EDUCATION & TRAINING FOUNDATION

OUTSTANDING TEACHING, LEARNING AND ASSESSMENT

TECHNICAL SKILLS NATIONAL PROGRAMME

Case study on project led by Derby College
Created by: Robin Webber-Jones and Melanie Lanser
December 2017

Managed by

ASSOCIATION OF COLLEGES

In partnership with

emfec

CONTENTS

BEYOND COMPETENCY: A PARADIGM SHIFT IN EDUCATING ENGINEERS FOR THE FUTURE	**3**
Overview: From Factories to Communities of Discovery	3
Hypotheses	3
Partners	3
Aim	4
What We Did (Methods)	4
The PBL Scenarios – student feedback	5
Making sense of the student feedback	6
Lessons Learned	7
Tentative Conclusions	8
Unintended consequences to support outstanding teaching, learning, and assessment	9
Outstanding teaching, learning and assessment	9
What next? (How we plan to continue the work)	9
One take-away message	10
Project Outputs	10

DERBY college

New College Stamford
All round excellence

Leicester College

NOTTINGHAM COLLEGE

BEYOND COMPETENCY: A PARADIGM SHIFT IN EDUCATING ENGINEERS FOR THE FUTURE

Overview: From Factories to Communities of Discovery

Our project explored how we could think about assessment practice and employer engagement differently in the delivery of engineering and construction programmes. We had noticed that frequently the sectors used outcome-based assessment methods, teaching to the qualification, and this limited the design and delivery of the curriculum. Moreover, it did not help the professional development of students or bring employers closer to the curriculum. Indeed, every year at enrolment we saw significant numbers of students wanting to be 'an engineer' without really understanding the full breadth of careers on offer. Assessment methods limited the opportunity for trial, experiment and discovery which are some of the essential skills they would need in industry. Thus, we felt that a paradigm shift could be needed and we see emerging T-Levels as a way of opening up that change.

We set out to use problem-based learning (PBL) to create a future workforce with higher-level skills, knowledge and behaviours who can drive and respond to rapidly changing industry needs. Additionally, we felt it would help us to trial a totally different approach to longitudinal development of fledgling engineers, in partnership with employers with a view to using this approach in the forthcoming T-Levels as a way of forming highly skilled professionals for students undertaking study programmes

> *"This new concept will allow us to redevelop our curriculum to support the progress of our students. Having the opportunity to collaborate with various learning providers and employers, enabled us to share ideas and work together to formulate problems for our students which incorporate the majority of the subjects being delivered."*
>
> **A TEACHER INVOLVED IN THE PROJECT**

Hypotheses

1. PBL is an effective pedagogical model to support students to develop into technical professionals progressing to skills employment and higher level learning
2. Joint Professional Development (JPD) is an effective model to support the development of employer relationships for T-Level delivery

Partners

We set out to try to pull together a large regional consortium of providers. Indeed, many were very keen to take part. However, circumstances such as changes to leadership, staff shortages, time issues and other factors affected the continued commitment everyone could give. This became an interesting learning point. We knew that from a JPD perspective that 'change is hard and it takes time' and that the general condition of the sector at moments can make that more challenging. Those that stayed all commented on how much they

enjoyed working with other partners. In the end a core set of partners were involved and helped to deliver the PBL episodes. They were:

- Leicester College
- New College Stamford
- The Nottingham College (which were Central College Nottingham and New College Nottingham – both of whom merged during the life of the project)
- The Uniper Training Academy
- Rail Forum East Midlands

While all partners were very proactive in the CPD events that we delivered, the numbers of PBL episodes and the number of students involved varied by delivery partner based on capacity and volumes. A more longitudinal study may have given a more even split of learners.

Aim

The aim of our project was to use PBL experiences to create a future workforce with higher-level skills and knowledge who can drive and respond to rapidly changing industry needs. We aimed to investigate and trial a totally different approach to longitudinal development of fledging engineers, in partnership with employers with a view to using this approach in the forthcoming T-Levels as a way of forming highly skilled professionals for those learners undertaking college-based study programmes.

What We Did (Methods)

We facilitated a series of workshops with teaching staff to explore the features of problem-based learning and the skills-set required for effective development and facilitation of problem-based learning, aligning with the Professional Standards. The workshops were designed to be good fun, highly collaborative and
required teachers to think about, and experience, the effects of conducting problem-based learning with students – especially if the students had spent considerable time in their previous educational experience being prepared for exams. The workshops allowed teachers to develop action plans, probe what effective “facilitation” of learning looks and sounds like, plan ways to engage employers, construct problem-based learning episodes and reflect together on strategies for promoting inclusion. Students, colleagues from other institutions, and employers joined us for the workshops.

LEVEL 2 ENGINEERING STUDENTS WORK ON CREATING AN ELECTRICAL CIRCUIT

There were 5 CPD days between May and November 2017. (see Output 1 for a copy of slides used). The first two days focused on what problem based learning is and how the professional standards could be used as a tool to think about practitioners’ skills development to facilitate this new way of learning. The next workshop focused on speakers who have used PBL in higher education settings sharing what they had learned. Additionally, we used the time to plan employer visits, and to spend time understanding T-Levels. This became increasingly critical as we were

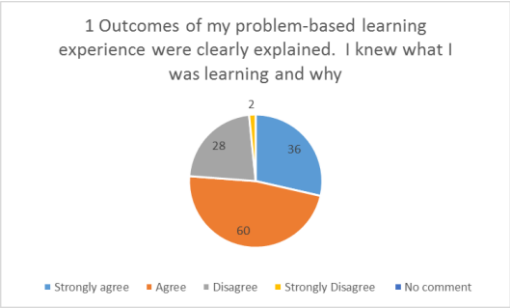
sharing emerging information on the project at our base institutions. The project became a reference point for how curriculum delivery and design may need to be different for these qualifications.
The final two sessions focused on reflecting on student feedback, practitioners' reflections relating to their problem-based learning "story" (see Outputs 14-18 for poster stories from practitioners/students) on what was working, barriers experienced and tentative conclusions on how problem-based learning could be used to improved practice.

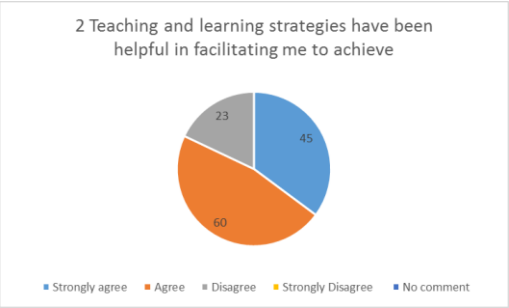
Seven PBL scenarios were created and facilitated in four different FE Colleges by nine practitioners and one student-facilitator, reaching over 130 students. There was a spectrum of activities and results. (See Outputs 8-13 for the different PBL scenarios). Generally, though, where the activities were well-prepared/planned and involved an employer, students were able to overcome a 'fear of failure' and come up with innovative solutions to problems (See Output 5 for a template to support employer-provider collaboration).

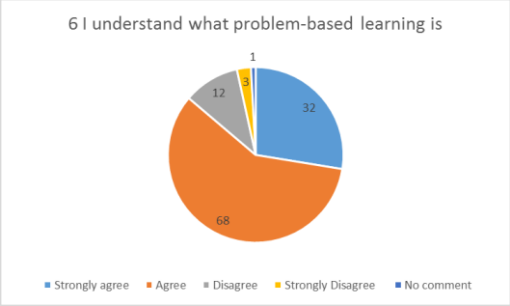
> *"I enjoyed every bit of it, and so did the students. I have spoken to my course leader and we are intending to link with a tool company to support the development of PBL*
>
> **A TEACHER INVOLVED IN THE PROJECT**

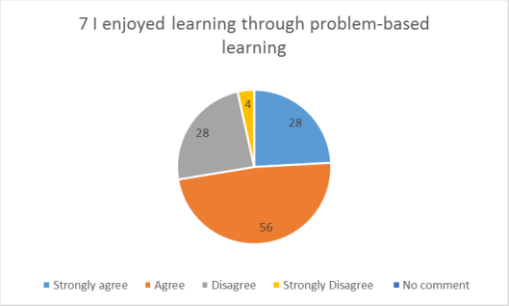
The PBL Scenarios – student feedback

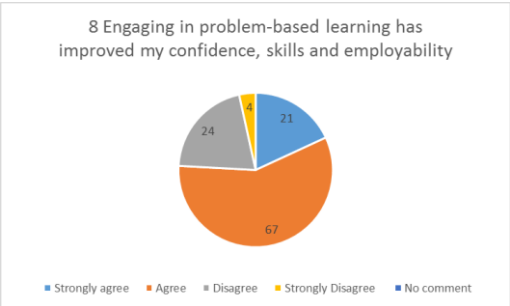
After each scenario learners were asked to complete a questionnaire. We also ran focus groups to further probe student reflection.

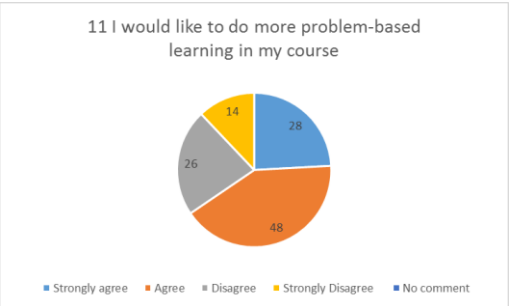












Making sense of the student feedback

The data shows that a significant majority enjoyed PBL and would like to do more. In the most successful PBL activity, students reported:

> *"I liked working as a team and working out specific problems together"*

> *"I enjoyed figuring out a way to overcome the problem"*

> *"During problem-based learning I have been more confident by working in a group and by how we knuckled down since day one"*

Tutor reflections on the process broadly agree with student feedback:

> *"The Level 2 group exceed both our expectations of coming up with some very strong ideas of the "how, what, why and when" and the Level 1 students, by session 2 "took more ownership", group work and responsibilities were much improved".*

L3 ENGINEERING STUDENTS PRESENTING THEIR ROLLERCOASTER DESIGN SOLUTION DURING INDUCTION

The differing views shown in the charts can be related to constructivist learning and the importance of locating the "new learning and skills" within the existing knowledge and experience of students. In some trials, the feedback suggests the problem was too challenging. The learners were not working within their zone of proximal development (Vygotsky), but outside in a "panic zone". Supporting students to recognise that they are starting with the highest-order thinking skills might have supported the safe introduction of problem-based learning methods. Careful scaffolding and devising appropriately engaging and practical problems which do not threaten can start to develop collaborative skills. Closely related to this is the mind-set of those students who did not enjoy the experience. For those coming straight
from school, immersed in high-stakes assessment, they may have a fixed mind-set and struggle to shift from the primary responsibility of learning the content" to a host of new responsibilities, including responsibility to their group members. (Dweck, 1991).

> *"As a student, I prefer a more linear pathway for learning. I felt confused for the majority of the project as tutors didn't explain how I could apply skills"*

> *"I felt confused for the majority of the project as tutors didn't explain how I could apply skills, or what was right"*

In a different PBL episode, a small minority of student feedback indicated the problem was too easy and possibly these learners were working well within their comfort zone and were not progressed up Bloom's taxonomy. Boud (1985) suggests that a core characteristic of problem-based learning courses is an acknowledgement of the base of experience of students. Attention to fostering an emotionally safe learning environment is crucial in the first few weeks of a new learning programme (Rogers, 1968). Increased skills in facilitation, with the timing and nature of the task at the forefront, may have made this a more positive experience for a greater number of students. Teacher-student reflections can support this process, where teachers ask open and reflective questions to help students to reach a greater level of

understanding and summarising the position the team has reached to help them move on and giving feedback to the team on team process and progress (Brookfield, 1985). The complexity of these skills poses significant questions about teacher development and support.

A feature of problem-based learning (Barrows and Tamblyn, 1980) is "complex, real world situations that have no one right answer". In one PBL episode the involvement of an employer presented a "real life" problem. The employer supported a competition although there is a danger that the competition may have shifted the focus of the learners to the "product" (or solution) rather than the processes they were using to solve the problem (see Output 10). In the least successful problem-based learning trial (based on student feedback) an employer was not involved and students may not have connected to the "real world learning element". Indeed, in focus group data, only one of the six learners showed an awareness that her employability skills were developed through this process, and this learner had carried out work experience at a large engineering employer already. So the emphasis on the skills and employability developed through this learning had not been absorbed by the participating students.

Lessons learnt

By undertaking this activity, drawing on experts, undertaking employer visits, and by engaging with employers we devised a series of problem-based scenarios which were run across the partnership during induction. While there was significant positive impact in the activity, we have been able to highlight some factors which may support the successful implementation of Problem Based Learning:

- Problems need to represent real-world experiences and weave theory and practice; employers can support this significantly;
- Practitioners require dedicated CPD to successfully facilitate PBL;
- Team building, students' collaborative and independent study skills need developing before PBL should be undertaken (see Output 3 for roles students could adopt during PBL learning);
- PBL should start with one unit or part of a unit and then be 'funnelled' into covering a whole course;
- Scaffolding is required, with careful planning of potential resources and experts (practitioners and employers) (see Output 2 for a Learning Plan than can support this)
- The assessment of the PBL experiences involves assessing process-led outcomes (such as contribution to group task, leadership skills, working to deadlines, presentation skills) as well as the "solution" and justified product led outcomes); involving employers (such as interrogating the proposed solution) in the assessment is popular with students (See Outputs 4 and 6) for examples
- It may be worth considering developing a 'programme' specification for each T-Level which ensures that activity goes beyond the qualification focusing on behaviours, skills and knowledge for technical professionals.

> *""The opportunity to make mistakes is an opportunity they won't get in industry. But the mistakes really supported deep learning"*
>
> **A TEACHER INVOLVED IN THE PROJECT**

Indeed, all teachers commented that they struggled to hand more control to the students but were amazed at the energy, enthusiasm and quality of results once they did.

> *"It was a struggle to step back and the L1 group struggled with plumbing skills and tools, but they learned how to use the tools, they struggled and made mistakes. We were astounded by the models they built"* (Practitioner Reflection)

See Outputs 7 and 8 for an overall summary of findings)

Tentative Conclusions

Most of our PBL episodes were conducted during induction or during the first 6 weeks of a course, which may have skewed the data. However, the results of the trials are positive. Although we have no definite evidence that PBL is effective in supporting students to develop into technical professionals, we believe we have sufficient "green shoots" to keep going, thus moving towards an evidence-based pedagogy. There are tensions to resolve:

1. Articulating the employer role and relationships required for successful PBL and engaging employers in this pedagogical approach, in order to have an effective JPD model with employers for T-Level Delivery. Possible, Higher-level apprentices could be effectively used to bring the "real world" element;

2. PBL focuses on holistic learning to be a "professional" so we need to be clear on what is to be "weighed and measured" in the delivery of T-Levels and the focus of "qualification" and the surrounding audit culture;

3. Educational leaders need to have a depth of understanding of this pedagogical approach to effect change of cultures within the sector.

4. Learning environments need to be conducive to PBL –these may not be single classrooms with single teachers.

We also feel that PBL requires different approaches to assessment. PBL is about holistic accumulation of work through trial, error and research which can then be mapped to outcomes. It shatters the linear progression in Bloom's taxonomy as before students can understand they need to be able to analyse and evaluate the problem they are confronting and work out what questions to ask and what knowledge to gain. So students start with higher-order thinking skills to decide what knowledge and understanding they require. Sharing this with students before problem-based learning is recommended. Generally, teachers noted joy in learners' faces when they achieved this. The hardest part for the teachers was giving all that creative freedom to students. That is where the paradigm shift has started!

Unintended consequences to support outstanding teaching, learning, and assessment

This leads to one of the most interesting conclusions within the project. Most teachers found the initial CPD challenging as there was no 'right' answer. They were seeking affirmation. The sessions were designed to model the practice teachers would need in the classroom to model good PBL. Indeed, this element is one that most of the students struggled with; their schooling to date has involved them preparing for/being prepared for exams. In their 14-16 education, teachers have directed learning. A few months later, we gave students freedom to ask questions and trial things, and there was no one 'right' answer. Teachers described how the majority of students showed delight at solving problems, 'fist pumping the air' and demonstrating creative skills, learning from mistakes and high quality team working skills. However, others were confused:

Outstanding teaching, learning and assessment

The project features a number of factors that represent outstanding teaching, learning and assessment:

- We are rethinking technical education as T Levels emerge
- We have trialled a new pedagogy, we have experimented, we have taken risks
- We have reflected and systematically analysed findings
- We have worked collaboratively to develop our own professional skills
- We have contributed to developing and evidence-based pedagogy
- We have embraced being a research-informed profession

Additionally, there have been a number of other things that have taken place to move teaching, learning and assessment to outstanding across organisations as a result of the project. In at least three partners CPD events have already taken place to share what PBL is and its potential impact and further events and trials, outside of Engineering and Construction are planned. These move beyond instigating PBL in engineering and construction sectors. In one case a College has started to include references to PBL through its observation system.

What next? (How we plan to continue the work)

All of the partners have expressed the real energy that has been generated as a result of the project and everyone is keen to continue to work together. Even external partners who helped to inform CPD events have said that they are willing to continue to support activity because the impact it has had in trusting teachers and trusting students has been great.

The CPD programme, PBL, experiment, and ensuing deep reflections by practitioners, students and employers has helped prepare practitioners, organisations, partners and employers for T-Level teaching, and developed a potential pedagogy for high quality learning during the work-placement

One take-away message

Indeed the overall sentiment emerging from practitioners and students alike is that great teaching, learning and assessment involves trust!

Project Outputs

The following outputs accompany this case study and are intended to support other organisations build on our approach.

1. 4 Problem-based learning scenarios
2. Poster-stories from four providers
3. Overarching Poster of Project
4. CPD materials to support development of problem-based learning pedagogy

For more information:
Melanie Lanser, melanie.lanser@derby-college.ac.uk
Robin Webber-Jones, robin.webber-jones@derby-college.ac.uk

For further resources and PBL stories, visit our PADLET at:
https://padlet.com/melanie_lanser/njbzbtstiegf