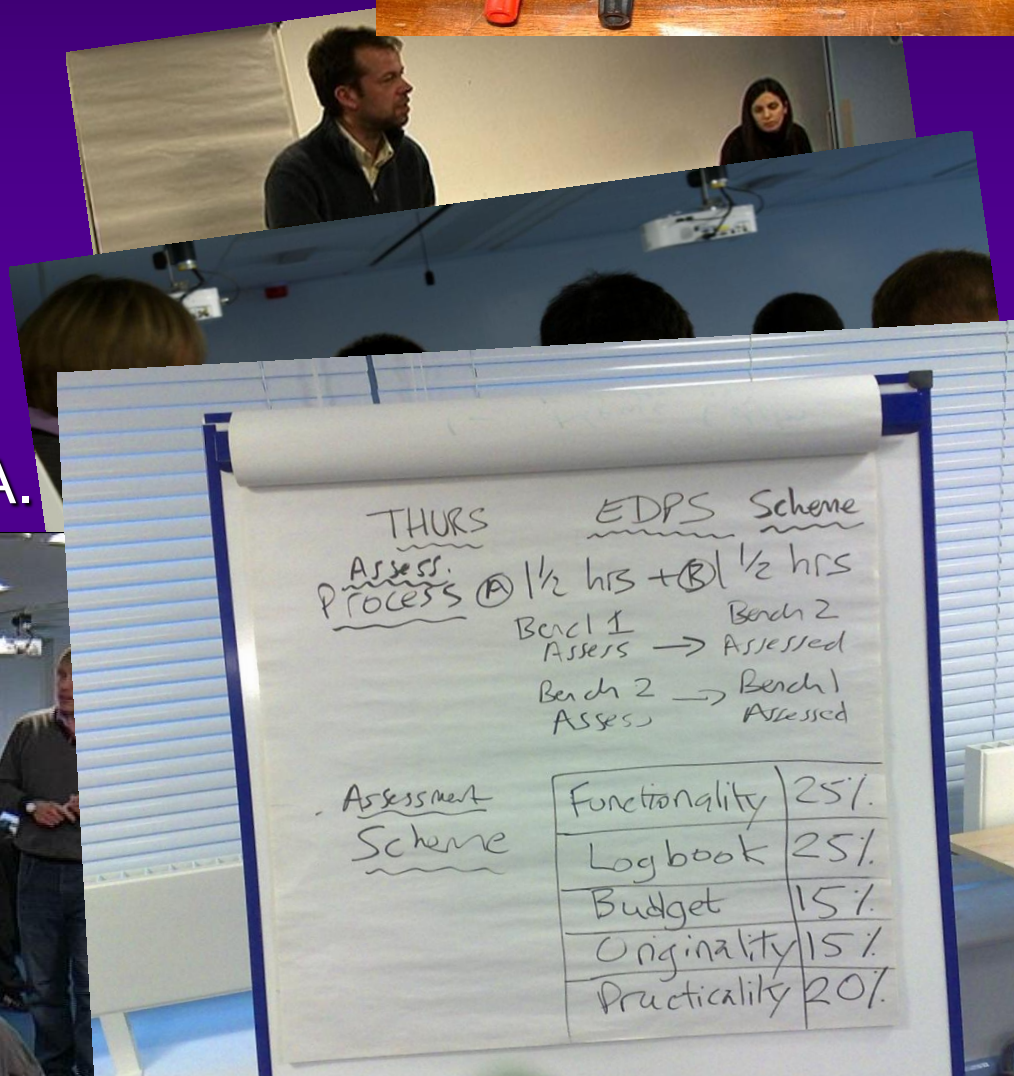
Implementation

Design session :

Brain storming

Mind mapping

Peer Designed PA.



Analysis

Student questionnaire

	pre-PBL	PBL	
Interest	**2.96**	**3.12**	
Presentation and delivery	**3.36**	**3.45**	
Effectiveness of learning	**3.07**	**3.42**	
	Professional Skills		

Table 1 Summary of mean responses to the three questions polled.

Analysis

Student questionnaire: Prof Skills

Comments from Professional Skills course Questionairre	
Pre-PBL	**PBL**
examples being given now should aid learning	the new exercises were fun
emphasis on trivial points	good to mix with labs so feels like it has some use
obvious, done it before	
silly subject, don't see the point	EDPS/lab very unclear at times
good very helpful to get understanding of work in the field	Boring but an effective learning experience
	Doing lab prep within edps makes lab more interesting.
some aspects seem pointless	
exercises are a good way to get points across	Gained a better understanding of circuits with this mode of learning
insufficient feedback on practical tasks	
bit boring, some practicals are pointless	Mostly dull, but group work is interesting
some workshops seem childish	Complicated
fairly well structured, but trivial at times	Higher level of interaction now means its more engaging and effective
some of this is a waste of time	
insufficient feedback on presentations work	Not a lot to comment on since there wasn't much Prof Skills work happening
	The 'experiment' was successful IMO
	Great idea connecting Labs to EDPS
	Didnt like new methods of working
	Much more complicated than before - the prep requires much time to find out about new things we havent seen before

Analysis

Student questionnaire

	pre-PBL	PBL
Interest	3.93	3.82
Presentation and delivery	3.45	3.43
Effectiveness of learning	3.66	3.75
	Laboratory	

Table 2 Summary of mean responses to the three questions polled.

Analysis

Student questionnaire: Lab

Laboratory Course Questionairre Comments	
Pre-PBL	**PBL**
more feedback on how to improve wanted	Getting more fun all the time
a lot of prep needed	Project work is difficult to understand
lenghty but most enjoyable part of the course	Interesting projects, theory difficult
need more help when I don't understand	Demonstrators less helpful, and have higher expectations of prior knowledge
good experience	
more background/theory needed	Demonstators good but sometimes too picky
more background on project needed	I preferred the old method of working
better than last semester	A nessacery evil, but fun at times
biased demonstrator assessments	Linking Labs/EDPS works well - the school should continue with this
don't understand error handling	
	Great idea, but drawing on a whiteboard hasnt helped me with lab
	Fun and interesting
	After last 2 weeks of the new system I think the assessments were much fairer
	Generally OK and very interesting, but often not sure what is expected from us
	Good module, especially combining with lab

Conclusions

Students seamlessly adopted directed web-based learning

- rapidly became self-directed learners.

Professional skills teaching now taken seriously.

Students valued ‘real world’ problems
→ creativity → engagement.

The pilot study represented first steps moving on from being professional students to professional engineers/learners.

Acknowledgements

I would like to thank the following staff that helped make this SCEPTrE Fellowship project:

SCEPTrE: Jo Tait, Norman Jackson and Fred Buining

EE : Janco Calic

Jeremy Allan, Phil Jackson, Graham Reed

Richard Clarke, Bill Backhouse, Dave Fishlock

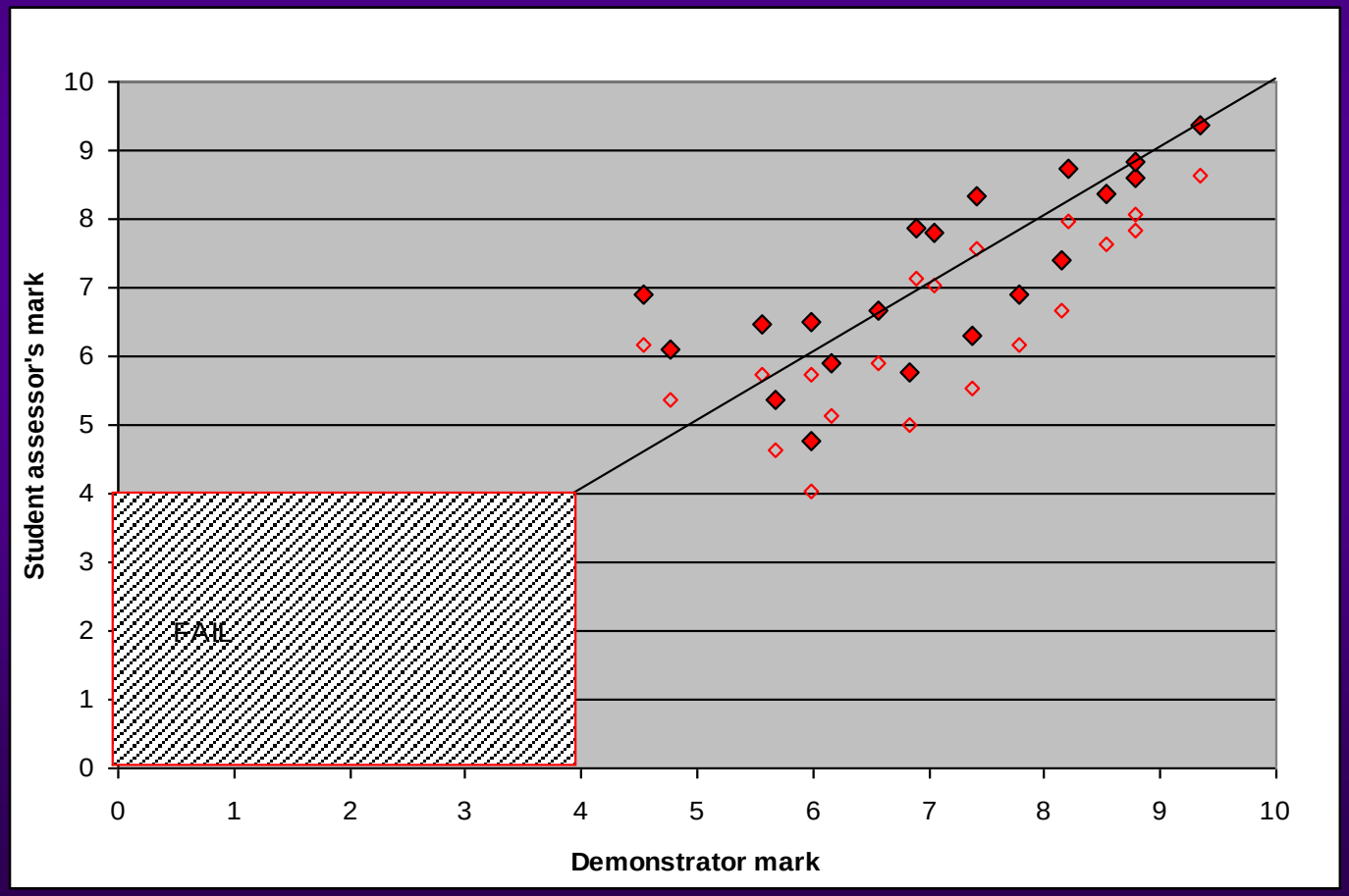
Follow On

Spring Semester Lab/Prof Skills Programme

- Choose 3 from 5 scripted experiments
- 4 weeks of Design Briefings
- 3 week Lab Project
- 1 week Project Showcase + PA

Analysis

Plot PA marks vs PG Demonstrator marks



Follow On

Autumn Semester Lab Programme

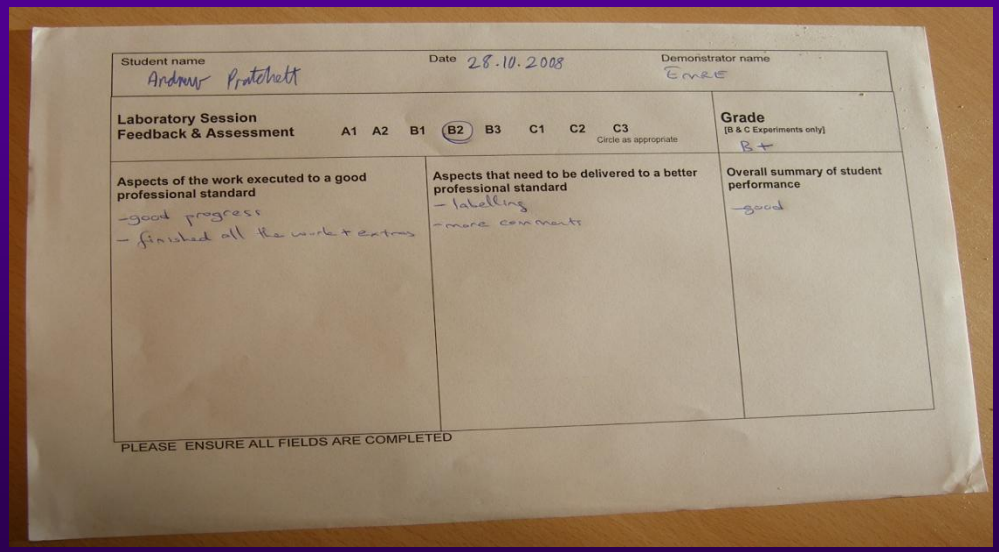
- new workshop training session
- new competency test

→ open-access for competent users

Follow On

Autumn Semester Lab Programme

- 2 weeks assessment free
- feedback forms + single grades



Student name Andrew Pratchett | Date 28.10.2008 | Demonstrator name Emre

Laboratory Session Feedback & Assessment: A1 A2 B1 (B2) B3 C1 C2 C3 — Circle as appropriate

Grade [B & C Experiments only]: B+

Aspects of the work executed to a good professional standard:
- good progress
- finished all the work + extras

Aspects that need to be delivered to a better professional standard:
- labelling
- more comments

Overall summary of student performance:
- good

PLEASE ENSURE ALL FIELDS ARE COMPLETED