



**Oide**

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Supporting the Professional  
Learning of School Leaders  
and Teachers

# Leaving Certificate Computer Science National Workshop 3

Day 2





# Workshop Overview

<b>Session 4</b> 9:00 - 11:00	Introduction to Data Analytics and ALT2 (Investigate)
<b>Tea/Coffee</b> 11:00 – 11:30	
<b>Session 5</b> 11:300 - 13:00	ALT2: Plan and Design
<b>Lunch</b> 13:00 - 14:00	
<b>Session 6</b> 14:00 – 15:30	Python libraries, NCCA resources and Curriculum planning



# By the end of this session..

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

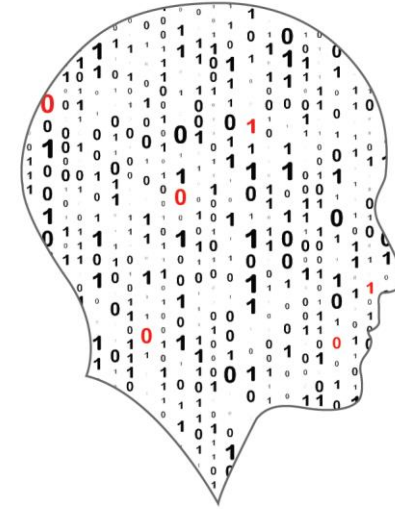


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# Session 4: Introducing data analytics and ALT2 (investigate)



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# Overview of the session

<b>Part 1</b>	Introduction to data analytics
<b>Part 2</b>	Introducing ALT2
<b>Part 3</b>	ALT2 Investigate



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# Introducing Data Analytics



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# “Data is the new oil”

*Clive Humby, 2006*





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

<https://youtu.be/D049hhpD6WA>

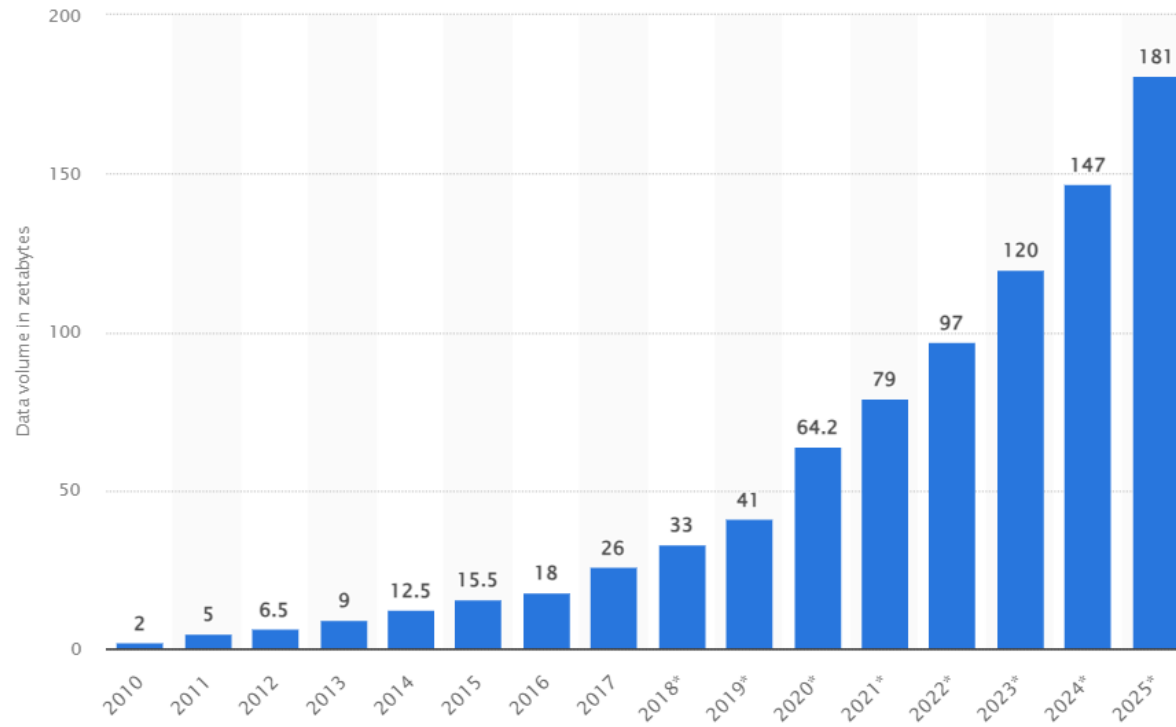




# What words do you associate with Data Science/Data Analytics?



# Annual Size of the Global Datasphere



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



Mobile Sensors



Social Media



Video Surveillance



Video Rendering



Smart Grids



Geophysical Exploration



Medical Imaging



Gene Sequencing



# 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

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

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



# 200 years in 4 minutes

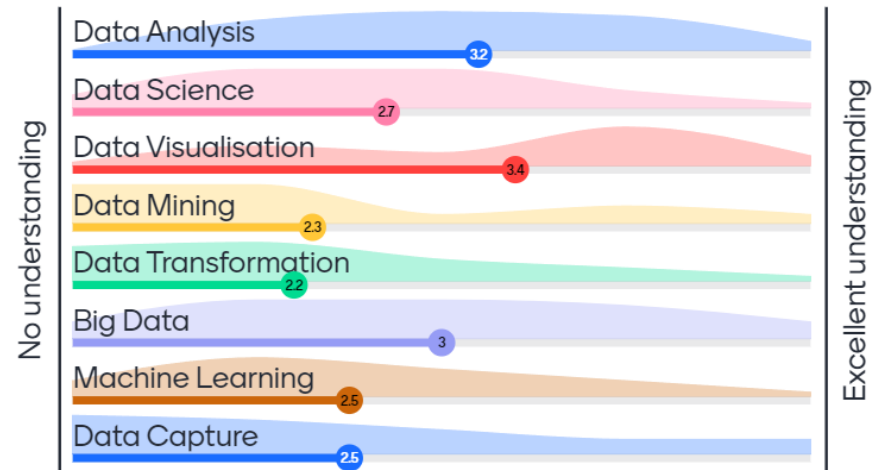


<https://youtu.be/Z8t4k0Q8e8Y>



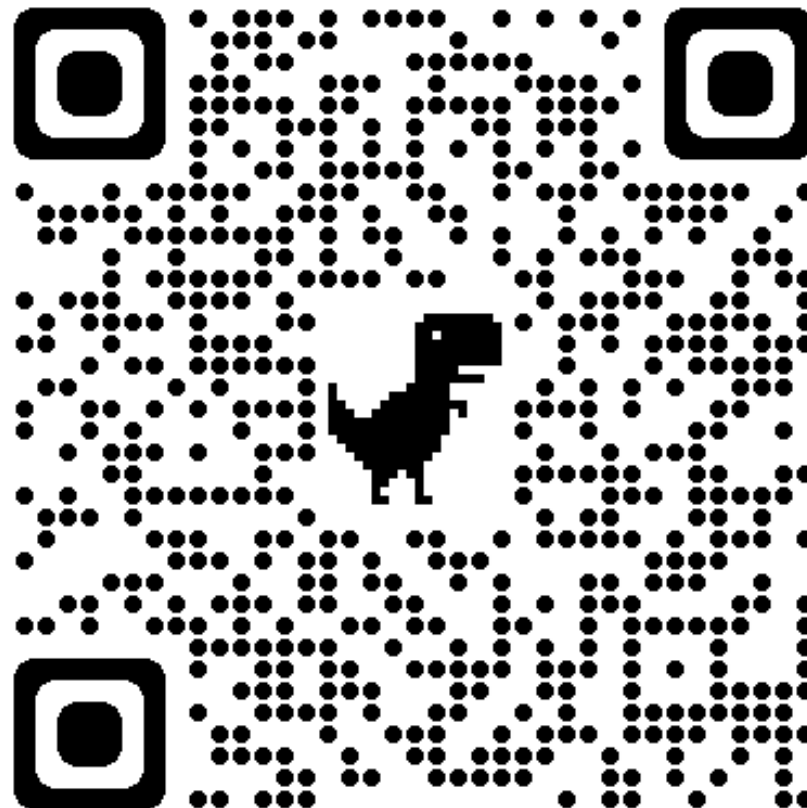
# Reflection

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





# 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.

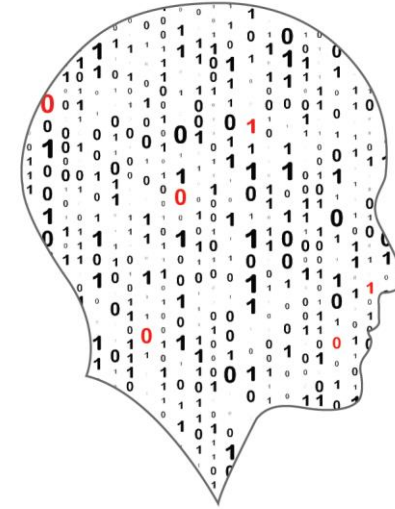


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## Introducing ALT2



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# Context

Strand 1: Practices and principles	Strand 2: Core concepts	Strand 3: Computer science in practice
<ul style="list-style-type: none"><li>▶ Computers and society</li><li>▶ Computational thinking</li><li>▶ Design and development</li></ul>	<ul style="list-style-type: none"><li>▶ Abstraction</li><li>▶ Algorithms</li><li>▶ Computer systems</li><li>▶ Data</li><li>▶ Evaluation/Testing</li></ul>	<ul style="list-style-type: none"><li>▶ Applied learning task 1<ul style="list-style-type: none"><li>- Interactive information systems</li></ul></li><li>▶ Applied learning task 2 - Analytics</li><li>▶ Applied learning task 3<ul style="list-style-type: none"><li>- Modelling and simulation</li></ul></li><li>▶ Applied learning task 4<ul style="list-style-type: none"><li>- Embedded systems</li></ul></li></ul>



# 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.'*

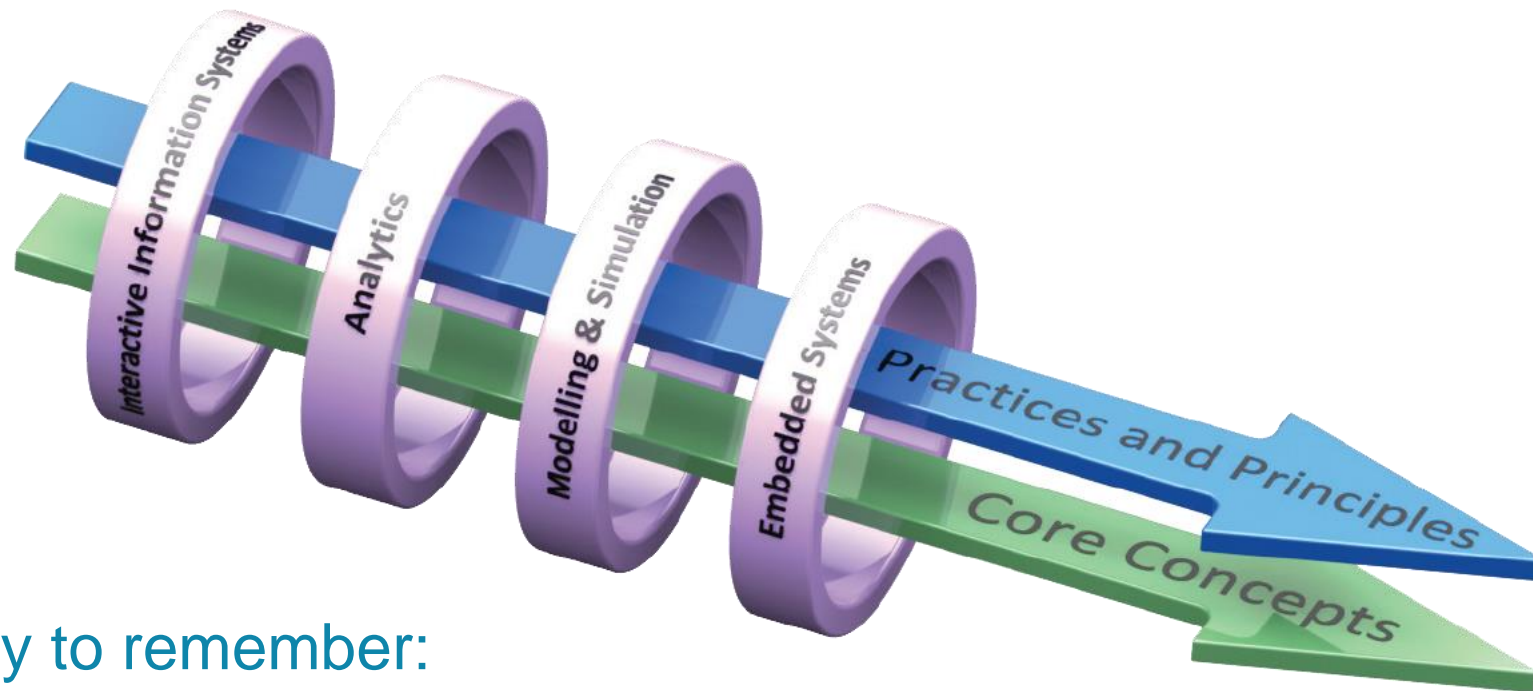
*'Examples of computational artefacts include programs, games, web pages, simulations, visualisations, digital animations, robotic systems, and apps.'*

*'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).

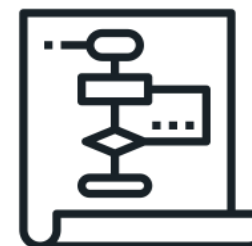
It means an idea made from limited evidence.

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?
2. What may challenge students in dealing with ALT2?
3. What approach could you take to introduce ALT2 to your students and support their progress?

Record your answers in your participant booklet.



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# ALT2 Investigate



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# 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.





# Considering the Data Science Arc

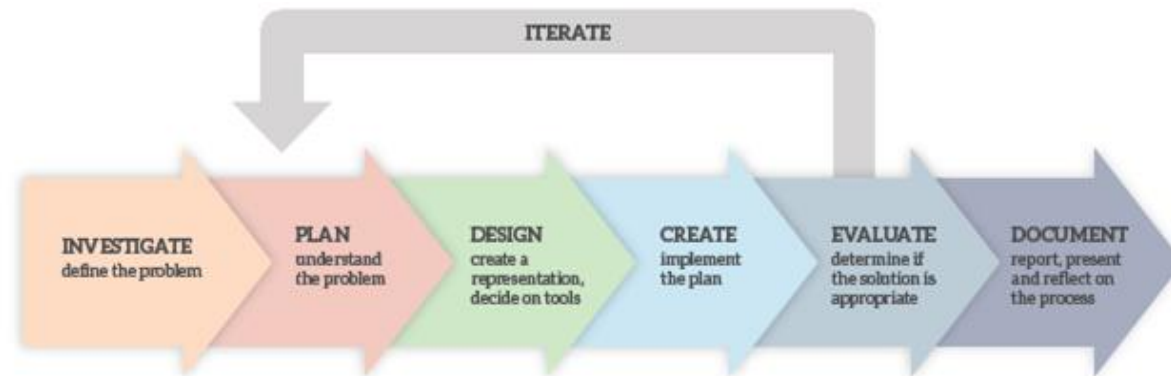


Figure 3: Overview of a design process



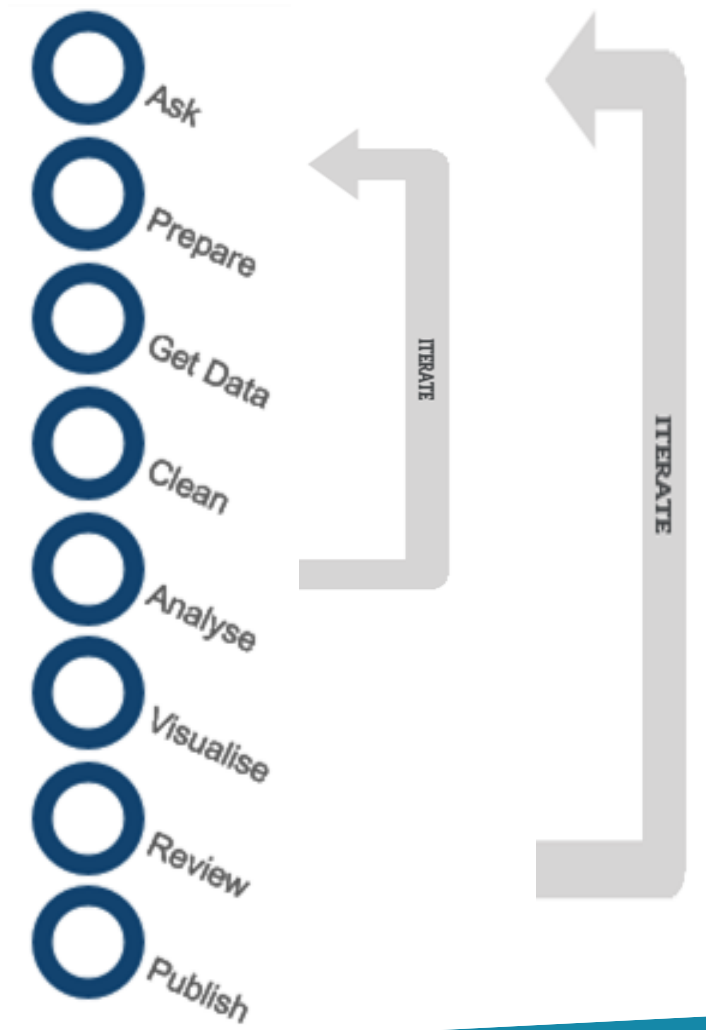
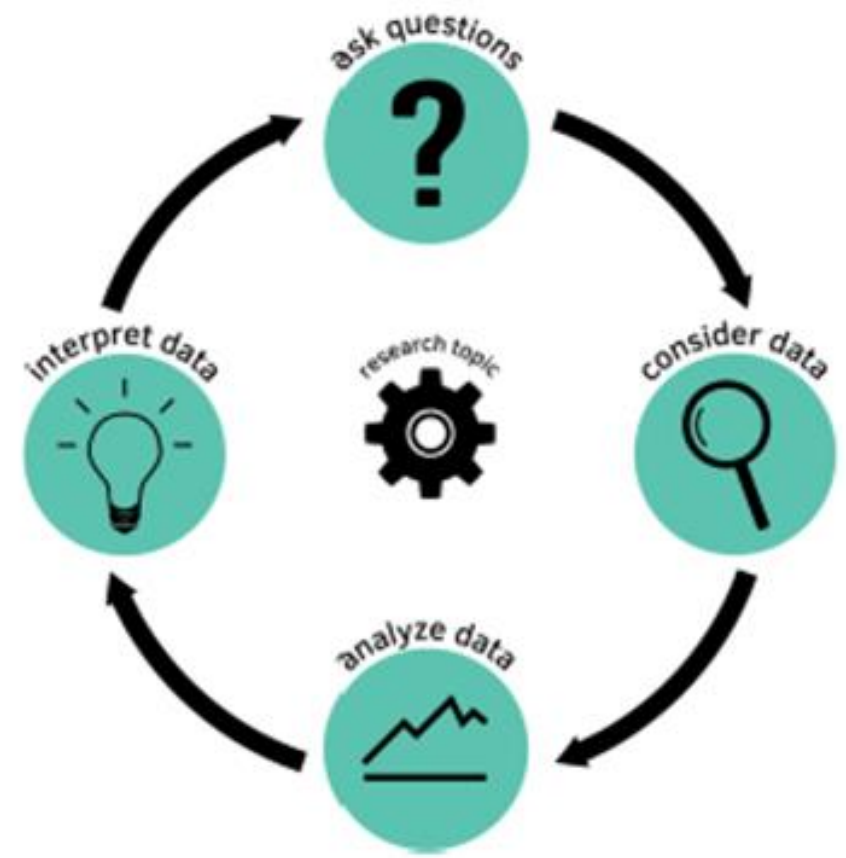
# What is data cleansing?

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



# 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

Agriculture Section of CSO Website:  
<https://www.cso.ie/en/statistics/agriculture/>

Our World in Data: <https://ourworldindata.org/population-growth>

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.

kaggle



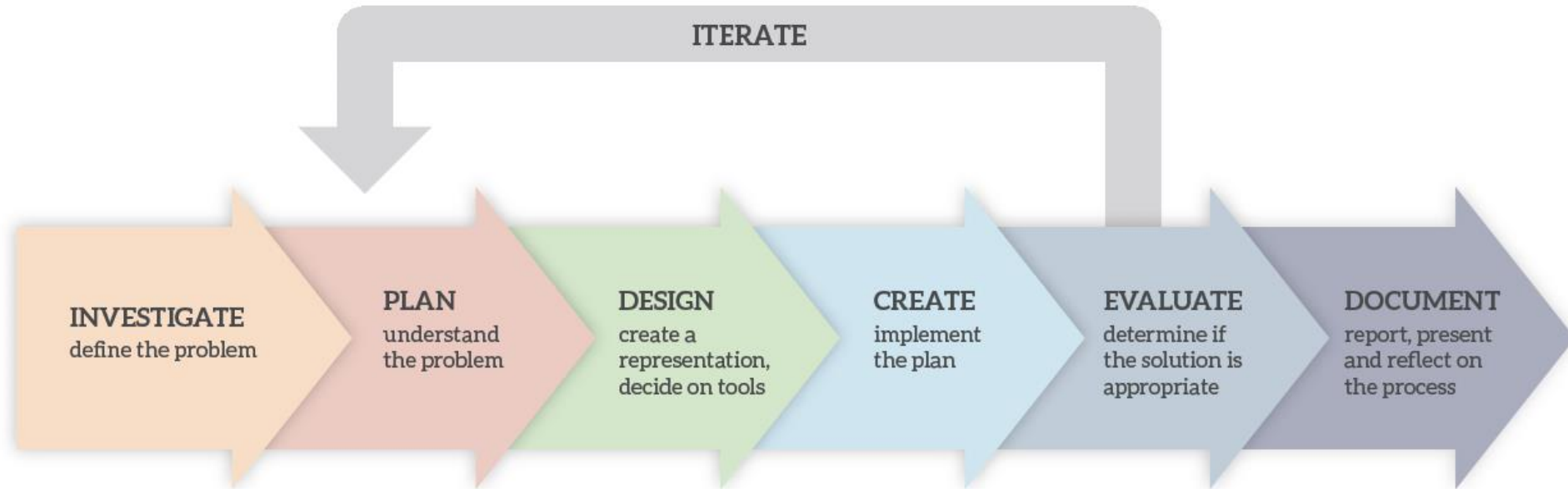
# Group Activity





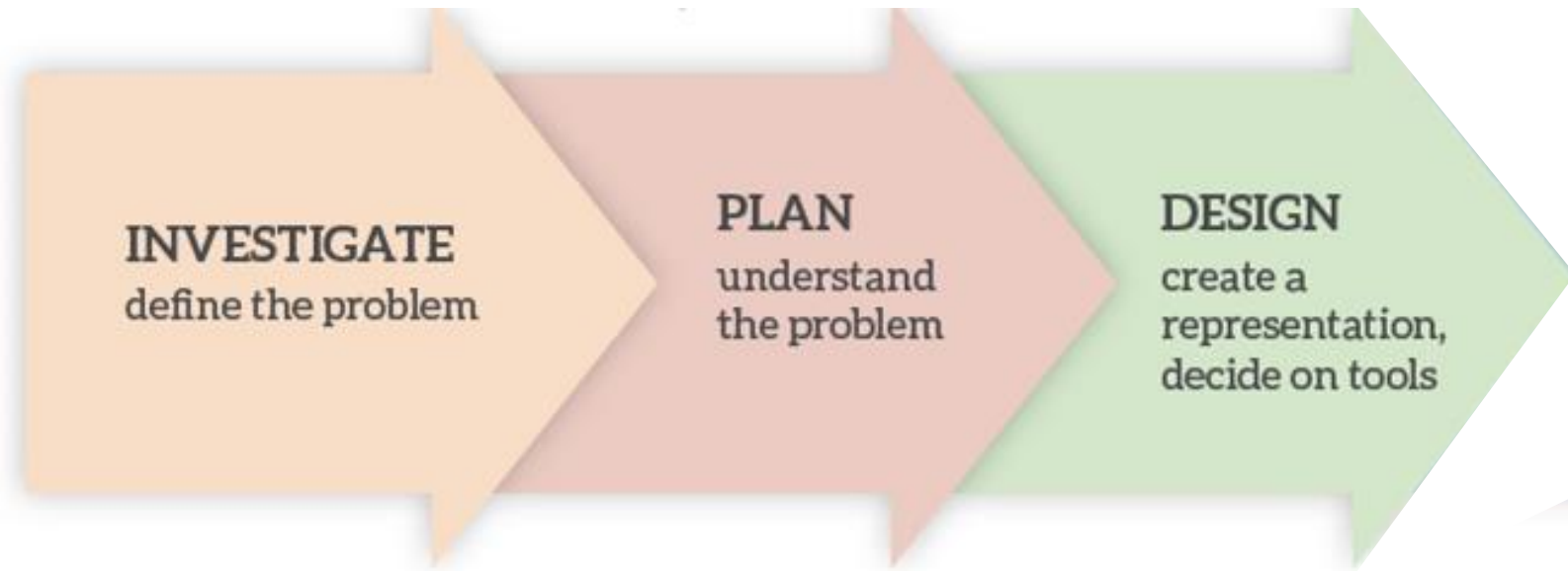


# The Design Process





# Focus of today's workshop





# Focus of this morning's workshop

**INVESTIGATE**  
define the problem



# 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

	<b>Dataset</b>
<b>Groups 1 &amp; 5</b>	World happiness
<b>Groups 2 &amp; 6</b>	IMDb Top 100 Movies
<b>Groups 3 &amp; 7</b>	FIFA World Cup 2022
<b>Groups 4 &amp; 8</b>	Significant earthquakes



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Department of Education

