4.1 Lesson Planning Assessment

TEACHING SESSION PLAN	
Module: *Statistics and Experimental Design (STAT08011)*	**Level:** ***8*** **Year: 4**
Duration: 2 *hours - 6:30pm to 8:30pm*	*Wednesday the 3rd April '19*
Title of session/ topic: *Design of Experiments (DOE)*	
Mark the type of session: **Lecture ☐✓** **Tutorial ☐** **Lab ☐** **Studio ☐** **Workshop ☐**	

Module Outcome (What module outcome(s) is the class/session aligned to)**:**

Learning Outcome No.3, 4 and 5 from the Module Descriptor:

3. Design and manage the execution of experiments to gather data.
4. Evaluate and interpret experimental data (with the use of a statistical package).
5. Explain how to set up and interpret a Design of Experiment (DOE)

Class/Session Outcomes : Upon completion of this session, you should be able to: (Share with students e.g. Write on board /slide/ project image at beginning of lecture for students)

1. *Complete the analysis of a two factor, full factorial experiment on Minitab.*
2. *.Understand the important steps in planning and carrying out a Design of Experiment (DOE).*
3. *Successfully answer the DOE related questions on the past exam paper.*

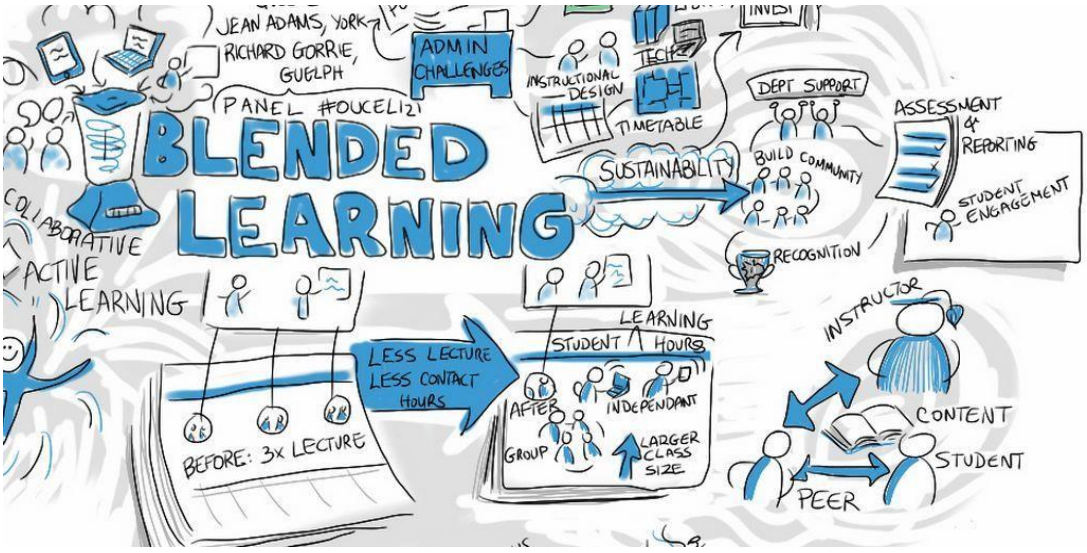
Select & Prioritise Your Content:

For the session, decide what material is used in class and what material the students should study independently and/or online. To do this, think about the material and its relative importance and prioritise and list in the appropriate quadrant.

	Independent Learning – Teacher led	Independent Learning – Student led
Priority (Need to know)	**1** *The lecture will follow the class lecture notes on DOE on my Statistics for Experimental Design Moodle page.* *Use of my industry experience to guide exam question and discussion of practical application of DOE.*	**2** In advance – flipped classroom *Read the DOE notes on Moodle* *Go through the notes from the DOE Workshop* *Spend time on Minitab getting familiar with the DOE commands on Minitab.*
Supplementary Learning (Nice to know)	**3** *Read: Design and Analysis of Experiments (Springer Tests in Statistics), Angela Dean, 2017.*	**4** *Students have been advised to talk to colleagues in their workplace who have worked on a Design of Experiment to get some practical*

Material in quadrants <u>1 and 3 typically become the focus during classes</u>. Quadrants 2 and 4 represent material students could study themselves and use the VLE/Moodle and online learning objects to support this learning.

Think about how you might incorporate *Technology Enhanced Learning Tools and Blended Online Learning Objects,* that will develop students learning and engagement with the module.



Teacher Activity (what you will do during the class):	**Student Activity** (what students will do during workshop/lecture):
Stage 1: 0 to 30 mins. *Ask open ended questions to recap on the class activity in the previous lecture and the learning outcomes.* *Review the past exam question that was worked on by the group in the last lecture.* ***Stage 2: 30 - 60 mins.*** Introduction of the new elements of DOE using the class lecture notes on PowerPoint and the Minitab statistical analysis package. Set up the students working in teams on answering the next DOE exam question from the past exam paper. Walk around to each team checking for clarity on question to be answered. ***Stage 3: 60 to 90 mins.*** *Do a debrief of the exam question, by asking the student for the answers they used for the exam question and documenting the best model answer on a Word document by taking the best elements of all the students answers.* *This document will be shared on Moodle as a reusable learning object.* ***Stage 4: 90 to 120 mins.*** *Lead discussion on how the DOE material we have covered in this lecture and the information from the exam question could be applied in industry. This provides a recap on the learning objectives for the lecture and highlights to students how much knowledge they now have on the topic and how to apply it.* *Outline the topics for the following week's lecture.*	***Stage 1: 0 to 30 mins.*** *Students to answer the questions that I am asking and encourage them to ask any questions about what they may not fully understand before moving on to the new exam question for this lecture.* ***Stage 2: 30 - 60 mins.*** Ask questions on the new material to consolidate understanding. Use printed lecture notes, and Minitab to answer the past exam question, the students get to put into practice the theory and the Minitab analysis they have just learned. This lecture takes place in a computer lab. so the students can type up a model answer of the exam question as they are working on it in their teams. Save the document their GMIT OneDrive as an exam revision tool. ***Stage 3: 60 to 90 mins.*** *Students to offer their own opinions as to the best answers and use information from fellow students as an opportunity for peer learning.* *Ask questions of anything needing clarification.* *Debate or question answers different to theirs until the class come up with a model answer to the question.* ***Stage 4: 90 to 120 mins.*** *Students to share their experiences on the issues relating to DOE that were discussed in this lecture and to determine how this would actually work in practice in their companies.* *This will give the students the opportunity to demonstrate their knowledge and comprehension of the topics covered in the lecture and to ask for clarification of the correct use of the tools in the workplace. The students will leave the lecture with the confidence that they have achieved the learning outcomes of this lecture and should be able to put the DOE topic into practice if they have the opportunity in their workplace. Students are clear on the expectations and plan for the following week.* 

Online Student Engagement Tools:

All my lecture notes and Minitab notes are on my Statistics for Experimental Design Moodle page. I have also placed the past Exam Paper from May 2018 on the Statistics for Experimental Design Moodle page for easy student access and to encourage engagement and practise of the past exam paper as a study and revision tool.

All students have been given access to Minitab 18 on their home or work PC so that they can stay engaged with this statistical package and practise it outside of lectures.

On the Statistics for Experimental Design Moodle page, there are data sets for Design of Experiments so that students can download a data set and practise doing the statistical analysis of a DOE that they have learned in this lecture.

Teacher Reflection: What worked?

The lecture worked very well, the students could really see the benefit of the use of DOE after the work related discussion with input from students working in several different companies. I also gave them my examples and experience of using DOE to improve processes in the medical device industry.

Students are always happy to work on past exam questions in class in preparation for their exams, with the safety net of the lecturer there to guide them. What worked particularly well was the class activity of creating the model answer, rather then me giving them the model answer, the students between them came up with the best answer as a combination of all their answers so they now have a really good revision tool for their exams. This was excellent peer learning in action. The students left with a good understanding of a difficult topic and the added bonus of having successfully answered an exam question. There was a nice balance of academic and practical application in this lecture.

What did not work?

Some of the students who are not currently working in a technical role in their workplace and they did not see the immediate opportunity for applying the DOE knowledge at work. I pointed out that they would not be in the same role for ever and that this is a tool that is widely used in industry and they might get the opportunity to use it in a future role.

To what extent did you address different domains of learning?

The three domains of learning are:
1. Cognitive: mental skills (knowledge)
2. Affective: growth in feelings or emotional areas (attitude or self)
3. Psychomotor: manual or physical skills (skills)

Cognitive: mental skills (knowledge):

The Cognitive Domain of learning was addressed with the delivery and absorption of the lecture content – the students received new knowledge about designing of experiments. Students were able to Identify and distinguish between the different types of factorial designs that are best suited to a particular experiment. Comprehension and application of the new knowledge was demonstrated by the completion of the exam question. They were able to draw conclusions from the experimental data. The discussion on the use of DOEs in the work place allowed the students to evaluate where they could apply this knowledge and practical skill in their workplace.

Affective: growth in feelings or emotional areas (attitude or self):
The Affective Learning Domain involves our feelings, emotions and attitudes. In completion of the exam question in their groups, the students had to listen to others point of view and acknowledge which was the best answer in the group. In the class exercise of creating the model answer, the students compared their answers to others and respectively explained why some answers were better than others and why.

Students participated in the class discussion of the application of DOE in the workplace. This gave the students a chance to question and discuss the applicability of the DOE concepts to their workplace and help them to them in context and embed the understanding of them.

Psychomotor: manual or physical skills (skills):

The psychomotor domain is concerned with utilising motor skills and coordinating them.
The students had to organize the large volume of material into a clear concise exam question answer. They had to construct a DOE on the software Minitab which had to be designed according to the criteria outlined.

What would I do differently next time?

Overall, the lecture worked very well and the students, in their teams demonstrated knowledge of the learning outcomes and successfully completed the exam question task in the allocated time. Next time, I would ask the students to work on the exam question first, on their own, and then in a team in order to simulate the exam experience more realistically (answering the question on their own). Though this can be off-putting and demotivating to a student if, working on their own gets stuck at the beginning of the question. Depending on the class size, I can usually spot this and work with that students to give them the scaffolding to get through the section that they are having difficulty with.

Thanks to my Statistics and Experimental Design class for agreeing to have an observer in their class on the 3rd April 19.

Thank you to James Corbett for doing the Peer Observation of this lecture for me.

Regards,

Rachel