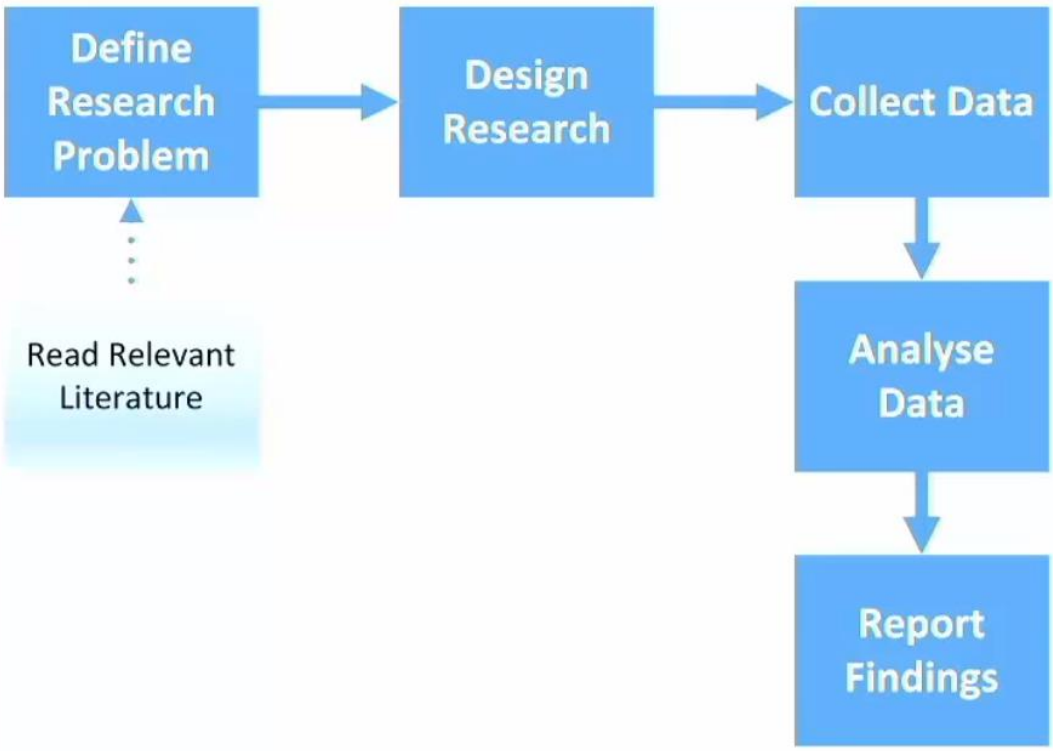
BSC203Question1: Research Project



Research: is the making of new knowledge using a suitable method to the satisfaction of the user of the research. Process can be replicated.

> An example is research on how to stimulate emotions using non-playable characters. This research can be used to create scarier and advanced NPC for horror games

Aims of research include:

Describe what goes on and seeing

Allows for future predictions

Understand why things happen

Categories of research:

Exploratory research is about finding something out about a problem that is not clearly defined. Often for deeper understanding of things

Descriptive research is about answering the what question. Provides features of a population, phenomenon or situation studied

Explanatory research focuses on finding the relationship between variables. Addresses why question

Outcomes of research project:

Product that is new or improved (so creating software, system or item)

A modified or new model or theory (often conceptual, blue print and not tangible, more abstract and doesn't tell you how. Framework)

Technique that is new or improvement (how you do something differently, less abstract but not a product. Practically useful compared to model)

More in-depth understanding of a certain situation

ICT research is the making of new knowledge in any discipline of ICT (AI, security, networking, e-learning, Business intelligence). An example is research on how to stimulate emotions using non-playable characters. This research can be used to create scarier and advanced NPC for horror games

Project is a temporary sequence of unique and connected tasks which have one objective or purpose and that needs to be finished within a defined start and finish date, according to specification and within budget. Something is produced.

> For example (IT project) migrating PCs to new operating systems since project usually has a budget and timeframe to complete and implementation of a new system. While IT job may be learn c programming

Attributes of a project:

A project must have a deadline or end date

A completed project should have a deliverable (something is always produced not always physical)

A project has an unique aim or purpose (specific thing that's got to be done)

Project is allocated resources like money, people, equipment

Project has some risk and uncertainty since we are doing something that hasn't been done (we need to managed the risk)

ICT research project is a project which has the goal of creating new knowledge in any ICT area. For example- a current Griffith university ICT research project looks at efficient object detection for low powered devices. This knowledge will then allow for the creation of less resource consuming object detection devices

Phases of research project: *[REFER TO TUTORIAL FOR HOW TO APPLY]

- Read relevant literature to understand what's been done before
- Define research problem which is about working out what problem we are trying to address with our research. Past literature helps shape our research problem
- Design research which is planning who's involved and what resources are needed and the tasks required in project. Also involves selecting research strategy or approach
- Collect data is about carrying out the research, involves one or more research approaches (surveys..). The testing may output data
- Analyse data from the data collected and hopefully answering the research question
- Report findings for others to know, use and build on

Research approach or strategy summary- *[REFER TO TUTORIAL FOR HOW TO APPLY]

Survey research is the collection of data from many respondents or events that are relevant to the research. The data collected is usually of the same kind. The data can be quantitative (numerical data) for example- ask students to rate their university experience from 1 to 10 or qualitative which is non numerical data. For example- questionnaires with open ended questions such as describe your university experience or interviews. Must be set up to reduce bias thus allow effective analysis

EG- market research or unit surveys

Design and creation research goal is the creation of new ICT products. The ICT produce may include software, hardware, algorithms, or even models or methods to represent something. For example- coming up with new system development methodologies or creating auto-phishing game or modification to network routing protocols

Experimental research is finding out the relationships between the defined variables in a setting that controls for alternative explanations. So controls everything except variables that are relevant to your research and those variables are manipulated. For example- an experiment comparing the affect-

sensitive and nonaffective tutors on students learning. The students learnt better with the affect sensitive tutor

Laboratory-based which is

Field experiments which is

Case study research is in depth study of one or a few instances of a particular subject (the cases). Different ways to collect data are used when studying the subject in depth. Ideal for comparing, describing and understanding different aspect of a research problem. For example- investigate recent cyber-attacks on organisations, how the organisation tried protect themselves and impacts of the cyber-attacks. Thus resulting in new recommendations for how organisations should defend against cyber-attacks.

Action research is where the researcher is actively involved in the scenario being studied (similar to case study). The researcher will directly influence the scenario by making change. The researcher will be able to do his research project while potentially creating practical outcomes for participants (unlike case study no practical outcomes). For example- looking at improving employees compliance with information system security policies through the implementation of system security training.

BSC203Question2: Project Managment

- [Project management]: Explain? Purpose
- [Reason for project failures]: Explain
- [Project scope]: Explain

- [Project management tools]: List
    - [Project scope statement]: Explain? Activities
    - [Work breakdown structure]: Explain
    - [Gantt chart]: Explain? Critical time + slack time
    - [Network diagram]: Explain

- [Project management body of knowledge (PMBOK)]: Explain

- [PMBOK knowledge areas]: List
    - [Scope management]: Explain
    - [Time management]: Explain
    - [Cost management]: Explain
    - [Quality management]: Explain
    - [Human resource management]: Explain
    - [Communication management]: Explain
    - [Risk management]: Explain
    - [Procurement management]: Explain

- [Project management process groups]: List
    - [Project initiation]: Explain
    - [Project planning]: Explain
    - [Project execution]: Explain
    - [Project monitoring & controlling]: Explain
    - [Project closing]: Explain

- [PMBOK knowledge areas vs Project management process groups]: Explain

Project management is using skills, knowledge, *tools and techniques* to project tasks and process in order to make the project outcomes better and carry out the project

For example- allow a project to be completed in time, and within budget

Reasons for project failure:

- Members of the project team only care for the outcome of the result, so if stakeholders not interested then chances are project will not be successful
- No leader thus lacks of clearly defined roles in a project
- Project has insufficient details or structure so team members are unsure of their roles
- Not enough resources are provided to the project (financial or time allocation or qualifications)
- Project deviates from its mapped plan
- Lack of communication in the project team
- The initial goals of the project are not adhered or ignored

Purpose of project management is to reduce the likelihood of project failing. It helps outline what activities needs to be done and the order of the activities in order to produce the outcome of the project. Also outlines what resources are required which helps reduce the chance of having insufficient resources being allocated to the project. Also answers the question of who will complete the task. This allows project to have more structure. In addition, answers the question of when the activities are to be completed, and the amount of time needed to complete the project

Project scope outlines what tasks are needed to create project deliverables (hardware, software, research papers) and procedures used to make them. Activities to determine project scope can include- [Refer to PowerPoint]

Project management tools and techniques- (help assist project managers in project management)

Project scope statement is a document used to describe deliverables of the project and helps create a common understanding between stakeholder. Includes

- Project justification
- Brief description of the requirements and characteristic of the project
- Brief description of what will be produced
- Project success criteria (how you know if it is a successful project)
- Assumption and constraints

Work breakdown structure is a hierarchical grouping of tasks involved in a project that outlines the full project scope. (for planning). Every Gantt chart and Network diagram consist of a work breakdown structure

Planning Gantt chart displays the tasks of a project scheduled overtime in a horizontal bar chart. The chart includes. Represent project schedule. (for planning)

Milestones [diamonds] are task that have zero duration. They indicate the achievement or completion of an important project deliverable

Predecessors are task that depend on other task to either finish or be mid-way through in order for the task to start (Number refer to task)

Each bar indicates a project task

Summary task group related subtask often indicates when a task is planned to be completed

Positive Lag (Gap between task)

Negative Lag (Overlap between task)

-30% ← Mean the task can start when [1 (-lag)] 70% of predecessor task are completed

-60% ← Means the task can start when 40% of predecessor task are completed

1,…,..FS[Lag]%

Planning Network diagram (PERT) displays tasks of a project and the relationship between those task in a graphical network model. Represent workflow of project. Each task will be displayed in individual box. (for planning)

Arrow represent dependencies between task. So if one task can't start until another task is complete

Two lines through- Task completed

One line- Task part completed

Project management body of knowledge provides a document containing the description of different kinds of knowledge areas, skills, standards, and procedures for project management

PMBOK knowledge areas- (These knowledge areas are completed in different Project management process groups)

Scope management is defining what work is going to be done as part of the project so we don't do things we don't need to do

Time management is about creating a project schedule outlining all the activities of a project and keeping track of the progress of the project against milestones so the project completes on time

For example- Gantt chart and Network diagram

Cost management is working out benefits and cost for the project and how we are going to track the cost

Quality management is about creating a plan to ensure that the product and deliverables produced are suitable quality

Human resource management deals with getting the right team and also managing them so don't leave the organisation or team

> For example, managing staff on parental leave

Communication management is planning how the team is going to communicate with each other and to stakeholders

Risk management deals with identify and looking into potential risks for failure and creating procedures to reduce these risk

Procurement management deals with getting the products and services required for project

Stakeholder management is identifying and temper the stakeholder's expectations

Integration management focuses on the activities that ensure the project is performed, coordinated, and monitored and controlled successfully

Project management life cycle is a combination of project phases that work out what tasks will done in each phase. When the project deliverables will be produced and what are they. In each phase who will be involved. The management involvement in approving work produced in each phase.

Project management process groups-

Project initiation is about working out the scope of project with the stakeholders and identifying the constraints.

The PMOK knowledge area- stakeholder management and integration management is relevant here.

> Scope sets the boundaries of the project.
>
> The constraints may be scope, cost of project, time allocated for project, and quality of deliverables of project.

This phase may create - a project charter.

Project planning objective is to guide the execution of the project

The PMOK knowledge area- are all of them are relevant here.

Project scheduling is about scheduling individual task but task duration is estimated. In addition, the project is scheduled. Project scheduling also involves working out which task need to be completed in order for other task to start and which task can start regardless of completion of other task

This phase may create – a scope statement, Gantt chart with all dependencies and resources entered, work breakdown structure, network diagram (PERT) and list of risk prioritised

Project execution deals with carrying out and managing the task explained in the project management plan. Project managers help handle the risks that arise during this phase through their leadership

The PMOK knowledge area- stakeholder management, quality management, and procurement management are relevant here

This phase may create- a milestone report which helps keep the project on track by tracking milestones

Project monitoring & controlling measuring progress towards goals of the project, keeping track of when the project deviates from the plan, and correct course when needed to ensure project is always progressing in accordance with the plan. Occurs in all phases of project life cycle

The PMOK knowledge area- scope management, time management, cost management, risk management and quality management

Baseline is what has been approved for project plan including approved changes

This phase may create- performance reports, requested changes, and updates to various plans

Project closing is about closing out the project and finalising the tasks and giving the project in its current state to the appropriate individuals. The transfer of the project to the appropriate individuals happens regardless of the success or failure of the project. Project failures can still provide valuable knowledge for future projects. This phase may also involve getting product acceptance from the stakeholders and customers

The PMOK knowledge area- procurement management and integration management are relevant here

This phase may create- a project archives, lesson learned, final report and presentation to the sponsor or senior management

PMBOK knowledge areas vs Project management process groups:

Knowledge areas are different aspect of project that can be managed such as cost, time and quality. While process groups are a way of pulling together tools and techniques that need to be used in different parts of the project. So each process group complete activities in one or more knowledge areas

BSC203Question3: Literature Review

- [Literature review]: Explain

Literature review is written analysis of previous literature on a topic. They help act as a lead in our own research project. Find research problems for our research project and find a specific research question

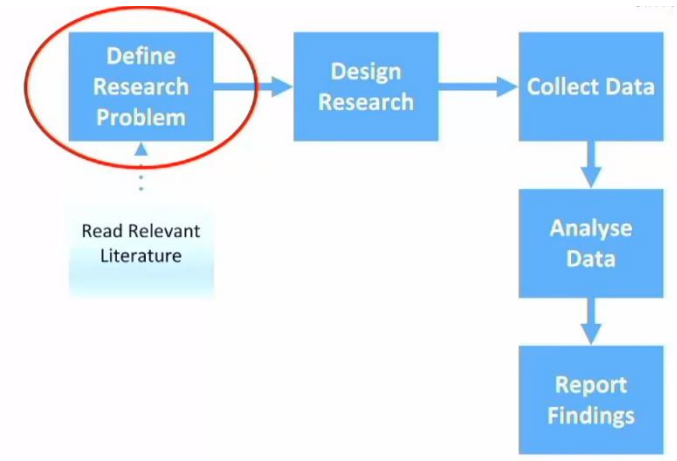
Literature review is a critical analysis of published sources, or literature, on a particular topic. The review should describe, summarise, synthesise and evaluate and clarify this literature. Our job is to add value the abstracts (eg- we have more confidence in first research because of quality of research) by comparing and commenting

Objective of stand-alone literature review:

- Enable others to understand the field
- Points to strength, weakness and omission or bias
- Identify key issues or crucial questions
- Point to gaps

Tips: Don't talk paper by paper but instead concept/themes or relationship between concepts

BSC203Question4: Experiment



Experiments

Define research problem is determining what the research project is trying to do or answer. Good starting point is write a *research question* or if no research question then there should be a *research aim or objective*

Research question is working out what the question is I'm trying to answer with this project?

Examples may include-

what factors influence a user security behaviour and why are users susceptible to phishing attacks and what phishing attacks target

How does system quality affect the maintenance cost?

How does system life affect maintenance cost?

Research aim or objective applies to design and creation since we are trying to create something and not answering a specific question unless it's is it possible to do something or create something.

An example- to find an effective way to train people to identify and avoid phishing websites, to investigate the nature of phishing targets

Research question vs Research aim/question:

Difference between research question is something the research is going to be answered while research aim/objective is something that is going to be achieved during the study

Explanatory research problem (refer to above for category of research) must include research questions and may include *variables*, *hypotheses*, *theories* and *models*

Variable in research is something we are going to measure in the research problem and can take on different values.

Examples include processor speed, ease of use, transmission rate and user satisfaction

Operational definitions are how we are going to measure the variables in our research.

An example-

Weight → Weight in *grams* measured on a scale

Processor speed → Processor speed in *GHZ* measured by a benchmarking software

Ease of use → Ease of use is a *score* on system usability scale

User satisfaction → User satisfaction measured as a *score* on the 7 point Likert scale

Transmission rate → Transmission rate in *megabit per second* measure by a benchmarking software

Hypothesis expresses the relationships between independent and dependent variables in a statement. The relationship can be positive, negative or no relationship. Must be possible to disprove via testing (testable)

Examples includes-

Users with prior experience with similar software will have greater user satisfaction with the software

Better system quality leads to lower maintenance cost

Older system life leads to greater the maintenance cost

(NOTE: Short and sharp. Should not be able to derive the independent variable**s** from it only independent variable)

Independent variable impacts the dependent variables (what we change)

For example-

Prior experience

System life

System quality

Code productivity

(defined based of past literature)

Dependent variable changes in response to changes in the independent variable (what we measure)

For example-

User satisfaction

Maintenance cost

Software quality

(MUST be measurable)

Type of hypothesis-

Non-directional hypothesis is where a relationship exists between the two variables but does not predict/know the exact nature of the relationship. So independent variable will have an effect on dependent variable but direction of effect is not known

[Variable 1] will influence [Variable 2]

[Variable 1] will have an effect on [Variable 2]

Directional hypothesis is where there is a change and it will be caused one variable over another. (Will have a direction and there will be a relationship between two variables) Examples may include

Better system quality leads to lower maintenance

Older system life leads to greater the maintenance cost

Null hypothesis (usually in contrary to our non-directional hypothesis) is where there is no relationship between the two variables. Nothing will change if it does it's due to chance. Examples may include

System quality will have no effect on maintenance

[Variable 1] does not affect [Variable 2]

[Variable 1] has no impact on [Variable 2]

There is no relationship between [variable 1] and [variable 2]

Theories is a series of hypothesis used to explain how something works and predict what's going to happen in the future

Models represent a system or situation and *helps understand* how something works but doesn't always have to helps us understand how something works.

For example- so you have a theory (that helps us understand something) and create a theory to represent a system or situation

EG: OSI

BSC203Question5: Ethics

Ethics is a set of belief about what is right and wrong behaviour in society

Code of ethics set of principal that guides and helps individual make ethical decisions. Also specific expectation of how professional should behave

Themes in code of ethics:

Honesty is about making sure knowledge, services, skills and products is represented truthfully and honest. Important since breaking honesty may lead to repercussion from law and consumers

Confidentiality is about making sure sensitive information about business or customers isn't disclosed to public without permission. Since it may lead to loss of client or business or this information can be misused by someone else to commit illegal activity.

Legality making sure you behave within the law. Not following this will lead to repercussion

Responsibility is about making sure you are accountable for actions. This is important because it often prevents mistakes or the same unintended actions from reoccurring in the future

Competence is about making sure the task is completed successful or efficiently. Lack of competence could lead to not fulfilling requirements of project thus not completing the project

Ethical issues are situation where a moral conflict MIGHT arise.
https://www.geeksforgeeks.org/ethical-issues-in-information-technology-it/

> For example- distributing sensitive information without permission of owner. This could be user data to advertisers (personal privacy)
>
> For example-(piracy) redistributing software without owner of software permission
>
> For example- security of program. So as software developer make sure appropriate security is used to protect user sensitive information

Ethical risk so miners might breath in toxic fumes from mining

BSC203Question6: Project Management

- [Project management process groups]: List
  - [Project initiation]
  - [Project planning]
  - [Project execution]
  - **[Project monitoring & controlling]: Explain**
  - [Project closing]

- [Project monitoring & controlling processes/activities]: List

- [Integrated change control]: Explain
- [Scope verification process]: Explain
- [Scope control process]:
- [Schedule control process]: Tools
  - [Tracking Gantt chart vs Tracking Network Diagram]: Explain
- [Cost control process]
- [Managing the project team process]
- [Manage the stakeholders process]
- [Quality control process]: Tools

Monitoring and controlling project involves taking note of progress of project and taking corrective action when project is not on track (compare to baseline)

Baseline what has been approved for project plan including approved changes

Tracking Gantt is a viewing option used to track the current progress of project and adds more information that show how much of each task have been completed against plan. Used in project monitoring & controlling phase (plan Gantt chart). They show-

Critical path (in red) is sum of the task that depend on one another that have the *longest times* planned for them. Indicates the earliest date a project can be completed. Can't be delayed without delaying entire project schedule

Slack time is time in the non-critical task that can be allocated to other (critical) tasks without the risk of delaying the project completion date. The slack time available can be used to use to ensure task on critical path are completed on time

Does not include date which finished. Includes date slack time finished

Base line (line under task bar) what has been approved for project plan including approved changes

Project task bar/Task projection indicate when the task is projected to be started and complete

Summary task shows percentage of whole summary task completed

Tracking Network diagram is a view to displays tasks of a project and the relationship between those task in a graphical network model and add information in that it allows you to track project progress

Two lines through- Task completed

One line- Task part completed

Ways to take corrective action to make sure schedule is on track

Use Slack time is time in the non-critical task that can be allocated to other (critical) tasks without the risk of delaying the project completion date. The slack time available can be used to use to ensure task on critical path are completed on time

Get more resources

Use quality control tool

Monitoring and controlling project processes/activities-

Monitoring and controlling project work is where project performance is tracked and reported against the plans. Forecast where corrective action might be taken.

Output- Where corrective actions are recommended and forecast

Integrated change control process makes sure changes made are integrated across all of the project knowledge management areas.

Output- Approve or disapprove corrective actions and update project management plan

For example, if we add more staff how do we make it work across all knowledge areas

Scope verification process makes sure projects submitted meets the objectives of the project

Output- Project specification documentation

Scope control process ensures changes to scope of project are controlled and approved

Output- Project specification documentation

Schedule control process keep track and controls deviations to project schedule. Gantt charts used!

Output- Updates the project management plan so everyone know what the changes are

Cost control process keeps track and controls the deviations to project budget

Output- Keeps track of estimated cost of project and updates it in accordance

Managing the project team process keep track of project team members, give feedback, and aim to resolve issues they may have and manage changes

Output- Resolve issues with team members, and provide status reports

Manage the stakeholders process work with stakeholders to make sure their issues are dealt with, requirements met, and communication with the stakeholders are maintained and available

Output- Resolve issues with stakeholders, and provide status reports

Quality control performance process looks at specific outcomes from the project and works out whether tasks completed for the project are sufficient quality. Troubleshoot quality performance issue and to monitor and control a project

Cause and effect diagrams (Ishikawa) visually shows a list of causes and what effect is a result. So finds causes of problems. Will have an effect (Patients not given right manual) and causes will be listed (why) and the causes of those causes

I.E no clear guideline (cause) ← no local policy (cause).

Helps quickly identify he causes and thus take action to get project back on schedule (relates to Monitoring and controlling project)

Control chart illustrates how a process changes overtime. Show where big variations occur and thus lead that to implementation of corrective action**.** shows acceptable upper bound, lower bound limits and centreline.

Run chart is a line chart (think scatterplot but with connections) that also shows data plotted overtime and some kind of relationship over time. There is no upper bound, lower bound limits or centreline and it shows general picture of process which can be used to identify trends or variations and thus implement corrective action to bring [schedule on track] …

Scatter diagrams plots two variable of interest against one another to show relationship between two variables.

Histograms illustrates the frequency of independent variable

Parento chart contains both a line graph and a bar graph and show frequency of independent variable in order from largest frequency to smallest frequency. Allows for better prioritisation of bigger issues and taking corrective actions to bring [schedule on track] ...

Flow chart illustrates the flow or process of complex processes so that it is easy to digest and understand. Get the steps of process so we can track the project

BSC203Question7: Survey research

Survey research

Survey research is where the same kind of data are collected from a group of people, events or entities and are collected in a standard and systematic method. The approaches or methods for data generation in survey research include- questionnaires, interviews, observation, and document analysis

> For example- ask students to rate their university experience from 1 to 10 or qualitative which is non numerical data.
>
> For example- questionnaires with open ended questions such as describe your university experience or interviews. Must be set up to reduce bias thus allow effective analysis
>
> EG- market research or unit surveys

Planning survey:

Determine the data requirements so what data we require to solve the research question

Actually design the data collection tools (so the data generation approach)

Select the data generation approach or method

Get the sampling frame

Work out sampling technique

Data generation methods/approaches for survey research-

Questionnaires are where primarily numerical data is collected and it is a series of printed or online questions given to the respondents to answer. Forms of questionnaires

> Printed questionnaires vs online questionnaires:

Good response rate compared online questionnaire since people tend to ignore online questionnaires and take it less seriously

Printed questionnaire covers less geographical area than an online questionnaire

Printed questionnaires are more expensive than online questionnaire since you need to take paper cost into account

Printed questionnaires are more difficult to update compare to line questionnaire

Interviews are a one on one conversation between an interviewer and participant and it is where questions are asked by the interviewer and the answers to those questions are based on what the participant says.

> Face to face interview vs Telephone interview

Face to face interview we can decipher the respondents body language for additional data as opposed telephone interview where we don't see respondents body

Face to face interview are more of a hassle since geographical and location constraints are applied while telephone interview is more convenient but less accurate

Face to face AND telephone interviews can ask the respondent to clarify and elaborate further on their answers. So get better qualitative data.

Observation is where you use your eyes to count quantitatively the number of the thing of interest

Document analysis is a secondary form of data collection. It is the data that is collected from the analysis of reports, databases, or documents (single document)

Questionnaire vs interview:

The economical cost of questionnaires tends to be greater than the cost of interviews. With questionnaires you can send many printed or online questionnaires to many respondents but with interviews each respondent needs to be paired up with an interviewer in order to collect data

Questionnaires provide the most time for the participants to respond to the questions compared to an interview where the time allowed for the participant to respond is dictated by how long the interviewer can wait.

Questionnaires usually have more unclear responses than compared to an interview. For an interview, the interviewer can request an on the spot clarification or elaboration of an answer

https://en.wikipedia.org/wiki/Interview_(research)

Determine the sampling frame- *(Findings relevant beyond data collection and can be generalizable)*

Population of interest is the group we want the research to apply to

eg- all students interested in e-learning and IT professionals

Sampling frame is the list from which you are going to get the sample. Ideally should contain all the population of interest but not always possible. Subset of population of interest

For example- all members of the Gym, all members of library, membership of ACS, and all students from college

Sample is subset of the population you actually use in your study (so drew from sampling frame). The data obtained from the sample enable us to draw conclusions about the whole population thus sample must be representative of the population.

Determine sampling technique-

Probability sampling techniques is where every member of the population has an understood non-zero chance of being selected.

Random sampling is where every member of the population has the equal chance of being selected for the sample and it is where the sample is randomly chosen from population of interest

All still random sampling but we narrow scope/add constraints to randomly sample

Systematic sampling (instead of selecting items from population at random) is where elements are selected in a fixed interval

i.e. every $10^{th\ item}$

Stratified sampling is where randomly select elements based on a proportion that match population. Sort of like cluster sampling except instead of geographical location …

i.e. for a CS class the gender breakdown should have greater proportion of males than females

Cluster sampling is where elements are randomly selected based on geographical location.

So narrow location scope i.e. Willetton, and Riverton

Non-probability sampling techniques is where every element of the population has an unknown chance of being selected.

Purposive sampling is where elements are deliberately selected for the sample for a reason (for interviews)

For example- Hackers or CEO given they are difficulty to find

Snowball sampling is where one person is selected for the sample, from the target population, and ask the one person to suggest other people for our research

For example- Get one library member and ask them to recruit

Convenience sampling is where researchers pick respondents who are assessable and convenient to select

For example- Researchers pick respondents from college course

For example- Sit at library and ask people as they walk past

Factors influencing sample size:

Amount of sample needed in order to reflect the population

Amount of money and time available

Response rate so if low then more sample size is needed

Statistics needed to test hypothesis or answer research questions *[REWORD]

What needs to be done before collecting the data for questionnaire?

Pre-test is where you try out questions on potential respondents. Thus helping identify any problems or clarity problems regarding questions asked

Pilot test is where all instruments and procedures for collecting the data are tested. Make sure it doesn't fail when finally collecting data

Advantages of survey research:

Allows findings to be generalisable to the wider population

Fast way of collecting data specifically online questionnaires

Inexpensive to conduct in comparison with other approaches such as **action research**

Helps work out the relationship between the variables because generally getting quantitative data

Can use random selection unlike **experiment** where random allocation is used!!!!!

Disadvantages of survey research:

Respondents may not provide honest answers

Lack depth because a survey research is where alot of people are asked few things and we make a sweeping generalisation of it

Can't prove a cause and effect relationship from a survey unlike **experiment**!!!!

Less richer description than a **case study**

BSC203Question8: Experimental Research

- [Experiment]: Explain? Characteristics? Advantages? Disadvantages?
- [Experimental design]: Explain? List types
    - [Field/Quasi experiments]: Explain
    - [Lab/True experiments]: Explain? Methods to create

- [Experimental treatment]: Explain
- [Control group]: Explain? EG

- [Correlation]: Explain? EG
- [Causality]: Explain? EG? Properties

- [Validity]: Explain? List types
    - [Internal validity]: Explain? Factors that affect internal validity
    - [External validity]: Explain? Factors that affect external validity

Experimental research

Experiments are used to test a hypothesis in a controlled condition and observe the outcome. Investigates how variables effect on another, so the cause and effect relationship (causality). Designed to either disprove or prove hypotheses. Difference with survey research is that survey find association with variables but we can't show causality

> For example- an experiment comparing the affect-sensitive and nonaffective tutors on students learning. The students learnt better with the affect sensitive tutor

Characteristic of experiments (what makes it experiment)

Precise measurements and observation of variables

We can show causality

Hypotheses is involved and experiment tries to disprove and prove them

Find the factors that cause something to happen

Used to predict and explain

Should be able to be repeated with same outcomes

Advantages of experiments

is that it is the only method to *show causality which is a cause and effect relationship*.

Also allows people to *repeat the same experiment* with same outcomes possibly in different settings, which gives people confidence in the study.

Provides an established framework to testing hypotheses

Disadvantages of experiments

is that because experiments are conducted in controlled conditions the experiment would likely have *poor external validity* thus means study's finding unlikely to apply to real world.

Also, sometimes *highly controlled conditions may be impossible*.

Sometimes *obtaining a representative sample is difficult*

Experimental design refers to how experiments are designs such as number of experimental groups, or use of randomisations. Different types of experimental design include

Field/Quasi experiments is where experiment is conducted in realistic real world realistic settings. Likely poor internal validity since less controlled conditions. Likely good external validity since experiment is conducted in a realistic real world setting thus study findings is likely to apply to other settings.

Lab/True experiments are where experiments are conducted in highly controlled conditions. Thus, good internal validity which is where the manipulations of the independent variable causes the results of the study and the results are not due to other factors. But poor external validity because highly controlled condition thus may be an unrealistic setting, which means study's finding unlikely to apply to real world.

Methods create a controlled condition (lab experiment not field experiment)

Get rid of unwanted factors that might have an impact on the experiment but we are not interested in.

Also, hold factors constant (age must be between).

As well as use random selection and allocation.

Also use a control group which is a group without the change in the independent variable

~~**Random sampling** is where every member of the population has the equal chance of being selected for the sample and it is where the sample is randomly chosen from population of interest. For surveys~~

Random allocation is where the members from the sample is allocated to the experimental groups. For experiments (Think refers to groups not sample)

Experimental treatment (adjective) what is done to manipulate the independent variable

Control group is group without the change in the independent variable. So group without experimental treatment. We use it to compare with experimental group. Highlights the effect of the treatment via isolation due to everything kept consistent with all group except for the treatment

> For example- user task experience with a new system (experimental group) vs an old one (control group). New protocol and old protocol

Correlation/correlation relationship determines that two variables are related and have a relationship.

> Example may include one variable increases another variable decreases, level of use is associated with user satisfaction with system and users who believe they are vulnerable to security threats are more likely to believe that threats will be severe.

Causality/casual relationship is a change in one variable makes a change in another variable. So both variables don't just move in parallel.

> Examples may include pair programming improves program quality, and user who receive password memorisation training will create stronger passwords.

Properties of causality

include *correlation* which is where two variables are related and have a relationship.

Also *time order* (not found in survey research but in experiment) so an independent variable changes first and thus causes a change in values of dependent variable.

Rules out other possible factors as explanation of study's findings by having controlled conditions

NOTE: we still can't prove causality even if all the properties are met. But say study findings support the link

Validity is worried about how successful the study has been to measure what the study has been set out to measure. The types include

Internal validity relates to how well the study has been carried out. Good internal validity is when the manipulations of the independent variable causes the results of the study and the results are not due to other factors

Factors that impact internal validity

may include *instrumentation* because it may be faulty or changed during the experiment which results in inconsistent results.

Another may be *experimental mortality* where participants drop out of a group because study is long. Also *maturation* which is where participant change/mature during the length of the experiment (not drop out) for example young child participates in experiment and age they use technology better.

Also *reactivity and experimenter effects* where participants try to behave in a way they think the researcher would like them to behave.

The other factor includes *history* and *differences between the experimental and control group*

External validity refers to the extent to which what we find in one study is transferable and generalizable to other settings. Examples of external validity could be whether or not our study results apply to China and also America, results hold true in a year.

Factors that impact external validity

may include picking *samples that don't represent a realistic population* thus we can't expect our study findings to apply to other settings. (EG all IT students)

Also *sample size is small* which also means our study findings is unlikely to apply to other settings since it doesn't reflect a realistic population.

Finally, *test cases are not representative* so does not reflect full range of situations thus study findings is unlikely to apply to other settings

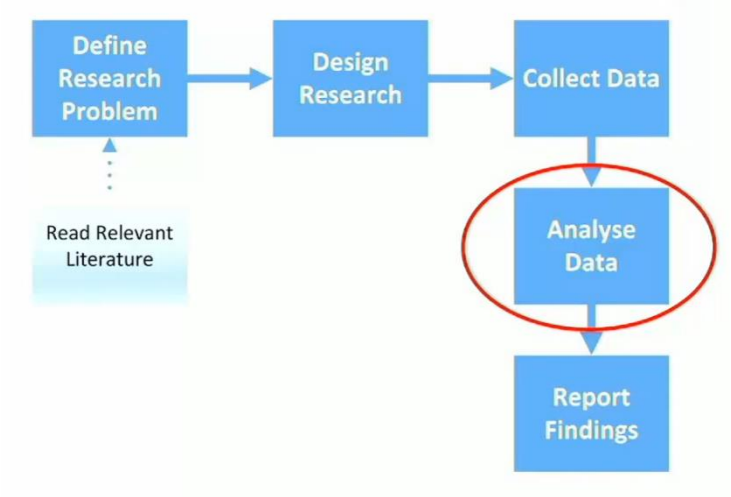
Experimental research vs Survey research:

Experimental research is where we investigate how variables effect on another, so the cause and effect relationship. Difference with survey research is that survey find association with variables but we can't show causality.

Experimental research is where researchers will manipulate the independent variable of an experiment. For survey research the researchers will not manipulate anything and will only assess and record what is occurring

Survey research is where you only use one data generation approach to answer the research question. Experiment research is where you can use one data generation approach but it only a part of the experiment not the whole experiment

BSC203Question9: Data Analysis



- [Data analysis]: Explain? List types

- [Quantitative data analysis]: Explain
  - [Nominal data]: Explain? EG
  - [Ordinal data]: Explain? EG
  - [Interval data]: Explain? EG
  - [Ratio data]: Explain? EG
- [Qualitative data analysis]: Explain? Advantages? Disadvantages

- [Descriptive statistics]: Explain? List types of descriptive statistics
  - [Graphical descriptive methods]: Explain
  - [Numerical descriptive methods]: Explain
    - [Measure of central tendency]: Explain? EG
    - [Measure of variability]: Explain? EG
- [Inferential statistics]: Explain? List types of inferential statistics test
  - [Chi-square]: Explain
  - [Correlation]: Explain
  - [T-test]: Explain

Data analysis

Data analysis utilises the data gathered in the research to solve research questions. The types

Quantitative analysis involves the analysis of numerical data or numbers which can be calculated.

Often include looking at data that is tangible so multiple-choice questions, yes or no questions

Types of quantitative (numerical) data: (important as it influences how you analyse)

Nominal data often refers to categorical data. Often count and compare frequencies of categories (So, think represents labels/groups with words to describe the group)

No specific order in categories

Example- ethnicity, race or Gender or technology devices in tech shop (printer, PC, Mouse)

Ordinal data can be grouped on a scale and there is an order between the groups.

But intervals are not equal (no common difference between groups that are ordered)

For example- PC privileges such as root and user

For example, Likert happiness 1-7 scale or education level (highschool, college, primary school) or iPhone iterations. Even though it may seem there is a common difference but how do we know 1 to 2 is the same as 2 to 3? "OK" and "Unhappy" the same as the difference between "Very Happy" and "Happy?" We can't say

Interval data similar to ordinal data. The data type can be measured on scale, order matters between the data types, and also the data types share a common distance between them

But no zero point on the scale (so 0 is a zero point but if it allows <0 then not a zero point/start point)

For example- Time on a 12-hour clock (no 0 o'clock or start point)

Ratio data similar to interval data. The data type can be measured on scale, order matters between the data types, data types share a common distance between them, and there is a zero point on the scale

For example- Memory storage (like 4gb)

For example- Age because age starts from zero-point (0) height can also be a ratio data as there is no height less than 0 (no < 0 data) and there is start point

Qualitative data analysis focuses on non-numerical data which can't be calculated.

Often include looking at data that is less tangible/abstract so written feedback by customers, or open-ended answers or photographs and sound

Advantages of qualitative data analysis

Makes it easier to understand the reason for particular quantitative responses and helps with creating a narrative around the quantitative responses. For example, story of why a person crashed his car

Superior in analysing feelings or opinions

Disadvantages of qualitative data analysis

Lack of standard technique for qualitative data analysis

As a result of the data being less tangible and subjective it is prone to having many different acceptable interpretations

Descriptive statistic used to summarise and describe what we have collected about the sample. Types (methods) of descriptive statistics

Graphical descriptive methods capture what we found about a sample and present it as a graph

Numerical descriptive methods capture what we found about a sample and present it numerically through statistical measures

> **Measure of central tendency** lets us know where most of our data lies or the centre point these include mean, median and mode
>
> **Measure of variability** lets us know how far apart your data are from each other include range, quartiles, and standard deviation (average distance of each data value from mean)

Inferential statistics determines whether results found from the sample (through descriptive statistics) is true with the wider population and statistically significant. And not due to chance and but a systematic effect. Thus, allows for predictions about a wider population from given sample. Types of inferential statistics test

Chi-square used for testing differences between the categorical variables in regards to the expected and observed distribution.

> P (asymptomatic significant) represents probability of whether relationship is significant.
>
> So < 0.05 means there is a statistical difference between x and y. Therefore, results not due to chance and so we reject null hypothesis
>
> For example- P = 0.485 or P(robability)/ (sig.) = 48.5% chance that the difference between x, y is due to chance and not a systemic effect

Correlation measures the extent two quantitative variables have a linear relationship. First P(roability) + then

> R (Pearson correlation) represents direction and strength of relationship between two variables.
>
> > So = 0 means no direction/correlation to the relationship
> >
> > > 0 then positive correlation/direction (x goes up y goes up)
> >
> > < 0 then negative correlation/direction (x goes positive (up), goes down negative (down)). Range is between -1 → 1

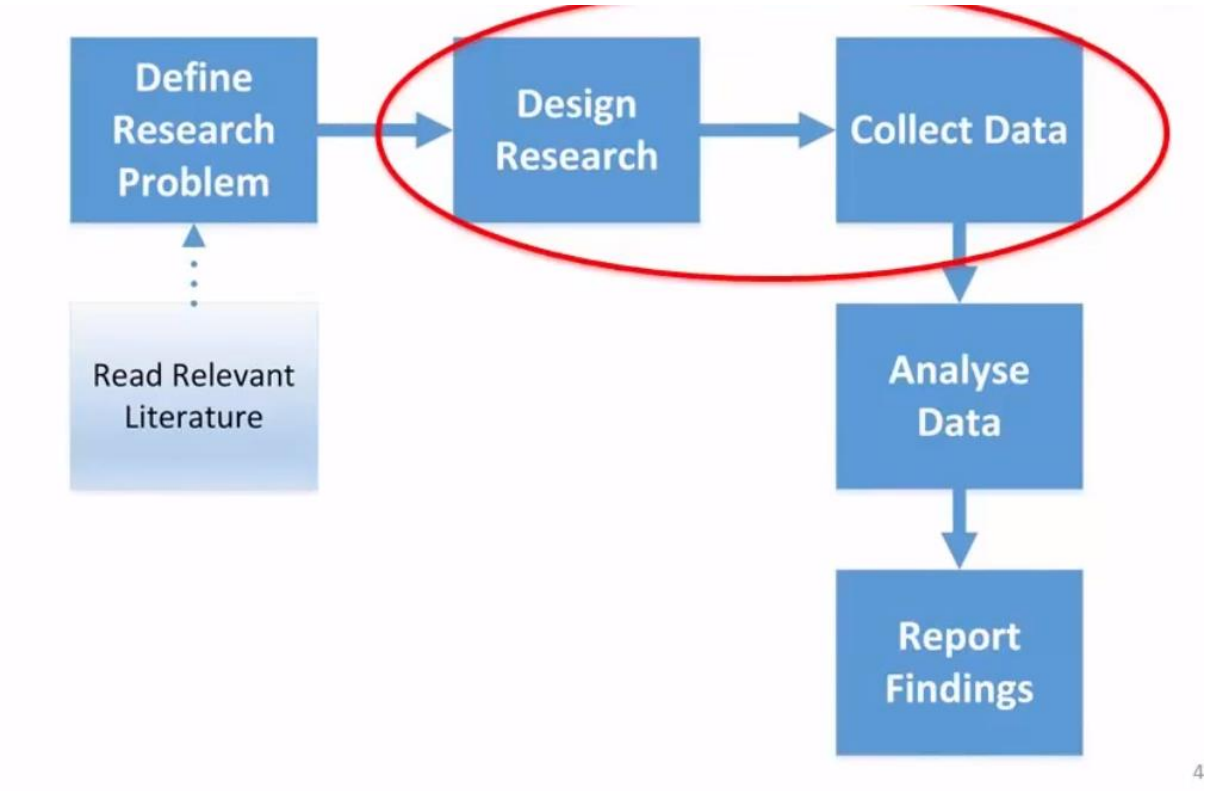
P(sig/probability) represents probability of whether relationship is significant

T-test can measure the significant difference between the average of two groups for a single variable

For example- (males vs females' satisfaction), average of 2 variables in a single group (before and after) or …

P(probability) (sig.)

BSC203Question10: Design and Creation



Design and creation

Design and creation research goal is the creation of new ICT products**.**

For example- coming up with new system development methodologies or creating auto-phishing game or modification to network routing protocols

ICT Products (artefacts) in design and creation research include

NOTE: Can be multiple ICT products created in a research!!!!!!!! Such as Models the instantiation

Constructs where you come up with vocabulary or concepts to describe a particular IT domain

For example, object oriented and notion of cloud computing

Instantiations is the creation of systems that show implementations in a system.

For example, proof of concepts or prototypes

Methods is the creation of different ways to solve various problems

For example, algorithms, system development methodology

Models anything designed to represent a situation and help develop a solution

For example- OSI model

Design and creation/research project vs normal system development:

Needs to contribute to knowledge and something new. So making an accounting system is not new. Evaluates artefacts (products) and new approaches

Design and creation research criteria (for evaluating whether design and creation research is done well) are the following

- Clearly shows what IT artefact has been made
- Demonstrates why contribution is research as opposed to normal system development
- Given enough information about how they went about the project in particular the development methodology
- Do the researchers describe their selected data generation methods
- Is the evaluation information provided detailed
- Are results in their studies generalised to other situations and is it appropriate
- Honest about the limitations of their research

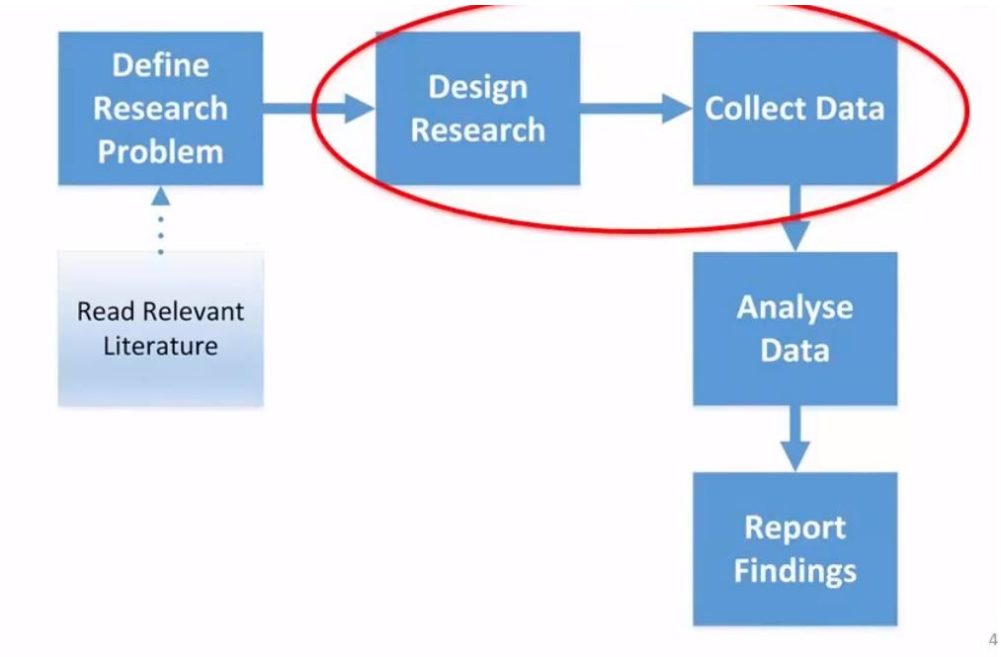
Design and creation process-

Awareness of problem

Proof of concept/proof of demonstration is a way to show that an idea of a proposed product has merit. They often are not evaluated on whether they work in a real life context. More cost and resource efficient than trying to create the actual marketable product. Prototypes show enough so that it can be compared with the current existing approaches

Clients are stakeholders, organisations, individuals or entities that provide funding and improve relevance of research but they may not have same interest as the researchers thus conflict arises. Clients focused only on the artefact but the researcher is focused on additional things

BSC203Question11: Action and Case Study Research



- [Case study]: Explain
- [

Case study

Case study focuses on the in-depth investigation of one case. They are just explanation or description of the one case. Helps examine the phenomena within its context.

Case study research focuses on the investigation of one or more case studies. Helps researchers understand everything in the domain that we are researching. A case study research is better than a case study because for a case study it generally harder to determine whether the findings can be applied to any other situation.

> For example- investigate recent cyber-attacks on organisations, how the organisation tried protect themselves and impacts of the cyber-attacks. Thus resulting in new recommendations for how organisations should defend against cyber-attacks.

Characteristics of case study research:

Focuses on depth as opposed to shallow and broad like a survey research

Use multiple approaches to collecting data because you want detailed data and information

Researchers does not control or manipulate unlike experiment

Research is likely observed in natural settings such as organisations in IT

Investigating more than one instances of whatever we are interested in to determine whether the findings apply to another situations

Looks into one or a more entities

Factors for designing case study research:

What type of case study research planned (exploratory, descriptive explanatory)?

Approach to time (historical, contemporary or longitudinal)?

Case selection characteristics- amount of cases studied and site of selection

Data collection approaches

Different types of case study research are:

Exploratory case study research is where there is not much literature known about the topic. Thus we have trouble determining a detailed hypothesis or research question. Therefore, after exploration we may develop new hypothesis about new research topic

Descriptive case study research aim is to describe what is going on without explaining why

Explanatory case study research aim is try to explain why something has happened. Must be able to identify variables of importance and have ideas about relationships between them

Approach to time: (what we are trying to study in relation to time)

Historical case study research is looking back at past information to get an understanding about existing situation

Contemporary case study research is a snapshot of current situation and doing case study research as it unfolds.

> For example- Enter an organisation and get a current understanding of situation

Longitudinal case study research follows a situation or variable over an extended period of time

> For example- Enter an organisation and follow the developments of their use of a particular technology

Case selection characteristics (what we are trying to study in relation to number of cases)

Multiple case designs looks to compare cross cases with similar sites

> For example- Investigate three small to medium enterprises who implement the same software and look for similarities. Because given sites are similar we can draw a confidence in the findings

Single case designs is chosen when the case is rare, occurs in one situation and a revelatory case. Then multiple case design isn't reliable. Also single case design is needed to test for a particular case in order to fully complete the research

Data collection methods:

Data can be collected using different approaches.

> These methods may include- Interviews (open ended vs closed), documentation like financial records, direct observation such as observe meetings and artefacts (eg review software)

Triangulation is the process of where multiple sources and methods of data are used to enhance the credibility of the research findings. Helps capture the contextual complexity

> For example- Interview people and also review software logs and find the same problems we are triangulating the finding

Advantages of case study research:

Good for complex situations where it is not possible to use a simple data collection strategy and where it is hard to isolate and study individual factors

Good for situations where controlling the environment or factors is difficult

Ideal for new areas

Disadvantages of case study research:

Difficult to make generalisations from a single case study. Often generalisations made from a single case study is not credible

Can take a lot of time to conduct the case study research

Case study research vs Survey research: (think different properties difference)

Survey research is data that is collected that is shallow and broad such as only twenty questions and how we measure. While case study research collects data that is more detailed, informative and a lot we need to analyses

> For example- Survey research uses has a twenty question questionnaire with true and false on how you felt about something
>
> For example- Case study research uses financial report of an organisation

Use multiple approaches to collecting data because you want detailed data and information unlike survey where you have one approach

Case study research vs Experiment research: (think different properties difference)

Case study research does not aim to reduce complexity while experiment research we control environment and simplify so we can understand one or two relationship

Case study researchers play a less active role in the experiment and often observe only while researchers in experiment will manipulate certain variables to see the effect

Case study research vs Design and creation research: (think different properties difference)

Case study research is where an ICT artefact is not always produced while with a design and creation research an ICT artefact is always produced

Prior knowledge can help in the creation of a new ICT artefact in a design and creation research. With case study research prior knowledge is necessary valuable or affect a case study research

Action research

Action research approach aims to answer research questions or get a deeper understanding of a situation with immediate practical outcomes for stakeholders in the process. Researchers themselves are actively involved in the situation being studied. They are considered participants and researchers at the same time. This approach is usually for an unstructured field experiment with no controlled environment and defined variables

> For example- Invited by organisation. Organization say they have a problem and researcher solve the practical problem as well getting deeper understanding of that situation that can be used elsewhere
>
> For example- looking at improving employees compliance with information system security policies through the implementation of system security training.

Characteristics of an action research include:

Produce practical outcomes (not products) as well as research outcomes

Focus on practical issues

Primary focus is on changing something

Use several data collection methods (not always) (like case study)

Often is iterative with a plan-act-reflect-cycle (not always)

Stages of conducting an action research:

- Diagnosing a practical problem that you are hoping to address
- Planning a solution
- Directly intervening
- Evaluating the results
- Reflecting on the solution

Approaches to conducting an action research:

- **Degree of structure** for an action research differs. A degree of structure is defined as how rigidly you have to follow the steps
- **Degree of researcher involvement** is defined as how much the researcher is actively involved.

Advantages of action research:

- Produce immediate practical outcomes for participants or organisation
- Address real world problems therefore research is more relevant and valuable

Disadvantages of action research:

- Potential conflict of interest and bias between researcher and organisation/employer
- Can take a lot of time to conduct an action research
- Lack of repeatability and rigour which results in the research having poor credibility

Action research vs Experiment Research: (think different properties difference)

Action research is not structured and researcher make change directly themselves while in an experiment the researchers remain independent they just define variables, manipulate, control the environment but then step fully back and measure. With an experiment there is a clear point where the researcher will not make any more changes to the experiment

> For example- an action research could new training approach to make employees follow good internet security practises where it is hard to narrow down to the variables

Action research findings generally have poor credibility because this research approach primarily focuses on problems relating to a localise and specific environment. Experimental research findings aim to be applicable to a generic environment

> For example- Action research could be new approach to making mining employees follow good internet security practises
>
> For example- Experimental research could be new e-learning approach to teaching English to Indian students

Action research vs Design and Creation research: (think different properties difference)

Action research intervention occurs in a real setting while design and creation research setting can be more controlled and artificial.

> For example- an action research could new training approach to make employees follow good internet security practises
>
> For example- testing new e-learning approach on 5 students instead of a classroom

Action research produces practical real world products that are applicable to solving real world problems. On the other hand, design and creation can produce products or artefacts that can theoretically solve problems thus design and creation products are allowed to be more abstract.

> For example- a design a creation artefact could be a construct where the construct is the concept AI which is used to describe machines that try to mimic humans
>
> For example- an action research could be the creation of a wiki based knowledge management system for emergency responses

For action research the product solution is limited to the current technology available but for design and creation research there is less limitation on the existing technology used for the ICT artefact

> For example, design and creation could be the creation of fully robotic human brain

For Action research the researchers are actively intervening with the situation being studied in order to create the product that resolves the current real life problem. On the other hand, for design and creation the researcher will propose a fleshed out solution as opposed to an intervention right away

Action research vs Case study research: (think different properties difference)

Action research the researchers are intervening with the research while case study the research collect data that exist, observe and don't make change

> For example- an action research could new training approach to make employees follow good internet security practises
>
> For example- an action research could be study why employees don't follow good security internet practises

Action research goal is to produce practical outcomes or solutions for a current problem while case study research focuses on collecting data on a problem

Action research vs Survey research

Action research is not structured and researcher make change directly themselves while in a survey research the researcher just observers and record. No influence

Survey research is inexpensive to conduct in comparison with other approaches such as action research

Tips

To determine research approach go through order of elimination