

Self Instructional Slide Pack Resource for CPD.

This resource provides a project overview of the journey for the application of LEAN Management practices in the drive to improve Teaching, Learning and Assessment within the Engineering Department at Reaseheath College.

January 2019



OTLA PROJECT



Programme Aims

- Systematic improvement of teaching, learning and assessment.
- Focus on technical skills teaching.
- To aid the preparation for T-levels
- Centered on cross-provider collaboration.
- Enhancement of employer- provider partnerships.

Working towards outstanding provision for all learners on technical routes

Key Principles

- Enhancing teaching, learning and assessment towards outstanding.
- Focusing on technical skills teaching.
- Implementing and promoting the use of the professional standard.
- Offering peer-led, collaborative development of teaching for leaders and practitioners.
- Creating sector-led solutions to sector defined problems.
- Evidence based, research informed.
- Supporting equality and diversity.



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THE LEAN PROCESS

Reaseheath Engineering





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Explanation of Lean Management

Lean is a customer focused methodology used to continuously improve any process through the elimination of waste in everything you do; it is based on the ideas of “Continuous Incremental Improvement” and “Respect for People.”

There are variants to the process, the one stated below is tailored to the service industry and the one applied to this project.

- Focus on the customer.
- Identify and understand how the work gets done (the value stream).
- Manage, improve and smooth the process flow.
- Remove Non-Value-Added steps and waste.
- Manage by fact and reduce variation.
- Involve and equip the people in the process.
- Undertake improvement activity in a systematic way.

Education has been transformed through a re-designed curriculum based on LEAN principles. Participants have been upskilled in identifying what outstanding teaching and learning may look like from a student perspective.

This has enabled students to apply their learning and be more independent. They benefit from close links with employers through applied initiatives and work placement opportunities.

Context to this project

Overview

- This is an extension project in the application of Lean Management to curriculum development and delivery.
- Lean Management is a technique developed with the aims of minimizing waste and maximizing the value of a product or service to the customer , without compromising quality. This project is testing how we can apply Lean Principles to curriculum planning, teaching and learning.
- It follows on from an employer led Dairy Lean Management Project within the Agricultural Department and the college farm. In this project, Lean management principles were integrated where relevant into schemes of work, protocols developed for practical teaching sessions and further development of work placement for students. The success of this project led to extending the project to test other sectors within FE and also consider its use as tool in the preparation of T-Levels.

Project

- Two members of Reaseheath Academic Engineering staff participated in LEAN Management training. An outcome of the training required the participants to identify a business improvement activity that would lead to an improvement in the quality of teaching and learning through the concept of lean management.
- One of the chosen projects was the introduction of Lecture/Practical structured teaching session for a core engineering subject. This essentially combined all aspects of the teaching required to deliver the skills and underpinning knowledge for a complete unit of study.
- The following slides discuss the strategies, rationale and the core benefits for employers.

Road Map to:

LEAN MANAGEMENT



Step 1

Identify Need
(supported by industry)

Step 2

Train Staff

- Train core staff in Lean principles.
- Provide dissemination CPD to target key areas for development led by trained staff.
- Use core teaching team to develop protocols for new models of delivery for teaching student skills

Step 3

Develop SOW & Resources

- Managers identify staff and subject area to trial new protocol.
- Managers plan new curriculum delivery.
- Trained Staff with wider team develop SOW based on the new teaching protocol.
- Support material is produced to support this mode of delivery.

Step 4

Delivery new teaching protocol to students.

Managers support students and staff, and seek feedback & review performance against college standards.

Step 5

Review effectiveness of Delivery, adapt and plan the next step.

- Review student performance
- Review and adapt protocols.
- Identify new subjects to deploy new protocols.
- Continue CPD to a wider audience.



Key Drivers For Change.

The Department & Industry

- Establishment of new Agri-Technology facility. New equipment, requiring higher level of technical skill e.g. mechatronics, GPS, Driverless technology, Can-Bus, industry standard training rigs.
- Staff specialization, efficiency for staff, quality of subject knowledge- experts rather than jack of all trades.
- More inline with industry expectations. *Which would directly benefit the apprenticeship programmes we provide off-the-job training to.*
- Introduction of the new T-Levels.

The student

- On some programmes the number of learners requiring exam resits were high in some core subjects. – A fresh look at what was happening.
- Consider the learning styles of the majority of our learners and focus on a teaching protocol which embodies experiential learning and the hands on approach. *Learners get it quicker.*
- Balance, cost, flexibility of staff, quality and careful curriculum planning tools



A Fresh Look Using a Systematic Approach.

- Improve what we are trying to do! Through the use of agreed protocols.
- Essentially produce protocols (standard operating procedures) for all processes within Engineering to set agreed standards and ensure consistent delivery.
- Curriculum & technician staff working together as a cohesive team.
- Use LEAN to determine the equipment required to establish an efficient operated engineering workshops. (*7 New Workshops established*)
- Integrate LEAN into schemes of work where relevant and adds value.
- Review and amend *how* we teach –what is excellence from a student perspective?
- New dynamic learning materials – use of new technologies.
- Stimulate increase student engagement - problem based led

Project - Curriculum Development



Concept: Lecture-Practical

- All elements of a unit 352-Repair Land Based Compression Engines outcomes are complete within the workshops environment, to include the underpinning knowledge.
- New delivery 2 full days per week over a 6 week period.
- Individual staff take full ownership of module delivery. (*teaching is not split with the broader team*)

	GLH	Classroom Hrs.	Workshop Hrs.	Staff Involved in delivery
Old Programme (IMI) (previous)	60	12 X 2	10 X 6	3 - 4
New Programme (C&G)	60	-	11 X 6	3

Perceived Benefits of The Lecture-Practical Over The More Traditional Delivery Methods.

- Tutor can drip feed theory into sessions at the appropriate time and better relate to practical applications.
- Learners are better able to contextualize and apply theory to practice.
- Tracking and monitoring of student progress is better managed by subject tutor.
- Teaching of engineering concepts is more dynamic and can be completed in two day teaching sessions.
- More effective use of teaching time - less time spend on refreshers, recaps and reminders of previous sessions. Students were more focused on the task.
- Majority of the learners prefer active teaching sessions where the underpinning knowledge is completed in short break out sessions within the the workshop/practical sessions.
- Learner's note taking were often more informed and valuable to them.

DEVELOP NEW SCHEMES OF WORK

Using Lean principles the Curriculum team worked collaboratively to share best practice in the development of new SOW and operating protocols. The 'Lean Champions' pulled together a team of subject specialists for different subjects and together used lean principles to develop resources. *Staff took a fresh look at what they were doing!*

9x 2 day sessions



Session number / Title	Learning Objectives - what are the students going to learn today?	Learning Activities - what activities will be used to facilitate this learning?	Assessment - how will the learning be assessed?	Workplace & Wider Skills Development (Numeracy, Literacy, Industry Skills, PLTS & PRIDE Values)	Resources & Safeguarding Considerations (including H&S)	Session notes (use this to reflect on session)
1 Single cylinder engines <i>2 day Much + time</i>	1. Component Ident Piston, crank, block, bore, con rod, valves 2. ID D.O.R of crank, and the 4 Stroke cycle, using observation of the valve operation. 3. Setting of engine Timing. 4. Ensuring the correct reassembly of components, to ensure engine rotation is achieved upon completion.	1. Identify the engine configuration, operation and four stroke cycle. 2. Dismantle the engine, as demonstrated, and place labels on each component with its relevant name on, and compare the results with the rest of the group. 3. Rebuild the engine, ensuring the correct timing setting is achieved between the cam shaft and the crank shaft, in order to make sure the valves are driven in the correct order. 4. Learners to determine the four stroke cycle, and engine crankshaft direction of rotation by observing the valve operation.	1. Learners record the dismantling and rebuilding processes on the job card. 2. Learners work in pairs to place the labels on components, this is to be whole group assessed, with Q&A's. 3. Each pair of learners to verbally explain and demonstrate engine rotation and 4 stroke cycle to the instructor, explaining valve operation. 3. Engine turns over correctly	SLR/L1.1 Listen for and identify relevant information from explanations and presentations on a range of straightforward topics. SLR/L1.2 Listen for and understand explanations, instructions and narratives on different topics in a range of contexts. MSS1/L1.2 Read and measure time accurately and use timetables MSS1/L1.3 Calculate using time in familiar contexts. Link to industry and time constraints/money/workshop manager (employability). Complete All tasks PPP, (personal learning & thinking skills). Talk about lesson and departmental ground rules.	Welcome, check attendance, introduces the subject. Badge check and room H&S. Challenge lateness. ① I can deliver both aspects ② Resources are available	
2 Multi cylinder (Top end)	1. Component Ident. (Revision from previous week) 2. Function and purpose of valves, and their operation, identifying a different style of valve drive train, compared to the system identified the previous week. 3. Cylinder head	1. Removal of cylinder head as instructed, laying all components out in order and numbering them, along with valves. 2. Learners observe a demonstration of exhaust and inlet valve removal, measurement of valve stems, guides and cylinder head flatness. 3. Learners then carry out	1. Learners record the dismantling and rebuilding processes on the job card. 2. Tutor observation of measurement tasks to ensure the correct results are being obtained. 3. A verbal explanation to the tutor of the reason	SLR/L1.1 Listen for and identify relevant information from explanations and presentations on a range of straightforward topics. SLR/L1.2 Listen for and understand explanations, instructions and narratives on different topics in a range of contexts. MSS1/L1.2 Read and measure time accurately and use timetables MSS1/L1.3 Calculate using time in familiar contexts. Link to industry and time constraints/money/workshop	Welcome, check attendance, introduces the subject. Badge check and room H&S. Challenge lateness.	

Unit 352: Engine Strip Measure and Rebuild



Example Protocol

Engine strip measure and rebuild.

Unit 352 repair land based compression ignition (diesel) engines.

Objective

Compare engine component wear against manufactures specifications through completing an engine strip, rebuild and measure engine components using measuring equipment.

Scope

The practical task will be completed under the following considerations:

- All engines to be in place and be in working order/ turning over.
- All engines all have correct components in them and nothing is missing
- All engine manual are available before completing the engine strip.

Protocol

- 1) Ensure all engines are in the workshop and are drained of any oil/ coolant.
- 2) All measuring tools have been ordered in adequate quantities.
- 3) Make sure all engines are adequately placed around the workshop and space is given around them to complete the strip and rebuild.
- 4) Place a steel top workbench next to each engine so all components are laid out in order on a table to reduce slip hazards.
- 5) To explain the four-stroke cycle of an engine and what happens on each stroke of the engine.
- 6) Go through each measuring tool and explain how they are used and demonstrate how to use them.
- 7) Turn over all engines making sure they all turn over as they should and explain the importance of this prior to stripping.
- 8) Remove rocker cover
- 9) Remove rocker shaft
- 10) Remove pushrods keeping them in order (Place through cardboard to stop them rolling)
- 11) Remove cylinder head bolts in correct sequence from manufacture's specifications
- 12) Remove all valves out of the head and measure the valve stem and face and record the measurement and compare them against manufactures specifications
- 13) Remove cylinder head gasket and explain its function and how they could fail.
- 14) Remove engine sump
- 15) Remove conrod end caps keeping them in order to the conrod they were removed from.
- 16) Remove piston. Check bore ovality by using a cylinder bore gauge and record findings in engine measurement booklet and compare them against manufactures specifications. Do the same on all four cylinders.

Unit 352: Engine Strip Measure and Rebuild



Example Protocol

- 17) Measure piston height check using DTI gauge and compare them against manufactures specs.
- 18) Measure piston ring wear and gap through using feeler blades
- 19) Measure crankshaft end float and using a DTI and compare against manufactures specs.
- 20) Measure crankshaft wear using plaster gauge.
- 21) Record all measurements in engine booklet and record on whether the engine is serviceable or not.
- 22) Complete engine rebuild using service manual and rebuild in accordance to manufactures specification.
- 23) Check that all components is rebuilt correctly and all components are put in the correct place with correct torque settings in accordance to manufactures specifications.

Data to be collected

Engine measurements and serviceability of engines.

Risks

RISKS	CONTROL
Slips trips falls	All tools and components are to be placed on table so reduce the tripping hazards.
Manual handling	To use correct lifting techniques and make sure path way is clear.
Confined space	Work to space provided and make others aware if anything is going to be moved or rotated
Finger trapping	Us use correct techniques for moving objects and communicate with others in group
Sharp edges	Wear gloves and correct PPE
COSHH	Wear barrier cream or gloves and use granules on spilt oils on the floor.
Correct use of tools	Use the correct tools for the correct job to reduce any injuries.

Materials

- 5 x JCB Triple 4 engines
- 5 x JCB Triple 4 Engine Manuals
- 4 x Halfords tool trolley
- 1 x Wooden tool trolley from stores
- 5 x work benches
- 5 x micrometre
- 5 x Vernia callipers'
- 5 x Torque wrenches
- 5 x DTI

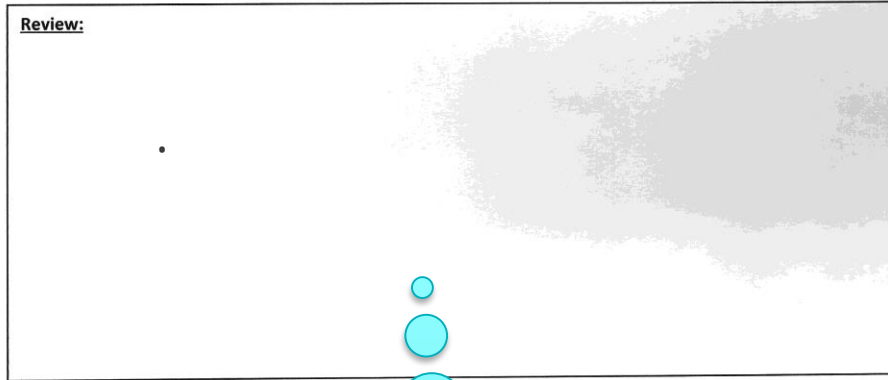
Unit 352: Engine Strip Measure and Rebuild

- 5 x Piston ring clamp
- 5 x Valve spring compressors
- 5 x Feeler Blades
- 5 x Oil cans
- 5 x Plaster Gauge
- 5 x Gear pullers
- 5 x Pry Bars
- 5 x step down sockets

Other relevant protocol

Manual handling

Spark ignition



Learners review their achievements and through agreement can adapt the protocol to suit their future needs.



Example Protocol

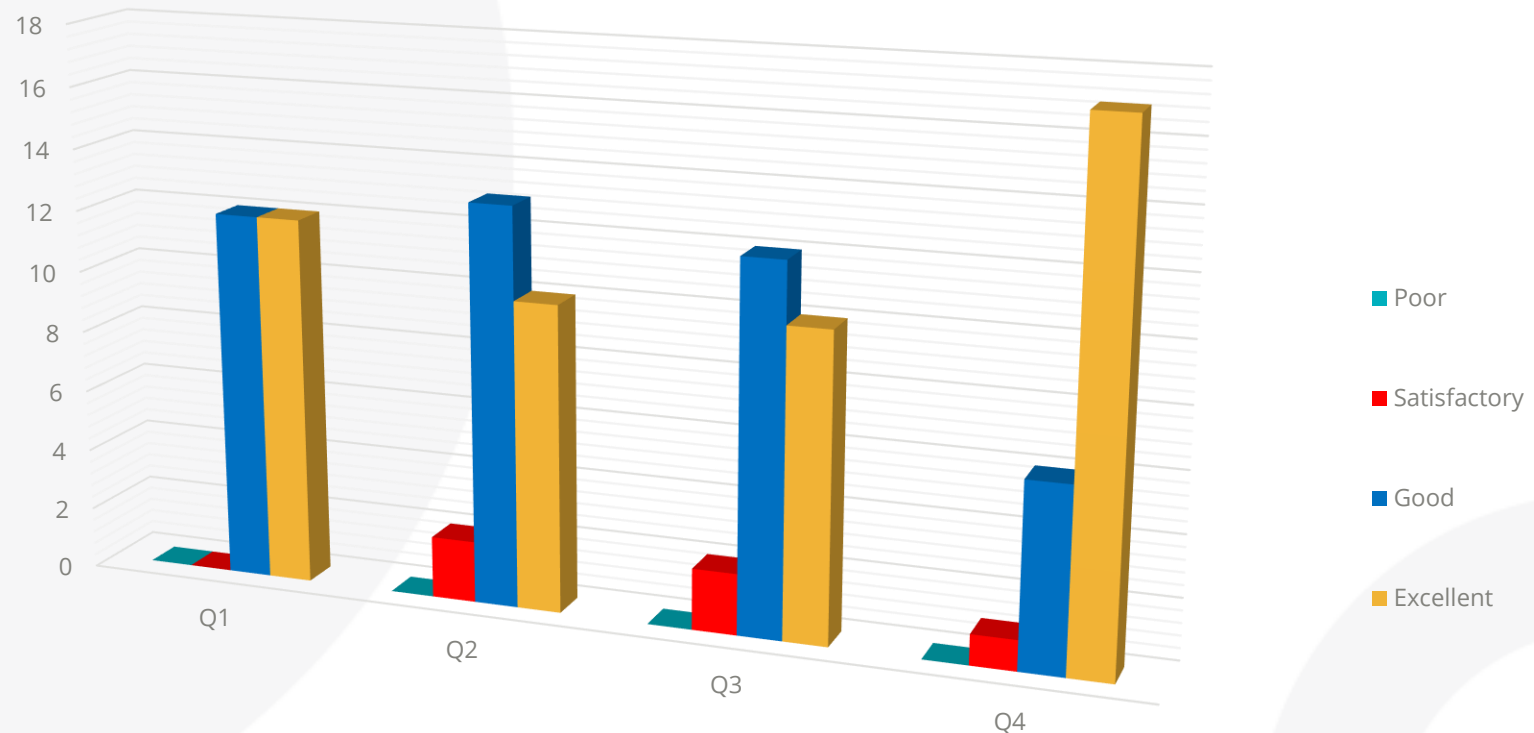


LEARNERS POINT OF VIEW

- 'We learn the theory whilst doing the practical, it seems to make more sense.'
- 'I prefer to learn this way'
- 'The protocols has helped to give us a structure to work to and what's needed to complete the job'.
- ' The job sheets are really great, I know exactly what to do and how, so there is much less hanging around waiting to be given a job.'

A survey was completed to measure the learner satisfaction rates for the delivery of the Lecture-Practical. By combining both the good and excellent responses it clearly demonstrates that learners enjoyed and prefer this style of lesson. The data is set out in the table below.

Learner Feedback for the Delivery of the Lecture-Practical Lessons



Survey Continued.....

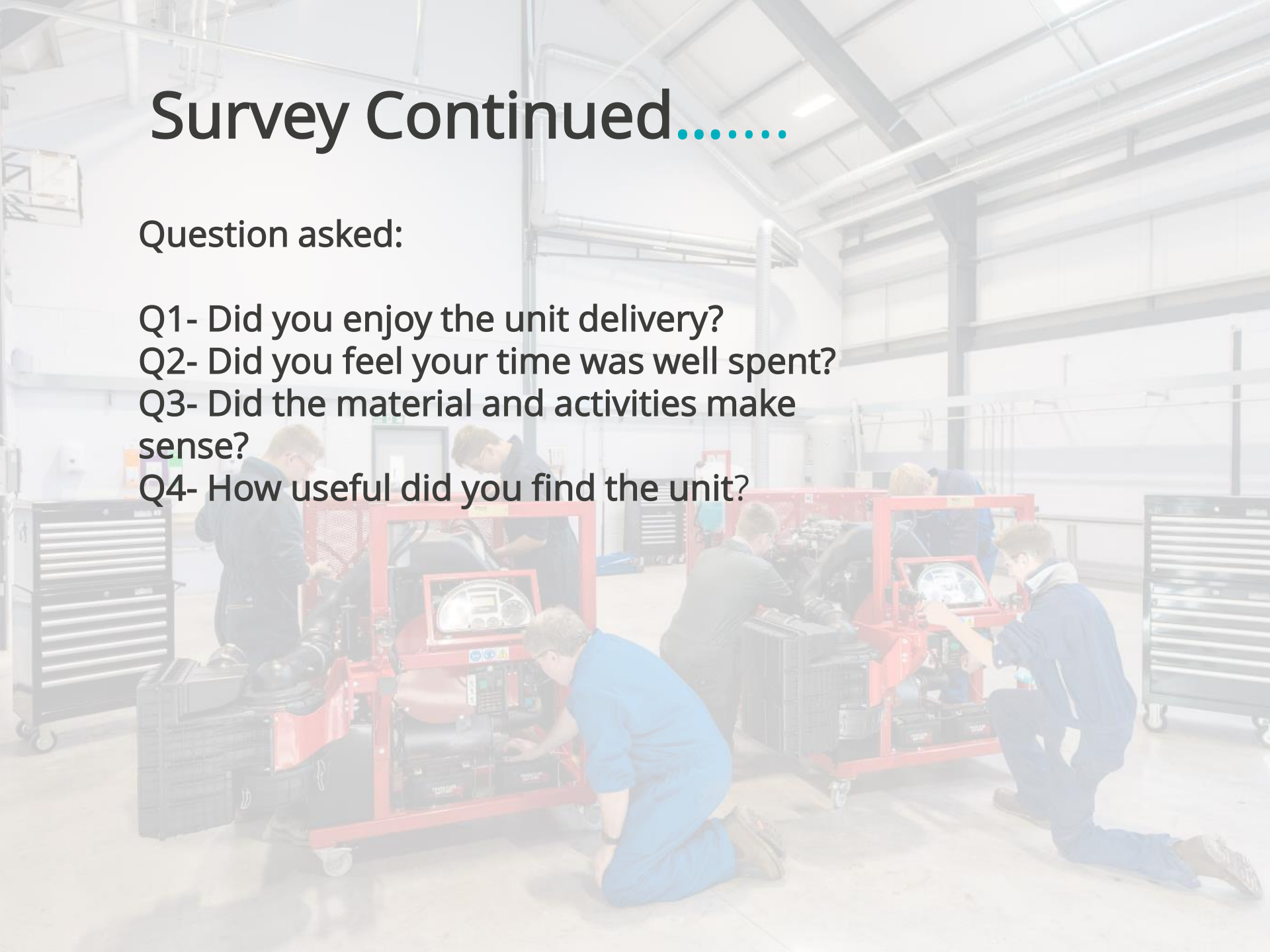
Question asked:

Q1- Did you enjoy the unit delivery?

Q2- Did you feel your time was well spent?

Q3- Did the material and activities make sense?

Q4- How useful did you find the unit?



PRACTITIONERS POINT OF VIEW...



- 'I feel that the lecture- practical are better as I have ownership of the unit and can be more flexible on the how its delivered'
- 'the students prefer it as they feel they are able understand it better as they are viewing the components in front of them while it is being delivered.'

Reflection and Lessons Learned



- Through the use of the LEAN management process, all teams are now better prepared for the introduction of the new T-Levels. Looking at a new initiative through the eyes of a LEAN practitioner will provide partners with the tools to objectively design an efficient and learner-focused curriculum. The Lean methodology provides a different way of working to achieve the best value for the product or service (learner). When applying Lean to curriculum, an essential component and focus in the design, is working towards outstanding teaching and learning. This should be used as a benchmark. The participating teams and their respective departments now collaborate at a greater level, which is leading to quality improvements.
- Using the LEAN process as a tool to re-design the training delivery of Engineering subjects has led to an increase in levels of participation and understanding by learners. The lecture-practical delivery was clearly preferred by learners.
- The project timing was not fully aligned with the academic year. In this project, the evaluation of the teaching and work placement projects were a challenge, because the LEAN project was completed in January. The ability to observe and report on outcomes in early January would only provide an initial indicator, which would necessitate further analysis.