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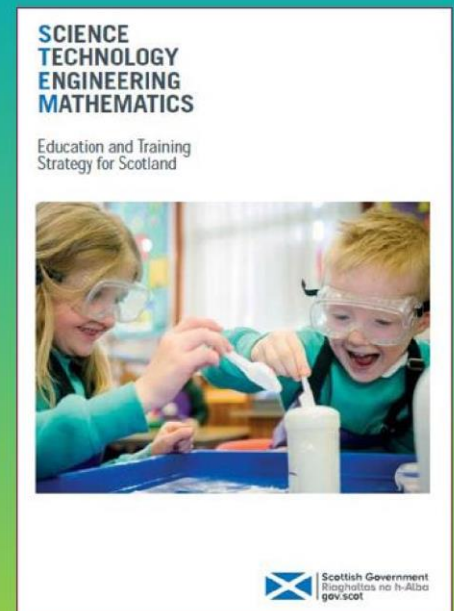
For Scotland's Learners, with Scotland's Educators

SCIENCE
TECHNOLOGY
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Working with Data
The ABCs of Noteable workbook

CONTINUOUS LEARNING MATERIAL FOR COMPUTING SCIENCE TEACHERS FOLLOWING THE SQA CURRICULUM FOR COMPUTING SCIENCE

Requirements if this is your first time using Noteable

Before making use of the materials described in this workbook, please make sure that you have done the following to gain access to Noteable:

1. Access supporting service Documentation: https://noteable.edina.ac.uk/documentation/   2. Access supporting video playlists for Schools using Noteable:
https://studio.youtube.com/channel/UCKhcyiuFyq8xTUlg_DpKIlA/playlists

3. Review the template Data Protection Impact Assessment available for teachers, schools and Local   Authorities: https://blogs.glowscotland.org.uk/glowblogs/digilearn/2021/08/11/noteable-dpiainformation/

4. Request access to Noteable from your Local Authority, **if access has not already been approved**

5. Once the request is approved, Noteable is available as an Application through the GLOW App Library.

If you are an independent school, please contact your local GLOW officer or the Scottish Council for Independent Schools.

Welcome to this introductory guide on using computational notebooks and data with Noteable.

In this workbook, you will find instructions and information on the following:
1. Definitions of Noteable service components for GLOW users
2. Noteable, computational notebooks and accessing the service
3. Introduction to Python in Noteable for teaching the Scottish Computing Science curriculum
4. How to launch a Jupyter notebook with Noteable for teaching in Python
5. How to launch an RStudio notebook with Noteable for teaching in R
6. Available resources for Python and R in GitHub
7. Accessing Available Coding Resources for use with Noteable Accessing Available Coding Resources for use with Noteable using +GitRepo in Noteable
8. Available External Resources for Python, R and Noteable

1. Definitions and further information:

Authentication: authentication within the Noteable service refers to the ability to provide access to a subset of users for a specified customer. Authentication is pluggable, supporting a number of authentication protocols. For schools in Scotland, authentication takes place through the GLOW system.

Documentation: the documentation made available to schools online via www.noteable.edina.ac.uk/Documentation or such other web address notified by EDINA to the Subscriber on an ad hoc basis, which sets out a description of the Service and the user instructions for the Service.

EDINA: a centre for digital expertise, based at the University of Edinburgh as a division of the Information Services Group providing the Noteable service.

Git: software for tracking changes in any set of files, usually used for coordinating work among programmers collaboratively developing source code during software development. Its goals include speed, data integrity, and support for distributed, non-linear workflows (thousands of parallel branches running on different systems).

GitHub: a provider of Internet hosting for software development and version control using Git. It offers the distributed version control and source code management functionality of Git, plus its own features.

Jupyter notebook: Jupyter notebooks are an open-source web application that facilitates the creation and sharing of documents that contain live code and supporting commentary in the form of an explanatory text. It is a platform that can be used throughout the academic process to organise an articulate elements of a teaching and learning workflow where programming and/or data analysis are involved. The Jupyter notebook web application is open source and supports interactive data analysis in over 40 programming languages.

Learning Management System: the web-based platform used by teachers to access Noteable. For teachers and students in Scottish school accessing Noteable, this will be through the GLOW system App Library.

**Service**: the Noteable service provided by EDINA, the University of Edinburgh

User ID: the unique identifier or username provided by a school for each individual Authorised User.

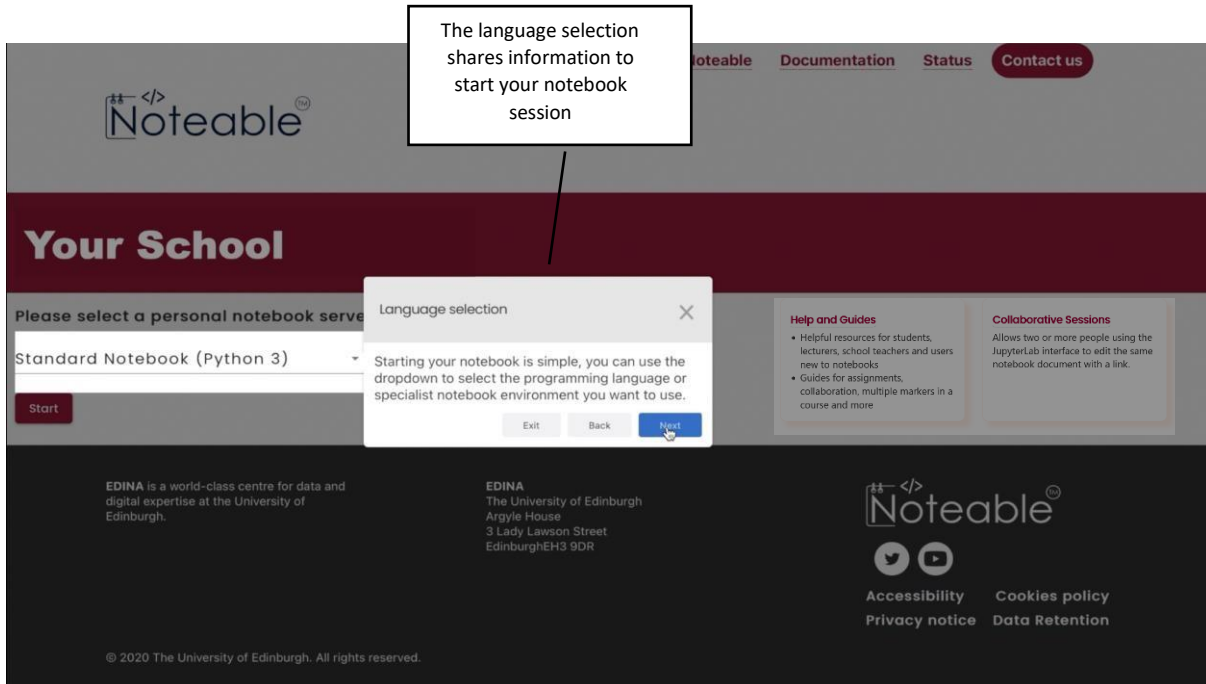## 2. Noteable, notebooks and teaching

Noteable is a platform that adopts Jupyter notebooks and expands upon this open-source technology to write code and explanations in that allows for a Jupyter notebook file to be saved as an '.ipynb' file format, with additional features to help you in your teaching of computing science topics and other topics that include the Python and R programming languages.

Once you have accessed Noteable, you will have access to environments for coding activities, explanations, showing input and output, visualisations and more combined in one file and place. With Noteable, your files are saved online, and can be accessed any time by authenticating into GLOW and launching Noteable in the App Library.

If it is the first time you access Noteable, you will see this virtual guided tour screen of the service:
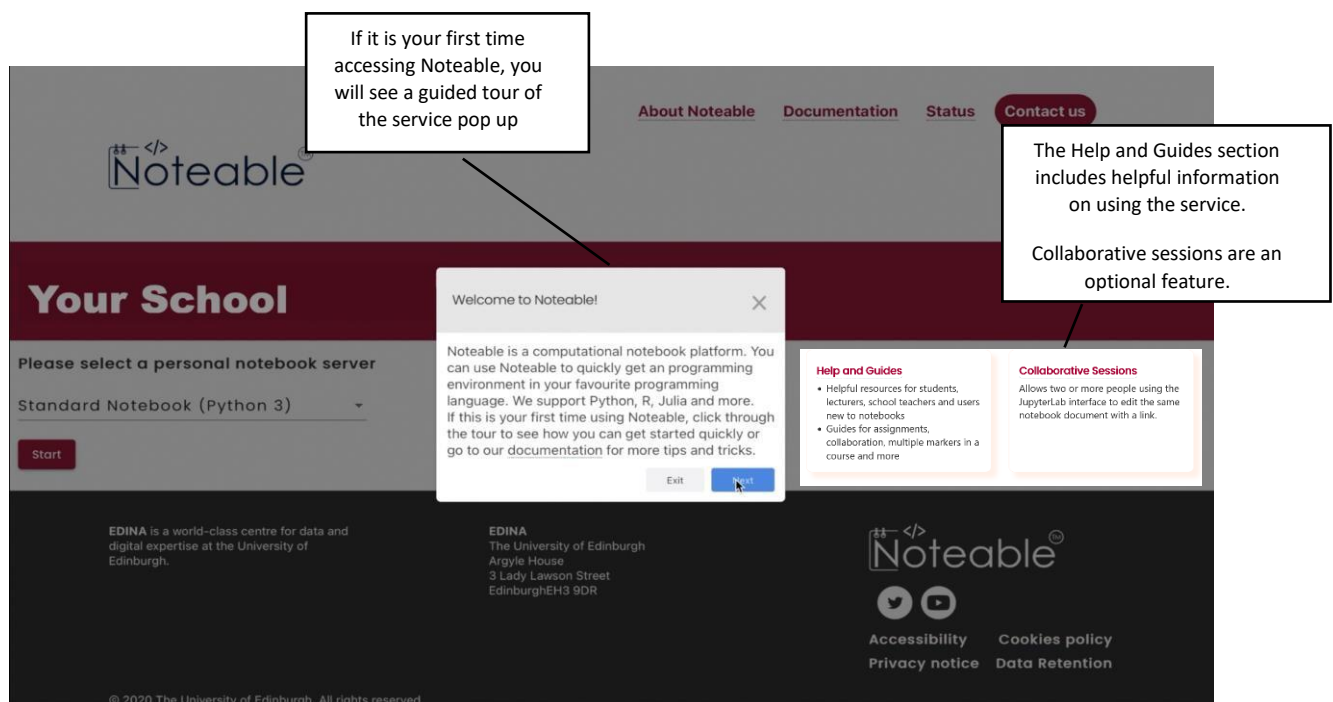
You will then be able to select a notebook server from the drop-down menu. The Standard Notebook on Noteable will be the default selected notebook when you first launch the service. You can go ahead and click 'Start' if you would like to launch to Standard notebook server, alternatively if you would like to choose another server, such as RStudio, you can select a different notebook server from the dropdown menu.

The language selection shares information to start your notebook session

If you are looking to use Python on Noteable, select the default 'Standard Notebook'. The section below outlines some of the characteristics of Python as a programming language in Jupyter notebooks on Noteable.

3. Introduction to Python in Noteable for teaching the Scottish Computing Science curriculum

Python is an increasingly popular programming language.

Python can be used to code for a variety of reasons, including on a server through web applications such as Noteable, or on a server to create web applications!

It was created by Guido van Rossum, and released to the public in 1991.

Python can be used for:

- Learning general programming tenets,
- web development (server-side),
- software development,
- mathematics,
- system scripting.

Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc) and has a simple syntax similar to the English language.

Python has syntax that allows developers to write programs with fewer lines than some other programming languages.

Python runs on an interpreter system, meaning that code can be executed as soon as it is written. This means that prototyping can be very quick.

Python can be treated in a procedural way, an object-oriented way or a functional way.

4. Accessing Available Coding Resources for use with Noteable

Noteable includes a button that allows you to collect data from an external source on the internet and import it into Noteable. This feature works with Github, a provider of Internet hosting for software development and version control, including the ability to organise files such as Jupyter notebooks and R files that include teaching and learning materials.

To import Pyhon and R files into Noteable using Github, you can use the '+GitClone' button available on Noteable when you access a Jupyter notebook environment. When you have uploaded data into Noteable using this method, the data is stored on your Noteable user profile throughout the duration of access to Noteable, unless you delete data. Guidance on how to do this is provided below.

Alternatively, you can also work on materials locally on your device, and upload them to Noteable using the 'Upload' buttons available on the Jupyter notebook and RStudio user interfaces.

How to import data from Github on Noteable:

1. Launch Noteable through GLOW
2. Access a 'Standard Notebook' in Python 3 from the dropdown menu
3. Click on the '+GitClone' button from the Noteable service dashboard
4. Insert the link to Github for the desired data to import in the blank field for 'Git Repository URL' in the pop-up tab, remove any pre-existing text in remaining fields.
5. Click on 'Clone', this will import all data from the specified Github repository

To import teaching and learning content for Python and RStudio, please use this URL in the pop-up tab: https://github.com/edina/Python-and-RStudio-school-resources

Available Resources from EDINA for Python, R and Noteable on GitHub

This repository serves to host the teaching and learning content: **https://github.com/edina/Pythonand-RStudio-school-resources**

This repository is for coding activities developed in Jupyter notebooks and RStudio using the Noteable platform (www.noteable.edina.ac.uk) for Scottish teachers and learners. It includes the following materials:

Jupyter notebooks for Python in the Scottish Computing Science Curriculum:

1. About the Python Lab
2. Computer Programmes
3. Algorithms
4. Flowcharts

5. Sequence, Selection, Iteration
6. Printing Messages
7. Inputs and Variables
8. Maths
9. If Statements
10. Loops
11. Lists
12. Functions
13. Activites and Solutions (from across all the notebooks above)

This repository also includes a sample of activities that can be carried out in RStudio for Statistics Higher and Advanced Higher. These activities can be referred to as classroom materials or independently. The topics these RStudio activities cover include:

1. Using comparative boxplots
2. Using standard deviation
3. Correlation and regression, choosing an appropriate model
4. Testing Hypotheses

Reference Attributions & Available Resources for Python, R and Noteable

Attributions

This workbook and exercises included in the Python and RStudio resources alongside this workbook include content adapted from a number of sources with creative commons licenses open to share and compatible with the **Creative Commons Attribution 4.0 International License** for these resources.

The copyright for these materials is attributed to © Education Scotland.

The Python Workbook has been adapted by material developed by Geek Tutorials and Timothy Bateup, a Teacher in the Australian Noosa District.

RStudio activities have also been adapted by classroom materials shared with EDINA by Education Scotland's Mathematics & Numeracy Officer.

References for Python

- Callysto Lesson Plans, including lesson plans to solve a variety of problems (including TED-Ed Riddles) using Python code in Jupyter notebooks. For each problem, there are three resources:
  - Teacher lesson plan (how to introduce and teach the problem) ○ Teacher Jupyter notebook (including instructions)
  - Student Jupyter notebook

Link to resource: https://www.callysto.ca/lesson-plans/

- An online starter's guide to Jupyter Notebooks: https://www.analyticsvidhya.com/blog/2018/05/starters-guide-jupyter-notebook/ • Markdown for Jupyter notebooks cheatsheet, including information on how to format Markdown cells in Jupyter notebooks.

Link to resource: https://www.ibm.com/docs/en/watson-studio-local/1.2.3?topic=notebooks-markdown-jupyter-cheatsheet

- IBM guidance on using Jupyter notebooks: https://www.ibm.com/docs/en/watsonstudio-local/1.2.3?topic=data-notebooks
- Python W3 Tutorials: https://www.w3schools.com/python/

References for R and RStudio

- Hands-on programming with R: https://rstudioeducation.github.io/hopr/basics.html#summary

- R W3 Tutorials: https://www.w3schools.com/r/