

Welcome

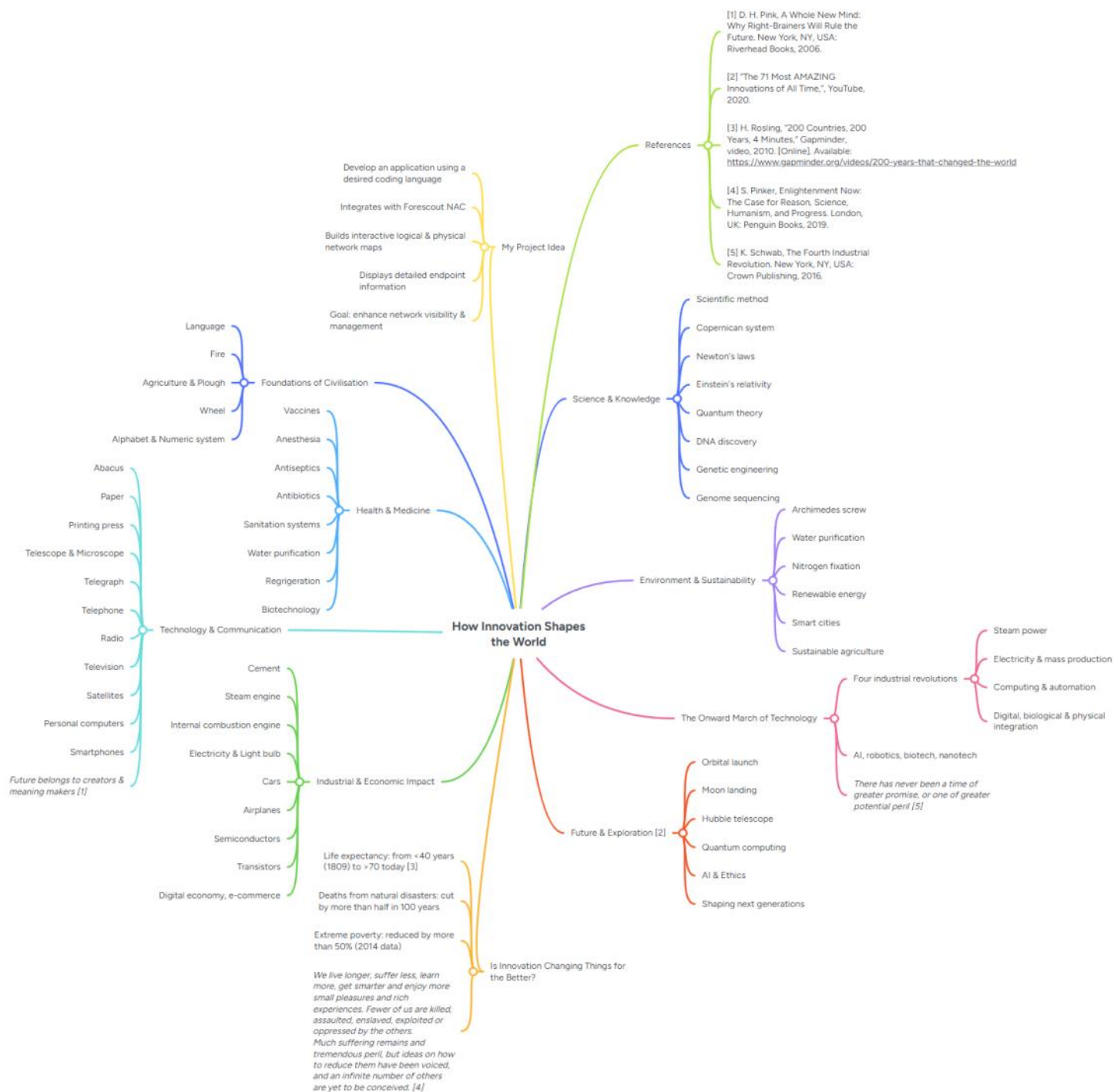
CHANGEMAKERS: CREATIVITY AND VALUE CREATION (ACCA5033)

Assignment 1: Innovation & Research

Carlos Yanez | 2413875

BSc: Computing (Computer Networks & Cybersecurity)

Task 1: Ideation & Mind Map



Task 2: Aim & Objectives and Research area

Q1. Aim and Objectives

Aim

The primary aim of this project is to design and implement a C# application that integrates with Forescout Network Access Control (NAC) systems to produce interactive logical and physical network maps. These maps will enable administrators to visualise endpoints, track their compliance with security requirements, and maintain up-to-date documentation to support cybersecurity frameworks such as ISO/IEC 27001. By doing so, the project addresses both operational efficiency and regulatory compliance, two critical dimensions in modern enterprise cybersecurity management.

Objectives

1. To analyse Forescout NAC APIs and identify relevant endpoints and topology information suitable for network mapping.
2. To design an application architecture in C# capable of collecting, processing, and storing endpoint and network data securely.
3. To implement interactive visualisation methods for logical and physical network maps, including detailed node attributes (device type, operating system, patch level, and security posture).
4. To ensure that the visualisation supports cybersecurity compliance (e.g., ISO/IEC 27001 controls regarding asset management and operational procedures).
5. To evaluate the tool through usability testing, scalability analysis, and its utility in generating compliance reports.

Q2. Research Philosophy

The guiding research philosophy for this project is epistemology, as the focus lies on the creation, validation, and application of knowledge derived from network data. Unlike ontology, which is concerned with what exists, or axiology, which emphasises values and ethics, epistemology prioritises how knowledge is structured and validated [1].

In this project, epistemology manifests in three ways:

- Transformation of raw data into knowledge: Device and network attributes collected from NAC logs and APIs are processed into validated knowledge in the form of accurate visual maps.
- Validation of compliance knowledge: The application ensures knowledge is actionable by aligning endpoint attributes with compliance requirements, thereby enabling administrators to make evidence-based decisions.
- Application of knowledge to practice: Administrators use visualisations to improve security posture, identify non-compliant endpoints, and generate audit-ready compliance documentation.

Epistemology is therefore the most suitable lens, as the project's success depends on how knowledge about the network environment is constructed and used effectively.

Q3. Research Tools and Search Strategies

Research Question

How can a C# application integrated with Forescout NAC generate reliable, interactive visualisations of network topology that enhance cybersecurity compliance (e.g., ISO 27001) and support real-time decision-making?

This central research question is further supported by a set of testable sub-questions:

1. What specific NAC data attributes (e.g., endpoint type, operating system, patch level) are necessary to ensure accurate and compliant network visualization?
2. To what extent can the proposed application improve compliance reporting compared to existing monitoring solutions?
3. How scalable is the solution in handling large enterprise environments with thousands of endpoints?

Search Tools and Databases

To answer these questions, the following tools and databases will be used:

- IEEE Xplore Digital Library
- ACM Digital Library
- Google Scholar

Search Strategies and Preliminary Results

Boolean logic and keywords strategies were applied:

1. "Forescout NAC" AND "network visualisation" AND "compliance"
 - Result: ForeScout CounterACT products but none of them gives a GUI of a network topology/map.
2. "C# application development" AND "network mapping tools"
 - Result: Documentation and case studies on NodeXL, a C#/.NET-based tool for network visualisation, demonstrating the feasibility of implementing graph visualisation in .NET environments [2].
3. "ISO 27001 network diagram requirement"
 - Result: A ScienceDirect paper on security management standards [3].

These results validate that the project is supported by both academic and industry-relevant literature. NodeXL, in particular, demonstrates how C# can be effectively applied for interactive visualisation, serving as a practical precedent for the proposed system.

References

[1] M. N. K. Saunders, P. Lewis and A. Thornhill, Research methods for business students, Harlow, England: Pearson Education Limited, 2023.

[2] "NodeXL: Network Overview, Discovery and Exploration for Excel" Social Media Research Foundation, 2023. [Online]. Available: <https://en.wikipedia.org/wiki/NodeXL>

[3] "The ISO/IEC 27001 information security management standard: literature review and theory-based research agenda," The TQM Journal, vol. 33, no. 7, pp.76–105, /07/28 2021. doi: 10.1108/TQM-09-2020-0202. Accessed: Aug 17, 2025, [Online]. Available:

Task 3: Research Strategies

Q1. Validity, Reliability, Generalisability, and Ethical Considerations

Ensuring research quality requires strategies that address validity, reliability, and generalisability.

- Validity will be ensured through construct validity and content validity. Endpoint data retrieved via the Forescout NAC API (e.g., OS version, patch level, compliance status) will be cross-referenced with ISO/IEC 27001 control requirements [1]. Triangulation will also be employed: visualisation outputs will be compared with both static network diagrams and existing monitoring tools (e.g., SolarWinds, Nagios) to confirm that generated maps reflect real network states.
- Reliability will be addressed through consistency in both technical and human data collection. All NAC API queries will be scripted to run under the same parameters, and tests will be repeated under identical network conditions. Reliability will also be measured by logging outputs, which can be replayed to confirm reproducibility [2].
- Generalisability is more challenging, as the pilot will be performed in one organisational environment. However, steps will be taken to design a modular architecture that can adapt to other NAC systems beyond Forescout. The adoption of visualisation frameworks such as NodeXL, built in C# and .NET, provides an example of transferable technology [3]. This design choice increases the likelihood that findings can be applied across different organisational contexts.
- Ethical considerations are paramount because NAC data includes sensitive attributes such as IP addresses, usernames, and device names. To protect confidentiality, all pilot data will be anonymised. Only attributes necessary for compliance analysis will be processed, and personal identifiable information (PII) will be excluded. Ethical research also requires informed consent from participating administrators providing usability feedback [4].

Q2. Research Strategies and Data Collection

Research Strategy

This study will adopt a mixed-methods approach, combining quantitative data (e.g., endpoint compliance rates, visualisation performance) with qualitative data (e.g., administrator experiences). As Saunders et al. argue, mixed-methods enable a richer understanding of both the technical and organisational dimensions of IT research [5].

Data Collection Methods

1. System Logs and API Outputs (Quantitative): The application will collect data directly from Forescout NAC APIs, capturing attributes such as endpoint type, OS, and compliance posture.
2. Administrators Surveys (Quantitative + Qualitative): Likert-scale questionnaires will capture perceptions of usability, reliability, and compliance utility.
3. Semi-structured Interviews (Qualitative): Interviews with administrators will provide deeper insights into challenges and expectations.
4. Benchmarking Tests (Quantitative): Performance and accuracy will be compared against outputs of commercial monitoring tools to establish baseline effectiveness.

Pilot Data Collection

A pilot study will be conducted using ~50 endpoints from a mid-sized organisational network. Data

will be extracted via the Forescout NAC API and visualised in the prototype application. Administrators will then complete a short survey (see Appendix), focusing on usability and compliance clarity. Feedback will help refine which attributes should be prioritised in the final system design.

Q3. Quantitative and Qualitative Analysis

Quantitative Analysis

- Performance Metrics: Node processing speed, visualisation latency, and endpoint compliance detection rates.
- Compliance Accuracy: Percentage of endpoints correctly flagged as compliant/non-compliant with ISO/IEC 27001.
- Survey Data: Likert responses will be analysed using descriptive statistics (mean, variance) to identify trends in perceived usability and reliability.

Qualitative Analysis

Qualitative data from interviews and open-ended survey questions will be analysed using thematic analysis as outlined by Braun and Clarke [6]. Themes such as usability, clarity of visualisation, compliance reporting usefulness, and integration challenges will be coded iteratively. This approach allows the identification of recurring patterns across different administrators' experiences. The combination of thematic analysis with quantitative survey results will ensure methodological triangulation, increasing the credibility of findings.

Conclusion

The proposed research design integrates strategies to maximise validity, reliability, and ethical rigor. By adopting a mixed-methods strategy, combining NAC system data with administrator feedback, and applying both quantitative and qualitative analyses, the project aims to develop a robust and compliant network visualisation tool. The inclusion of a pilot data collection method ensures early refinement and increases the likelihood that the final application will be both technically effective and practically valuable for cybersecurity compliance.

Appendix. Pilot Data Collection Instrument

Survey: Evaluating the Prototype Network Visualisation Tool

Section 1 - Likert-scale Questions (1 = Strongly Disagree, 5 = 5 Strongly Agree)

1. The visualisation accurately reflects the current network topology.
2. Endpoint information (OS, patch level, compliance status) is clear and accessible.
3. The visualisation supports compliance monitoring (e.g., ISO 27001).
4. The system is easy to use and intuitive.
5. The performance of the visualisation (speed, responsiveness) is satisfactory.
6. The tool provides added value compared to static network diagrams.
7. I would recommend this system for compliance reporting purposes.
8. The application improves my ability to detect non-compliant endpoints.

Section 2 - Open-ended Questions

9. What features of the tool did you find most useful?

10. What improvements would you suggest for the final version?

References

- [1] International Organization for Standardization, *ISO/IEC 27001:2022 Information security, cybersecurity and privacy protection — Information security management systems — Requirements*, Geneva, Switzerland: ISO, 2022.
- [2] P. Mell and T. Grance, "The NIST definition of cloud computing," NIST, Gaithersburg, MD, USA, Special Publication 800-145, 2011.
- [3] "NodeXL: Network Overview, Discovery and Exploration for Excel," Social Media Research Foundation, 2023. [Online]. Available: <https://en.wikipedia.org/wiki/NodeXL>
- [4] B. Kitchenham and S. Charters, "Guidelines for performing Systematic Literature Reviews in Software Engineering," EBSE Technical Report, Keele University, 2007.
- [5] M. Saunders, P. Lewis, and A. Thornhill, *Research Methods for Business Students*, 8th ed. Harlow, UK: Pearson Education, 2019.
- [6] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, 2006.

Appendices

Unit 1 Topic 1

Reflect

1. Studying with an AI (mainly for coding)
2. Fast grocery apps for cooking
3. Cloud gaming

Probably 1 because AI compresses research, saving lots of hours

Apply

Now that you have watched the video, **which invention** do you think has had the biggest impact on the development of society as we know it today?

Internet

Why do you think this innovation has had such a big impact? Think about how you would **justify your choice**.

Because it connected everyone and everything. It turned lack of information into abundance and shrank distances. Almost zero delays communications, remote/learning, etc

"We will never have a perfect world. But there's no limit to the betterments we can attain if we continue to apply knowledge to enhance human flourishing."

-Steven Pinker 2019

What is the fourth Industrial Revolution?

Revolution		Year	Information
	1	1784	Steam, water, mechanical production equipment
	2	1870	Division of labour, electricity, mass production
	3	1969	Electronics, information technology, automated production
	4	?	Cyber-physical systems

Reflect

As you can see, the characteristics of each industrial revolution have changed a lot over time.

Now you have seen an overview of the fourth industrial revolution, we will look at some of the new technologies that will potentially change our way of living.

Check

Drag the revolution to the correct definition.

a. Steam, water and mechanical means of production

First Industrial Revolution

These are the correct definitions for the first and fourth industrial revolutions.

If you'd like to remind yourself of the definitions of each, let's [revisit that slide](#).

d. Cyber physical systems

Fourth Industrial Revolution

? Check

By 2025, what percentage of people are expected to be wearing clothes connected to the internet?

☐ 5%

☒ 10%

☐ 15%

Within the next decade, how many sensors are estimated to be connected in the Internet of Things?

☐ One billion

☐ One million

☒ One trillion

Submit



Apply

In a couple of sentences describe an experience from your past where you feel you were **discouraged/encouraged** to be creative and how this might have affected how you feel about your levels of creativity.

Why is creativity important in your subject area? What might you be asked to do that might involve the need for you to be creative?

A few years back I pitched cutting paper use across the company and rolled out digital workflows and e-signing. Watching it worked, made me realise I can design solutions, and it boosted my confidence to try bolder ideas (which so far I've been encouraged by my peers)

Creativity matters in cyber/networking because attackers are also extremely creative in coming up with new ways of exploiting systems.

Unit 1 Topic 2



Reflect

Describe the last time you felt as though you were being creative. For example, you might have been painting, playing a musical instrument, sewing, or cooking. **How did it make you feel?**

A couple of weeks back I was playing with the orchestra in a festival (Wilderness Festival), and the whole experience is just amazing. To see all of those people enjoying what we (the orchestra as a collective) are performing, doesn't have a price.



Check

Using creativity to **avoid stress** is:

- ☐ A contemplation tool
- ☒ A distraction tool
- ☐ A means of self-development to face challenges by building up self-esteem and confidence

Correct!

When we use creativity simply to avoid something challenging or ignore something we find stressful, it is a **distraction tool**.

Only when we use creativity to give us the mind space to reassess problems in our lives and make plans can we consider it a **contemplation tool**.

Correct

That's right! You selected the correct response.

Axiology is the study of what is valuable.

Epistemology is the study of knowledge.

Ontology is the study of being.

Continue

Unit 1 Topic 3

Check

1. A keyword is like a...

- ☐ A word that unlocks others.
- ☐ A word like a hashtag that summarises the meaning of a sentence.
- ☐ A way of distilling meaning that can be used to search databases.

☒ All of the above.

Correct!

A keyword is all of these descriptions.

Check

2. We can locate the keywords in our research by...

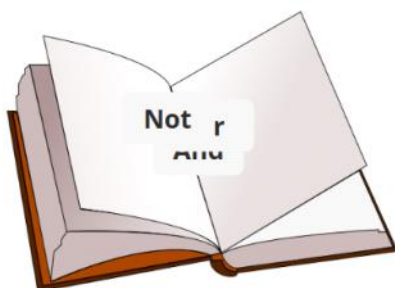
- ☐ Asking the library staff
- ☐ Using a piece of software

☒ Remove all superfluous words

Correct!

Check

3. Drag all the correct common Boolean operations to the book. Drag the incorrect options into the bin.



Bugged
:(

Network

Given an appreciation of the different approaches to data collection, **can you think of a way of collecting data** that would be appropriate for your next assignment?

If any aspect of your research involves people's responses, **how will you account for the Hawthorne Effect?**

Note down your approach on the **forum**.

I'll combine passive logs for hard metrics with admin surveys (Likert + a few open questions), a handful of semi-structured interviews, and benchmarking tests against a reference tool.

I'll account for Hawthorne Effect by collecting logs passively, anonymising responses.

Check

In this knowledge check activity you will be presented with three research questions.

Question 1 of 3

What do we call it when we reduce the data of the population into a smaller manageable unit? We call it a...

 Sample

 Snowball

Correct!

A sample is a group of people, objects, or items that are taken from a larger population for measurement. The sample should be representative of the population to ensure that we can generalise the findings from the research sample to the population as a whole (Bineham, 2006).

? Check

Question 2 of 3

Which of the following are relevant reasons for why we have to reduce the data we research into a smaller unit? (Choose which ones you think apply)

- ☒ Your time and resources may be stretched
- ☐ There are limited people who have experiences you are studying
- ☒ There are limited people/results with the relevance to the area you are studying

Not quite...

If your sample size is large, it may limit your ability to produce findings that represent your population as a whole. It is therefore good practice for triangulation purposes to recruit a variety of respondents (e.g., children, adults, service users and providers).

? Check

Question 3 of 3

When you select a sample from the population by picking the names out of a hat, what type of sampling are you conducting?

- ☒ Unusual sampling
- ☒ Random sampling
- ☒ Stratified sampling

Correct!

In this approach, every piece of data is considered to be equally relevant. This means if you include it in your research it is based on a random chance whether it's included or excluded from the sample you study.

Testing a causal relationship	☐	☒	☐	☐	☐
Understanding the general opinions of a group	☒	☐	☐	☐	☐
Gaining the perceptions of a group	☐	☒	☐	☐	☐
Understanding something in its natural setting	☐	☐	☒	☐	☐
Understanding the culture of a community 1st hand	☐	☐	☐	☐	☒
Understanding current or historical events or practice	☐	☐	☐	☐	☒
Analysing populations where you don't have access	☐	☐	☐	☐	☒

Check

Question 1 of 2

If you wanted to understand the general characteristics or opinions of a group of people you would use a...

- ☒ Survey
- ☐ Interview
- ☐ Experiment

Check

Question 2 of 2

A 'Likert scale' is?

- ☒ Respondents specify their level of agreement or disagreement on a symmetric agree-disagree scale for a series of statements
- ☐ A way of confirming the validity of experimental research invented by Donald Likert in 1967

Correct!

This method will be based on you conducting a survey that can be distributed online, or in person over a phone or in a live meeting. It can produce mixed data (quantitative and qualitative) based upon how the questions are framed.

Correct!

A good solution to measure success would be to consider a 'Likert scale'. A Likert scale is a five-point answer like the one you have used in the previous 'research approach' activity.

Unit 4 Topic 1

Google Quantitative research of

Wikipedia
https://en.wikipedia.org/wiki/Quantitative_research

Quantitative research

Quantitative research is a research strategy that focuses on quantifying the collection and analysis of data. It is formed from a deductive approach where ...

People also ask

- What are the 4 types of quantitative research?
- Which is an example of quantitative research?
- What is meant by quantitative research?
- What are 5 examples of quantitative research titles?

[Feedback](#)

scribbr.co.uk
<https://www.scribbr.co.uk/research-methods/intro...>

What Is Quantitative Research? | Definition & Methods - Scribbr

4 Apr 2022 — Quantitative research is the process of **collecting and analysing numerical data**. It can be used to find patterns and averages, make predictions, test causal ...

[Quantitative research methods](#) [Advantages of quantitative...](#)

CASP - Critical Appraisal Skills Programme
<https://casp-uk.net/articles>

What Is Quantitative Research? CASP

Quantitative research is a structured approach designed to quantify variables and generalise findings. Its primary aim is to establish patterns and predict ...

UK Research and Innovation (UKRI)
<https://www.ukri.org/who-we-are/esrc/quantitative...>

Quantitative research – UKRI - What is social science?

31 Mar 2022 — **Quantitative research** can measure and describe whole societies, or institutions,

Quantitative research

Type of research design

Quantitative research

What's the difference between qualitative and quantitative research?

Quantitative Research

How to Choose a Quantitative Research Topic

Quantitative research is a research strategy that focuses on quantifying the collection and analysis of data. It is formed from a deductive approach where emphasis is placed on the testing of theory, shaped by empiricist and positivist philosophies.

Source: [Wikipedia](#)

[Feedback](#)

? Check

Question 1 of 2

Would a survey of 300 students, chosen at random, from your university and asking them the question: "On a scale from 1-5, how satisfied are you with your professors?" be a good sample?

✓ Yes

✗ No

Not quite...

The survey will of course have some bias as it is a sample of the entire university, but it has mitigated this by randomising the trial. The survey has been conducted at random to avoid any bias.

Check

Question 2 of 2

Could research of the recovery of people from Covid living on the island of Jersey be used be applied to people living in the city of New Delhi, India?

 Yes

 No

 It depends

Correct!

It depends. Do you think that the people living in Jersey are comparable to the people who live in New Dehli? If yes then the research is valid, if not then the research should not be used in the New Delhi context.