

Lesson Plan 2022-28-04

Data Analysis in Sport&Exercise Science (Part 2)

Peer reviewed

TEACHING SESSION PLAN	
Module: Foundations of Human Movement	Level / Stage (6,7,8) - 9 Year: 1
Title of session/ topic: Length of session: 1.5h	
Mark the type of session: Lecture <input checked="" type="checkbox"/> Tutorial <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Studio <input type="checkbox"/> Workshop <input type="checkbox"/>	
Module Outcome (What module outcome(s) is the class/session aligned to): Learn to analyse and visualise biomechanical data using Python librarier (Pandas and Matplotlib) Class/Session Outcomes: Upon completion of this session, you should be able to: 1. Understand the fundamentals of the Pandas library in Python and how it is used to handle data 2. Learn how to work with dataframes and apply knowledge to an example biomechanical data using dynamic notebooks 3. Learn how to use the groupby, merge, and join methods in Pandas 4. Understand basics of data visualisation and how Matplotlib can be used	

Select & Prioritise Your Content:

	In Class or in a Live Online Class (Support Learning)	Independent Learning (student completes on their own)
Priority (Need to know)	1 Fundamentals of the Pandas and Matplotlib library in Python and how they are used to handle data	2 Work through the Jupyter Notebook notebook to learn how to use the groupby, merge, and join methods in Pandas
Supplementary Learning (Nice to know)	3 Working with dataframes and applying knowledge to an example biomechanical data using dynamic notebooks	4 Read supplementary literature, documentation provided.

Time/Lesson Stage	Teacher Activity	Student Activity	Resource Used
Stage 1 0 - 10 min	Welcome, ask if there are any questions from the previous lecture	Access materials via Moodle and Github, ask questions	Moodle, Jupyter Notebook, Python
Stage 2 10-25	Fundamentals of the Pandas library in Python and how it is used to handle data	Listen and ask questions	MS Teams, Jupyter Notebook
Stage 2 25 - 45 min	Basics of data visualisation with Matplotlib	Engage by giving examples and code along	MS Teams, Jupyter Notebook, Python
Stage 3 55-50 min	5 min break		
Stage 3 50 - 80 min	Practical assignment	Practice code presented to analyse sample problems and creating interactive plots	Jupyter Notebook, Python
Stage 4 80 - 90 min	Wrap up reflecting on LO		MS Teams

Teacher Reflection:

What worked well?

Student engagement – I have engaged one of my PhD students to deliver a part of the lecture in order to give her opportunity to gain teaching experience. On the picture (Figure 1) below Madhuri is teaching an introductory lecture to Level 9 students.

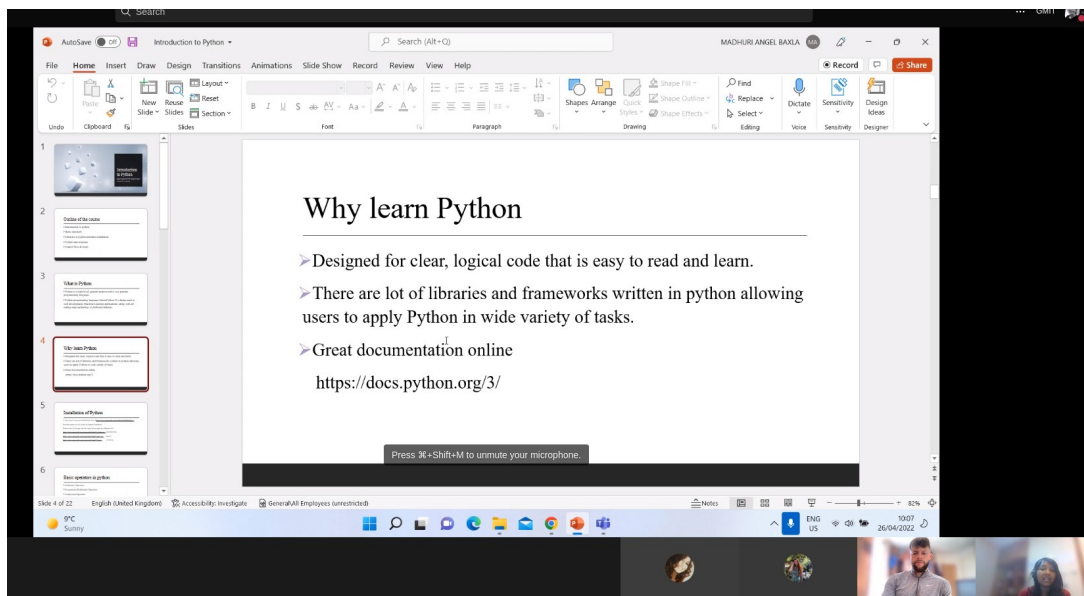


Figure 1: Student Engagement – student teaching a lesson

Using Jupyter Notebooks as a *digital reusable learning object* worked really well. They also allow students to engage effectively with the materials presented while completing interactive tasks. Jupyter Notebook is a software tool which supports learning (<https://jupyter4edu.github.io/jupyter-edu-book/>). Jupyter notebooks belong to the Project Jupyter which is a broad collaboration that develops open-source tools for interactive and exploratory computing. It is a platform to use in the classroom, to develop teaching materials, to share lessons and tutorials. Notebooks are documents containing text narratives with images and math, combined with executable code (many languages are supported) and the output of that code. Jupyter Notebooks allow to engage students. A screenshot of the notebook used in class is shown on Figure 2.

Data Visualisation using Python - Matplotlib



Matplotlib is a library for producing publication-quality figures. It was designed from the beginning to serve two purposes:

- allow for interactive, cross-platform control of figures
- plots make it easy to produce static raster or vector graphics files without the need for any GUIs

It gives a complete control over the appearance of the plots, while still being very usable through a powerful defaults system.

[Some examples](#)

```
In [43]: # import matplotlib
# print(matplotlib.__version__)
# print(matplotlib.get_backend())
```

Learning Objectives

1. Learn the fundamentals of Python's Matplotlib library and its main features
2. Customize objects in Matplotlib
3. Create multiple plots in Matplotlib
4. Customize plots in Matplotlib (annotations, labels, linestyles, colors, etc)
5. Understand the different plot types available

Class Outcomes

1. Students have basic knowledge of Matplotlib library
2. Students are able to produce appealing plots

```
In [42]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

Pyplot

Figure 2: Digital Reusable Learning Object - Jupyter Notebook

More information on using Jupyter Notebooks in education can be found here:

<https://jupyter4edu.github.io/jupyter-edu-book/notebooks-in-teaching-and-learning.html>

<https://www.epfl.ch/education/educational-initiatives/jupyter-notebooks-for-education/>

All class materials are accessible interactively via Github (a code repository <https://github.com/lyashevskya/python-for-biomechanics>) as shown on Figure 3. This repository was created in collaboration with a PhD student.

Lack of student engagement was one of the peer reviewer's comments from the first semester. I believe this time I have managed to reflect on it and address effectively while planning this lesson.

Finally, material was presented in 2 lessons of 45 minutes on 2 different days. This was a good decision and worked really well.

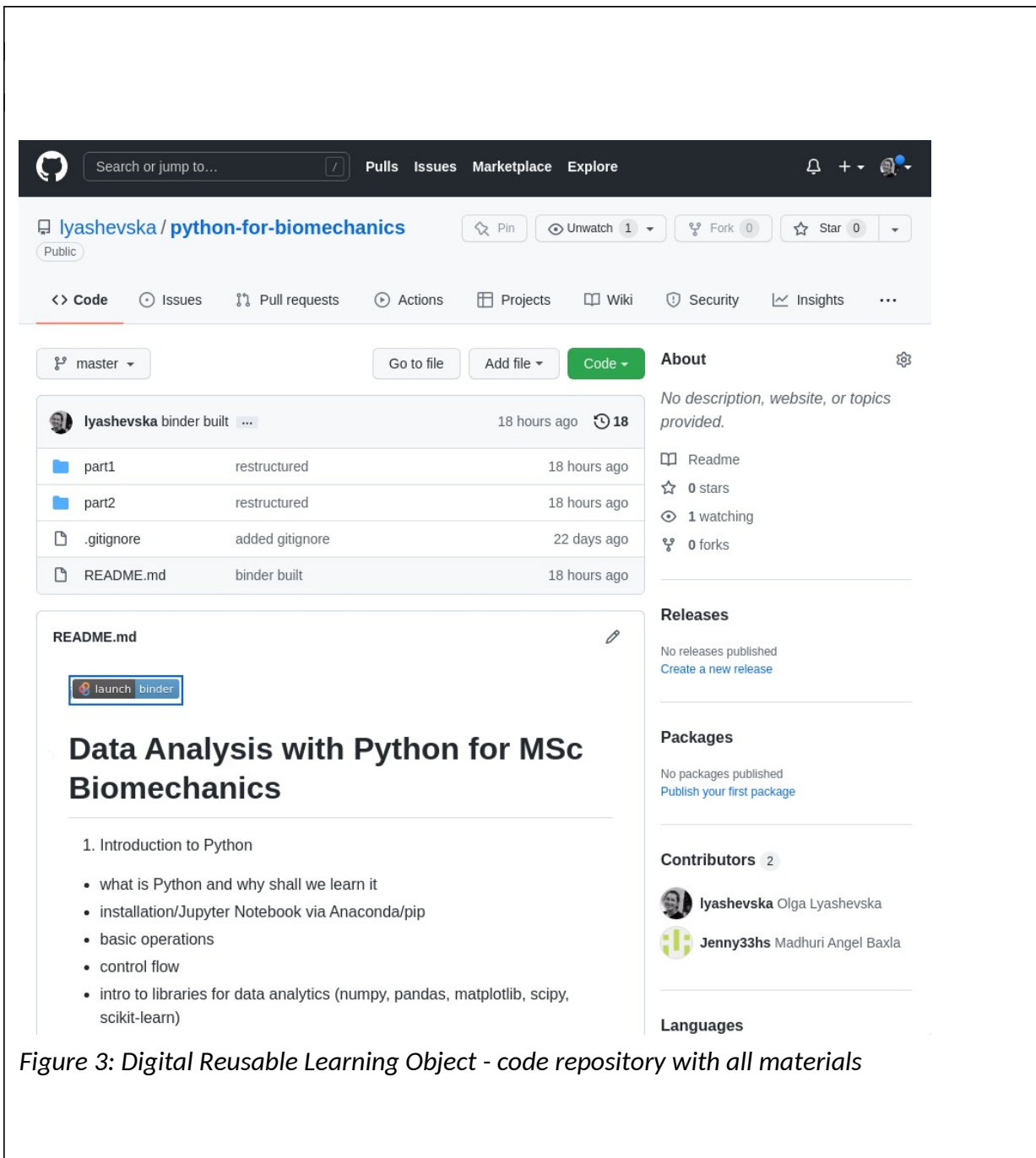


Figure 3: Digital Reusable Learning Object - code repository with all materials

What did not work well?

Small number of students (3 out of total of 5) limited options in terms of group work. Content was delivered asynchronously, some of the students were working through the materials at a later time. Also this was an optional lesson which was not assessed and was introduced to give students an overview of possibilities with data analytics. Some of the students were therefore less motivated.

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).



Cognitive domain:

In the second lesson students applied knowledge from the first lesson and reinforced it. Live coding helped students to process information and understand and interpret learned informations. Students demonstrated ability to apply learned material in new situation.

COGNITIVE



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.

PSYCHOMOTOR



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.

AFFECTIVE

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 like to introduce an assessment element.

I would 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.