PDST
Professiona Deve opment Service for Teachers | An tSeirbhís um Fhorbairt Ghairmiúi do Mhúinteoirí

An Roinn Oideachais
Department of Education

LEAVING CERTIFICATE
COMPUTER SCIENCE

National Workshop 3

Schedule

Session 1	Introduction to Data Analytics and ALT2 (Investigate)
11.00 – 11.30	Tea/Coffee
Session 2	ALT2: Plan and Design
13.00 – 14.00	Lunch
Session 3	Python libraries, NCCA resources and Curriculum planning

Learning intentions

By the end of the day, participants will have…

Deepened their understanding of data science and ALT2

Worked in groups to develop an ALT, including approaching datasets

Enhanced their understanding of the Investigate, Plan, Design and Create stages of the Design Process with particular focus on ALT2

Considered their next steps in relation to Curriculum Planning

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Session I

Introducing data analytics and ALT2 (investigate)

Overview of the Session

Part 1	Introduction to data analytics
Movement Break	
Part 2	Introducing ALT2
Movement Break	
Part 3	ALT2 Investigate

Section I

Introducing data analytics

“Data is the new oil”


Too often, we sort of bow
to the grey hair,

Reflection: data science/data analytics

What **words** do you associate with data science/data analytics?

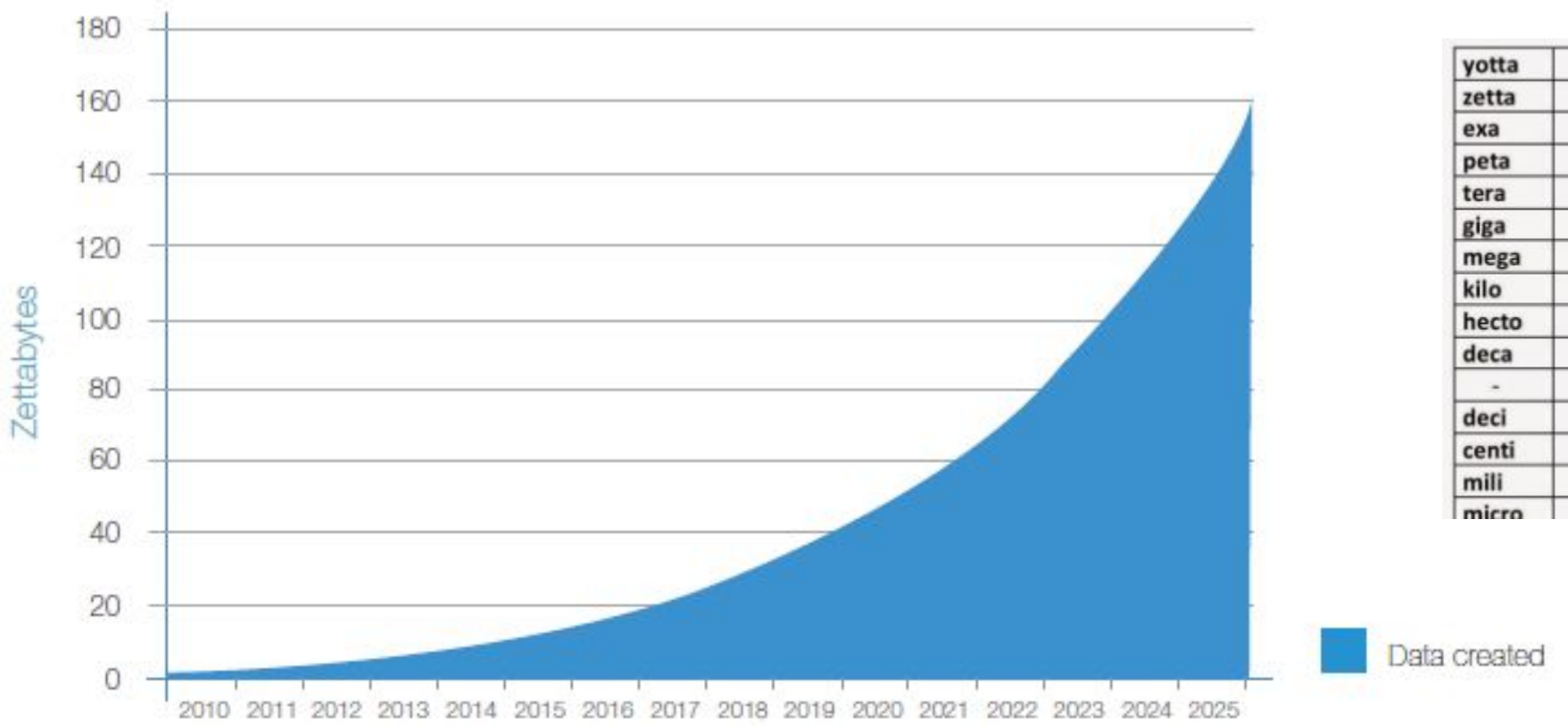
Go to menti.com and enter the code:

2365 6876

Enter three of your words.

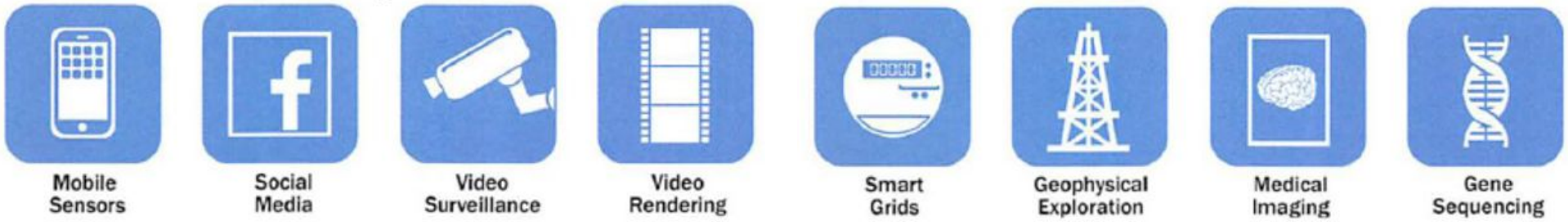

decision making
collecting
interpreting data
big date
consumer behaviour
information
crossreference
gathering
range
data
database
graphs
algorithm
prediction
programming
analysis
spreadsheets
min
facebook
process
max
data mining
mean
trends
analyse
big brother
big data
36038813
visualisation
influencing
data streams
velocity
feed the monstor

Annual Size of the Global Datasphere



Source: IDC's Data Age 2025 study, sponsored by Seagate, April 2017

yotta	Y	10^{24}	1 000 000 000 000 000 000 000 000
zetta	Z	10^{21}	1 000 000 000 000 000 000 000
exa	E	10^{18}	1 000 000 000 000 000 000
peta	P	10^{15}	1 000 000 000 000 000
tera	T	10^{12}	1 000 000 000 000
giga	G	10^{9}	1 000 000 000
mega	M	10^{6}	1 000 000
kilo	k	10^{3}	1 000
hecto	h	10^{2}	100
deca	da	10^{1}	10
-	-	10^{0}	1
deci	d	10^{-1}	0,1
centi	c	10^{-2}	0,01
mili	m	10^{-3}	0,001
micro	u	10^{-6}	0,000 001



Data Capacity / Information Representation

A single bit can be used to encode (represent) two pieces of information

3 bits 8 things – 7 colours of the rainbow

7 bits can represent 128 ASCII values

8 bits == 1 Byte

Q. How many bytes would it take to store your name?

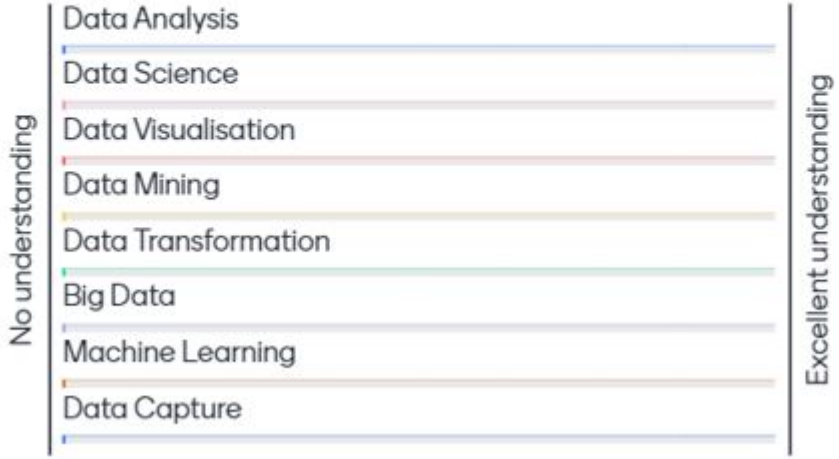
Unit	Symbol	Powers of 2	Decimal
Kilobyte	1KB		
Megabyte	1MB		
Gigabyte	1GB		
Terabyte	1TB		
Petabyte	1PB		

200 years in 4 minutes

https://www.youtube.com/watch?v=Z8t4k0Q8e8Y

Reflection:

Assess your own knowledge/skill in relation to the following Data Science terminology



Go to menti.com and enter the code:

8461 2286

Quizlet Activity (data science terminology)

https://quizlet.com/762045425/match

Data Science … Analysis … Big Data

Data Science is an interdisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from data in various forms, both structured and unstructured, similar to data mining.

Data Analysis is a process of inspecting, cleansing, transforming, and modelling data with the goal of discovering useful information, informing conclusions, and supporting decision-making

Big Data is extremely large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions.

Data Mining is the practice of examining large pre-existing databases in order to generate new information.

Machine Learning is a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention.

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Section II

Introducing ALT2

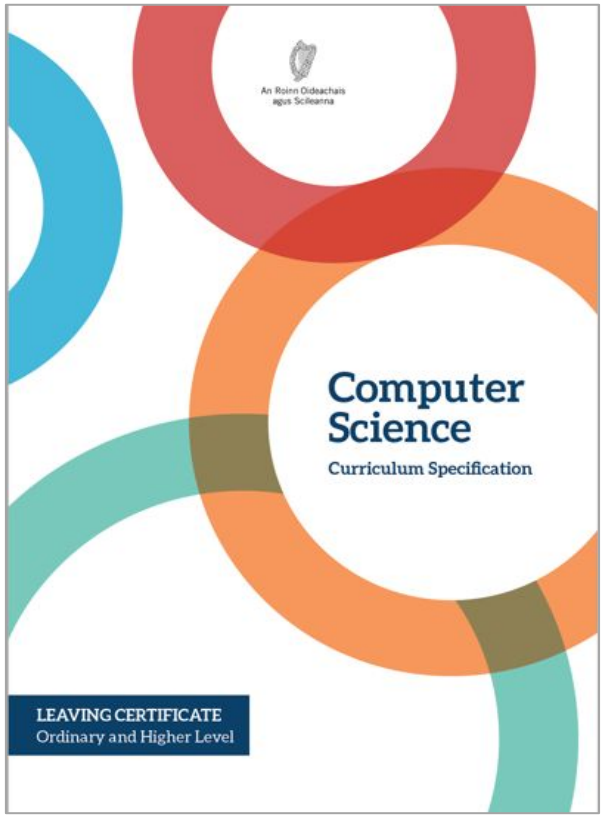
Context

Strand 1: Practices and principles	Strand 2: Core concepts	Strand 3: Computer science in practice
▸ Computers and society ▸ Computational thinking ▸ Design and development	▸ Abstraction ▸ Algorithms ▸ Computer systems ▸ Data ▸ Evaluation/Testing	▸ Applied learning task 1 - Interactive information systems ▸ Applied learning task 2 - Analytics ▸ Applied learning task 3 - Modelling and simulation ▸ Applied learning task 4 - Embedded systems

Applied Learning Tasks (ALTs)

‘Each of which results in the creation of a real or virtual computational artefact and a report.’

‘Where possible, the artefacts should be beneficial to the community and society in general.’



‘These artefacts should relate to the students’ lives and interests.’

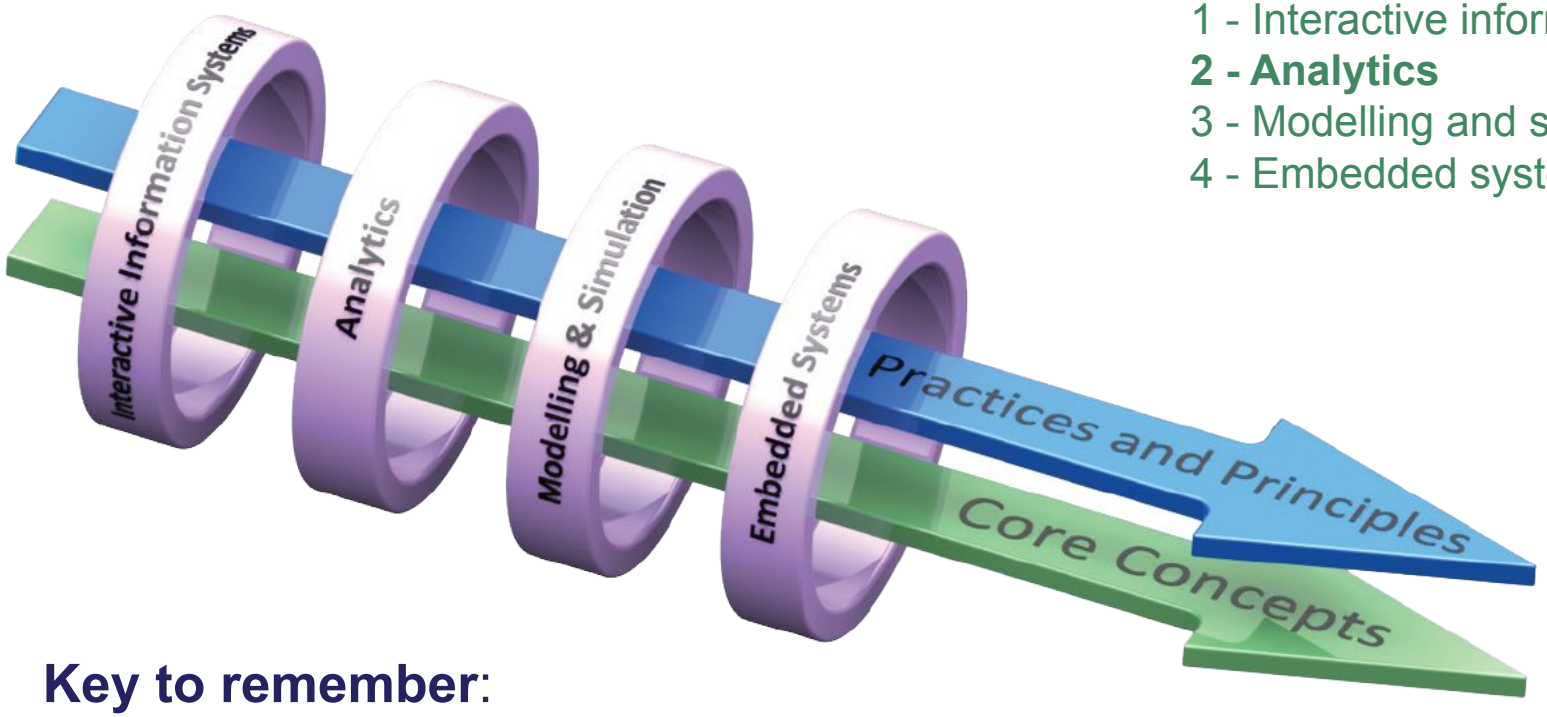
‘Examples of computational artefacts include programs, games, web pages, simulations, visualisations, digital animations, robotic systems, and apps.’

'Students work in teams to carry out four applied learning tasks over the duration of the course.'

LCCS Interwoven

The four applied learning tasks explore the four following contexts:

1 - Interactive information systems
2 - Analytics
3 - Modelling and simulation
4 - Embedded systems.



Key to remember:

Explore and teach the LOs through the lens of ALTs.

Applied Learning Task 2: Analytics

"Hypothesising, making predictions, examining evidence, recognising patterns and reaching conclusions are at the heart of computer science"

"Students will identify an interdisciplinary topic, develop a hypothesis and utilise existing resources to highlight the salient information and inform future decisions"

"By identifying, analysing, and deconstructing a problem, students will deepen their understanding of the practices and principles of computer science"

LCCS Specification: p22

Hypothesising

Hypothesis originates from the Greek work *hupo* (under) and *thesis* (placing).
It means an idea made from limited evidence.
It is a starting point for further investigation.

ALT2 Learning Outcomes

3.4. Develop algorithms that can find the frequency, mean, median and mode of a data set.

3.5. Structure and transform **raw** data to prepare it for analysis.

3.6. Represent data to effectively communicate in a graphical form.

3.7. Use algorithms to analyse and interpret data in a way that informs decision-making.

Reflection: Considering ALT2

1. What *prior knowledge* will students have that is relevant to ALT2?

1. What may *challenge* students in dealing with ALT2?

1. What *approach* could you take to introduce ALT2 to your students and support their progress?

Record your answers in your participant booklet.

Section III

ALT2 Investigate

Considering the Data Science Arc

ASK – The Question that starts the journey

PREPARE – Sketch out, think through ideas to organise work.

GET DATA – Collect, enter, reuse or repurpose.

CLEAN – Format, layout, organise.

ANALYSE – Format, layout, organise, sort, filter, summarize, triangulate.

VISUALISE – Format charts, tables, add logos, branding, colours.

REVIEW – Gather feedback, find errors, check interpretations.

PUBLISH – Secure and share within or outside the team.

Microsoft

aka.ms/HackingStem

Considering the Data Science Arc

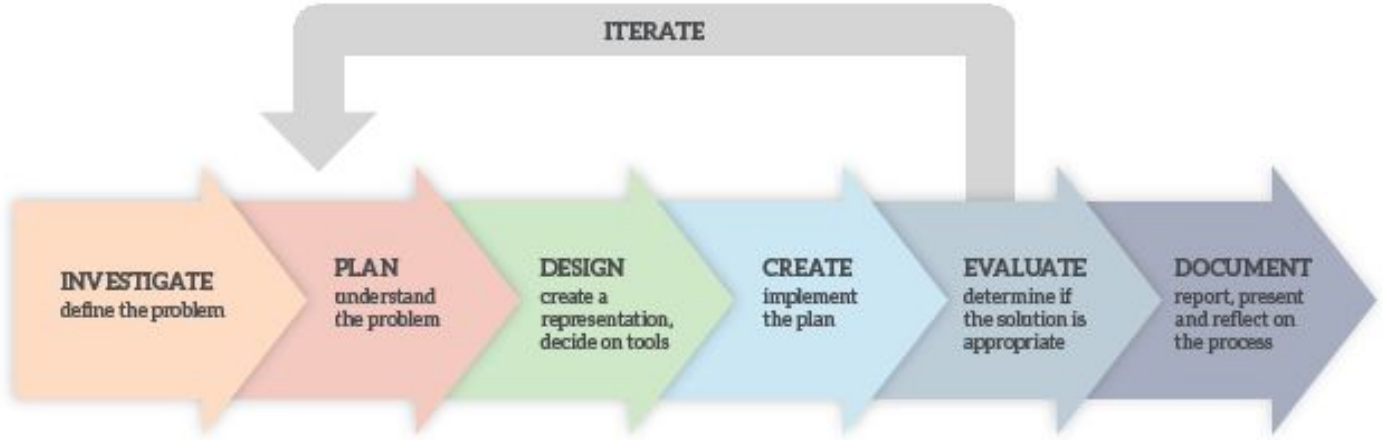


Figure 3: Overview of a design process

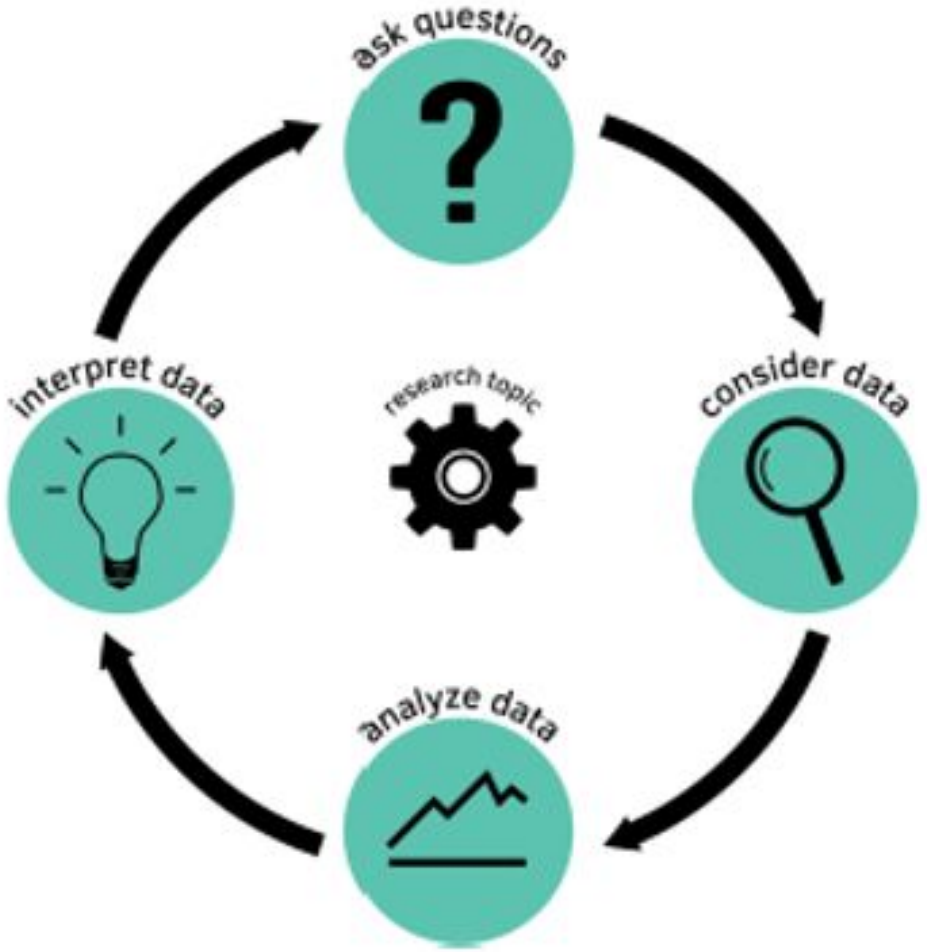
What is data cleansing?

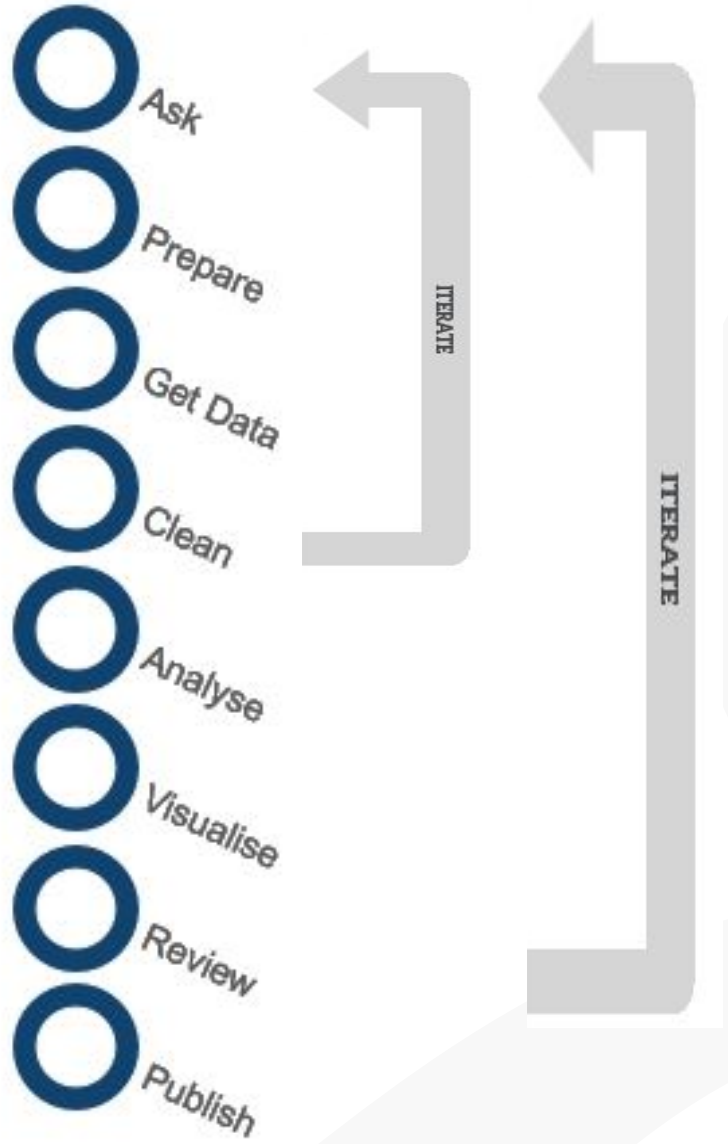
The data set below shows the raw data collected from the result of a 100m school race.

Surname	Gender	Age	Time
Murphy	M	17	13,12
Ogene	M	16	12.14
Ogene	M	16	12.14
Mc Intyre	F.	17	12.87
Lopez	F	-18	14.01
	F	17	1 329
McCarthy	M	77	13.65
Ó Brádaigh	f	16	13.09

Problems?

The data cycle - an alternative framework





Why use ready-made datasets?

Curated

Differentiation

Scaffolding

Authentic

Students should be able to:	
3.4	develop algorithms that can find the frequency, mean, median and mode of a data set
3.5	structure and transform **raw** data to prepare it for analysis
3.6	represent data to effectively communicate in a graphical form
3.7	use algorithms to analyse and interpret data in a way that informs decision-making

Data Science Supports

Teagasc National Farm Surveys: https://www.teagasc.ie/search/?q=national+farm+survey
Beef Price Watch: https://publicapps.agriculture.gov.ie/bpw-ui/#/
Agriculture Section of CSO Website: https://www.cso.ie/en/statistics/agriculture/
Agriland.ie: https://www.agriland.ie/factory-prices/

IBM Data Science Community: https://community.ibm.com/community/user/datascience/home
Open Data Science: https://ods.ai/
Data Science Central: https://www.datasciencecentral.com/
Driven Data: https://www.drivendata.org/
Central Statistics Office: https://data.gov.ie/organization/central-statistics-office
Census at School: https://censusatschool.ie/
Kaggle: https://www.kaggle.com/

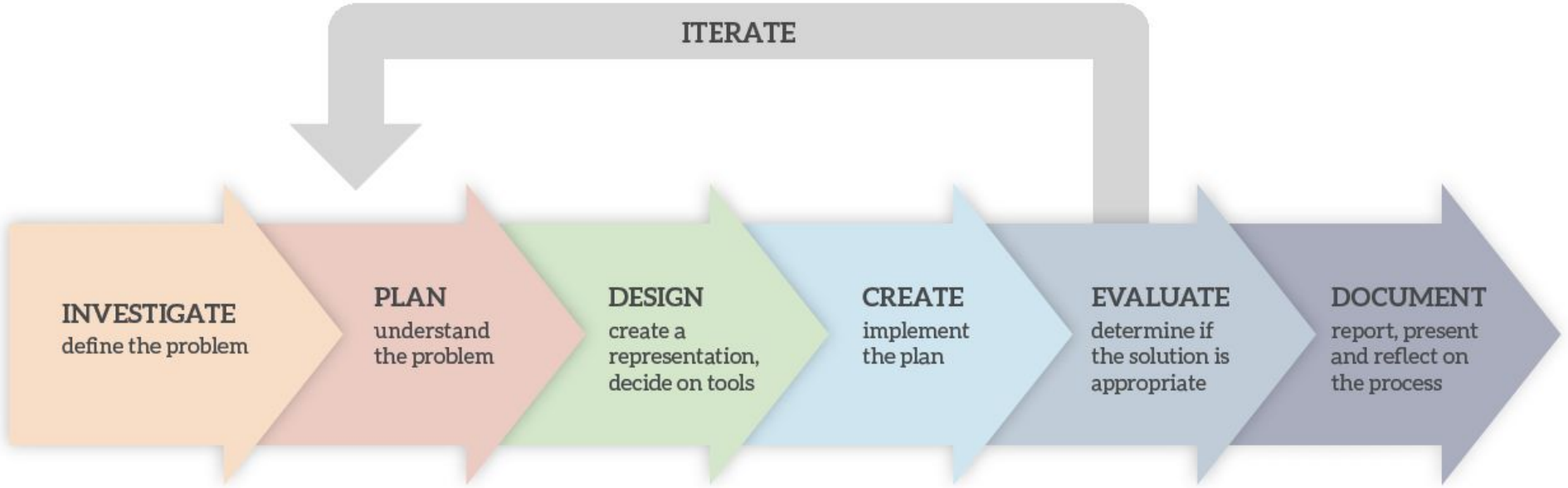
A data science resource

Searchable repository of user-generated datasets

Detailed and user-friendly search function

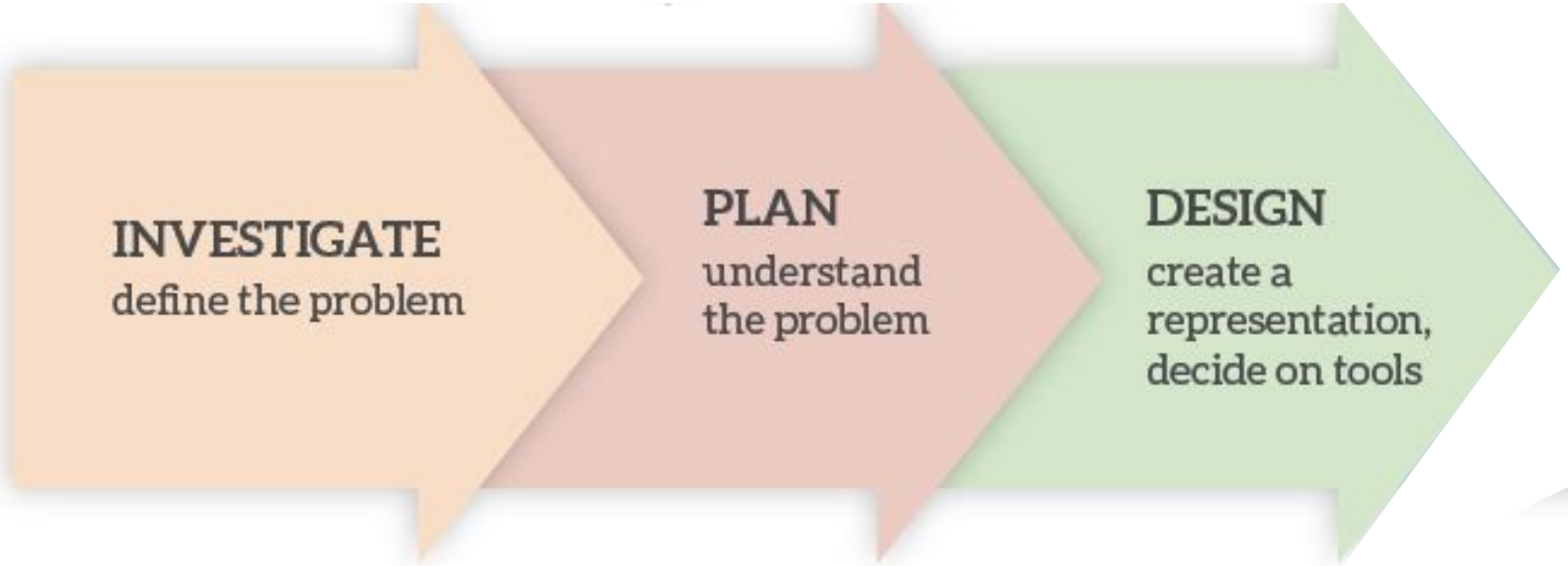
Free courses on Python, Machine Learning, Pandas, SQL, etc.

Group Activity



The Design Process

Focus of today's workshop



Focus of this morning's workshop

Group Activity: ALT 2 - Investigate

In your groups, brainstorm possible hypotheses for your dataset.

Aim for as many ideas as you can.

Group activity: ALT 2 - Investigate

	Dataset
Groups 1 & 5	World happiness
Groups 2 & 6	IMDb Top 100 Movies
Groups 3 & 7	FIFA World Cup 2022
Groups 4 & 8	Significant earthquakes

https://tinyurl.com/ALT2Investigate

Tea/Coffee

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