Lesson Plan 2021-11-19

Fractional Factorial Design

Peer reviewed

TEACHING SESSION PLAN	
Module: Design and Analysis of Experiments	**Level / Stage (6,7,8) - 9** **Year: 1**
Title of session/ topic: **Length of session: 1h**	
Mark the type of session: **Lecture** ■ **Tutorial** ☐ **Lab** ☐ **Studio** ☐ **Workshop** ☐	
Module Outcome (What module outcome(s) is the class/session aligned to)**:** **3. Design, analyse and interpret the results of the fractional factorial design** **Class/Session Outcomes:** Upon completion of this session, you should be able to: 1. Know how to construct $2^{(k-p)}$ fractional factorial design 2. Know how to analyse $2^{(k-p)}$ fractional factorial design 3. Know how the analysis of variance can be extended to fractional factorial experiments. 4. Know how to check model assumptions in a fractional factorial experiment. 5. Understand the benefits of using fractional factorial experiments.	

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.

	In Class or in a Live Online Class (Support Learning)	**Independent Learning (student completes on their own)**
Priority (Need to know)	1 Definition of fractional factorial design, model assumptions in a factorial experiment and benefit of using.	2 Practice code presented in the lecture to design and analyse fractional factorial design.
Supplementary Learning (Nice to know)	3 Sample size decisions for fractional factorial experiments	4 Read supplementary literature and research papers

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/Digital Learning Objects*, that will develop students learning and engagement with the module.

Explanations:

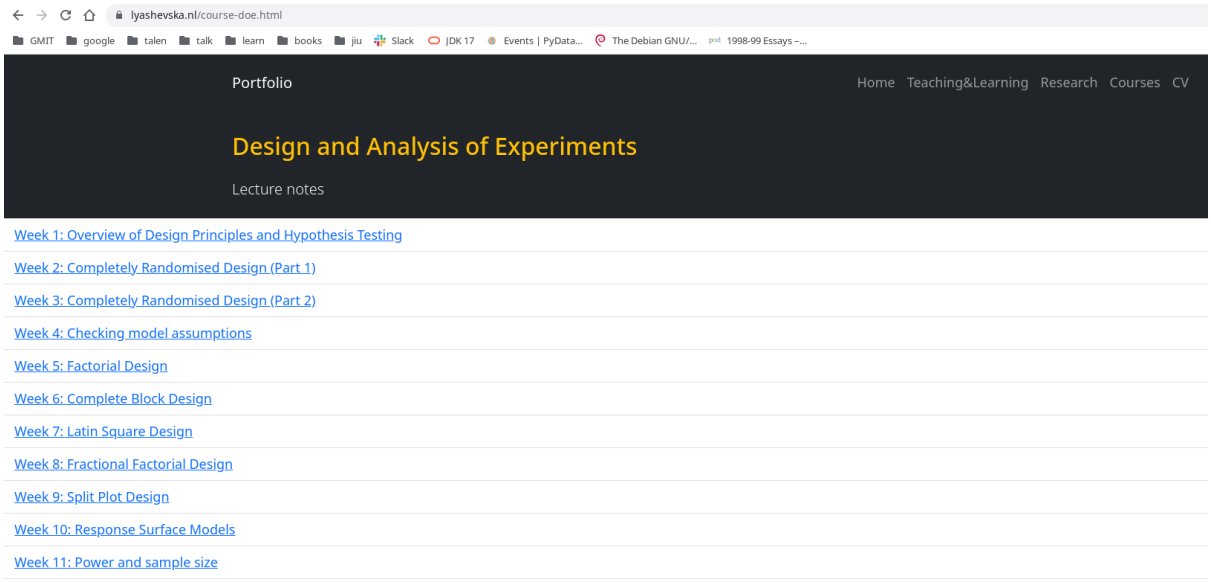
RStudio is a cross-platform integrated development environment (IDE) for the R statistical language.
Class materials are designed as an interactive html presentation.

Time/Lesson Stage	Teacher Activity	Student Activity	Resource Used
Stage 1 0 - 10 min	Welcome, ask if there are any questions	Open/download materials, ask questions	Moodle, html presentation
Stage 2 10-25	Revision of factorial design, its principles, advantages and disadvantages.	Listen and ask questions	MS Teams, html presentation
Stage 2 25 - 35 min	Definition and basic principles of fractional factorial design	Engage by giving examples and code along	MS Teams, RStudio
Stage 3 35-55 min	Practical assignment - construct $2^{(k-p)}$ fractional factorial design	Practice code presented in the lecture	RStudio
Stage 3 55 – 70 min	15 min break		
Stage 4 70 – 90 min	Analysis of $2^{(k-p)}$ fractional factorial design	Practice and ask questions	MS Teams , Rstudio
Stage 4 90 – 115 min	Analysis of variance and checking model assumptions	Application of model assumptions checks to fractional factorial design	MS Teams , Rstudio
Stage 5 115-120 min	Adress any questions/ queries, difficulties	Ask questions (if any), potentially one on one.	MS Teams

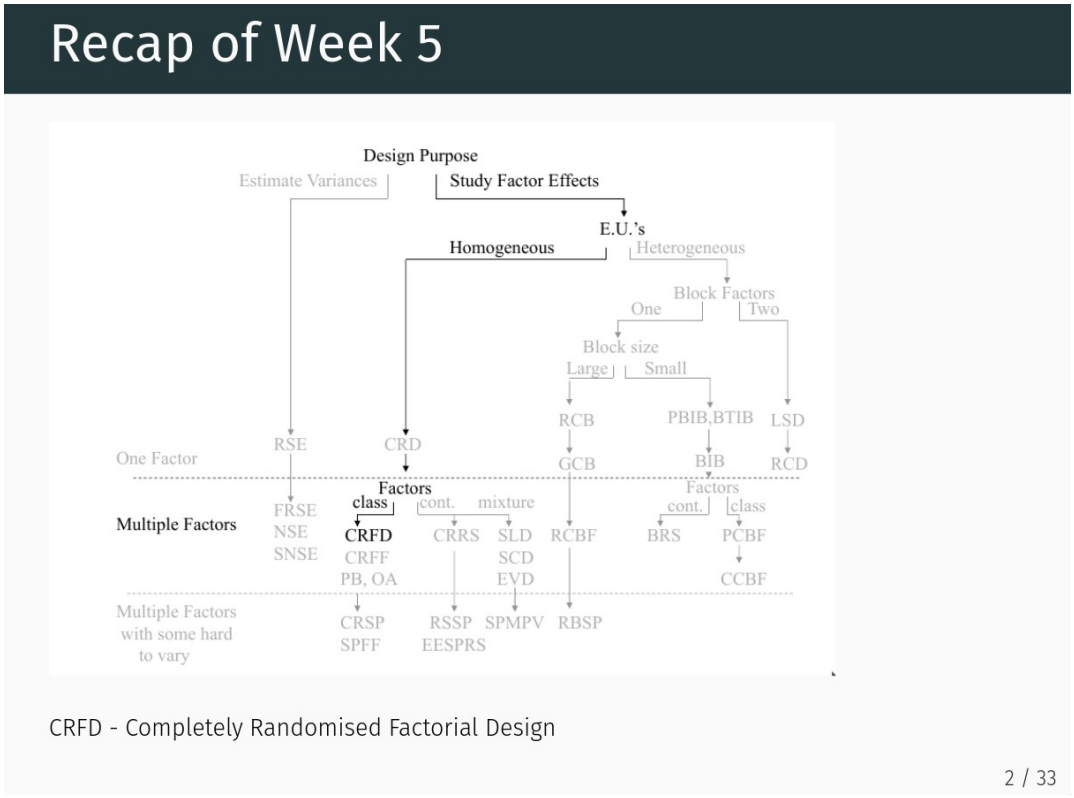
Teacher Reflection:

What worked well?

This module runs in the evenings. It is specially designed to accomodate working students. They can easily access and navigate all materials via dedicated website in their own time. All materials are available well before the class to accomodate different needs. Many students watch it asynchroniuosly hence group work is limited but it makes it easier to call all students by the names.



I start by recaping materials of the previous week by using a diagram which helps students to structure their knowledge and relate to what they have already learned.



Because it is a small group students usually engage well and are not shy to speak on microphone and express verbally their questions/concerns.

Link to the materials: https://lyashevska.nl/course-doe/2021/lectures/week8.html#1

What did not work well?

Limited opportunities to organise students in groups, since many students attend lectures asynchroniously.

I fail to request ideas for future evaluations/assessments and do not use classroom aps which may enhance students experience. For example, quick MS polls can be used more frequently to collect answers.

To what extent did you address different domains of learning?

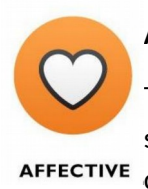
The lecture addressed to some extent all three domains of learning according to Bloom's taxonomy: cognitive domain (knowledge), psychomotor domain (skills) and affective (attitudes).

Cognittive domain:

Students applied knowledge from the previous lectures to the new material - e.g. checking model assumptions and model validation used in factorial experimental design were transferred to the fractional factorial experimental design. Live coding along with me helped students to process information and understand and intepret learned informations. Students demonstrated ability to apply learned material in new situation.

Psychomotor domain:

Students develop the ability to convert learned response into habitual actions through regular coding practices. First I demonstrate what needs to be done so they can observe and copy my actions by imitating.



Affective domain

This domain includes appreciation, enthusiasm, motivation, and attitude. Examples are: students listened lecture and responded by asking questions and participating in discussions or following directions when they are asked to do an exercise.

Image source: Fig 1 from M. Enamul Hoque, Three Domains of Learning: Cognitive, Affective and Psychomotor The Journal of EFL Education and Research (JEFLER) Volume 2 Number 2 September 2016: ISSN-2520-5897

What would I do differently next time?

I would be more aware of offering students the opportunity to provide ideas for future evaluations and assessments. I would use more classroom aps to enhance students experiences and diversify tools. For example, quick MS polls can be used more frequently to collect answers.

I would also like to consider including all three learning domains at high level e.g. in affective domain not just receiving and responding, but also valuing, organising and characterising. Students are lifelong learners, diversity of levels helps to make this process more effective and enjoyable.