Health Information Engineering Workshop Handbook

2021

This handbook applies to the *Health Information Engineering* workshop run in the year 2021.
We reserve the right to make changes to this document at any point

Contents

1 Key contacts

Workshop tutors

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2 Workshop overview

The workshop aims to introduce participants to the modern software development process using the Agile software methodology which is now widely used for general project management in addition to software projects. Enterprise software is usually created by a team of people, rather than individuals. Working on such projects collaboratively using modern tools and processes is vital for ensuring good quality, well tested code that is delivered on time in small end-to-end slices that build up key functionality gradually. This is done through short iterative cycles (Sprints) of requirements gathering, building and testing through to review and deployment. Figure 1 provides an overview of this process which involves doing just enough and just in time activities, including: planning, designing, building, testing, reviewing and releasing small incremental chunks of working code that add value to the customer. The rapid process allows for early testing and course correction of a project.

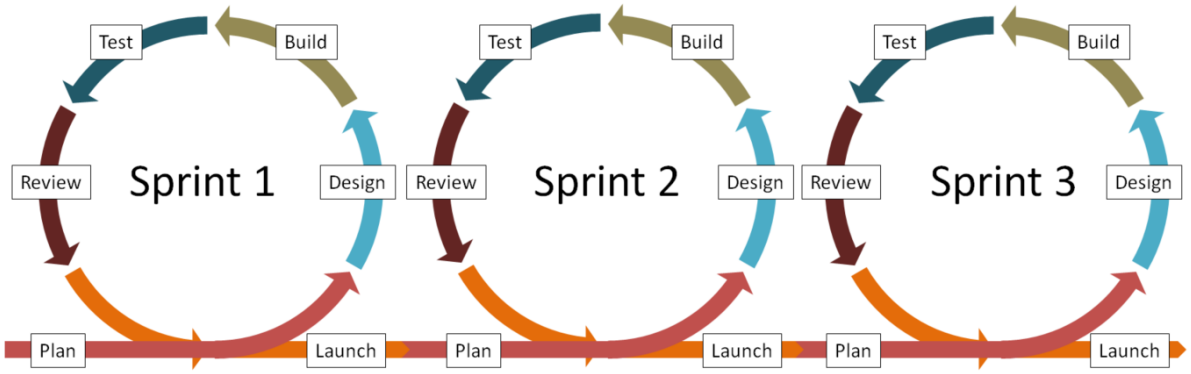

Figure 1: The iterative cycles (sprints) of an Agile project

This workshop aims to provide participants with an opportunity to experience this process by creating a modern software system in the form of an interactive dashboard that visualises prescribing data. This allows participants to take part in front and back end development, taking data stored in a back-end database and processing this to display it in a meaningful way via a web-based front-end (figure 2) using a full software stack and software project management tools.

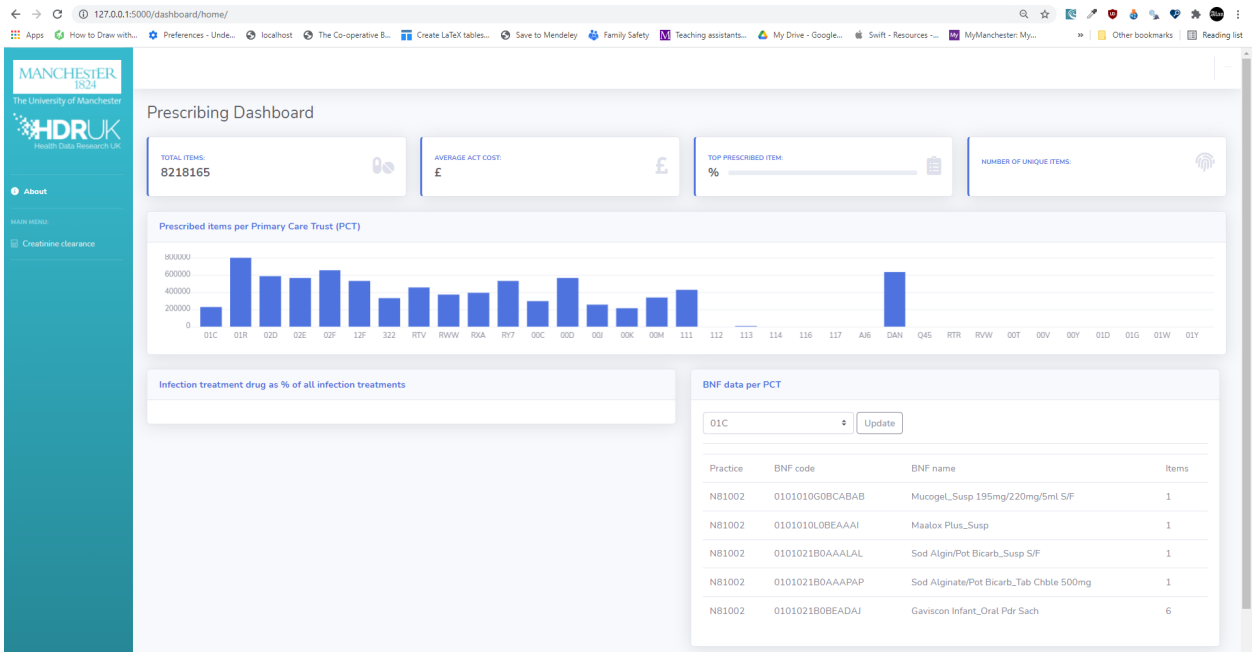

Figure 2: Skeleton dashboard provided to workshop participants

3 Target audience

Digital transformation in health and social care operates at different levels of maturity from extending existing EHR (Electronic Health Record) systems to developing stand-alone digital initiatives driven by demand. The majority of these digital systems and technologies are driven by software. This workshop aims to span the various traditional silos exposing participants to the end-to-end process of modern software engineering by giving them hands-on experience working on a software project applying the Agile software methodology. The workshop is aimed at people interested in learning about coding, software development and managing software projects. This includes professionals such as health analysts, informaticians, data scientists, clinicians wanting to make use of available data, and managers interested in digital transformation. Participants do NOT require any prior knowledge or experience of programming, databases of software development to take part.

3.1 What will I get out of the workshop?

- You will experience a taster of the technologies, terminology and processes used in modern software development allowing you to better understand and communicate with developers in future projects
- You will learn the fundamentals of programming with Python, databases with SQL and web-development
- You will learn how to go from data processing with a database, through the data engineering process to displaying data in an interactive dashboard from scratch
- You will learn about software testing and test driven development, code coverage and writing test suites
- You will be introduced to topics around data security when designing bespoke systems
- You gain hands on experience using a version control system (Git) to manage and collaborate on a software project
- You will experience using the Scrum framework (part of the Agile software development methodology) to manage a modern software project

4 Aims and learning objectives

4.1 Aims

The workshop aims to provide participants with hand-on-experience of a software development project applying the Agile software development methodology (specifically the Scrum framework). We also aim to expose participants to a range of collaborative and project management tools for modern software development, communication and project management tasks.

4.2 Learning objectives

The key Learning Objectives (LOs) for the workshop are described in table 1.

Outcome category	**Participants should be able to:**
A. Knowledge and understanding	***LO1:*** Describe the key stages used in the Scrum framework ***LO2:*** Critically discuss different database management technologies ***LO3:*** Explain the role of version control systems in systems quality assurance and longer term maintainability of software ***LO4:*** Describe key aspects of data security (e.g. encryption, consequences of data breaches, designing secure systems)
B. Intellectual skills	***LO5:*** Design data input validation tests ***LO6:*** Critically appraise different software design processes ***LO7:*** Evaluate different database types and their suitability for storing different types of data based on requirements
C. Practical skills	***LO8:*** Apply a range of open access software tools to project management, communication and collaboration for software projects ***LO9:*** Create a series of SQL statements to extract data from a database system ***LO10:*** Develop software using a range of programming languages (e.g. Python, JavaScript) ***LO11:*** Develop a web-based 'front end' ***LO12:*** Build a test suite for a software project ***LO13:*** Apply version control to collaborate on a software project
D. Transferable skills and personal qualities	***LO14:*** Develop a system for a clinical team ***LO15:*** Work through the problem-solving cycle ***LO16:*** Experience 'team science' to solve problems collaboratively ***LO17:*** Develop an analytical problem solving mind-set ***LO18:*** Develop programming skills in a variety of programming

	languages

Table 1: Workshop learning objectives

5 Key topics

The workshop covers a set of topics briefly described in table 2:

Topic	Description
Programming/coding skills	Introduction to programming covering the Python language. An introduction to core web technologies (HTML, CSS and JavaScript)
Databases	Different types of database, how to model data, extract data from a database by writing 'queries' with SQL (Structured Query Language). Integration of databases with modern languages using Object Relational Mapping (ORM)
Version control systems	Introduction to version control with Git for collaboration and maintenance/sharing of software projects
Software engineering methodologies	Using Agile to manage a software project. Wider issues of software design and development
Data security	Technical and legal aspects of data security when developing systems

6 Workshop structure

The module has two main parts (figure 3). The first part introduces participants to the workshop via an introductory webinar. Participants can then work through a set of videos and interactive self-directed materials that introduce the fundamentals of programming with Python, relational database management systems with SQL and core web technologies.

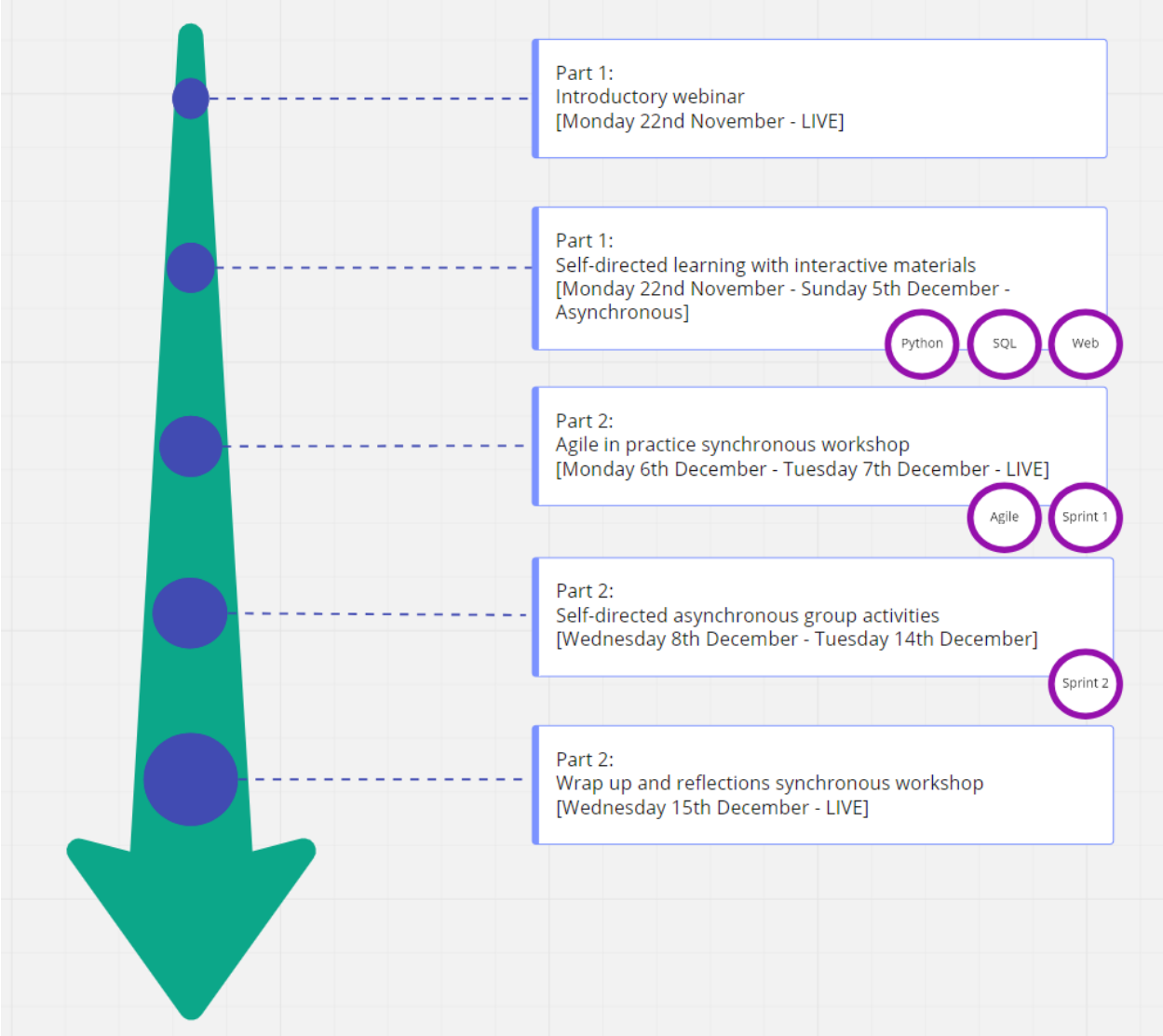

Figure 3: Workshop 'roadmap'

The second part of the workshop brings participants together in groups to work on a software project (prescribing data dashboard) using the Agile Scrum framework.

6.1 Workshop dates

- Introductory webinar & release of self-directed learning material: Monday 22nd of November (11:00-12:00)
- Workshop live session (day 1): Monday 6th of December (10:00-17:00)
- Workshop live session (day 2): Tuesday 7th of December (10:00-17:00)
- Workshop live session (day 3): Wednesday 15th of December (10:00-13:00)

Please note all times given are UK time.

6.2 Workshop outline

All 'live' sessions are delivered via Zoom. Participants are given some time (2 weeks) from the introduction/welcome webinar to work through the self-directed materials. This ensures that participants start at the same baseline for the group work portion of the workshop. The live sessions of the workshop run for two and half days so participants can experience the iterative nature of Agile project management by taking part in 2 mini Sprints. The first 2 days are back to back and provide the background and support with facilitated group work to develop the first Sprint. Individual groups can choose which task(s) they pick for the second sprint depending on their ability and interests. This allows them more time to work on the second sprint before the final half day which reviews the work and discusses challenges, culminating in a reflection on learning points.

	Day 1: Monday (6th of December 2021) Online via Zoom	**Day 2: Tuesday (7th of December 2021)** Online via Zoom	**Day 3: Wednesday (15th of December 2021)** Online via Zoom
10:00 11:00	Introduction to workshop, Agile and Scrum framework	Front end development	Introduction to data security
11:00 11:10	***Break***		
11:10 12:00	Introduction to dashboard and dataset, release Sprint 1	Testing and Test Driven Development (TDD)	Sprint 2 - review and discussion
12:00 13:00	***Lunch***		Workshop wrap up - What the future looks like - Summary and reflection on learning
13:00 14:00	Scrum sprint planning	Scrum sprint review and retrospective	
14:00 15:00	Clinic to help setup development environment Sprint 1 - group work	Sprint 1 - group work	
15:00	***Break***		

15:10			
15:10 16:00	Continue Sprint 1 group work	Sprint 1 - group work	
16:00 17:00	Group Work, summary and end of day wrap up	Sprint review and reflections Release Sprint 2 tasks	

6.3 Workshop resources (learning material)

The workshop is supported by a set of self-directed learning resources in the form of videos and interactive digital notebooks.

6.3.1 Videos

The following short bite-sized videos from HDRUK's Health Information Engineering curriculum provide a relevant introduction to some of the core components covered by the workshop:

- Core web technology: HTML
- Core web technology: CSS
- Core web technology: JavaScript
- Modern databases RDBMS with SQL
- Unit testing: Software product testing
- Web applications: Jupyter notebooks
- The Scrum Framework
- Introduction to Agile Software Development and Project Management Methodology
- Agile in Practice: Requirements Gathering

6.3.2 Digital notebooks

As participants have varying abilities and backgrounds, we have provided a set of interactive digital (Jupyter) notebooks (figure 4) that allow participants to engage in self-directed learning. These notebooks cover introductions to:

- Programming with Python
- Databases with SQLite
- Web technologies (HTML, CSS and JavaScript)

The notebooks contain explanatory material about the related topics with embedded code that can be run and altered. They also contain tasks where a model answer can be toggled on and off allowing participants to check their code/solutions.

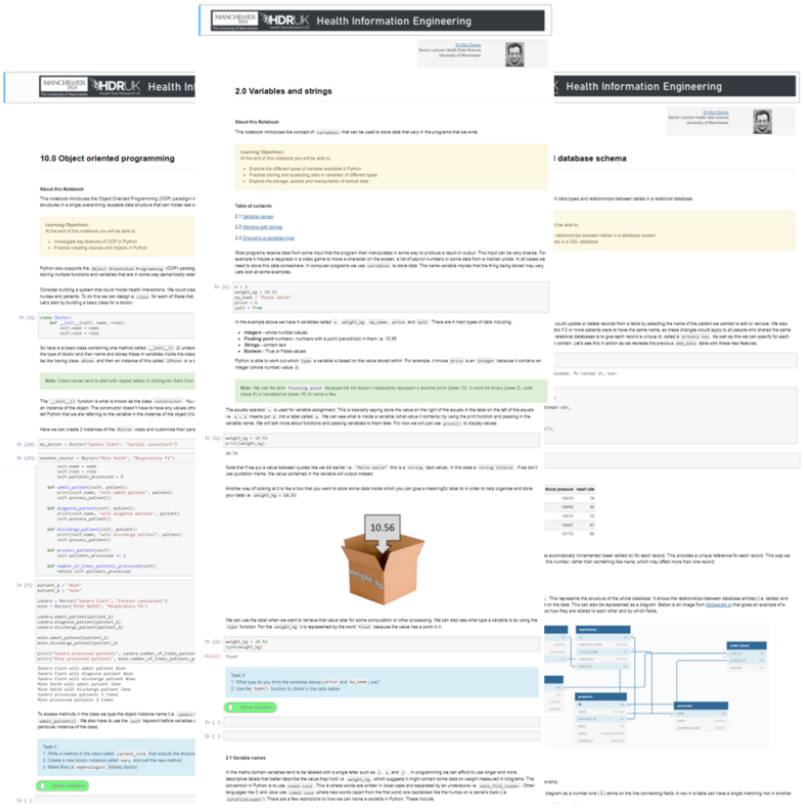

Figure 4: A subset of the self-directed interactive digital notebooks

7 Requirements of participants

This workshop is aimed at people that are eager to develop technical skills and will be able to devote time outside of the live sessions to group work and self-directed study. Participants should have access to, and the ability to use a machine (laptop/desktop etc.) for the workshop. This will require being comfortable with and have admin permissions for downloading, installing and managing software on their machine (e.g. Git, Python anaconda, Slack, Trello). The workshop requires a high degree of group work simulating an Agile team, so participants should be comfortable with the idea of carrying out group work, including between the first two days and the final half day. Finally we expect participants to respect each other and the workshop tutors and act in a professional manner at all times during the workshop.

8. Who will you learn with?

The workshop will be delivered by experienced teaching staff from the University of Manchester who have, among other projects; delivered machine learning training for the Topol digital fellows and developed the FutureLearn MOOC “AI for Healthcare: Equipping the Workforce for Digital Transformation”.

Dr. Alan Davies	Dr. Iliada Eleftheriou
Senior Lecturer in Health Data Science, Programme director Clinical Data Science	Lecturer in Healthcare Sciences
Alan is a former software engineer/app developer in industry and more recently a Research Software Engineer (RSE) at the University of Manchester supporting researchers by developing software. Alan has qualifications in Computer Science (PhD) and was a former cardiac nurse as well as having a formal qualification in teaching in higher education. Alan is the module lead for several units teaching programming and data modelling/databases as well as developing usable systems using co-design and user centered design principles. Alan is also involved in workforce development contributing to the Faculty of Clinical Informatics core competency framework and leading on the development of the upcoming AI and Digital Healthcare capability framework with Health Education England.	Iliada has a background in computer science (PhD). She now specialises in health informatics and socio-technical factors affecting data landscapes and is a digital consultant at The Christie Hospital. Iliada works on projects involving the feasibility of embedding new digital tools into large and complex environments and developing infrastructure to support the data science pipeline. Iliada also works as a data engineer as part of Greater Manchester’s integrated care record, supporting teams to carry out studies to help tackle the Coronavirus pandemic.
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