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SCHOOL OF BUILDING AND ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

UNIT – I –Research methodologies in built environment– SAR5610

I. UNIT 1

Basic research issues and concepts- Orientation to research process- Types of research: historical, qualitative, co-relational, experimental, simulation and modelling, logical argumentation, case study and mixed methods- illustration using research samples.

Introduction

- Research is an art of scientific investigation.
- It is commonly refers to a search for knowledge.
- It is involved with creativity and innovation.
- Exposes the hidden things to the world.
- It provides a solution to a problem.
- Research also helps in generalization and formulation of new theories and invention.

Meaning of research

Research is defined as the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes.

Research is defined as the scientific investigation of phenomena which includes collection, presentation, analysis and interpretation of facts that lines an individual's speculation with reality.

Research is the systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions.

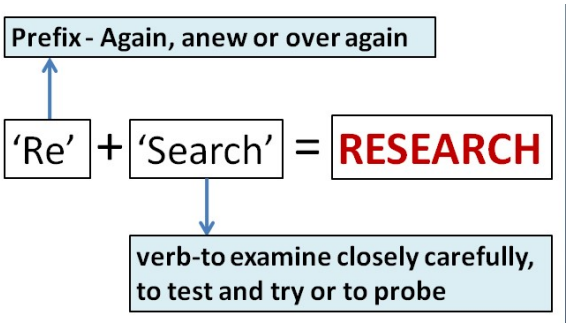
Research is a process of systematic inquiry that entails collection of data; documentation of critical information; and analysis and interpretation of that data/information, in accordance with suitable methodologies set by specific professional fields and academic disciplines.

According to the American sociologist Earl Robert Babbie, "Research is a systematic inquiry to describe, explain, predict, and control the observed phenomenon. Research involves inductive and deductive methods."
Clarke and Clarke: Research is a careful, systematic and objective investigation conducted to obtain valid facts, draw conclusions and established principles regarding an identifiable problem in some field of knowledge.

John .W. Best: Research is a systematic and objective analysis and recording of controlled observations that may lead to the development of generalizations, principles, theories and concepts, resulting in prediction for seeing and possibly ultimate control of events.

Clifford woody: Research is a careful enquiry or examination in seeking facts or principles, a diligent investigation to ascertain something.

Mouley: It is the process of arriving at dependable solution to the problems through the planned and systematic collection, analysis and interpretation of data.



Characteristics of research

1. Empirical - based on observations and experimentation on theories.
2. Systematic - follows orderly and sequential procedure.
3. Controlled - all variables except those that are tested/experimented upon are kept constant.
4. Employs hypothesis - guides the investigation process
5. Analytical - There is critical analysis of all data used so that there is no error in their interpretation
6. Objective, Unbiased, & Logical - all findings are logically based on empirical
7. Employs quantitative or statistical methods - data are transformed into numerical measures and are treated statistically.

Types of research

Basic research: A basic research definition is data collected to enhance knowledge. The main motivation is knowledge expansion. It is a non-commercial research that doesn't facilitate in creating or inventing anything. For example: an experiment to determine a simple fact.

Applied research: Applied research focuses on analyzing and solving real-life problems. This type refers to the study that helps solve practical problems using scientific methods. Studies play an important role in solving issues that impact the overall well-being of humans. For example: finding a specific cure for a disease.

Problem oriented research: As the name suggests, problem-oriented research is conducted to understand the exact nature of a problem to find out relevant solutions. The term "problem" refers to multiple choices or issues when analyzing a situation.

For example, revenue of a car company has decreased by 12% in the last year. The following could be the probable causes: there is no optimum production, poor quality of a product, no advertising, or economic conditions.

Problem solving research: This type of research is conducted by companies to understand and resolve their own problems. The problem-solving method uses applied research to find solutions to the existing problems.

Qualitative research: Qualitative research is a process that is about inquiry. It helps create in-depth understanding of problems or issues in their natural settings. This is a non-statistical method.

Qualitative research is heavily dependent on the experience of the researchers and the questions used to probe the sample. The sample size is usually restricted to 6-10 people. Open-ended questions are asked in a manner that encourages answers that lead to another question or group of questions. The purpose of asking open-ended questions is to gather as much information as possible from the sample.

There are three purposes of research:

Exploratory: As the name suggests, exploratory research is conducted to explore a group of questions. The answers and analytics may not offer a final conclusion to the perceived problem. It is conducted to handle new problem areas which haven't been explored before. This exploratory process lays the foundation for more conclusive research and data collection.

Descriptive: Descriptive research focuses on expanding knowledge on current issues through a process of data collection. Descriptive studies are used to describe the behavior of a sample population. In a descriptive study, only one variable is required to conduct the study. The three main purposes of descriptive research are describing, explaining, and validating the findings. For example, a study conducted to know if top-level management leaders in the 21st century possess the moral right to receive a huge sum of money from the company profit.

Explanatory: Explanatory research or causal research is conducted to understand the impact of certain changes in existing standard procedures. Conducting experiments is the most popular form of casual research. For example, a study conducted to understand the effect of rebranding on customer loyalty.

To understand the characteristic of research design using research purpose here is a comparative analysis:

	Exploratory Research	Descriptive Research	Explanatory Research
Research approach used	Unstructured	Structured	Highly structured
Research conducted through	Asking research questions	Asking research questions	By using research hypotheses.
When is it conducted?	Early stages of decision making	Later stages of decision making	Later stages of decision making

Research method is defined as the tools or instruments used to accomplish the goals and attributes of a study. Think of the methodology as a systematic process in which the tools or instruments will be employed. There is no use of a tool if it is not being used efficiently.

Research begins by asking the right questions and choosing an appropriate method to investigate the problem. After collecting answers to your questions, you can analyze the findings or observations to draw appropriate conclusions.

Qualitative Methods

Qualitative research is a method that collects data using conversational methods. Participants are asked open-ended questions. The responses collected are essentially non-numerical. This method not only helps a researcher understand what participants think but also why they think in a particular way.

Types of qualitative methods include:

One-to-one Interview: This interview is conducted with one participant at a given point in time. One-to-one interviews need a researcher to prepare questions in advance. The researcher asks only the most important questions to the participant. This type of interview lasts anywhere between 20 minutes to half an hour. During this time the researcher collects as many meaningful answers as possible from the participants to draw inferences.

Focus Groups: Focus groups are small groups comprising of around 6-10 participants who are usually experts in the subject matter. A moderator is assigned to a focus group who facilitates the discussion amongst the group members. A moderator's experience in conducting the focus group plays an important role. An experienced moderator can probe the participants by asking the correct questions that will help them collect a sizable amount of information related to the research.

Ethnographic Research: Ethnographic research is an in-depth form of research where people are observed in their natural environment without This method is demanding due to the necessity of a researcher entering a natural environment of other people. Geographic locations can be a constraint as well. Instead of conducting interviews, a researcher experiences the normal setting and daily life of a group of people.

Text Analysis: Text analysis is a little different from other qualitative methods as it is used to analyze social constructs by decoding words through any available form of documentation. The researcher studies and understands the context in which the documents are written and then tries to draw meaningful inferences from it. Researchers today follow activities on a social media platform to try and understand patterns of thoughts.

Case Study: Case study research is used to study an organization or an entity. This method is one of the most valuable options for modern This type of research is used in fields like the education sector, philosophical studies, and psychological studies. This method involves a deep dive into ongoing research and collecting data.

Quantitative Research Methods

Quantitative methods deal with numbers and measurable forms. It uses a systematic way of investigating events or data. It is used to answer questions in terms of justifying relationships with measurable variables to either explain, predict, or control a phenomenon.

There are three methods that are often used by researchers:

Survey Research — The ultimate goal of survey research is to learn about a large population by deploying a survey. Today, online surveys are popular as they are convenient and can be sent in an email or made available on the internet. In this method, a researcher designs a survey with the most relevant survey questions and distributes the survey. Once the researcher receives responses, they summarize them to tabulate meaningful findings and data.

Descriptive Research — Descriptive research is a method which identifies the characteristics of an observed phenomenon and collects more information. This method is designed to depict the participants in a very systematic and accurate manner. In simple words, descriptive research is all about describing the phenomenon, observing it, and drawing conclusions from it.

Correlational Research— Correlational research examines the relationship between two or more variables. Consider a researcher is studying a correlation between cancer and married Married women have a negative correlation with cancer. In this example, there are two variables: cancer and married women. When we say negative correlation, it means women who are married are less likely to develop cancer. However, it doesn't mean that marriage directly avoids cancer.

Other types of Research

- One-time research or longitudinal research (based on time)
- Field-setting research or laboratory research or simulation research (based on environment)
- Clinical or diagnostic research (based on medical field)
- Case study research
- Historical research (based on historical sources)
- Conclusion-oriented (a researcher is free to pick up a problem, redesign the enquiry as he proceeds and is prepared to conceptualize as he wishes).
- Decision-oriented (the researcher in this case is not free to embark upon research according to his own inclination) – Example: operational research

Social Research

Positivism holds that science or knowledge creation should be restricted to what can be observed and measured. Positivism tends to rely exclusively on theories that can be directly tested

Post-positivists view science as not certain but probabilistic (i.e., based on many contingencies), and often seek to explore these contingencies to understand social reality better.

Subjectivists who view the world as a subjective construction of our subjective minds who believe that there is an external reality that is independent of a person's thinking – Questionable?

Ontology refers to our assumptions about how we see the world, e.g., does the world consist mostly of social order or constant change.

Epistemology refers to our assumptions about the best way to study the world, e.g., should we use **an objective or subjective approach** to study social reality, such as by using standardized data collection tools like surveys, then they are adopting a paradigm of **functionalism**.

Interpretivism - best way to study social order is though the **subjective interpretation** of participants involved, such as by interviewing different participants and reconciling differences among their responses using their own subjective perspectives

Radical structuralism- If researchers believe that the world consists of radical change and seek to understand or enact change using an **objectivist** approach

Radical humanism - to understand **social change** using the subjective perspectives of the participants involved

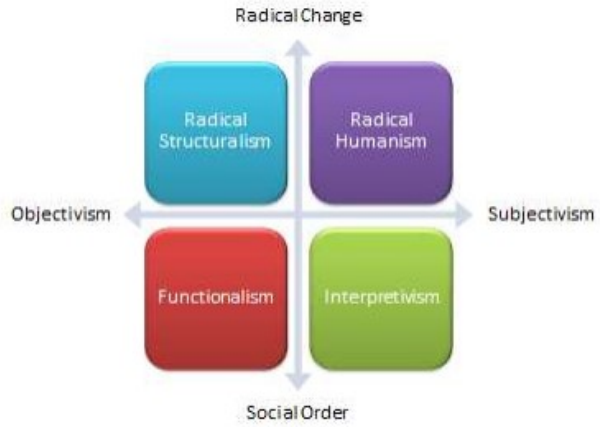


Figure 3.1. Four paradigms of social science research
(Source: Burrell and Morgan, 1979)

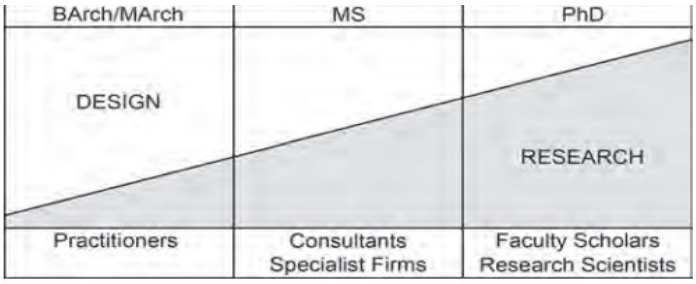


Figure 1.1 The complementary nature of research and design.

Facets of Similarity	Design	Research
Models of Reconstructed Logic	Systematic Design Process	"Scientific" Method
Multiple Logics	Abductive Inductive Deductive	Abductive (Research Design/Hypothesis Formation) Inductive Deductive
Logics in Use	Generator/Conjecture Model Problem/Solution	Multiple Sequences of Logics, Dependent on Research Questions and Purposes
Scope	Macro/Micro and Mid-level in applied/clinical setting	Big/Medium/Small Theory
Social Context	Situated Practice	Situated Research

Figure 2.2 Comparable and shared qualities of design and research.

Deduction: WHAT + HOW leads to ???

Induction: WHAT + ??? leads to RESULT

Abduction-1: ??? + HOW leads to VALUE

Abduction-2: ??? + ??? leads to VALUE
(thing) (working principle) (aspired)

Facets of Difference	Design	Research
Contribution	Proposal for Artifact (from small-scale to large-scale interventions)	Knowledge and/or Application that Is Generalizable (in diverse epistemological terms)
Dominant Processes	Generative	Analytical & Systematic
Temporal Focus	Future	Past and/or Present
Impetus	Problem	Question

Figure 2.1 Matrix of the primary differences between design and research.

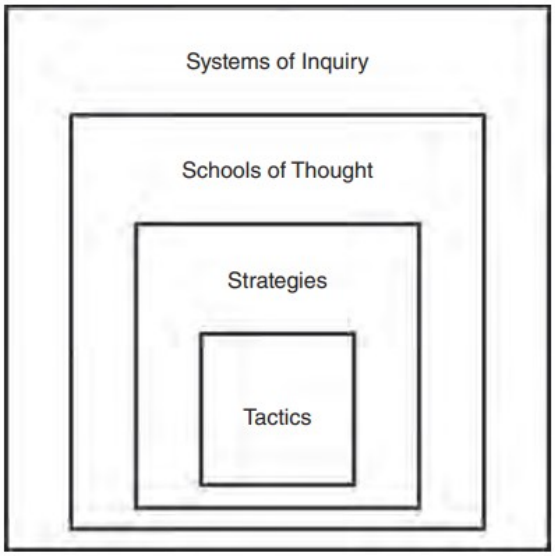
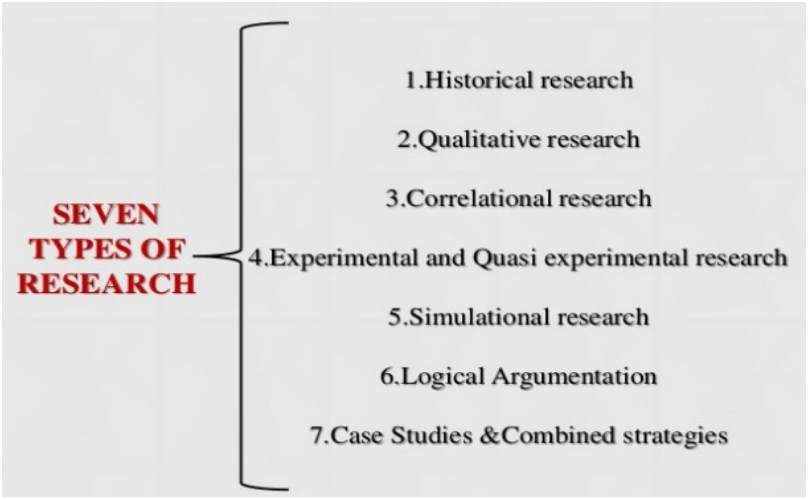


Figure 1.3 The methodological practices of strategies and tactics are framed by broader systems of inquiry and schools of thought.

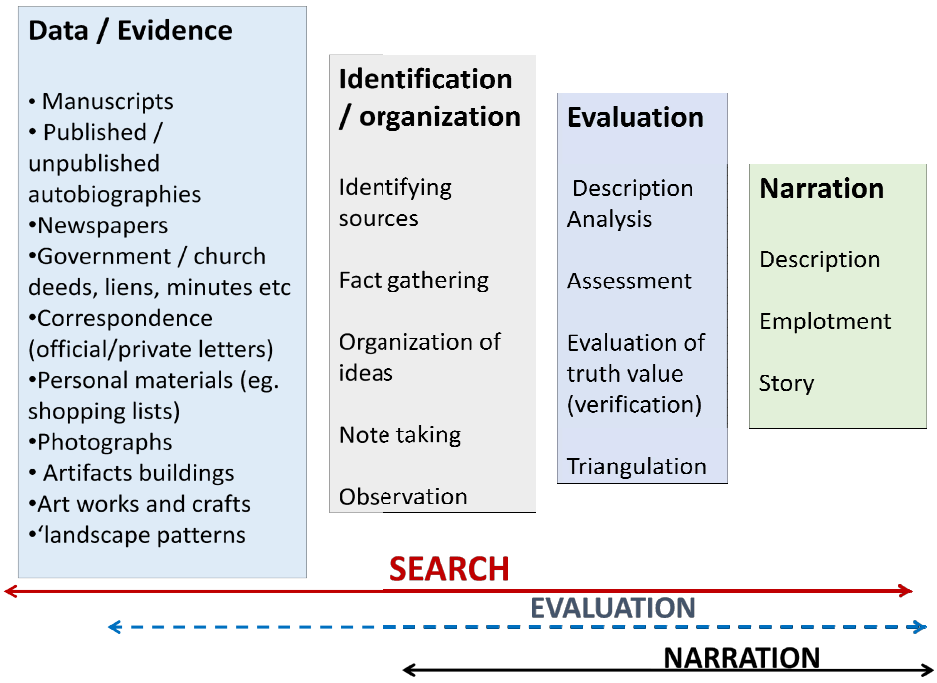
system of inquiry	Multiple choices of research strategies
School of thought	Frames the research question
Strategy /research design	The skilful management and planning of anything
tactics	Skilful move - a more detailed deployment of specific techniques, such as data collection devices, response formats, archival treatment, analytical procedures, and so on.

Seven types of research in architecture (Groat and Wang, 2002)



Interpretive-Historical research

- Investigations into social-physical phenomenon within complex contexts, with a view toward explaining those phenomena in narrative form and a holistic fashion
- Throughout the process, interpretation is the key.
- The emphasis is accessing evidence from the –past.



Identification	Organization	Evaluation/Analysis
Facts versus ideas	Researcher's mind	Audience
Fact finding	Accuracy	Attribution
Being a detective	Love of order	Clarification
Library	Logic	Check for falsification
Internet	Honesty	Bias
Catalogues	Imagination	Self-criticism
Encyclopedias	"Cross-questioning"	
References	Compilation	
Chronology	By topic	
Maps	By time	
Current opinion	By internal logical order	
Colleagues, "experts"	Verification	
Note taking	Composing	
	Paragraph, chapter, part	
	Use plain words, sentences	
	Tone and rhythm	
	Art of quoting	

Figure 6.7 A representative list of tactical concerns in history research mentioned in Jacques Barzun and Harry F. Graff, *The Modern Researcher,* 6th ed. (2004).

Four interpretive lenses in history

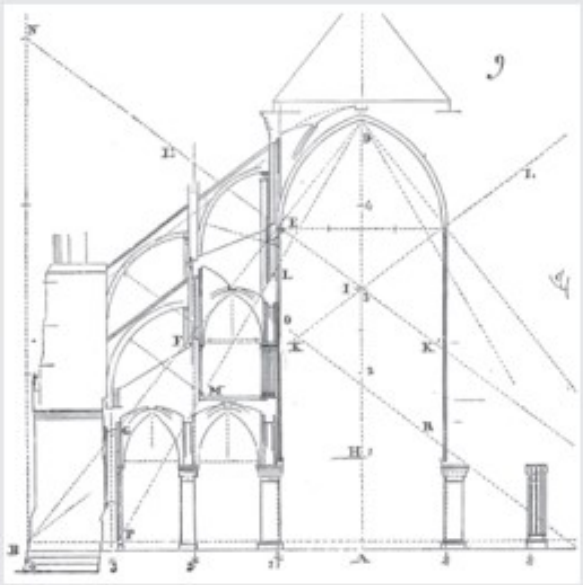


Figure 6.4b Diagram from Viollet-le-Duc's *Dictionnaire Raisonnée* highlighting the rational factors behind Gothic framing.

Causal explanations: The idea of 'covering law'

"No essential difference between the behaviour of natural phenomena and the behaviour of social phenomena'' – Hempel (1905)

"Possibility of large scale predictions are rejected and is addressed as piecemeal engineering' – Popper (1902)

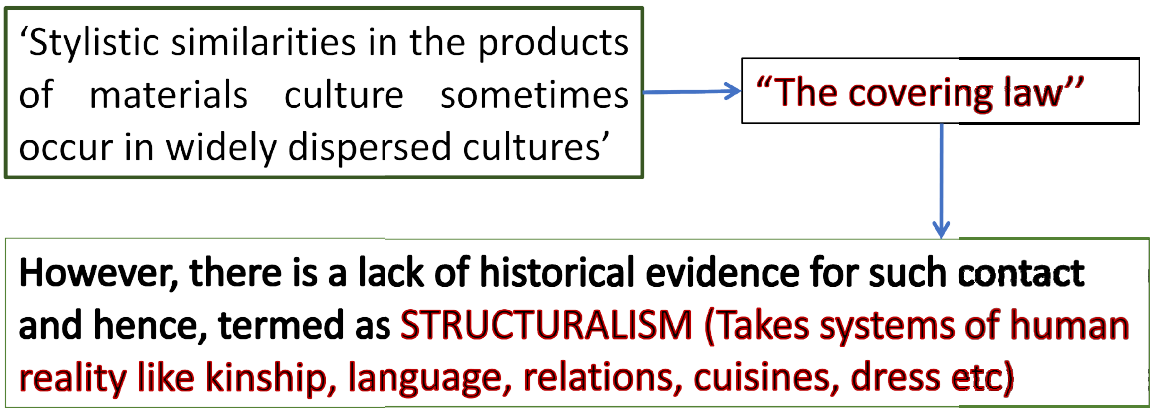
Example: Gothic structures are the results of forces acting on them identified as causal forces

History as the movement of absolute spirit

"communal consciousness is the sum of the individual consciousness of all individuals in a society at one time"

Example: Explanatory power for stylistic transitions through time

Structuralism



Post Structuralism

"the idea of an orderly self defining, self regulating and self transforming system is questioned."

" understands discourse as something like the cultural manifestations of the trafficking of thought"

"material products of culture are parts of a larger immanent discourse, and so any historical assessment of architecture is necessarily an assessment of the socio cultural discourse as well.

Evidences in history

Determinative evidence	Can situate the object of study in time and space of the one historic world Example: Digital photography of historical buildings
Contextual evidence	Elements of built environment are often used to situate the objects of inquiry in context Example: Construction of the Big temple
Inferential evidence	By proximity of date, by reasoned interpretation, or by other logical deductions, one proposition to be linked with another proposition even though 'hard' connections may not be available Example: Inscription in temples
Re collective evidence	Interviews targets memories rather than present day reaction to things which require interpretation to interpretation Example: Picture of Chennai from 19th to 20th century

Determinative evidences

Use of ‘amphorae’ in construction to reduce the self weight of the massive structures during the Roman era / Many architectural, clothing, etc references in these reliefs. These reliefs are made in the Satavahana period, but the Satavahana being one of the Mauryans successors carried on many of its style.

Inferential Evidence

Figure 6.10 Images on the left are of detailing on the western bays of San Lorenzo, while the images on the right are from the eastern bays. From this striking difference in quality, Cohen infers a significant gap in time during construction. By permission of Matthew A. Cohen.

Re-collective evidence

Figure 6.9 Frederick Robie, with driver, in the Robie Cycle Car, designed and built several years before the construction of the Robie House. Courtesy of Frank Lloyd Wright Preservation Trust.

Qualitative research

- concerned with developing explanations of social phenomena
- it aims to help us to understand the social world in which we live and why things are the way they are.
- It is concerned with the social aspects of our world and seeks to answer questions about: ·

- Why people behave the way they do ·

- How opinions and attitudes are formed

- How people are affected by the events that go on around them

- How and why cultures and practices have developed in the way they have

Qualitative approaches

Ethnography	**The term means "portrait of a people" and it is a methodology for descriptive studies of cultures and peoples. The cultural parameter is that the people under investigation have something in common**
Grounded theory (Example: Diverse opinions on workshops)	It is phenomenological (this means it attempts to understand how participants make sense of their experiences and does not assume that participants' accounts refer to some verifiable reality); but it goes beyond phenomenology because the explanations that emerge are used to develop new theories.
Interpretative phenomenological analysis	It is phenomenological, attempting to understand how participants make sense of their experiences (it does not assume that participants' accounts refer to some verifiable reality) but it recognises that this involves a process of interpretation by the researcher

Discourse analysis	**It focuses on text and talk as social practices. Researchers from this tradition are interested in how discourses are organised to be persuasive, or to present a particular 'world view', and would search for these patterns in the words that are used (linguistic repertoire) and the way that they are utilised (rhetorical strategies).**
Conversation analysis	Conversation analysis explores how social interactions are structurally organised and does this by analysing detailed transcripts of tape recordings, examining such things as turn-taking, lengths of pauses, inflections and so on
Content analysis	The emphasis in conventional content analysis is on counting/frequency
Narrative analysis	This focuses on people's narratives/stories either about themselves or a set of events. Tt concentrates on the sequential unfolding of someone's story so there is an emphasis on emplotment and characters. It is time-consuming and usually includes a very small number of cases.

Qualitative data collection methods

- Interviews
- focus groups
- observation
- collection of documented material such as letters, diaries, photographs
- collection of narrative
- open ended questions in questionnaires (other aspects of are covered in the resource pack surveys and questionnaires)

Ethnographic research

- **emphasizes in-depth engagement with site-specific settings, most especially through active and thorough observation (Groat & Wang, 2013)**

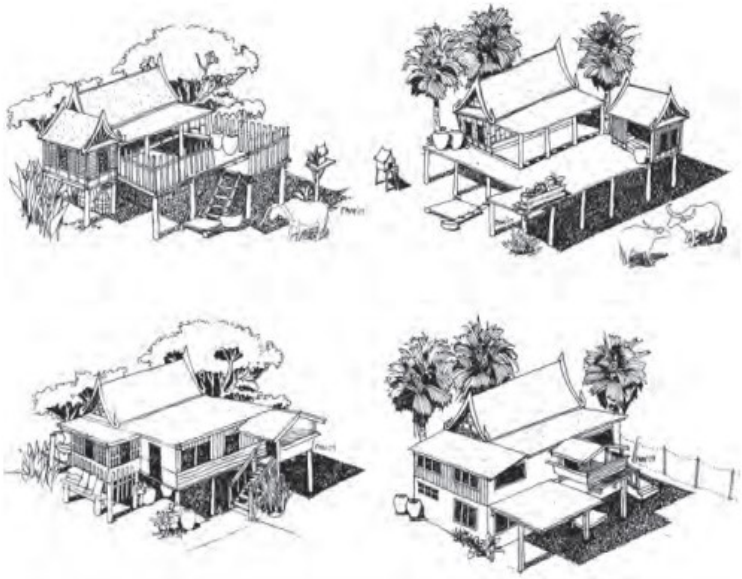


Figure 7.5 Transformation of two Thai vernacular dwellings. Historical dwellings are shown at the top with contemporary versions below. Courtesy of Piyarat Nanta.

Phenomenology (lived experiences)

"where experiences contain both the outward appearance and inward consciousness based memory, image, and meaning." - Creswell

Clare Cooper Marcus's study of people's attachments to their homes, House as a Mirror of Self, is a good example of what one might call "applied phenomenology based on 'The house is the symbol of self'

Figure 7.7 Drawings by the interviewees. Illustrations originally appeared in *House as a Mirror of Self* by Clare Cooper Marcus, used with permission of author.

Grounded Theory

- seeks to investigate a setting holistically and without
- aim to identify an explanatory theory as it emerges from the analytical process. preset opinions or notions.
- it depends on an intensive, open-ended, and iterative process that simultaneously involves data collection, coding (data analysis), and memoing (theory building).
- the process by which theory emerges within the iterative cycles of data collection, coding, and memoing has led a number of authors to characterize "grounded research" as an exclusively inductive process.

Tactics	Interactive	Noninteractive
Interviews & Open-Ended Response Formats	face-to-face or phone in-depth interviews focus groups task-oriented formats, e.g.: mapping exercises multiple sorting task projective surveys (games)	online response to open-ended questions prompted journaling activity logs photo logs
Observations	participant observation (research role concealed) participant observation (research role known)	nonparticipant observation
Artifacts and Sites	*in situ* observation & analysis of artifacts/ buildings/urban context/ landscape sites	photos, drawings, or virtual representations of artifacts and sites
Archival Documents		public documents audio visual material artifactual or site documentation personal journals, diaries, letters, sketches

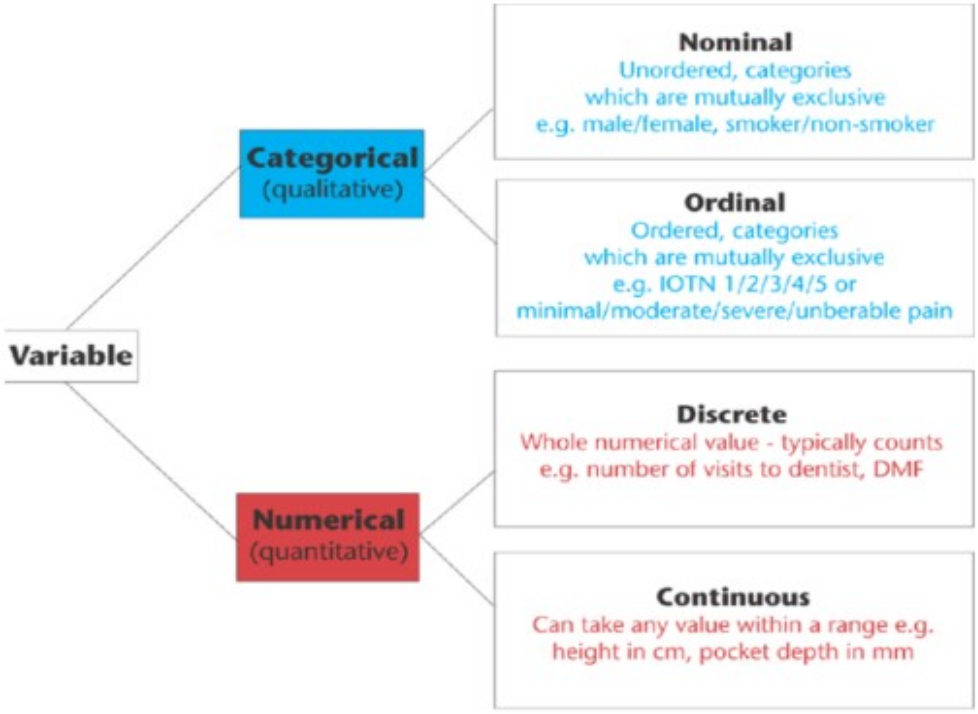
Figure 7.14 The variety of data sources for qualitative research. Linda Groat and David Wang, *Architectural Research Methods* (New York, NY: Wiley & Sons, Inc. 2002); and John W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (Thousand Oaks, CA: SAGE, 2009).

Strengths	Weaknesses
Capacity to take in rich and holistic qualities of real-life circumstances	Challenge of dealing with vast quantities of data
Flexibility in design and procedures allowing adjustments in process	Few guidelines or step-by-step procedures established
Sensitivity to meanings and processes of artifacts and people's activities	The credibility of qualitative data can be seen as suspect with the postpositivist paradigm

Figure 7.24 Qualitative research strengths and weaknesses.

Correlation Research

- to clarify patterns of relationships between two or more variables, that is, factors involved in the circumstances under study.
  - A Focus on Naturally Occurring Patterns
  - The Measurement of Specific Variables (Categorical Measurement / Ordinal Scales/ Interval and Ratio Scales)
  - The Use of Statistics to Clarify Patterns of Relationships



Nominal	describes a variable with categories that do not have a natural order or ranking. **Examples:** genotype, blood type, zip code, gender, race, eye color, political party
Ordinal	order matters but not the difference between values. Example: socio economic status ("low income", "middle income," "high income")
Interval	one where there is order and the difference between two values is meaningful. Example: temperature (Farenheit), temperature (Celcius)
Ratio	has all the properties of an interval variable, and also has a clear definition of 0.0. When the variable equals 0.0, there is none of that variable. Example: enzyme activity, dose amount, reaction rate, flow rate, concentration,

Types of correlation studies	
Relationship	focus specifically on both the nature and the potentially predictive power of those relationships
Causal comparative	a type of correlational research that stakes out an intermediate position between the predictive orientation of relationship studies and the focus on causality that characterizes experimental research.

Positive correlation	when the value of one variable increases with respect to another.
Negative correlation	when the value of one variable decreases with respect to another.
No or neutral correlation	when there is no linear dependence or no relation between the two **variables**.

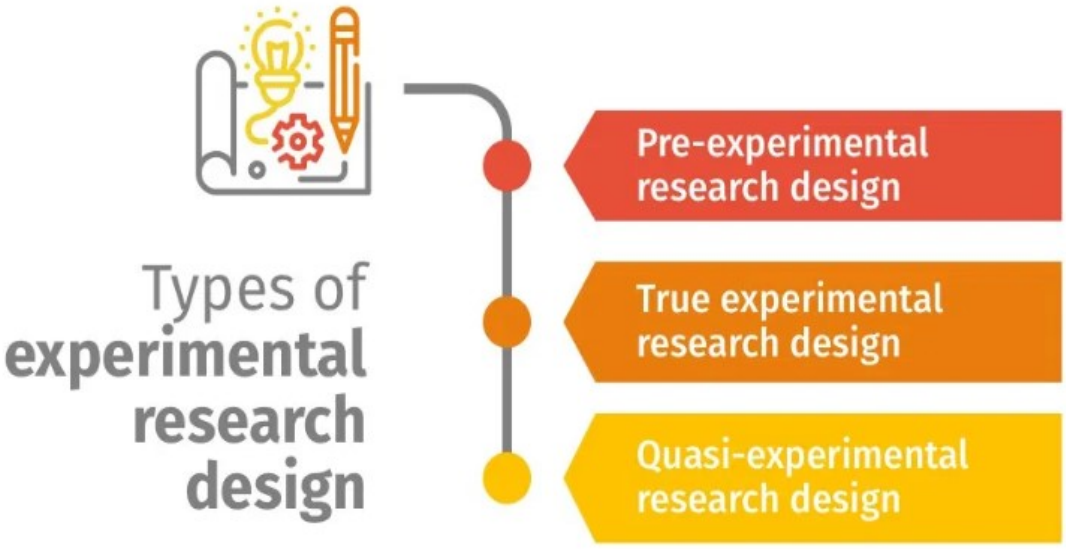
Strengths	Weaknesses
Can clarify the relationships among two or more naturally occuring variables	Researcher cannot control the levels or degrees of variables
Well suited to studying the breadth of a setting or a phenomenon	Less well suited to exploring the setting or phenomenon in depth
Can establish predictive relationships	Cannot establish causality

Figure 8.41 Strengths and weaknesses of correlational research.

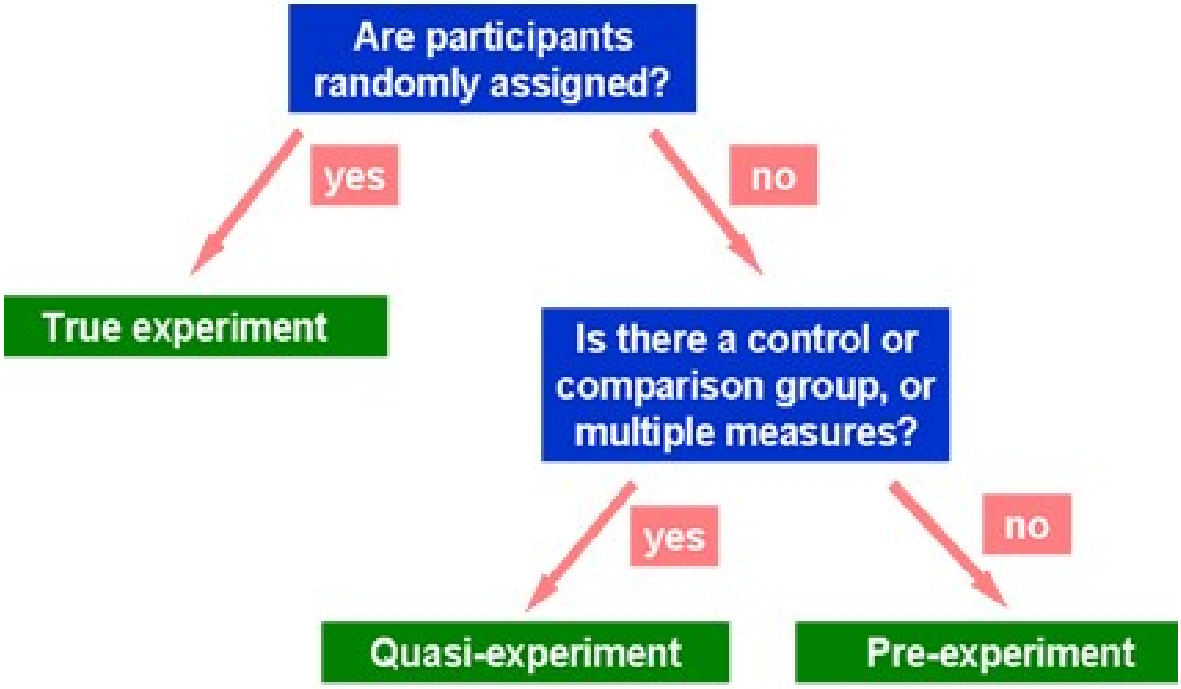
Experimental and Quasi-Experimental Research

Experimental research is research conducted with a scientific approach using two sets of variables.

The first set acts as a constant, which you use to measure the differences of the second set. Quantitative research methods, for example, are experimental.



Research on the performance of various building components has constituted a significant and long standing domain within architectural research



- Manipulation - ensures the cause precedes the effect & In a true experiment the value or level of the independent variable that a participant experiences, is **determined** - or manipulated - by the researcher
- Comparison - a control group ensures the effect did not occur naturally
- Random assignment - ensures that there are no other systematic differences between the groups that could explain the effect.

Two types of experimental research in architectural domain....

Givoni et al - focuses on radiant cooling by metal roofs, a significant issue for housing in developing countries. To be specific, Givoni et al. tested three distinct conditions of insulation operation:

(1) with the insulation panels closed both day and night;
(2) with the insulation panels open at night and closed during the day; and
(3) with the insulation positioned as in 2, but with the addition of a small ventilating fan from midnight to 5:00 a.m. In addition, two levels of thermal mass (as represented by water-filled bottles) were also tested.

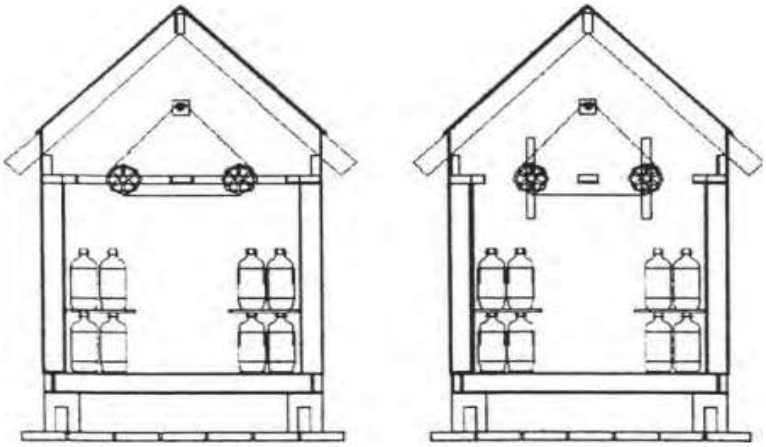
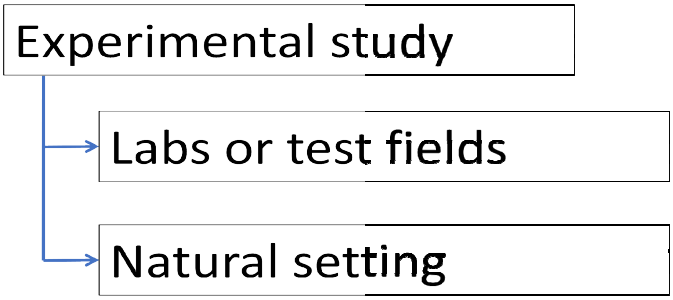


Figure 9.1 Test cell used by Givoni et al. Courtesy of American Solar Energy Society, Inc.

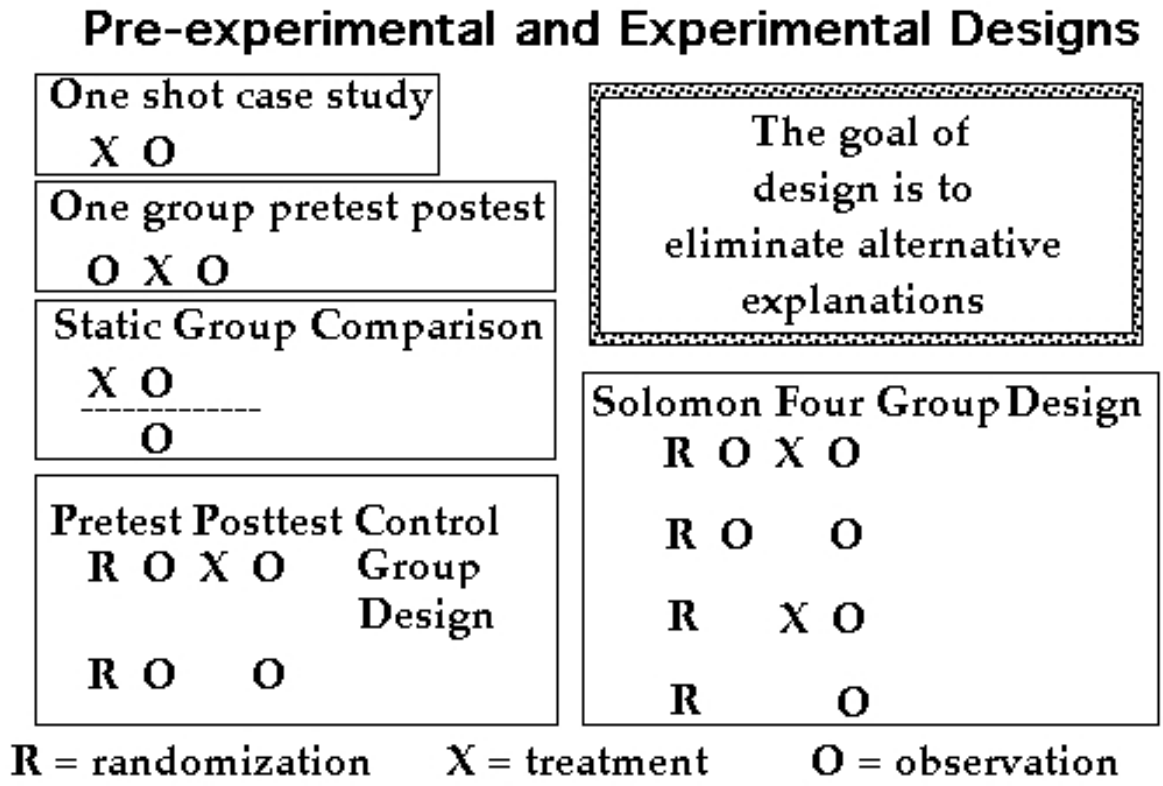


Devlin - "women architects would be less favourably rated than male architects,"

- created both a junior-level and senior-level résumé, the junior level with 4 years of architectural experience and the senior level with 13 years of experience.

- Half of each résumé type (junior or senior) was designated by a fictitious female name, and half by a fictitious male name.
- Each résumé included a career objective, professional experience, affiliation, registration, education, skills, and honors and awards.
- By using identical gender-designated résumés
- These respondents then randomly received one of the four fictitious résumés and were asked to evaluate the candidates on a 7-point scale for the following qualities:

  - technical aspects of the job
  - administrative aspects,
  - interpersonal aspects,
  - contribution to growth of firm's client base
  - creative contribution
  - advancement
  - overall rating.



Quasi experimental design (random assignment not possible)

A researcher wanted to test the effect of four lighting systems on employee productivity in four separate office areas (it is unlikely that management would agree to assign the employees randomly to the four office areas such that important work group functions would be disrupted.) Analysis can include:

- task or work objectives
- mix of job types
- gender mix
- age range
- level of education and so on.

Figure 10.2a A to-scale model of a proposed church interior. One can orient the model to the sun in such a way that would suggest how the actual space might look under the same conditions. But generally, fixed architectural models are representations more than simulations. Courtesy of Professor Matthew Melcher.

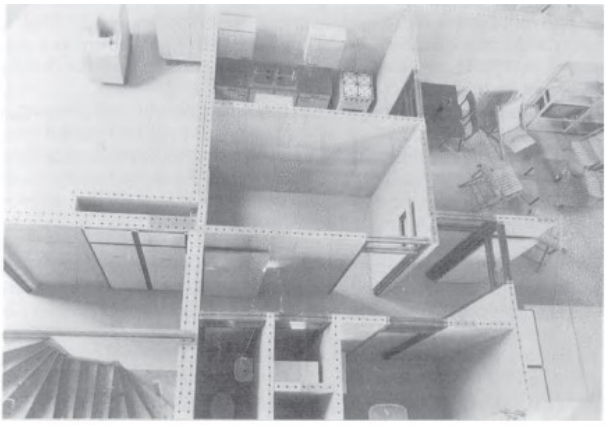


Figure 10.2b Full-size mock-ups of residential spaces in Amsterdam: residents participated in these simulated environments prior to actual construction of the design. Courtesy of Plenum Press. From Marans/Stokols *Environmental Simulation* (1993).

Strengths	Weaknesses
Potential for establishing causality	Reduction of complex reality to identify "causal" or independent variables
Potential for generalizing results to other settings and phenomena	Misuse by overgeneralization to different ethnic, gender populations
Ability to control all aspects of experimental design enables attribution of causality	Overemphasis on control yields ethical problems, dehumanization

Figure 9.25 Strengths and weaknesses of experimental research.

Simulation research

- ubiquitous research design that can be deployed across a broad range of topics, for purposes that span from highly targeted applications in **design projects to theory building**.
- the combination of **experiment and simulation** in sequenced phasing is commonly deployed

Examples: people's reactions to various settings, simulated by photographs, full-scale mock-ups, and the like, can be effectively investigated

simulation - "the representation of the behavior or characteristics of one system through the use of another system, especially a computer program designed for the purpose

Simulation of Complex Human Factors - Evacuation of Buildings during a Fire

Simulation in Earlier Stages of Architectural Design Process - Virtual Reality in Schematic Design and Design Development; Rapid Prototyping.

Integration of Simulation Software – UrbanSim (urban growth) , ESRI ArchGIS

Real-Time Simulation - Computer programs can tailor a building's mechanical and electrical systems to perform in response to user needs in real time.

Immersive Building Simulation - a user can be placed "into" a three-dimensional computer-generated environment, one that responds (ideally) to the user's real- time actions. The term virtual reality is often used in this sense.

Modeling Construction Sequences – enables dynamic simulation of at-one- point scenarios, but more significantly, the behavior of structures under construction over time (BIM)

Logical Argumentation

- Based on logical building blocks by which, or upon which, broad explanatory theories can be constructed. The tactics of logical argumentation:
- Defining the first principles: expressed by technical terms that, together, make up the conceptual chassis upon which the system is framed.
- Defining Relationships : After the technical definitions have been made clear, a logical framework must demonstrate certain relational linkages that make the system coherent.

Aristotle proposed four categories: the material, the formal, the efficient, and the final causes.

- A house requires material to build (without material, a house could not result)
- A house requires a formal cause (distribution of materials in the form).
- A house requires an efficient cause (efficient cause enormously influenced medieval conceptions of God as the efficient cause of the world)
- A house requires a final cause (The end of a thing is also a cause)

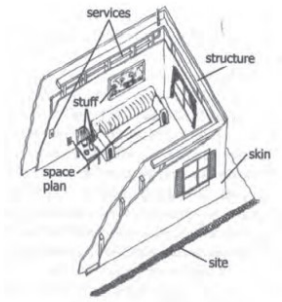


Figure 11.2 Student drawing illustrating the six "S" categories of Stewart Brand's theory for the rate at which building layers change. The site hardly ever changes; as we go up (or into) the hierarchy, the rate of change increases. A building's "stuff" changes every day. Courtesy of Angela Feser.

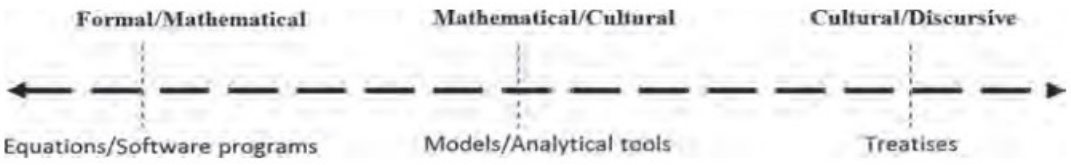


Figure 11.3 Spectrum of logical argumentation.

In between these two poles are logical frameworks that share characteristics of both formal/mathematical systems and cultural/discursive ones.

Like formal/mathematical systems, they may use numerical factors or rule-based constructs in their analyses of space and form.

But they do so with the view that the resulting data can shed light upon social/cultural values

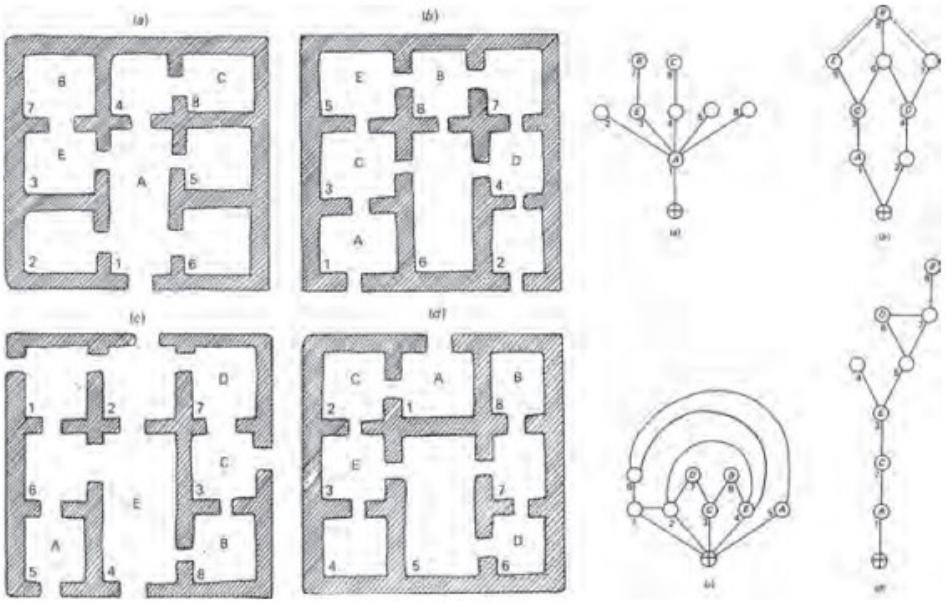


Figure 11.4 From Hillier and Hanson, *The Social Logic of Space:* The floor plans on the left are reduced to the gamma maps on the right. These maps are able to reveal patterns of spatial adjacencies. When the function of each space is factored in, along with how many spaces removed each space is from the entry, patterns of adjacencies, reflecting social values, can be defined over a large sample of plans. By permission of Cambridge University Press.

Strengths	**Weaknesses**
Logical argumentation identifies first principles as the common denominator(s) for a wide variety of seemingly disparate factors and provides an underlying (or overarching) framework that ties them together into a conceptual system that can describe, explain, and predict within its area of concern. First principles are part of any research design; hence the principles of logical argumentation can help identify them and organize them in an understandable manner. In other research designs, logical argumentation is therefore useful as a tactic for arranging fundamental principles coherently.	As with the Prince Charles example, it is not easy to identify fundamental categories; examples abound in the literature of unclear categories. It is also easy to fall into the trap of wishing for well-accepted numbers of categories: for example, three, or seven, while six tends to "feel" incomplete. Prince Charles was obviously thinking of precedent when he termed his list "the Ten Commandments." But there is no internal reason why the *substance* of his system had to be comprised of *10* items. A logical system may in fact not be an accurate representation of the reality it purports to explain and yet still be internally consistent from a logical point of view. For this reason, logical systems must be tested (and they should be amenable to testing).

Figure 11.15 Strengths and weaknesses of logical argumentation research.

Case Studies and Combined Strategies

- A **case study** is a **research** strategy and an empirical inquiry that investigates a phenomenon within its real-life context.
- **Case studies** are based on an in-depth investigation of a single individual, group or event to explore the causes of underlying principles.
- "an empirical inquiry that investigates a phenomenon or setting. By deleting the word contemporary and adding the word setting, this definition would specifically accommodate the explicit inclusion of historic phenomena and both historic and contemporary settings as potential foci of case studies" (groat & Wang, 2013)
- **Example:** Jacobs's study is a preeminent and well- respected example of the case study strategy; she uses the example of New York City—as a particular case—to explore the multiple socio-physical dynamics that contribute to the vitality of urban life.

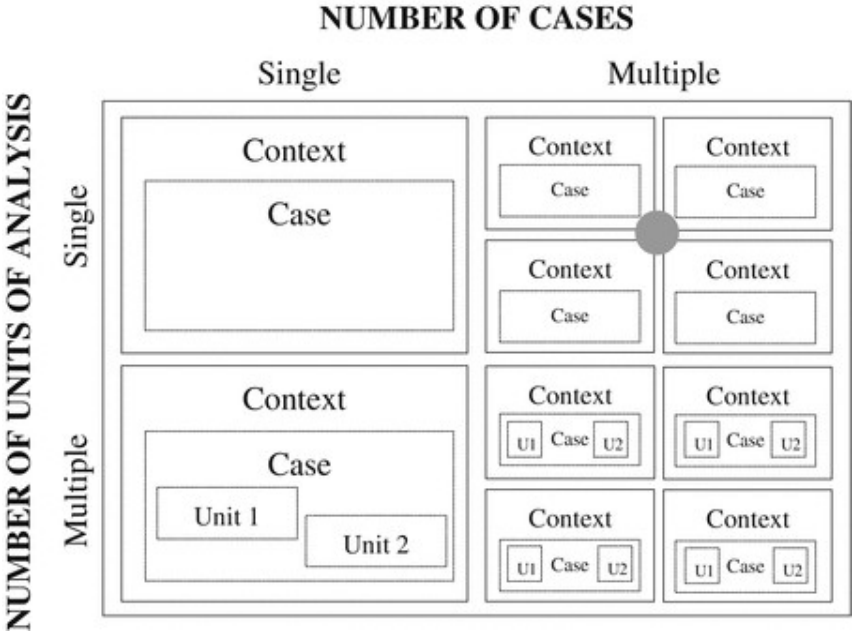
Characteristics

- a focus on either single or multiple cases, studied in their real-life contexts (vernacular architecture)
- the capacity to explain causal links (reasons for modifications & extension in vernacular D/U)
- the importance of theory development in the research design phase (Jacob's book)
- a reliance on multiple sources of evidence, with data converging in a triangular fashion
- the power to generalize to theory.

Reasons for the choice of single or multiple case studies (Groat & Wang, 2013):

- (1) the nature of the theoretical questions, or research questions, involved;
- (2) the role of replication in testing or confirming the study's outcomes.

Yin (1984) - Single / Multiple / Embedded (multiple units) design / Holistic (single unit) design



Strengths	Weaknesses
1. Focus on the embeddedness of the case in its context	1. Potential for overcomplication
2. Capacity to explain causal links	2. "Causality" likely to be multi-faceted and complex
3. Richness of multiple data sources	3. Challenge of integrating many data sources in coherent way
4. Ability to generalize to theory	4. Replication required in other cases
5. Compelling and convincing when done well	5. Difficult to do well; fewer established rules and procedures than other research designs

Figure 12.19 Case study strengths and weaknesses.

Combined strategies

- Increasingly, researchers in many fields, including architecture, are advocating a more integrative approach to research whereby multiple methods from diverse traditions are incorporated in one study.
- Creswell does offer three general models that are suitable for our consideration:
  - the two- phase approach
  - the dominant–less dominant design
  - the mixed methodology design.

Model of Combination	Strengths	Weaknesses
1. Two-phase	Each strategy can be presented fully and distinctly	Potential lack of connection and coherence
2. Dominant – less dominant	Potential for maintaining coherence through emphasis on dominant design Less dominant design can provide depth and validity	Complementary strengths of less dominant design not fully realized
3. Mixed methodology	Potential to maximize strengths and minimize weaknesses of each design	Need for level of sophistication in multiple research design Mixed methodology too unconventional for some purists

Figure 12.21 Strengths and weaknesses of combined strategies. Adapted from J. Creswell, *Research Design: Qualitative & Quantitative Approaches* (Thousand Oaks, CA: Sage, 1994), 177–178. Reprinted by permission of SAGE Publications.

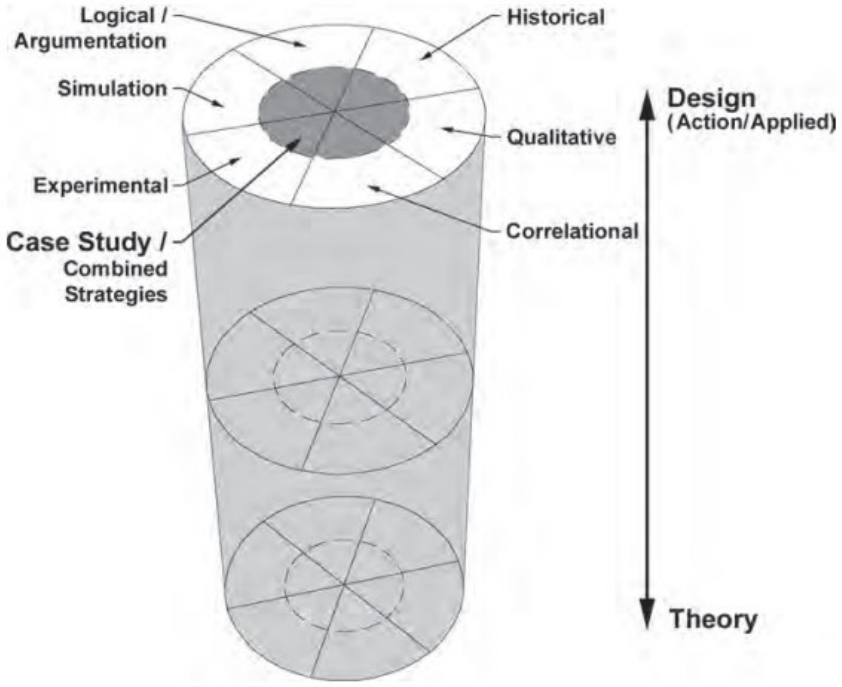
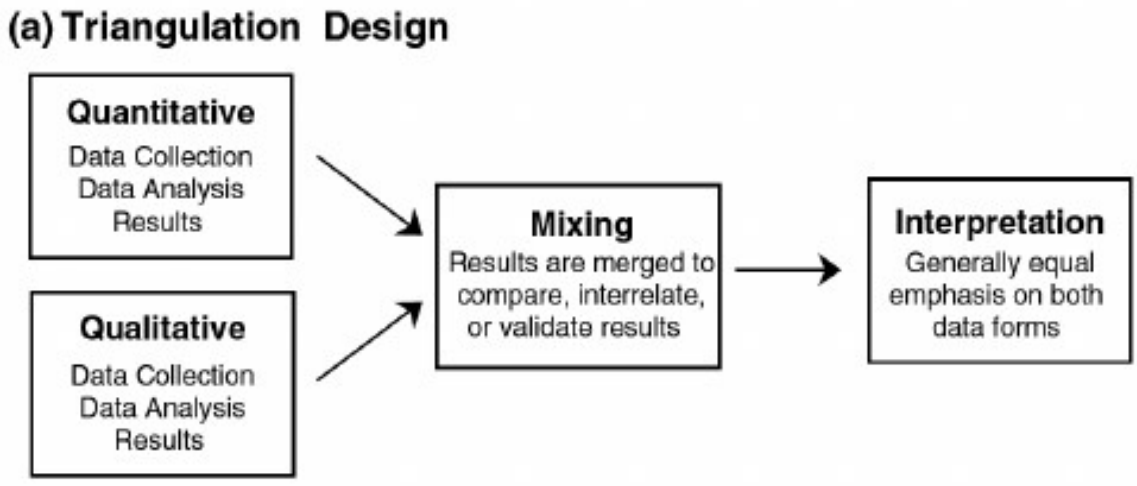


Figure 1.5 A conceptual framework for research methods.

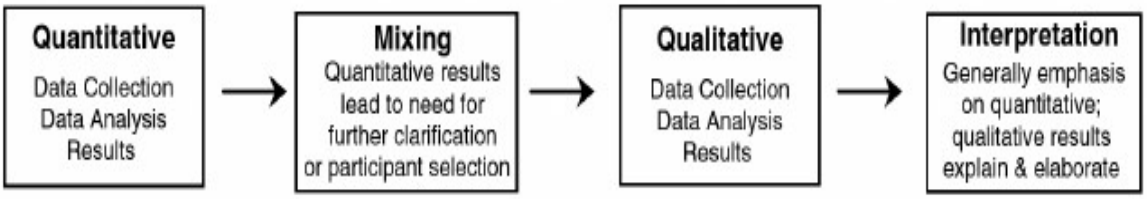
Mixed method analysis

The term "mixed methods" refers to an emergent methodology of research that advances the systematic integration, or "mixing," of quantitative and qualitative data within a single investigation or sustained program of inquiry.

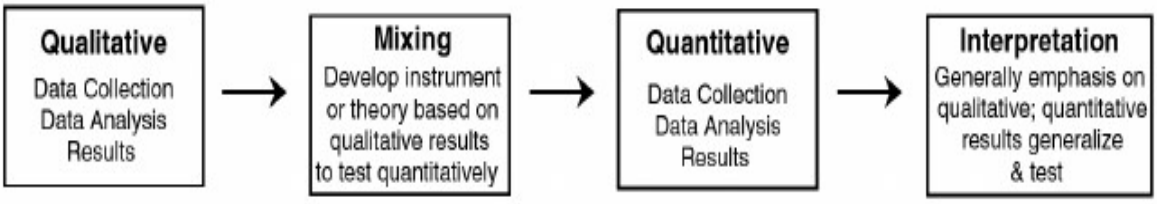
The four major types of mixed methods designs are the Triangulation Design, the Embedded Design, the Explanatory Design, and the Exploratory Design.



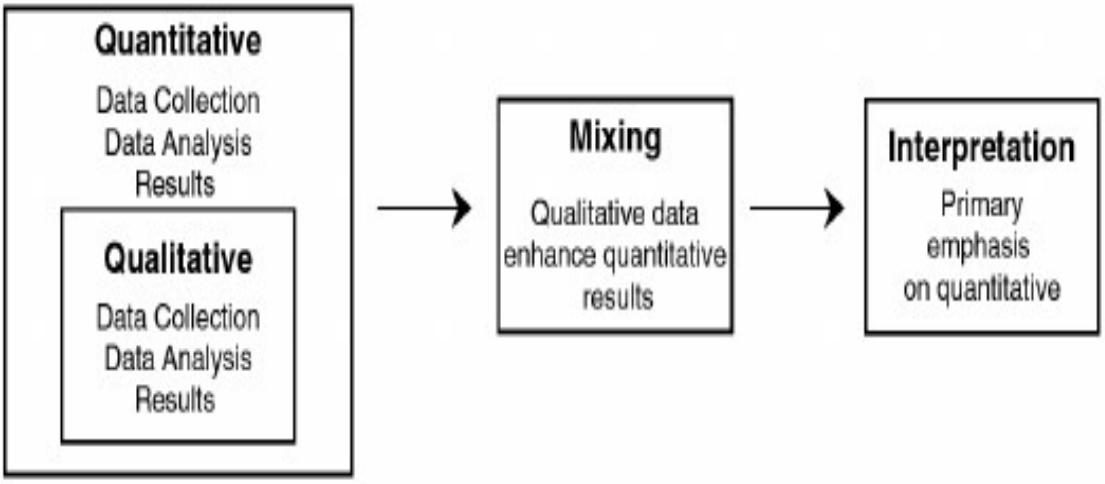
(b) Explanatory Design



(c) Exploratory Design



(d) Embedded Design[a]



Identifying Research Methodology

To choose the appropriate types of research, you need to clearly identify the objectives. Some objectives to take into consideration for your business include:

Find out the needs of your clients.

Know their preferences and understand what is important to them.

Find an appropriate way to make your customers aware of your products and services.

Find ways to improve your products or services to suit the needs of your customers.

After identifying what you need to know, you should ask what research methods will offer you that information.

Organize your questions within the framework of the 7 Ps of marketing that influence your company – product, price, promotion, place, people, processes, and physical tests.

A well-organized customer research process produces valid, accurate, reliable, timely, and complete results. Results that rigorously reflect the opinions and needs of your clients will help you grow your sales and improve your operations. To obtain the results, you need to establish and follow the processes that you have detailed out for your organization:

Set your goals

Consider the client's objectives and define those that identify with yours. Make sure that you set smart goals and objectives. Do not presume the results of your surveys.

Plan your research

Good planning allows the use of creative and logical approaches to select the methods that gather the most accurate information. Your plan will be influenced by the type and complexity of the information you need, the skills of your market research team, and how soon you need the information. Your budget also plays a large role in your ability to collect data.

Collect and collate your results

Make a list of how you are going to carry out the research process, the data you need to collect, and collection methods. This will help you keep track of your processes and make sense of your findings. It will also allow you to verify that your research accurately reflects the opinions of your clients and your market. Create a record table with:

The consumer research activity

The necessary data

The methods for data collection

The steps to follow for data analysis.

Remember, research is only valuable and useful when it is valid, accurate, and reliable. Relying on imperfect research is dangerous. Incorrect results can lead to customer churn and a decrease in sales.

It is important to obtain information about how the collection of customer information was carried out, and to ensure that your data is:

Valid – founded, logical, rigorous, and impartial.

Accurate – free of errors and including required details.

Reliable – that can be reproduced by other people who investigate in the same way.

Timely – current and collected within an appropriate time frame.

Complete – includes all the data you need to support your business decisions.

Analyze and understand your research

Analysis of the data can vary from simple and direct steps to technical and complex processes. Adopt an approach, and choose the method of data analysis based on the methods you have carried out.

Keep the findings ready

Choose a spreadsheet that allows you to easily enter your data. If you do not have a large amount of data, you should be able to manage them with the use of basic tools available in survey software. If you have collected more complete and complex data, you may have to consider using specific programs or tools that will help you manage your data.

Review and interpret the information to draw conclusions

Once you have gathered all the data, you can scan your information and interpret it to draw conclusions and make informed decisions. You should review the data and then:

Identify the main trends and issues, opportunities, and problems you observe.

Write a sentence describing each one. Keep track of the frequency with which each of the main findings appears.

Make a list of your findings from the most common to the least common. Evaluate a list of the strengths, weaknesses, opportunities, and threats that have been identified in a SWOT analysis. Prepare conclusions and recommendations about your research.

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SCHOOL OF BUILDING AND ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

UNIT – II– Sustainable Urban Planning – SAR5210

II. UNIT 2

Elements of research process: finding a topic- Writing an introduction- Stating a purpose of study identifying key research questions and hypotheses- Reviewing literature using theory, defining, delimiting and stating the significance of the study, advanced methods and procedures for data collection and analysis- illustration using research samples.

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SCHOOL OF BUILDING AND ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

UNIT – III–Research methodologies in built environment – SAR5610

III. UNIT 3

Library and archives- Internet: new information and the role of internet, finding and evaluating sources of misuse- Test for reliability ethics - Methods of data collection- From primary sources: observation and recording, interviews structured and unstructured, questionnaire, open ended and close ended questions and the advantages, sampling- Problems encountered in collecting data from secondary sources.

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DEPARTMENT OF ARCHITECTURE

UNIT – IV–Research methodologies in built environment – SAR5610

IV. UNIT 4

Writing & publishing the research work in journals - Research writing in general- Components: referencing- Writing the bibliography- Developing the outline – presentation etc. - Case studies - illustrating how good research can be used from project inception to completion- Review of research publications.

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SCHOOL OF BUILDING AND ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

UNIT – I I–Research methodologies in built environment– SAR5610

II. UNIT 2

Elements of research process: finding a topic- Writing an introduction- Stating a purpose of study identifying key research questions and hypotheses- Reviewing literature using theory, defining, delimiting and stating the significance of the study, advanced methods and procedures for data collection and analysis- illustration using research samples.

Elements of research process

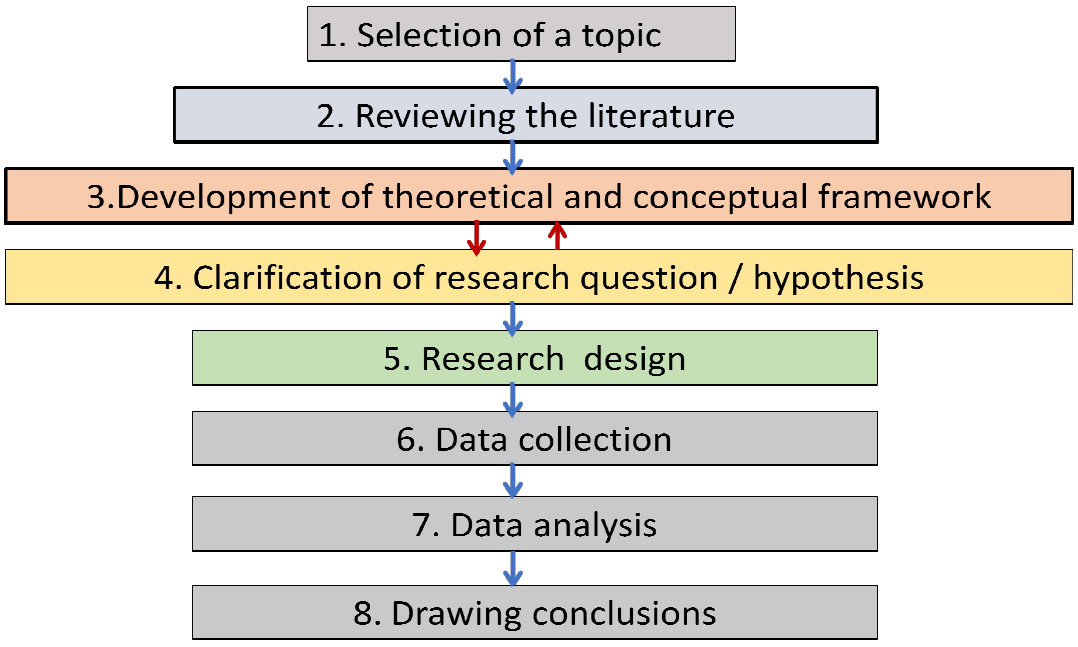
There are a variety of approaches to research in any field of investigation, irrespective of whether it is applied research or basic research. Each particular research study will be unique in some ways because of the particular time, setting, environment, and place in which it is being undertaken.

Nevertheless, all research endeavors share a common goal of furthering our understanding of the problem and thus all traverse through certain basic stages, forming a process called the **research process.**

An understanding of the research process is necessary to effectively carry out research and sequencing of the stages inherent in the process.

These 8 stages in the research process are;

1. Identifying the problem.
2. Reviewing literature.
3. Setting research questions, objectives, and hypotheses.
4. Choosing the study design.
5. Deciding on the sample design.
6. Collecting data.
7. Processing and analyzing data.
8. Writing the report.



<u>Step – 1:</u> Identifying the Problem

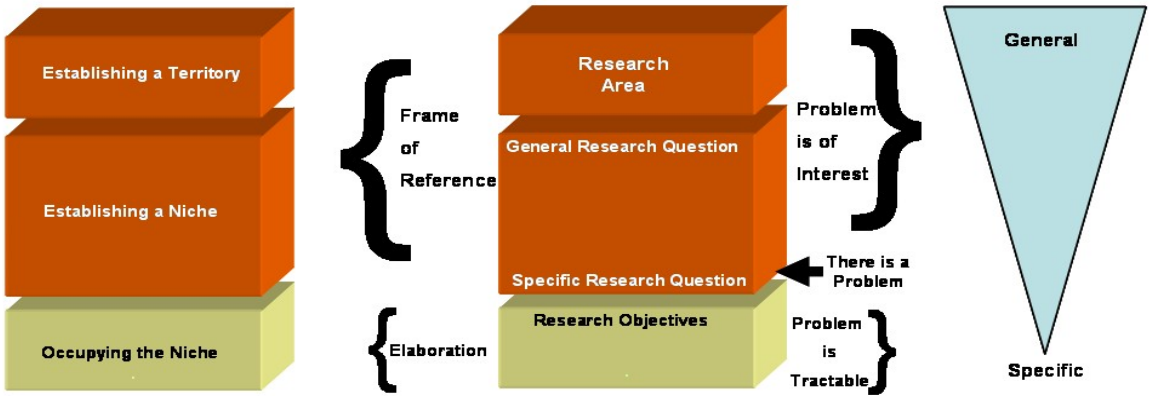
The first and foremost task in the entire process of scientific research is to identify a research problem.

A well-identified problem will lead the researcher to accomplish all-important phases of the research process, starting from setting objectives to the selection of the research methodology.

But the core question is: whether all problems require research.

We have countless problems around us, but all that we encounter do not qualify as research problems, and thus, these do not need to be researched.

Keeping this point in view, we must draw a line between a research problem and a non-research problem.



Research problem is a definite or clear expression for meaningful understanding and deliberate investigation addressing....

1. an area of concern
2. a condition to be improved upon
3. a difficulty to be eliminated,

a troubling question that exists in scholarly literature, in theory, or within existing practice

Intuitively, researchable problems are those who have a possibility of thorough verification investigation, which can be effected through the analysis and collection of data, while the non-research problems do not need to go through these processes.

Researcher need to identify both; Non-research Problem, and Research Problem.

A **non-research problem** is one that does not require any research to arrive at a solution. Intuitively, a non-researchable problem consists of vague details and cannot be resolved through research.

In contrast to a non-research problem, a research problem is of primary concern to a researcher.

A research problem is a perceived difficulty, a feeling of discomfort, or a discrepancy between the common belief and reality.

As noted by Fisher et al. (1993), a problem will qualify as a potential research problem when the following three conditions exist:

1. There should be a perceived discrepancy between "what it is" and "what it should have been." This implies that there should be a difference between "what exists" and the "ideal or planned situation";
2. A question about "why" the discrepancy exists. This implies that the reason(s) for this discrepancy is unclear to the researcher (so that it makes sense to develop a research question); and
3. There should be at least two possible answers or solutions to the questions or problems.

The third point is important. If there is only one possible and plausible answer to the question about the discrepancy, then a research situation does not exist.

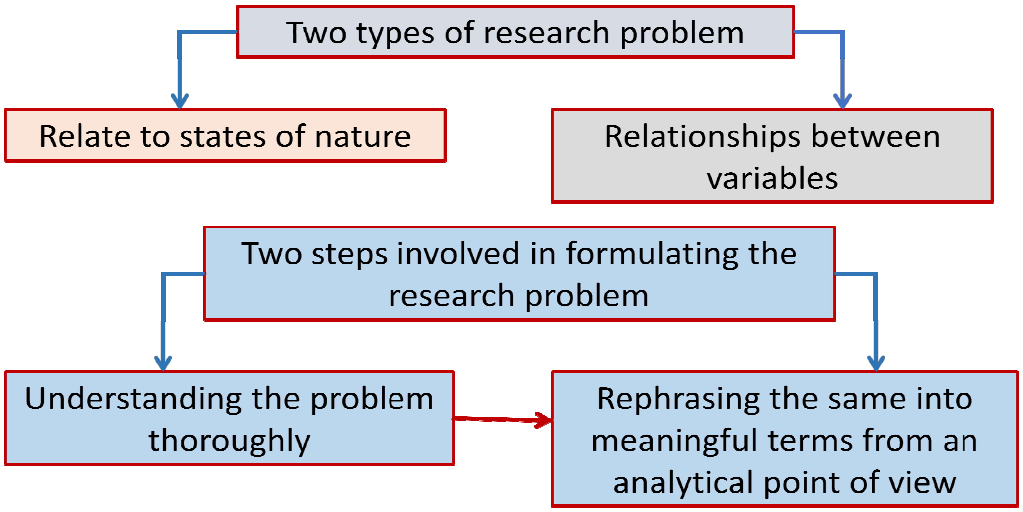
Statement of the Problem

A clear and well-defined statement of the problem is considered as the foundation for the development of the research proposal.

It enables the researcher to systematically point out why the proposed research on the problem should be undertaken and what he hopes to achieve with the findings of the study.

A well-defined statement of the problem will lead the researcher to formulate the research objectives, to understand the background of the study, and to choose a proper research methodology.

Formulating the research problem (Kothari ,2004)



Techniques involved in defining a problem

(i) statement of the problem in a general way
(ii) understanding the nature of the problem
(iii) surveying the available literature
(iv) developing the ideas through discussions
(v) rephrasing the research problem into a working proposition.

Justifying the Problem

Once the problem situation has been identified and clearly stated, it is important to justify the importance of the problem.

In justifying the problems, we ask such questions as to why the problem of the study is important, how large and widespread is the problem, can others be convinced about the importance of the problem and the like.

Answers to the above questions should be reviewed and presented in one or two paragraphs that justify the importance of the problem.

Analyzing the Problem

As a first step of analyzing the problem, critical attention should be given to accommodate the viewpoints of the managers, users, and the researchers to the problem through threadbare discussions.

The next step is to identify the factors that may have contributed to the perceived problems.

Step – 3: Setting research questions, objectives, and hypotheses

After discovering and defining the research problem, researchers should make a formal statement of the problem leading to research objectives.

An objective will precisely say what should be researched, to delineate the type of information that should be collected, and provide a framework for the scope of the study. The best expression of a research objective is a well-formulated, testable research hypothesis.

A hypothesis is an unproven statement or proposition that can be refuted or supported by empirical data. Hypothetical statements assert a possible answer to a research question.

Step -4: Choosing the study design

The research design is the blueprint or framework for fulfilling objectives and answering research questions.

It is a master plan specifying the methods and procedures for collecting, processing, and analyzing the collected data. There are four basic research designs that a researcher can use to conduct his or her study;

survey,

experiment,

secondary data study, and

observational study.

The type of research design to be chosen from among the above four designs depends primarily on four factors:

The type of problem

The objectives of the study,

The existing state of knowledge about the problem that is being studied, and

The resources are available for the study.

Step – 5: Deciding on the sample design

Sampling is an important and separate step in the research process. The basic idea of sampling is that it involves any procedure that uses a relatively small number of items or portions (called a sample) of a universe (called population) to conclude the whole population.

Sample design refers to the methods to be followed in selecting a sample from the population and the estimating technique, vis-a-vis formula for computing the sample statistics.

These methods are basically of two types: probability sampling and non-probability sampling. Probability sampling ensures every unit a known nonzero probability of selection within the target population.

The most widely used probability sampling methods are **simple random sampling, stratified random sampling, cluster sampling,** and **systematic sampling.** They have been classified by their representation basis and unit selection techniques.

<u>Step – 6:</u> Collecting data

The gathering of data may range from simple observation to a large-scale survey in any defined population. There are many ways to collect data.

The approach selected depends on the objectives of the study, the research design, and the availability of time, money, and personnel.

With the variation in the type of data (qualitative or quantitative) to be collected, the method of data collection also varies.

The most common means for collecting quantitative data is the structured interview.

Studies that obtain data by interviewing respondents are called surveys. Data can also be collected by using self-administered questionnaires. Telephone interviewing is another way in which data may be collected.

Other means of data collection include the use of secondary sources, such as the census, vital registration records, official documents, previous surveys, etc.

Qualitative data are collected mainly through in-depth interviews, focus group discussions, KII, and observational studies.

Step-7: Processing and Analyzing Data

Data processing generally begins with the editing and coding of data. Data are edited to ensure consistency across respondents and to locate omissions, if any.

In survey data, editing reduces errors in the recording, improves legibility, and clarifies unclear and inappropriate responses. In addition to editing, the data also need coding.

Because it is impractical to place raw data into a report, alphanumeric codes are used to reduce the responses to a more manageable form for storage and future processing.

This coding process facilitates processing the data. The personal computer offers an excellent opportunity in data editing and coding processes.

Data analysis usually involves reducing accumulated data to a manageable size, developing summaries, searching for patterns, and applying statistical techniques for understanding and interpreting the findings in the light of the research questions.

Further, the researcher, based on his analysis, determines if his findings are consistent with the formulated hypotheses and theories.

The techniques to be used in analyzing data may range from simple graphical technique to very complex multivariate analysis depending on the objectives of the study, research design employed, and the nature of data collected.

As in the case of methods of data collection, an analytical technique appropriate in one situation may not be appropriate for another.

Step-8: Writing the report – Developing Research Proposal, Writing Report, Disseminating and Utilizing Results

The entire task of a research study is accumulated in a document called a proposal.

A research proposal is a work plan, prospectus, outline, an offer, a statement of intent or commitment from an individual researcher or an organization to produce a product or render a service to a potential client or sponsor.

The proposal will be prepared to keep in view the sequence presented in the research process. The proposal tells us what, how, where, and to whom it will be done.

It must also show the benefit of doing it. It always includes an explanation of the purpose of the study (the research objectives) or a definition of the problem.

It systematically outlines the particular research methodology and details the procedures that will be utilized at each stage of the research process.

The end goal of a scientific study is to interpret the results and draw conclusions.

To this end, it is necessary to prepare a report and transmit the findings and recommendations to administrators, policymakers, and program managers for the intended purpose of making a decision.

There are various forms of research reports: term papers, dissertations, journal articles, papers for presentation at professional conferences and seminars, books, and so on. The results of a research investigation prepared in any form are of little utility if they are not communicated to others.

The primary purpose of a dissemination strategy is to identify the most effective media channels to reach different audience groups with study findings most relevant to their needs.

The dissemination may be made through a conference, a seminar, a report, or an oral or poster presentation.

The style and organization of the report will differ according to the target audience, the occasion, and the purpose of the research. Reports should be developed from the client's perspectives.

A report is an excellent means that helps to establish the researcher's credibility. At a bare minimum, a research report should contain sections on:

An executive summary;

1. Background of the problem;
2. Literature review;
3. Methodology;
4. Findings;
5. Discussion;
6. Conclusions and
7. Recommendations.

The results of the study can also be disseminated through peer-reviewed journals published by academic institutions and reputed publishers both at home and abroad.

These journals have their format and editorial policies. The contributors can submit their manuscripts adhering to the policies and format for possible publications of their papers.

There are now ample opportunities for the researchers to publish one's work online as well.

Many interesting studies have been conducted by the researchers without having any effect in actual settings. Ideally, the concluding step of a scientific study is to plan for its utilization in the real world.

Although researchers are often not themselves in a position to implement a plan for utilizing research findings, they can contribute to the process by including in their research reports a few

recommendations regarding how the results of the study could be utilized for policy formulation and program intervention.

Limitations

- The **limitations** of the **study** are those characteristics of design or methodology that impacted or influenced the application or interpretation of the results of your **study**.

- you should clearly acknowledge any limitations in your research paper in order to show readers—whether journal editors, other researchers, or the general public—that you are aware of these limitations and to explain how they affect the conclusions that can be drawn from the research.

Common Methodological Limitations

- Issues with sample and selection
- Lack of previous research studies on the topic
- Methods/instruments/techniques used to collect the data
- Limited access to data
- Time constraints
- Conflicts arising from cultural bias and other personal issues

Steps for Organizing Your Discussion of Limitations

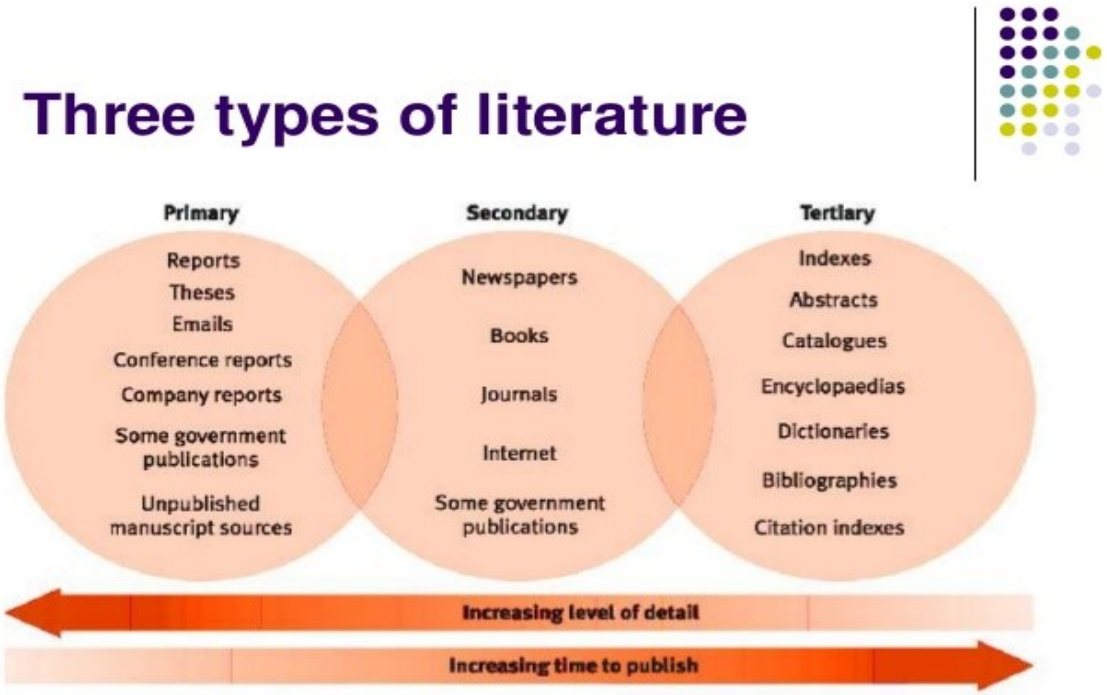
- Step 1. Identify the limitation(s)
- Step 2. Explain these limitations in detail
- Step 3. Propose a direction for future studies and present alternatives (optional)

Literature review

- A literature review is a **survey of scholarly sources** that provides an **overview** of a particular topic.

- Literature reviews are **a collection of the most relevant and significant publications** regarding that topic in order to provide a comprehensive look at what has been said on the topic and by whom.

- The **basic components** of a literature review include:
  - a **description** of the publication;
  - a **summary** of the publication's main points;
  - a **discussion** of gaps in research;
  - an **evaluation** of the publication's contribution to the topic.



Purpose of a literature review

- To provide a **review of writings** on the given topic in order to establish the reviewer's own
- position in the existing field on that topic.
- Provides a reader with a **comprehensive look at previous discussions** prior to the one the reviewer will be making in his/her own research paper, thesis, or dissertation.
- Shows the **positioning of a particular topic** of interest in thrust area.

Four main objectives of literature review

- It surveys the literature in your chosen area of study
- It synthesises the information in that literature into a summary
- It critically analyses the information gathered by identifying gaps in current knowledge; by showing limitations of theories and points of view; and by formulating areas for further research and reviewing areas of controversy
- It presents the literature in an organised way

A step-by-step approach to drafting your literature review

- Define Your Goal
- Do Your Research
- Ground Summary in Relevance
- Develop Review Logically
- Include References/Works Cited List

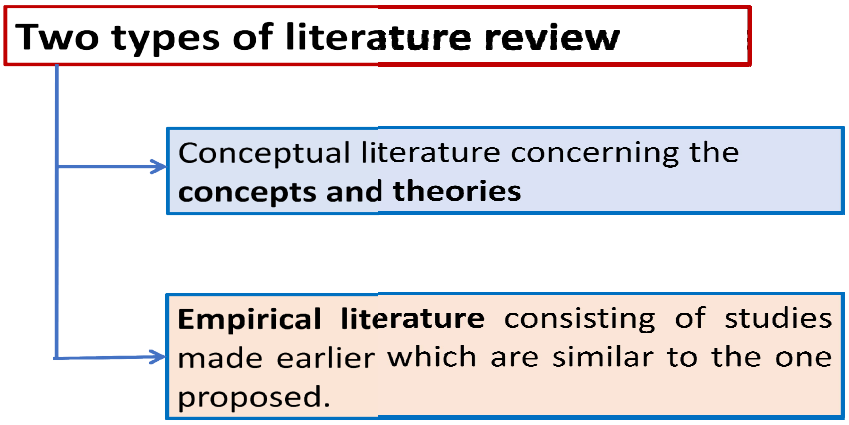
Why write a literature review?

- Identifies **gaps** in current knowledge.

- Avoids **reinventing the wheel** – i.e. it saves you wasting time researching something that's already been done.
- Allows you to show that you are **building on a foundation** of existing knowledge and ideas – i.e. carrying on from where others have already reached.
- Identifies **other people working in the same field**. Knowing who's already working in your area and getting in touch with them can be an invaluable source of knowledge and support.
- Demonstrates the **depth of your knowledge** about your research. Identifies the **important works in your area** and shows that you've read them.
- Provides an **intellectual context** for your own work, and enables you to position your project in relation to others in the field.
- Identifies **opposing views.**
- **Puts your own work in perspective** – are you doing something completely new, revisiting an old controversy in the light of new evidence, etc?
- **Demonstrates your research skills** – i.e. you not only know about work in your area, you also know how to access it.
- Identifies **information** and ideas that may be relevant to your project.
- Identifies **methods** that may be relevant to your project.

Literature review

- **Abstracting and indexing journals** and published or **unpublished bibliographies** are the first place to go to.
- **Academic journals, conference proceedings, government reports, books** etc., must be tapped depending on the nature of the problem.
- **Earlier studies**, if any, which are similar to the study in hand should be carefully studied.
- A **good library** will be a great help to the researcher at this stage.

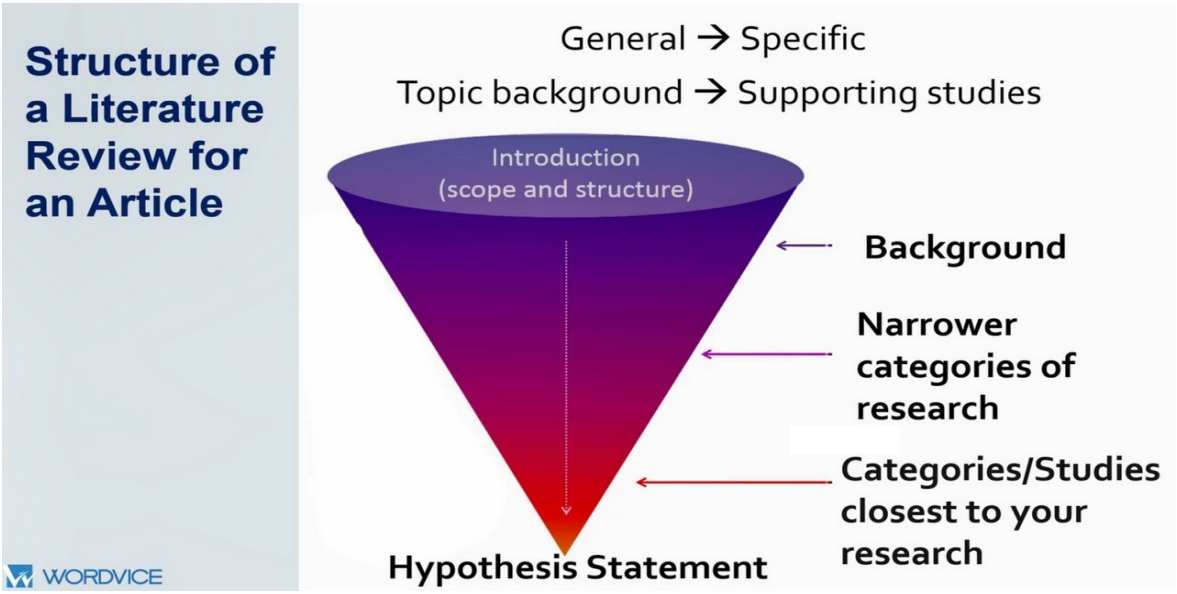


Types of Literature Reviews

- Argumentative Review
- Integrative Review
- Historical Review
- Methodological Review
- Systematic Review
- Theoretical Review

Types of literature reviews

Argumentative Review	The purpose is to develop a body of literature that establishes a **contrarian viewpoint**.
Integrative Review	reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that **new frameworks and perspectives** on the topic are generated.
Historical Review	examine research throughout a **period of time**, often starting with the first time an issue, concept, theory, phenomena emerged in the literature, then tracing its evolution within the scholarship of a discipline.
Methodological Review	provides a framework of **understanding at different levels** [i.e. those of theory, substantive fields, research approaches, and data collection and analysis techniques]
Systematic Review	goal is to deliberately **document, critically evaluate, and summarize scientifically** all of the research about a clearly defined research problem.
Theoretical Review	to **examine the corpus of theory** that has accumulated in regard to an issue, concept, theory, phenomena.



Research gap / Gaps in literature...

The **gap**, also considered the missing piece or pieces in the research **literature**, is the area that has not yet been explored or is under-explored.

A research gap provides **viability for your research**; it essentially alerts the reader and others in the field to a place in the **research that needs attention** it also denotes that the research you are conducting is not duplicated from existing research; and importantly it is the **contribution** you intend to make to the field of study (Moeini, 2014).

Data Collection, Processing and Analysis

Acquiring data: Acquisition involves collecting or adding to the data holdings. There are several methods of acquiring data:

collecting new data

using your own previously collected data

reusing someone others data

purchasing data

acquired from Internet (texts, social media, photos)

Data processing: A series of actions or steps performed on data to verify, organize, transform, integrate, and extract data in an appropriate output form for subsequent use. Methods of processing must be rigorously documented to ensure the utility and integrity of the data.

Data Analysis involves actions and methods performed on data that help describe facts, detect patterns, develop explanations and test hypotheses. This includes data quality assurance, statistical data analysis, modeling, and interpretation of results.

Results: The results of above mentioned actions are published as a research paper. In case the research data is made accessible, one has to prepare the data set for opening up.

Data collection

Data collection is defined as the procedure of collecting, measuring and analyzing accurate insights for research using standard validated techniques. A researcher can evaluate their hypothesis on the basis of collected data. In most cases, data collection is the primary and most important step for research, irrespective of the field of research. The approach of data collection is different for different fields of study, depending on the required information.

The most critical objective of data collection is ensuring that information-rich and reliable data is collected for statistical analysis so that data-driven decisions can be made for research.

Data Collection Methods: Phone vs. Online vs. In-Person Interviews
Essentially there are four choices for data collection – in-person interviews, mail, phone and online. There are pros and cons to each of these modes.

In-PersonInterviews
Pros: In-depth and a high degree of confidence on the data
Cons: Time consuming, expensive and can be dismissed as anecdotal

Mail Surveys
Pros: Can reach anyone and everyone – no barrier
Cons: Expensive, data collection errors, lag time

Phone Surveys
Pros: High degree of confidence in the data collected, reach almost anyone
Cons: Expensive, cannot self-administer, need to hire an agency

Web/Online Surveys
Pros: Cheap, can self-administer, very low probability of data errors
Cons: Not all your customers might have an email address/be on the internet, customers may be wary of divulging information online.

In-person interviews always are better, but the big drawback is the trap you might fall into if you don't do them regularly. It is expensive to regularly conduct interviews and not conducting enough interviews might give you false positives. Validating your research is almost as important as designing and conducting it. We've seen many instances where after the research is conducted – if the results do not match up with the "gut-feel" of upper management, it has been dismissed off as anecdotal and a "one-time" phenomenon. To avoid such traps, we strongly recommend that data-collection be done on an "ongoing and regular" basis. This will help you in comparing and analyzing the change in perceptions according to marketing done for your products/services. The other issue here is sample size. To be confident with your research you have to interview enough people to weed out the fringe elements.

Data collection is a systematic process of gathering observations or measurements. Whether you are performing research for business, governmental or academic purposes, data collection allows you to gain first-hand knowledge and original insights into your research problem.

While methods and aims may differ between fields, the overall process of data collection remains largely the same. Before you begin collecting data, you need to consider:

- The **aim** of the research
- The **type of data** that you will collect
- The **methods and procedures** you will use to collect, store, and process the data

To collect high-quality data that is relevant to your purposes, follow these four steps.

Step 1: Define the aim of your research

Before you start the process of data collection, you need to identify exactly what you want to achieve. You can start by writing a problem statement: what is the practical or scientific issue that you want to address and why does it matter?

Next, formulate one or more research questions that precisely define what you want to find out. Depending on your research questions, you might need to collect quantitative or qualitative data:

- **Quantitative data** is expressed in numbers and graphs and is analyzed through statistical methods.
- **Qualitative data** is expressed in words and analyzed through interpretations and categorizations.

If your aim is to test a hypothesis, measure something precisely, or gain large-scale statistical insights, collect quantitative data. If your aim is to explore ideas, understand experiences, or gain detailed insights into a specific context, collect qualitative data. If you have several aims, you can use a mixed methods approach that collects both types of data.

Examples of quantitative and qualitative research aimsYou are researching employee perceptions of their direct managers in a large organization.

- Your first aim is to assess whether there are significant differences in perceptions of managers across different departments and office locations.
- Your second aim is to gather meaningful feedback from employees to explore new ideas for how managers can improve.

You decide to use a mixed-methods approach to collect both quantitative and qualitative data.

Step 2: Choose your data collection method

Based on the data you want to collect, decide which method is best suited for your research.

- Experimental research is primarily a quantitative method.
- Interviews/focus groups and ethnography are qualitative methods.

- Surveys, observations, archival research and secondary data collection can be quantitative or qualitative methods.

Carefully consider what method you will use to gather data that helps you directly answer your research questions.

Data collection methods

Method	When to use	How to collect data
Experiment	To test a causal relationship.	Manipulate variables and measure their effects on others.
Survey	To understand the general characteristics or opinions of a group of people.	Distribute a list of questions to a sample online, in person or over-the-phone.
Interview/focus group	To gain an in-depth understanding of perceptions or opinions on a topic.	Verbally ask participants open-ended questions in individual interviews or focus group discussions.
Observation	To understand something in its natural setting.	Measure or survey a sample without trying to affect them.
Ethnography	To study the culture of a community or organization first-hand.	Join and participate in a community and record your observations and reflections.
Archival research	To understand current or historical events, conditions or practices.	Access manuscripts, documents or records from libraries, depositories or the internet.
Secondary data collection	To analyze data from populations that you can't access first-hand.	Find existing datasets that have already been collected, from sources such as government agencies or research organizations.

Step 3: Plan your data collection procedures

When you know which method(s) you are using, you need to plan exactly how you will implement them. What procedures will you follow to make accurate observations or measurements of the variables you are interested in?

For instance, if you're conducting surveys or interviews, decide what form the questions will take; if you're conducting an experiment, make decisions about your experimental design.

Operationalization

Sometimes your variables can be measured directly: for example, you can collect data on the average age of employees simply by asking for dates of birth. However, often you'll be interested in collecting data on more abstract concepts or variables that can't be directly observed.

Operationalization means turning abstract conceptual ideas into measurable observations. When planning how you will collect data, you need to translate the conceptual definition of what you want to study into the operational definition of what you will actually measure.

Example of operationalizationYou have decided to use surveys to collect quantitative data. The concept you want to measure is the leadership of managers. You operationalize this concept in two ways:

- You ask managers to rate their own leadership skills on 5-point scales assessing the ability to delegate, decisiveness and dependability.
- You ask their direct employees to provide anonymous feedback on the managers regarding the same topics.

Using multiple ratings of a single concept can help you cross-check your data and assess the test validity of your measures.

Sampling

You may need to develop a sampling plan to obtain data systematically. This involves defining a population, the group you want to draw conclusions about, and a sample, the group you will actually collect data from.

Your sampling method will determine how you recruit participants or obtain measurements for your study. To decide on a sampling method you will need to consider factors like the required sample size, accessibility of the sample, and timeframe of the data collection.

Standardizing procedures

If multiple researchers are involved, write a detailed manual to standardize data collection procedures in your study.

This means laying out specific step-by-step instructions so that everyone in your research team collects data in a consistent way – for example, by conducting experiments under the same conditions and using objective criteria to record and categorize observations.

This helps ensure the reliability of your data, and you can also use it to replicate the study in the future.

Creating a data management plan

Before beginning data collection, you should also decide how you will organize and store your data.

- If you are collecting data from people, you will likely need to anonymize and safeguard the data to prevent leaks of sensitive information (e.g. names or identity numbers).
- If you are collecting data via interviews or pencil-and-paper formats, you will need to perform transcriptions or data entry in systematic ways to minimize distortion.
- You can prevent loss of data by having an organization system that is routinely backed up.

Step 4: Collect the data

Finally, you can implement your chosen methods to measure or observe the variables you are interested in.

Examples of collecting qualitative and quantitative dataTo collect data about perceptions of managers, you administer a survey with closed- and open-ended questions to a sample of 300 company employees across different departments and locations.

The closed-ended questions ask participants to rate their manager's leadership skills on scales from 1–5. The data produced is numerical and can be statistically analyzed for averages and patterns.

The open-ended questions ask participants for examples of what the manager is doing well now and what they can do better in the future. The data produced is qualitative and can be categorized through content analysis for further insights.
To ensure that high quality data is recorded in a systematic way, here are some best practices:

- Record all relevant information as and when you obtain data. For example, note down whether or how lab equipment is recalibrated during an experimental study.
- Double-check manual data entry for errors.
- If you collect quantitative data, you can assess the reliability and validity to get an indication of your data quality.

Data analysis

Data Analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data. According to Shamoo and Resnik (2003) various analytic procedures "provide a way of drawing inductive inferences from data and distinguishing the signal (the phenomenon of interest) from the noise (statistical fluctuations) present in the data"..

While data analysis in qualitative research can include statistical procedures, many times analysis becomes an ongoing iterative process where data is continuously collected and analyzed almost simultaneously. Indeed, researchers generally analyze for patterns in observations through the entire data collection phase (Savenye, Robinson, 2004). The form of the analysis is determined by the specific qualitative approach taken (field study, ethnography content analysis, oral history, biography, unobtrusive research) and the form of the data (field notes, documents, audiotape, videotape).

An essential component of ensuring data integrity is the accurate and appropriate analysis of research findings. Improper statistical analyses distort scientific findings, mislead casual readers (Shepard, 2002), and may negatively influence the public perception of research. Integrity issues are just as relevant to analysis of non-statistical data as well.

Considerations/issues in data analysis

There are a number of issues that researchers should be cognizant of with respect to data analysis. These include:

- Having the necessary skills to analyze
- Concurrently selecting data collection methods and appropriate analysis
- Drawing unbiased inference

- Inappropriate subgroup analysis
- Following acceptable norms for disciplines
- Determining statistical significance
- Lack of clearly defined and objective outcome measurements
- Providing honest and accurate analysis
- Manner of presenting data
- Environmental/contextual issues
- Data recording method
- Partitioning 'text' when analyzing qualitative data
- Training of staff conducting analyses
- Reliability and Validity
- Extent of analysis

Having necessary skills to analyze

A tacit assumption of investigators is that they have received training sufficient to demonstrate a high standard of research practice. Unintentional 'scientific misconduct' is likely the result of poor instruction and follow-up. A number of studies suggest this may be the case more often than believed (Nowak, 1994; Silverman, Manson, 2003). For example, Sica found that adequate training of physicians in medical schools in the proper design, implementation and evaluation of clinical trials is "abysmally small" (Sica, cited in Nowak, 1994). Indeed, a single course in biostatistics is the most that is usually offered (Christopher Williams, cited in Nowak, 1994).

A common practice of investigators is to defer the selection of analytic procedure to a research team 'statistician'. Ideally, investigators should have substantially more than a basic understanding of the rationale for selecting one method of analysis over another. This can allow investigators to better supervise staff who conduct the data analyses process and make informed decisions

Concurrently selecting data collection methods and appropriate analysis

While methods of analysis may differ by scientific discipline, the optimal stage for determining appropriate analytic procedures occurs early in the research process and should not be an afterthought. According to Smeeton and Goda (2003), "Statistical advice should be obtained at the stage of initial planning of an investigation so that, for example, the method of sampling and design of questionnaire are appropriate".

Drawing unbiased inference

The chief aim of analysis is to distinguish between an event occurring as either reflecting a true effect versus a false one. Any bias occurring in the collection of the data, or selection of method of analysis, will increase the likelihood of drawing a biased inference. Bias can occur when recruitment of study participants falls below minimum number required to demonstrate statistical power or failure to maintain a sufficient follow-up period needed to demonstrate an effect (Altman, 2001).

Inappropriate subgroup analysis

When failing to demonstrate statistically different levels between treatment groups, investigators may resort to breaking down the analysis to smaller and smaller subgroups in order to find a difference. Although this practice may not inherently be unethical, these analyses should be

proposed before beginning the study even if the intent is exploratory in nature. If it the study is exploratory in nature, the investigator should make this explicit so that readers understand that the research is more of a hunting expedition rather than being primarily theory driven. Although a researcher may not have a theory-based hypothesis for testing relationships between previously untested variables, a theory will have to be developed to explain an unanticipated finding. Indeed, in exploratory science, there are no a priori hypotheses therefore there are no hypothetical tests. Although theories can often drive the processes used in the investigation of qualitative studies, many times patterns of behavior or occurrences derived from analyzed data can result in developing new theoretical frameworks rather than determined a priori (Savenye, Robinson, 2004).

It is conceivable that multiple statistical tests could yield a significant finding by chance alone rather than reflecting a true effect. Integrity is compromised if the investigator only reports tests with significant findings, and neglects to mention a large number of tests failing to reach significance. While access to computer-based statistical packages can facilitate application of increasingly complex analytic procedures, inappropriate uses of these packages can result in abuses as well.

Following acceptable norms for disciplines

Every field of study has developed its accepted practices for data analysis. Resnik (2000) states that it is prudent for investigators to follow these accepted norms. Resnik further states that the norms are '…based on two factors:

(1) the nature of the variables used (i.e., quantitative, comparative, or qualitative),

(2) assumptions about the population from which the data are drawn (i.e., random distribution, independence, sample size, etc.). If one uses unconventional norms, it is crucial to clearly state this is being done, and to show how this new and possibly unaccepted method of analysis is being used, as well as how it differs from other more traditional methods. For example, Schroder, Carey, and Vanable (2003) juxtapose their identification of new and powerful data analytic solutions developed to count data in the area of HIV contraction risk with a discussion of the limitations of commonly applied methods.

If one uses unconventional norms, it is crucial to clearly state this is being done, and to show how this new and possibly unaccepted method of analysis is being used, as well as how it differs from other more traditional methods. For example, Schroder, Carey, and Vanable (2003) juxtapose their identification of new and powerful data analytic solutions developed to count data in the area of HIV contraction risk with a discussion of the limitations of commonly applied methods.

Determining significance

While the conventional practice is to establish a standard of acceptability for statistical significance, with certain disciplines, it may also be appropriate to discuss whether attaining statistical significance has a true practical meaning, i.e., 'clinical significance'. Jeans (1992) defines 'clinical significance' as "the potential for research findings to make a real and important difference to clients or clinical practice, to health status or to any other problem identified as a relevant priority for the discipline".

Kendall and Grove (1988) define clinical significance in terms of what happens when "… troubled and disordered clients are now, after treatment, not distinguishable from a meaningful and

representative non-disturbed reference group". Thompson and Noferi (2002) suggest that readers of counseling literature should expect authors to report either practical or clinical significance indices, or both, within their research reports. Shepard (2003) questions why some authors fail to point out that the magnitude of observed changes may too small to have any clinical or practical significance, "sometimes, a supposed change may be described in some detail, but the investigator fails to disclose that the trend is not statistically significant ".

Lack of clearly defined and objective outcome measurements

No amount of statistical analysis, regardless of the level of the sophistication, will correct poorly defined objective outcome measurements. Whether done unintentionally or by design, this practice increases the likelihood of clouding the interpretation of findings, thus potentially misleading readers.

Provide honest and accurate analysis

The basis for this issue is the urgency of reducing the likelihood of statistical error. Common challenges include the exclusion of outliers, filling in missing data, altering or otherwise changing data, data mining, and developing graphical representations of the data (Shamoo, Resnik, 2003).

Manner of presenting data

At times investigators may enhance the impression of a significant finding by determining how to present derived data (as opposed to data in its raw form), which portion of the data is shown, why, how and to whom (Shamoo, Resnik, 2003). Nowak (1994) notes that even experts do not agree in distinguishing between analyzing and massaging data. Shamoo (1989) recommends that investigators maintain a sufficient and accurate paper trail of how data was manipulated for future review.

Environmental/contextual issues

The integrity of data analysis can be compromised by the environment or context in which data was collected i.e., face-to face interviews vs. focused group. The interaction occurring within a dyadic relationship (interviewer-interviewee) differs from the group dynamic occurring within a focus group because of the number of participants, and how they react to each other's responses. Since the data collection process could be influenced by the environment/context, researchers should take this into account when conducting data analysis.

Data recording method

Analyses could also be influenced by the method in which data was recorded. For example, research events could be documented by:

a. recording audio and/or video and transcribing later
b. either a researcher or self-administered survey
c. either closed ended survey or open ended survey
d. preparing ethnographic field notes from a participant/observer
e. requesting that participants themselves take notes, compile and submit them to researchers.

While each methodology employed has rationale and advantages, issues of objectivity and subjectivity may be raised when data is analyzed.

Partitioning the text

During content analysis, staff researchers or 'raters' may use inconsistent strategies in analyzing text material. Some 'raters' may analyze comments as a whole while others may prefer to dissect text material by separating words, phrases, clauses, sentences or groups of sentences. Every effort should be made to reduce or eliminate inconsistencies between "raters" so that data integrity is not compromised.

Training of Staff conducting analyses

A major challenge to data integrity could occur with the unmonitored supervision of inductive techniques. Content analysis requires raters to assign topics to text material (comments). The threat to integrity may arise when raters have received inconsistent training, or may have received previous training experience(s). Previous experience may affect how raters perceive the material or even perceive the nature of the analyses to be conducted. Thus one rater could assign topics or codes to material that is significantly different from another rater. Strategies to address this would include clearly stating a list of analyses procedures in the protocol manual, consistent training, and routine monitoring of raters.

Reliability and Validity

Researchers performing analysis on either quantitative or qualitative analyses should be aware of challenges to reliability and validity. For example, in the area of content analysis, Gottschalk (1995) identifies three factors that can affect the reliability of analyzed data:

- stability , or the tendency for coders to consistently re-code the same data in the same way over a period of time
- reproducibility , or the tendency for a group of coders to classify categories membership in the same way
- accuracy , or the extent to which the classification of a text corresponds to a standard or norm statistically

The potential for compromising data integrity arises when researchers cannot consistently demonstrate stability, reproducibility, or accuracy of data analysis

According Gottschalk, (1995), the validity of a content analysis study refers to the correspondence of the categories (the classification that raters' assigned to text content) to the conclusions, and the generalizability of results to a theory (did the categories support the study's conclusion, and was the finding adequately robust to support or be applied to a selected theoretical rationale?).

Extent of analysis

Upon coding text material for content analysis, raters must classify each code into an appropriate category of a cross-reference matrix. Relying on computer software to determine a frequency or word count can lead to inaccuracies. "One may obtain an accurate count of that word's occurrence and frequency, but not have an accurate accounting of the meaning inherent in each particular

usage" (Gottschalk, 1995). Further analyses might be appropriate to discover the dimensionality of the data set or identity new meaningful underlying variables.

Whether statistical or non-statistical methods of analyses are used, researchers should be aware of the potential for compromising data integrity. While statistical analysis is typically performed on quantitative data, there are numerous analytic procedures specifically designed for qualitative material including content, thematic, and ethnographic analysis. Regardless of whether one studies quantitative or qualitative phenomena, researchers use a variety of tools to analyze data in order to test hypotheses, discern patterns of behavior, and ultimately answer research questions. Failure to understand or acknowledge data analysis issues presented can compromise data integrity.

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DEPARTMENT OF ARCHITECTURE

UNIT – III–Research methodologies in built environment – SAR5610

III. UNIT 3

Library and archives- Internet: new information and the role of internet, finding and evaluating sources of misuse- Test for reliability ethics - Methods of data collection- From primary sources: observation and recording, interviews structured and unstructured, questionnaire, open ended and close ended questions and the advantages, sampling- Problems encountered in collecting data from secondary sources.

Introduction

In order to create rhetorically effective and engaging pieces, research writers must be able to find appropriate and diverse sources and to evaluate those sources for usefulness and credibility. This chapter discusses how to locate such sources and how to evaluate them. On the one hand, this is a chapter about the nuts and bolts of research. If you have written research papers before, searching for sources and citing them in your paper may, at times, have appeared to you as purely mechanical processes, chores necessary to produce a paper. On the other hand, when writers work with research sources, first finding and then evaluating them, they do rhetorical work. Finding good sources and using them effectively helps you to create a message and a persona that your readers are more likely to accept, believe, and be interested in than if unsuitable and unreliable sources are used. This chapter covers the various kinds of research sources available to writers. It discusses how to find, evaluate, and use primary and secondary sources, printed and online ones.

Types of Research Sources

It is a well-known cliché: we live in an information age. Information has become a tangible commodity capable of creating and destroying wealth, influencing public opinion and government policies, and effecting social change. As writers and citizens, we have unprecedented access to different kinds of information from different sources. Writers who hope to influence their audiences need to know what research sources are available, where to find them, and how to use them.

Primary and Secondary Sources

Definition of Primary Sources

Let us begin with the definition of primary and secondary sources. A primary research sources is one that allows you to learn about your subject “firsthand.” Primary sources provide direct evidence about the topic under investigation. They offer us “direct access” to the events or phenomena we are studying. For example, if you are researching the history of World War II and decide to study soldiers’ letters home or maps of battlefields, you are working with primary sources. Similarly, if you are studying the history of your hometown in a local archive that contains documents pertaining to that history, you are engaging in primary research. Among other primary sources and methods are interviews, surveys, polls, observations, and other similar “firsthand” investigative techniques. The fact that primary sources allow us “direct access” to the topic does not mean that they offer an objective and unbiased view of it. It is therefore important to consider primary sources critically and, if possible, gather multiple perspectives on the same event, time period, or questions from multiple primary sources.

Definition of Secondary Sources

Secondary sources describe, discuss, and analyze research obtained from primary sources or from other secondary sources. Using the previous example about World War II, if you read other historians' accounts of it, government documents, maps, and other written documents, you are engaging in secondary research. Some types of secondary sources with which you are likely to work include books, academic journals, popular magazines and newspapers, websites, and other electronic sources. The same source can be both primary and secondary, depending on the nature and purpose of the project. For example, if you study a culture or group of people by examining texts they produce, you are engaging in primary research. On the other hand, if that same group published a text analyzing some external event, person, or issue and if your focus is not on the text's authors but on their analysis, you would be doing secondary research. Secondary sources often contain descriptions and analyses of primary sources. Therefore, accounts, descriptions, and interpretations of research subjects found in secondary sources are at least one step further removed from what can be found in primary sources about the same subject. And while primary sources do not give us a completely objective view of reality, secondary sources inevitably add an extra layer of opinion and interpretation to the views and ideas found in primary sources. All texts are rhetorical creations, and writers make choices about what to include and what to omit. As researchers, we need to understand that and not rely on either primary or secondary sources blindly.

Writing Activity: Examining the Same Topic through Primary and Secondary Sources

Primary and secondary sources can offer writers different views of the same topic. This activity invites you to explore the different perspectives that you may get after investigating the same subject through primary and secondary sources. It should help us see how our views of different topics depend on the kinds of sources we use. Find several primary sources on a topic that interests you. Include archival documents, first- hand accounts, lab experiment results, interviews, surveys, and so on. Depending on how much time you have for this project, you may or may not be able to consult all of the above source types. In either case, try to consult sources of three or four different kinds. Next, write a summary of what you learned about your subject as a result of your primary-source investigation. Mention facts, dates, important people, opinions, theories, and anything that seems important or interesting. Now, conduct a brief secondary-source search on the same subject. Use books, journals, popular magazines and newspapers, Internet sites, and so on. Write a summary of your findings. Finally, compare the two summaries. What differences do you see? What new ideas, perspectives, ideas, or opinions did your secondary-source search yield? As a result of these two searches, have you obtained different accounts of the same research subject? Pay special attention to the differences in descriptions, accounts, or interpretations of the same subject. Notice what secondary sources add to the treatment of the subject and what they take away, compared to the primary sources.

Print and Electronic Sources

Researcher have at their disposal both printed and electronic sources. Before the advent of the Internet, most research papers were written with the use of printed sources only. Until fairly recently, one of the main stated goals of research writing instruction was to give students practice in the use of the library. Libraries are venerable institutions, and therefore printed sources have traditionally been seen (with good reason, usually,) as more solid and reliable than those found on the Internet. With the growing popularity of the Internet and other computerized means of storing and communicating information, traditional libraries faced serious competition for clients. It has

become impractical if not impossible for researchers to ignore the massive amount of information available to them on the Internet or from other online sources. As a result, it is not uncommon for many writers beginning a research project to begin searching online rather than at a library or a local archive. For example, several times in the process of writing this essay, when I found myself in need of information fast, I opened my Web browser and researched online. With the popularity of the Internet ever increasing, it has become common practice for many student writers to limit themselves to online research and to ignore the library. While there are some cases when a modified version of such an approach to searching may be justifiable (more about that later), it is clear that by using only online research sources, a writer severely limits his or her options. This section covers three areas. First, we will discuss the various types of printed and online sources as well the main similarities and differences between them. Next, I'd like to offer some suggestions on using your library effectively and creatively. Finally, we will examine the topic of conducting online searches, including methods of evaluating information found on the Internet.

Know Your Library

It is likely that your college or university library consists of two parts. One is the brick and mortar building, often at a central location on campus, where you can go to look for books, magazines, newspapers, and other publications. The other part is online. Most good libraries keep a collection of online research databases that are supported, at least in part, by your tuition and fees, and to which only people who are affiliated with the college or the university that subscribes to these databases have access. Let us begin with the brick and mortar library. If you have not yet been to your campus library, visit it soon. Larger colleges and universities usually have several libraries that may specialize in different academic disciplines. As you enter the library, you are likely to find a circulation desk (place where you can check out materials) and a reference desk. Behind the reference desk you will find reference librarians. Instead of wandering around the library alone, hoping to hit the research sources that you need for your project, it is a good idea to talk to a reference librarian at the beginning of every research project, especially if you are at a loss for a topic or research materials. Your brick and mortar campus library is likely to house the following types of materials:

- Books (these include encyclopedias, dictionaries, indexes, and so on)
- Academic Journals
- Popular magazines
- Newspapers
- Government documents
- A music and film collection (on CDs, VHS tapes, and DVDs)
- A CD-Rom collection
- A microfilm and microfiche collection
- Special collections, such as ancient manuscripts or documents related to local history and culture.

Reliability of Internet Sources

1. Who is the author (or, authors) of the website and the materials presented on it? What is known about the site's author(s) and its publishers and their agendas and goals?
2. What is the purpose of the website?

3. Who is the target audience of the website
4. How do the writing style and the design of the website contribute to (or detract from) its meaning?

Evaluating internet sources

Because of the hodge-podge of information on the Internet, it is very important you develop evaluation skills to assist you in identifying quality Web pages. There are six (6) criteria that should be applied when evaluating any Web site: **authority, accuracy, objectivity, currency, coverage, and appearance.** For each criterion, there are several questions to be asked. The more questions you can answer "yes", the more likely the Web site is one of quality.

Below is a chart listing key questions for each of the six criteria.

Authority	Is it clear who is responsible for the contents of the page? Is there a way of verifying the legitimacy of the organization, group, company or individual? Is there any indication of the author's qualifications for writing on a particular topic? Is the information from sources known to be reliable?
Accuracy	Are the sources for factual information clearly listed so they can be verified in another source? Is the information free of grammatical, spelling, and other typographical errors?
Objectivity	Does the content appear to contain any evidence of bias? Is there a link to a page describing the goals or purpose of the sponsoring organization or company? If there is any advertising on the page, is it clearly differentiated from the informational content?
Currency	Are there dates on the page to indicate when the page was written, when the page was first placed on the Web, or when the page was last revised?
Coverage	Are these topics successfully addressed, with clearly presented arguments and adequate support to substantiate them? Does the work update other sources, substantiate other materials you have read, or add new information? Is the target audience identified and appropriate for your needs?
Appearance	Does the site look well organized? Do the links work? Does the site appear well maintained?

Reliability and validity

Reliability and validity are concepts used to evaluate the quality of research. They indicate how well a method, technique or test measures something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure.

It's important to consider reliability and validity when you are creating your research design, planning your methods, and writing up your results, especially in quantitative research.

Reliability vs validity

	Reliability	Validity
What does it tell you?	The extent to which the results can be reproduced when the research is repeated under the same conditions.	The extent to which the results really measure what they are supposed to measure.
How is it assessed?	By checking the consistency of results across time, across different observers, and across parts of the test itself.	By checking how well the results correspond to established theories and other measures of the same concept.
How do they relate?	A reliable measurement is not always valid: the results might be reproducible, but they're not necessarily correct.	A valid measurement is generally reliable: if a test produces accurate results, they should be reproducible.

Understanding reliability vs validity

Reliability and validity are closely related, but they mean different things. A measurement can be reliable without being valid. However, if a measurement is valid, it is usually also reliable.

What is reliability?

Reliability refers to how consistently a method measures something. If the same result can be consistently achieved by using the same methods under the same circumstances, the measurement is considered reliable.

What is validity?

Validity refers to how accurately a method measures what it is intended to measure. If research has high validity, that means it produces results that correspond to real properties, characteristics, and variations in the physical or social world.

High reliability is one indicator that a measurement is valid. If a method is not reliable, it probably isn't valid.

Reliability can be estimated by comparing different versions of the same measurement. Validity is harder to assess, but it can be estimated by comparing the results to other relevant data or theory. Methods of estimating reliability and validity are usually split up into different types.

Types of reliability

Different types of reliability can be estimated through various statistical methods.

When you do quantitative research, you have to consider the reliability and validity of your research methods and instruments of measurement.

Reliability tells you how consistently a method measures something. When you apply the same method to the same sample under the same conditions, you should get the same results. If not, the method of measurement may be unreliable.

There are four main types of reliability. Each can be estimated by comparing different sets of results produced by the same method.

Type of reliability	Measures the consistency of…
Test-retest	The same test over **time**.
Interrater	The same test conducted by different **people**.
Parallel forms	**Different versions** of a test which are designed to be equivalent.
Internal consistency	The **individual items** of a test.

Test-retest reliability

Test-retest reliability measures the consistency of results when you repeat the same test on the same sample at a different point in time. You use it when you are measuring something that you expect to stay constant in your sample.

Interrater reliability

Interrater reliability (also called interobserver reliability) measures the degree of agreement between different people observing or assessing the same thing. You use it when data is collected by researchers assigning ratings, scores or categories to one or more variables.

Parallel forms reliability

Parallel forms reliability measures the correlation between two equivalent versions of a test. You use it when you have two different assessment tools or sets of questions designed to measure the same thing.

Internal consistency

Internal consistency assesses the correlation between multiple items in a test that are intended to measure the same construct.

Type of reliability	What does it assess?	Example
Test-retest	The consistency of a measure **across time**: do you get the same results when you repeat the measurement?	A group of participants complete a questionnaire designed to measure personality traits. If they repeat the questionnaire days, weeks or months apart and give the same answers, this indicates high test-retest reliability.
Interrater	The consistency of a measure **across raters or observers**: do you get the same results when different people conduct the same measurement?	Based on an assessment criteria checklist, five examiners submit substantially different results for the same student project. This indicates that the assessment checklist has low inter-rater reliability (for example, because the criteria are too subjective).
Internal consistency	The consistency of **the measurement itself**: do you get the same results from different parts of a test that are designed to measure the same thing?	You design a questionnaire to measure self-esteem. If you randomly split the results into two halves, there should be a strong correlation between the two sets of results. If the two results are very different, this indicates low internal consistency.

Types of validity

The validity of a measurement can be estimated based on three main types of evidence. Each type can be evaluated through expert judgement or statistical methods.

Type of validity	What does it assess?	Example
Construct	The adherence of a measure to **existing theory and knowledge** of the concept being measured.	A self-esteem questionnaire could be assessed by measuring other traits known or assumed to be related to the concept of self-esteem (such as social skills and optimism). Strong correlation between the scores for self-esteem and associated traits would indicate high construct validity.
Content	The extent to which the measurement **covers all aspects** of the concept being measured.	A test that aims to measure a class of students' level of Spanish contains reading, writing and speaking components, but no listening component. Experts agree that listening comprehension is an essential aspect of language ability, so the test lacks content validity for measuring the overall level of ability in Spanish.
Criterion	The extent to which the result of a measure corresponds to **other valid measures** of the same concept.	A survey is conducted to measure the political opinions of voters in a region. If the results accurately predict the later outcome of an election in that region, this indicates that the survey has high criterion validity.

How to ensure validity and reliability in your research

The reliability and validity of your results depends on creating a strong research design, choosing appropriate methods and samples, and conducting the research carefully and consistently.

Ensuring validity

If you use scores or ratings to measure variations in something (such as psychological traits, levels of ability or physical properties), it's important that your results reflect the real variations as accurately as possible. Validity should be considered in the very earliest stages of your research, when you decide how you will collect your data.

- Choose appropriate methods of measurement

Ensure that your method and measurement technique are high quality and targeted to measure exactly what you want to know. They should be thoroughly researched and based on existing knowledge.

For example, to collect data on a personality trait, you could use a standardized questionnaire that is considered reliable and valid. If you develop your own questionnaire, it should be based on established theory or findings of previous studies, and the questions should be carefully and precisely worded.

- Use appropriate sampling methods to select your subjects

To produce valid generalizable results, clearly define the population you are researching (e.g. people from a specific age range, geographical location, or profession). Ensure that you have enough participants and that they are representative of the population.

Ensuring reliability

Reliability should be considered throughout the data collection process. When you use a tool or technique to collect data, it's important that the results are precise, stable and reproducible.

- Apply your methods consistently

Plan your method carefully to make sure you carry out the same steps in the same way for each measurement. This is especially important if multiple researchers are involved.

For example, if you are conducting interviews or observations, clearly define how specific behaviours or responses will be counted, and make sure questions are phrased the same way each time.

- Standardize the conditions of your research

When you collect your data, keep the circumstances as consistent as possible to reduce the influence of external factors that might create variation in the results.

For example, in an experimental setup, make sure all participants are given the same information and tested under the same conditions.

Where to write about reliability and validity in a thesis

It's appropriate to discuss reliability and validity in various sections of your thesis or dissertation. Showing that you have taken them into account in planning your research and interpreting the results makes your work more credible and trustworthy.

Reliability and validity in a thesis

Section	Discuss
Literature review	What have other researchers done to devise and improve methods that are reliable and valid?
Methodology	How did you plan your research to ensure reliability and validity of the measures used? This includes the chosen sample set and size, sample preparation, external conditions and measuring techniques.
Results	If you calculate reliability and validity, state these values alongside your main results.
Discussion	This is the moment to talk about how reliable and valid your results actually were. Were they consistent, and did they reflect true values? If not, why not?
Conclusion	If reliability and validity were a big problem for your findings, it might be helpful to mention this here.

VALIDITY

Validity is the extent to which the scores from a measure represent the variable they are intended to. But how do researchers make this judgment? We have already considered one factor that they take into account—reliability. When a measure has good test-retest reliability and internal consistency, researchers should be more confident that the scores represent what they are supposed to. There has to be more to it, however, because a measure can be extremely reliable but have no validity whatsoever. As an absurd example, imagine someone who believes that people's index finger length reflects their self-esteem and therefore tries to measure self-esteem by holding a ruler up to people's index fingers. Although this measure would have extremely good test-retest reliability, it would have absolutely no validity. The fact that one person's index finger is a centimeter longer than another's would indicate nothing about which one had higher self-esteem.

Discussions of validity usually divide it into several distinct "types." But a good way to interpret these types is that they are other kinds of evidence—in addition to reliability—that should be taken into account when judging the validity of a measure. Here we consider three basic kinds: face validity, content validity, and criterion validity.

Face Validity

Face validity is the extent to which a measurement method appears "on its face" to measure the construct of interest. Most people would expect a self-esteem questionnaire to include items about whether they see themselves as a person of worth and whether they think they have good qualities. So a questionnaire that included these kinds of items would have good face validity. The finger-length method of measuring self-esteem, on the other hand, seems to have nothing to do with self-esteem and therefore has poor face validity. Although face validity can be assessed quantitatively—for example, by having a large sample of people rate a measure in terms of whether it appears to measure what it is intended to—it is usually assessed informally.

Face validity is at best a very weak kind of evidence that a measurement method is measuring what it is supposed to. One reason is that it is based on people's intuitions about human behavior, which are frequently wrong. It is also the case that many established measures in psychology work quite well despite lacking face validity. The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) measures many personality characteristics and disorders by having people decide whether each of over 567 different statements applies to them—where many of the statements do not have any obvious relationship to the construct that they measure. For example, the items "I enjoy detective or mystery stories" and "The sight of blood doesn't frighten me or make me sick" both measure the suppression of aggression. In this case, it is not the participants' literal answers to these questions that are of interest, but rather whether the pattern of the participants' responses to a series of questions matches those of individuals who tend to suppress their aggression.

Content Validity

Content validity is the extent to which a measure "covers" the construct of interest. For example, if a researcher conceptually defines test anxiety as involving both sympathetic nervous system activation (leading to nervous feelings) and negative thoughts, then his measure of test anxiety should include items about both nervous feelings and negative thoughts. Or consider that attitudes are usually defined as involving thoughts, feelings, and actions toward something. By this conceptual definition, a person has a positive attitude toward exercise to the extent that he or she thinks positive thoughts about exercising, feels good about exercising, and actually exercises. So to have good content validity, a measure of people's attitudes toward exercise would have to reflect all three of these aspects. Like face validity, content validity is not usually assessed quantitatively. Instead, it is assessed by carefully checking the measurement method against the conceptual definition of the construct.

Criterion Validity

Criterion validity is the extent to which people's scores on a measure are correlated with other variables (known as **criteria**) that one would expect them to be correlated with. For example, people's scores on a new measure of test anxiety should be negatively correlated with their performance on an important school exam. If it were found that people's scores were in fact negatively correlated with their exam performance, then this would be a piece of evidence that these scores really represent people's test anxiety. But if it were found that people scored equally well on the exam regardless of their test anxiety scores, then this would cast doubt on the validity of the measure.

A criterion can be any variable that one has reason to think should be correlated with the construct being measured, and there will usually be many of them. For example, one would expect test anxiety scores to be negatively correlated with exam performance and course grades and positively correlated with general anxiety and with blood pressure during an exam. Or imagine that a researcher develops a new measure of physical risk taking. People's scores on this measure should be correlated with their participation in "extreme" activities such as snowboarding and rock climbing, the number of speeding tickets they have received, and even the number of broken bones they have had over the years. When the criterion is measured at the same time as the construct, criterion validity is referred to as **concurrent validity**; however, when the criterion is measured at some point in the future (after the construct has been measured), it is referred to as **predictive validity** (because scores on the measure have "predicted" a future outcome).

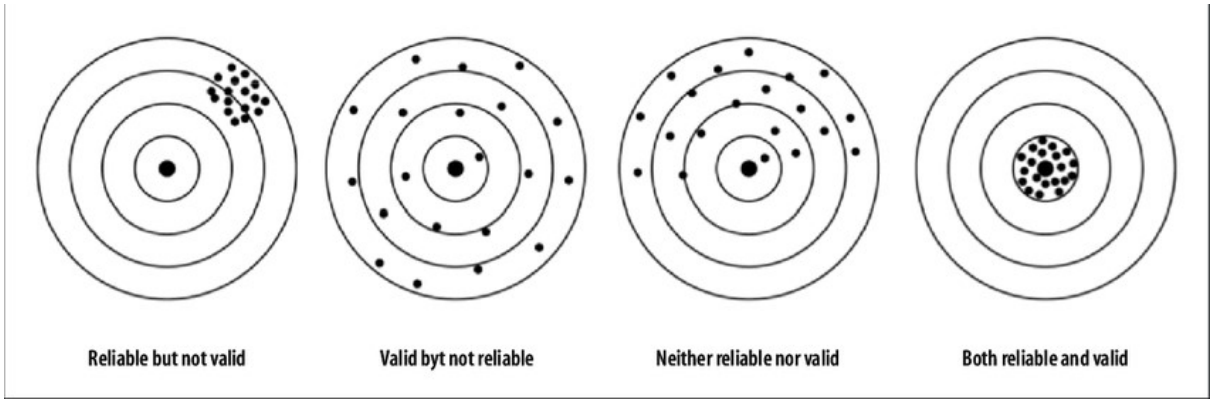
Criteria can also include other measures of the same construct. For example, one would expect new measures of test anxiety or physical risk taking to be positively correlated with existing established measures of the same constructs. This is known as **convergent validity**.

Assessing convergent validity requires collecting data using the measure. Researchers John Cacioppo and Richard Petty did this when they created their self-report Need for Cognition Scale to measure how much people value and engage in thinking (Cacioppo & Petty, 1982)[1]. In a series of studies, they showed that people's scores were positively correlated with their scores on a standardized academic achievement test, and that their scores were negatively correlated with their scores on a measure of dogmatism (which represents a tendency toward obedience). In the years since it was created, the Need for Cognition Scale has been used in literally hundreds of studies and has been shown to be correlated with a wide variety of other variables, including the effectiveness of an advertisement, interest in politics, and juror decisions (Petty, Briñol, Loersch, & McCaslin, 2009)[2].

Discriminant Validity

Discriminant validity, on the other hand, is the extent to which scores on a measure are *not* correlated with measures of variables that are conceptually distinct. For example, self-esteem is a general attitude toward the self that is fairly stable over time. It is not the same as mood, which is how good or bad one happens to be feeling right now. So people's scores on a new measure of self-esteem should not be very highly correlated with their moods. If the new measure of self-esteem were highly correlated with a measure of mood, it could be argued that the new measure is not really measuring self-esteem; it is measuring mood instead.

When they created the Need for Cognition Scale, Cacioppo and Petty also provided evidence of discriminant validity by showing that people's scores were not correlated with certain other variables. For example, they found only a weak correlation between people's need for cognition and a measure of their cognitive style—the extent to which they tend to think analytically by breaking ideas into smaller parts or holistically in terms of "the big picture." They also found no correlation between people's need for cognition and measures of their test anxiety and their tendency to respond in socially desirable ways. All these low correlations provide evidence that the measure is reflecting a conceptually distinct construct.



Primary Sources

A primary source provides direct or firsthand evidence about an event, object, person, or work of art. Primary sources provide the original materials on which other research is based and enable students and other researchers to get as close as possible to what actually happened during a particular event or time period. Published materials can be viewed as primary resources if they come from the time period that is being discussed, and were written or produced by someone with firsthand experience of the event. Often primary sources reflect the individual viewpoint of a participant or observer. Primary sources can be written or non-written (sound, pictures, artifacts, etc.). In scientific research, primary sources present original thinking, report on discoveries, or share new information.

Examples of primary sources:

- Autobiographies and memoirs
- Diaries, personal letters, and correspondence
- Interviews, surveys, and fieldwork
- Internet communications on email, blogs, listservs, and newsgroups
- Photographs, drawings, and posters
- Works of art and literature
- Books, magazine and newspaper articles and ads published at the time
- Public opinion polls
- Speeches and oral histories
- Original documents (birth certificates, property deeds, trial transcripts)
- Research data, such as census statistics
- Official and unofficial records of organizations and government agencies
- Artifacts of all kinds, such as tools, coins, clothing, furniture, etc.
- Audio recordings, DVDs, and video recordings
- Government documents (reports, bills, proclamations, hearings, etc.)
- Patents
- Technical reports
- Scientific journal articles reporting experimental research results

Secondary Sources

Secondary sources describe, discuss, interpret, comment upon, analyze, evaluate, summarize, and process primary sources. A secondary source is generally one or more steps removed from the event or time period and are written or produced after the fact with the benefit of hindsight. Secondary sources often lack the freshness and immediacy of the original material. On occasion, secondary sources will collect, organize, and repackage primary source information to increase usability and speed of delivery, such as an online encyclopedia. Like primary sources, secondary materials can be written or non-written (sound, pictures, movies, etc.).

Examples of secondary sources:

- Bibliographies
- Biographical works
- Reference books, including dictionaries, encyclopedias, and atlases
- Articles from magazines, journals, and newspapers after the event
- Literature reviews and review articles (e.g., movie reviews, book reviews)
- History books and other popular or scholarly books
- Works of criticism and interpretation
- Commentaries and treatises

- Textbooks
- Indexes and abstracts

Structured and unstructured interviews

Structured and unstructured interviews are common methods of gathering data in research. While structured interviews are mostly used in quantitative observation, an unstructured interview is usually applied to qualitative data collection because it pays attention to describing the research subjects.

Apart from the key difference highlighted above, there are other things a researcher must know about the natures of structured and unstructured interviews. Hence, it is important for the interviewer to understand the many differences between a structured interview and an unstructured interview.

Structured interview

A **structured interview** is a type of interview in which the researcher asks a set of premeditated questions in order to gather information about the research subjects. It is also known as a standardized interview or a researcher-administered interview, and it aims at investigating research variables using the same set of questions.

Typically, structured interviews are used to collect information with regards to the quantity or numerical value of the research subjects. It outlines events, behaviors, procedures, and guidelines for conducting the interview and recording the information collected to serve as the research data.

Characteristics of a Structured Interview

A structured interview utilizes a standardized process of inquiry.
It is a quantitative method of observation.
A structured interview is easy to replicate.
This type of interview is sequential in nature.

Strengths

1. Structured interviews are easy to replicate as a fixed set of closed questions are used, which are easy to quantify – this means it is easy to test for reliability.

2. Structured interviews are fairly quick to conduct which means that many interviews can take place within a short amount of time. This means a large sample can be obtained resulting in the findings being representative and having the ability to be generalized to a large population.

Limitations

1. Structure interviews are not flexible. This means new questions cannot be asked impromptu (i.e. during the interview) as an interview schedule must be followed.

2. The answers from structured interviews lack detail as only closed questions are asked which generates quantitative data. This means a researcher won't know why a person behaves in a certain way

Unstructured interview

An **unstructured interview** is a type of interview that does not make use of a set of standardized questions. Here, the interviewer does not generate any specific set of standardized questions for research, rather he or she asks different questions in line with the context and purpose of the systematic investigation.
Typically, an unstructured interview relies on spontaneity and follow-up questioning in order to gather detailed information from the research subject. In many ways, this type of interview can be viewed as an informal, everyday conversation because of its extremely colloquial style.

Characteristics of an Unstructured Interview
An unstructured interview is flexible in nature.
It relies on spontaneity in its method of inquiry.
An unstructured interview is a method of qualitative observation.
It is descriptive in nature.

Differences Between Structured and Unstructured Interview

- **Definition**

A structured interview is a type of interview that relies on a set of standardized and premeditated questions in order to gather information. On the other hand, an unstructured interview is a type of interview that does not rely on a set of premeditated questions in its data-gathering process.

In an unstructured interview, the researcher does not prepare a set of pre-planned interview questions while in a structured interview, the researcher depends on an interview sequence. A structured interview is a directive in nature while an unstructured interview is non-directive in nature.

- **Sequence**

In a structured interview, the researcher follows an interview sequence comprising standardized questions while in an unstructured interview, the researcher does not create any interview sequence. An interview sequence consists of standardized questions for conducting an interview arranged in the order of use.

The interviewer in a structured interview follows the sequence as he or she makes inquiries about the research subject. In an unstructured interview, the researcher does not follow any sequence but relies on spontaneity to direct the course of the conversation.

- **Question Types**

A structured interview makes use of close-ended questions, predominantly while an unstructured interview makes use of open-ended questions, predominantly. Close-ended questions allow the interviewer to limit the interviewee to a range of possible responses in line with the research context.

On the other hand, open-ended questions do not restrict the respondent to pre-conceived options. Rather, it gives the respondent the opportunity to explore the questions from multiple perspectives and this allows the interviewer to gather a variety of information about the research subject.

Strengths

1. Unstructured interviews are more flexible as questions can be adapted and changed depending on the respondents' answers. The interview can deviate from the interview schedule.

2. Unstructured interviews generate qualitative data through the use of open questions. This allows the respondent to talk in some depth, choosing their own words. This helps the researcher develop a real sense of a person's understanding of a situation.

3. They also have increased validity because it gives the interviewer the opportunity to probe for a deeper understanding, ask for clarification & allow the interviewee to steer the direction of the interview etc.

Limitations

1. It can be time-consuming to conduct an unstructured interview and analyze the qualitative data (using methods such as thematic analysis).

2. Employing and training interviewers is expensive, and not as cheap as collecting data via questionnaires. For example, certain skills may be needed by the interviewer. These include the ability to establish rapport and knowing when to probe.

Focus Group Interview

Focus group interview is a qualitative approach where a group of respondents are interviewed together, used to gain an in-depth understanding of social issues. The method aims to obtain data from a purposely selected group of individuals rather than from a statistically representative sample of a broader population.

The role of the interview moderator is to make sure the group interact with each other and do not drift off-topic. Ideally, the moderator will be similar to the participants in terms of appearance, have adequate knowledge of the topic being discussed, and exercise mild unobtrusive control over dominant talkers and shy participants.

A researcher must be highly skilled to conduct a focus group interview. For example, certain skills may be needed by the moderator including the ability to establish rapport and knowing when to probe.

Strengths

1. Group interviews generate qualitative narrative data through the use of open questions. This allows the respondents to talk in some depth, choosing their own words. This helps the researcher develop a real sense of a person's understanding of a situation. Qualitative data also includes observational data, such as body language and facial expressions.

2. They also have increased validity because some participants may feel more comfortable being with others as they are used to talking in groups in real life (i.e. it's more natural).

Limitations

1. The researcher must ensure that they keep all the interviewees' details confidential and respect their privacy. This is difficult when using a group interview. For example, the researcher cannot guarantee that the other people in the group will keep information private.

2. Group interviews are less reliable as they use open questions and may deviate from the interview schedule making them difficult to repeat.

2. Group interviews may sometimes lack validity as participants may lie to impress the other group members. They may conform to peer pressure and give false answers.

The Interviewer Effect

Because an interview is a social interaction the appearance or behavior of the interviewer may influence the answers of the respondent. This is a problem as it can bias the results of the study and make them invalid.

For example, the gender, ethnicity, body language, age, and social status of the interview can all create an interviewer effect.

For example, if a researcher was investigating sexism amongst males, would a female interview be more preferable than a male? It is possible that if a female interviewer was used male participants may lie (i.e. pretend they are not sexist) to impress the interviewer, thus creating an interviewer effect.

Data Collection: Problems with Using Secondary Sources

In research secondary sources of data collection and information are as important as primary sources. There are several reasons for that, in many cases primary data is not available and therefore the researcher uses secondary sources. In other researches the researcher knows that the secondary sources are as much reliable as primary sources and therefore he uses secondary sources.

Secondary sources are very helpful in conducting research but there are some problems associated with the use of these sources. The actual and the most basic issue is always with the validity and reliability of the source from which the data is taken. Primary sources like experiments are very reliable and valid as compared to the secondary sources. These problems can be eliminated to some extent where possible.

1) Validity and reliability

Validity and reliability are very important concerns in research and they cannot be taken for granted. Some secondary sources are as much reliable as primary sources like census as it covers the whole population. Other sources might not be as much reliable and they should only be used when no other data is available. Valid means that the data represents original and true findings and it has been collected using scientific methods. While using secondary sources of information it should be well-researched that the content is genuine and authentic.

2) Personal bias

In secondary sources the chances of bias are higher as compared to that in primary sources. Some secondary sources like personal records can be highly biased and they may be not. Personal diaries

and other records like newspapers, mass media products can be biased. Newspapers, magazines and websites do not use rigorous and well-controlled methods in documentation. Most of the time such writings are opinion-based and they are far from facts. In these publications writers can distort the facts to make the situation look better or worse.

3) Availability of data

Availability of data is another issue in using secondary sources. To obtain highly rigorous, scientific and valid data from secondary sources you need to work hard as such data is hardly available in secondary sources. Secondary sources are usually preferred in the research because of their ease of availability, in case it is hard to collect data using secondary sources the researcher should not use it.

4) Format of data

In secondary sources the format of the data should also be seen before using it in the research. The format of the data can be totally different and the researcher cannot use it in his research. Using another format in data collection that is not related to your research format can give biased and invalid results.

5) Quality of data

Quality of the data is related to its accuracy and accuracy comes with rigorousness in collecting the data. It depends on the source that you are using in your research; books and journals can provide you quality data. There might be some secondary sources that cannot provide high quality data. Again newspapers and magazines cannot provide good data for research, they should be avoided.

6) Obsolete data

Sometimes secondary sources are available to be used in the research but they are very old. Old data is of no use to be used in the research. You cannot use a book that has been written 20 years back, the data present in that book will be valid and reliable at the time when it was written but taking the current circumstances it is obsolete. Libraries are flooded with books that contain data related to your research but you have to check the date of publication to know whether you can use it or not. As a university scholar you should know how old data your university allows you to use in the research. In most of the cases data no more than 5 years can be used in the research. Only historical data can be used forever because it represents history that cannot be researched in other ways.

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SCHOOL OF BUILDING AND ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

UNIT – IV–Research methodologies in built environment – SAR5610

IV. UNIT 4

Writing & publishing the research work in journals - Research writing in general- Components: referencing- Writing the bibliography- Developing the outline – presentation etc. - Case studies - illustrating how good research can be used from project inception to completion- Review of research publications.

Steps to write a research paper

1. Determine the authors. When designing a research project, we recommend preparing an initial list and order of authors. Such a list authors should be based on established guidelines and should make explicit the estimated contribution of each individual to the project. We recommend that every research group establish and make known to its members the criteria for authorship on papers resulting from the work to be conducted. In so doing, the group may wish to make use of existing guidelines; see our essay on "Components of a Research Article."
A list of authors will ensure that all individuals to be involved in the project understand at the outset whether or not they can expect to be an author and, if so, what their contribution is to be. It should be viewed as a tentative list, as the final version should reflect actual contributions to the work. (Also, there may be more than one list as it might be anticipated that more than one paper will derive from a given project.)

2. Start writing before the experiments are complete. Start writing while you are still doing the experiments. Writing often evokes new ideas: you may realize that there are additional experiments to run or additional controls that you need to add. If you wait until you are done in the lab, have dismantled the equipment, and possibly moved on to another position, you will not have the opportunity to test these ideas.

3. Decide it is time to publish. It is time to publish when your findings represent a complete story (or at least a complete chapter), one that will make a significant contribution to the scientific literature. Simply collecting a given amount of data is not adequate.

4. Draft a title & abstract. Drafting a working title and an abstract helps define the contents of the paper, identifying which experiments you will publish in this paper, and which studies you will save for inclusion in another paper. (See our Components of a Research Article on the preparation of these two items.)

***5. (Re)examine the list of authors**. When you have now determined which experiments will be included in this paper you must select the authors and the order in which they will appear. If you have followed our advice to this point, you already have such a list. Reevaluate it based on the contributions that were made to those experiments and the additional contributions that will be made through the preparation of the manuscript. If a list already exists, make adjustments to ensure compliance with your guidelines. Of course, any changes should be done with caution and tact.

6. Determine the basic format. There are three basic formats for peer-reviewed research articles:
• *Full-length research articles*: These articles contain a comprehensive investigation of the subject matter and are viewed as the standard format. It uses the "IMRAD" format: Introduction, Methods, Results and Discussion. (See "Components of a Research Article.")
• *Short (or brief) communications*: While not as comprehensive in scope as full-length research articles, these papers also make a significant contribution to the literature. Their length will be set

by the journal but is usually 3500 words or less and will contain up to 2 tables and figures. Unlike full papers, methods, results, and discussions may be combined into a single section.
• *Rapid communications*: These articles quickly disseminate particularly "hot" findings, usually in a brief communication format. Articles that have immediate implications for public health would be appropriate for such a format, as might findings in a highly competitive and quickly moving field.

8. **Select the journal**. There are several factors to consider when choosing a journal. It is unlikely that one journal will have all the features you are looking for, so you may have to compromise. However, there is one essential feature you should not compromise on – *manuscripts must be peer reviewed for publication if they are to be considered research articles*.
9.

Language: English has become the dominant form for international scientific communication. Thus, if you are interested in communicating your results widely to the international scientific community, then it is essential to publish in English. If, on the other hand, you wish to communicate to a more localized community (e.g., physicians in a particular geographical area), you might chose a journal that permits another language.

Focus: What type of research does the journal publish? Is its focus broad or narrow? Which disciplines are represented? What is the journal's orientation – for example, is it clinical or basic, theoretical or applied?

Indexing: Is the journal indexed in the major electronic databases such as Medline, Biological Abstracts, Chemical Abstracts, or Current Contents?

Availability: Is the journal broadly available? Is there an online version of the journal? Are papers provided in PDF format?

Reputation: Although it can be rather subjective, there are several ways to gauge the reputation of a journal. Ask colleagues which journals they respect. Look at recent articles and judge their importance. Check the members of the editorial board and determine if they are leaders in their fields. Determine the journal's impact factor (an annual measure of the extent to which articles in a given journal are cited. How selective is the journal in accepting papers for publication? Note, however, these ratings can be artificially inflated in journals that publish review articles, which tend to be cited more than research articles. See www.isinet.com). Try to find out the acceptance rate of the journal.

Format: Do you like the appearance of published articles – the format, typeface, and style used in citing references? If relevant, does the journal publish short and/or rapid communications?

Figures: Do figures published in the journal have the resolution that you need? Time to Print: Using the "date submitted" and a "date accepted" that are published on the article, along with the date of the issue, you can estimate the length of the review process as well as the time from acceptance to publication in print.

Charges: Some journals bill the author for page charges, a cost per final printed page. Most journals have a separate charge for color plates. This may be as much as $1000 per color plate. Many journals will waive page charges if this presents a financial hardship for the author; color plate charges are less-readily waived and would at least require evidence that the color is essential to the presentation of the data (e.g., to show a double-labeled cell).
Once you decide on a journal, obtain and read that journal's instructions to authors. This document describes the format for your article and provides information on how to submit your manuscript.

You can usually obtain a copy of the journal's instructions to authors on its Web site or in the first issue of a new volume.

Stock the sections of your paper. As you think about your paper, store relevant material in folders marked Introduction, Methods, Results, and Discussion. This will save time and avoid frustration when the writing begins. Stored items might include figures, references, and ideas.

***9. Construct the tables, figures, and legends**. Yes, create figures and tables before the writing begins! The entire paper should be organized around the data you will present. By preparing the tables and figures (and their legends and appropriate statistical analyses), you will be certain of your results before you worry too much about their interpretation. You also may be able to determine if you have all the data you need. Note: except under unusual circumstance, you may not include any data that you have already published. (See "Components of a Research Paper.")

***10. Outline the paper**. An outline is like a road map. An outline details how you will get from here to there, and helps ensure that you take the most direct and logical route. Do not start writing without it! If you have coauthors, you may wish to get feedback from them before you proceed to the actual writing phase. And if you have "stocked" your sections (Step 8), those files should be useful here and in the writing that follows.

***11. Write the first draft**. Write the first draft of the entire manuscript. If you are writing with coauthors, you may wish to assign different aspects of the manuscript to different authors. This can save time, allow more individuals to feel that are making substantive contributions to the writing process, and ensure the best use of expertise. However, it also can lead to a mixture of styles. Thus, if you take this approach, be certain that the final product is carefully edited to provide a single voice. "Components of a Research Article" discusses what goes into each section of the manuscript. For a more extensive presentation of this and many other aspects of preparing a paper, see Day (1998). At this point, do not worry about it being intelligible. That comes later.
Some people recommend that you begin your writing with the Introduction and continue through in order each section of the paper. This can help ensure flow. However, others suggest that you start wherever you wish – anything to get rid of that blank screen or piece of paper. Whatever your approach, heed the advice of Charles Sides (1991): "If you try to write and edit at the same time, you will do neither well." And because editing is often a lot easier than writing, push through this step as quickly as possible. If you are taking much more than two full days, you have probably paused to edit!

***12. Revise the manuscript**. This step involves three major tasks, each to be carried out in the order given:

Make major alterations: Fill in gaps, correct flaws in logic, restructure the document to present the material in the most logical order.

Polish the style: Refine the text, then correct grammar and spelling.

Format the document: Make your manuscript attractive and easy to read. It is important to do the tasks in the stated order. Otherwise, you may find yourself spending a lot of time revising material that you later delete.

***13. Check the references**. Ensure that the citations are correct and complete. Do one last literature search to make certain that you are up to date. (See "Components of Research Article" on the matter of reference selection.)

***14. Write the final title and abstract**. Many changes are made during the editing process. Make certain that your title and abstract match the final version of your article.

***15. Reread the journal's Instructions to Authors.** Review the details of how the manuscript is to be formatted and submitted. Revise where necessary.

***16. Prepare the final illustrations**. Ensure that your tables, figures, and figure legends are complete, clear, self-contained, and in the format required by the journal. Do not allow any chance for misunderstanding.

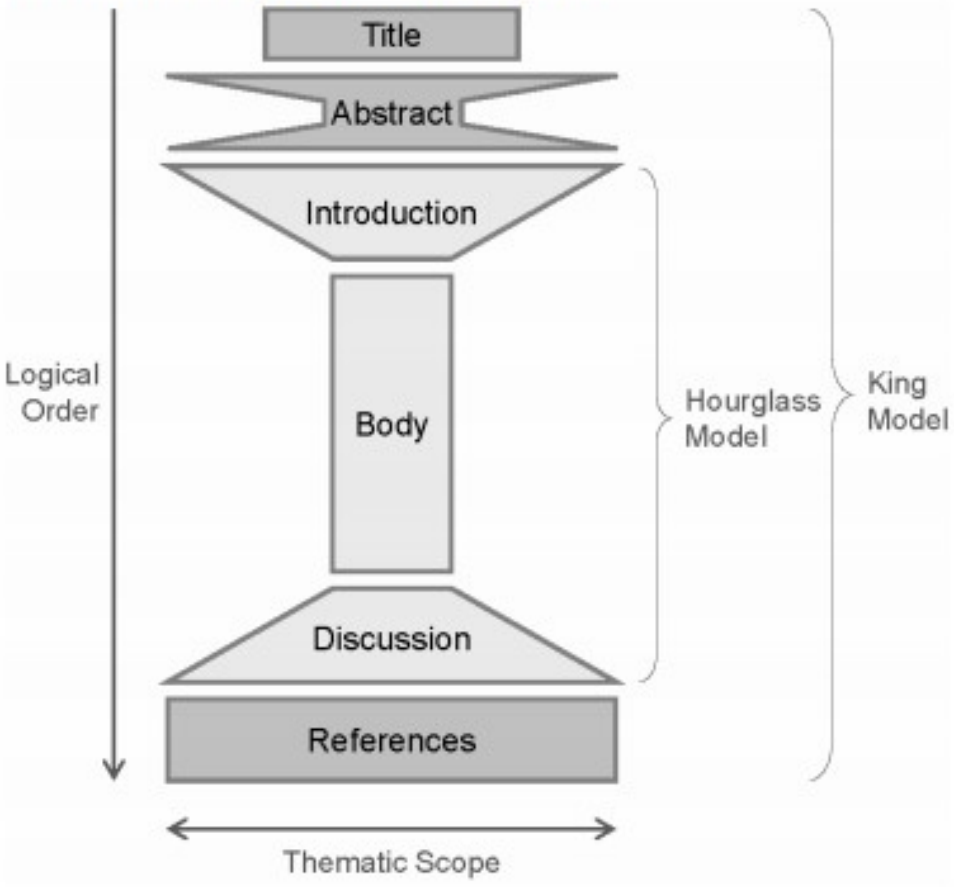
***17. Get feedback on your manuscript and then revise your manuscript again**. Getting feedback is one of the most important things that you can do to improve your article. First, be sure your co-authors have had a chance to read and comment on the draft. Then, when it is ready, give the manuscript to some colleagues. Indicate when you would like to receive their comments, and what levels of information you would like (e.g., comments on the science, logic, language, and/or style). After you get their comments, revise your manuscript to address their concerns.
Do not submit your manuscript until you feel it is ready for publication. Once it is accepted, further changes in your manuscript will be difficult and may also be costly.

***18. Submit the manuscript to the editor**. Follow the Instructions to Authors to determine what items you need to submit, how to submit them, and to whom you should send them. Note that some journals permit (or even require) a "pre-review,"i.e., a letter indicating the content of the article so that the editors can determine whether they will accept the manuscript for a full review. At this point you may wish to list possible reviewers (or individuals to be avoided). If necessary, contact the editor to be sure that the manuscript was received. And if after a month you have not received a response concerning the acceptability of your manuscript for publication you may wish to contact the editor about this, too.
***19. Deal with reviewers' comments**. Most manuscripts are not accepted on the first submission. However, you may well be invited to resubmit a revised manuscript. If you choose to do so, you will need to respond to the reviewer comments. Do this with tact. Answer every concern of the reviewers, and indicate where the corresponding changes were made in the manuscript if they were, indeed, made. You do not need to make all of the changes that the reviewer recommended, but you do need to provide a convincing rationale for any changes that you did not make. When you resubmit the manuscript, indicate in your cover letter that this is a revised version. An alternative is to submit the manuscript to another journal. However, if you do so, it may still be best to take the reviewer comments into consideration. Even if you feel that the reviewers have misunderstood something in your paper, others might do the same. Of course, if you submit to another journal you probably will need to modify the format. And please note: You may not submit your manuscript to more than one journal at a time!
***20. Check the proofs**. Once the manuscript is accepted and prepared for print, the publisher will send the corresponding author page proofs of the article. This may be accompanied by a list of queries, such as missing information regarding a reference. The proofs may be sent via e-mail or as hard copy. If there is a chance that you will be away when the proofs arrive, have a plan for making certain that they are received and you are notified. You may only have 24–48 hr to return the proofs. Carefully correct any typos and factual errors. And read the manuscript for clarity – this is your last chance!

However, try to limit changes to editorial queries plus minor modifications. If you think anything more major is required, you must first get permission from the journal editor and be prepared for additional costs and publication delays.

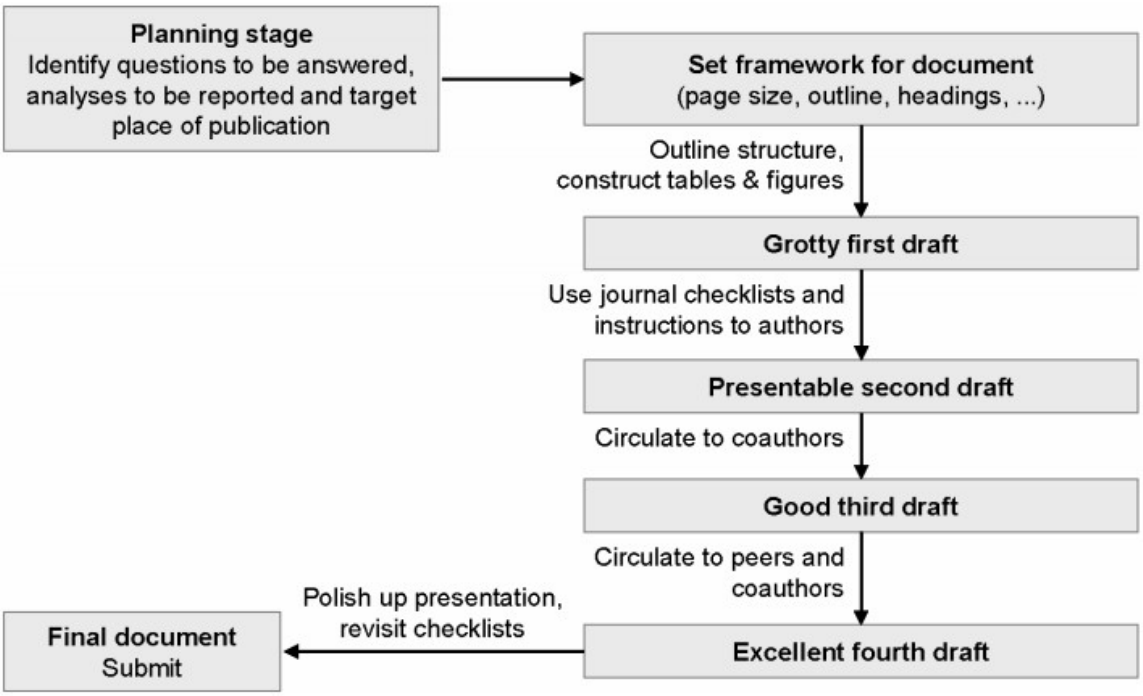
20+. Celebrate! As Robert Day says in How to Write and Publish a Scientific Paper (1998), "The goal of scientific research is publication…. A scientific experiment, no matter how spectacular the results, is not complete until the results are published." Your experiment – at least one phase of it – is now complete. Enjoy the moment!

Figure 1 The 'Hourglass Model' (light-grey parts) and the 'King Model', which covers an extended set of parts in a typical paper's structure



Source: Based on Swales (1993)

Figure 2 Plan for preparing and writing a paper for publication



Source: Adapted from Davis (1997)

Publishing scientific papers

When the paper writing is finished and the authors consider the paper to be worth publishing, the next step is to submit it for publication (e.g. to a conference, a journal or a book editor). Essentially, there are two obstacles to publication: the editors and the reviewers. The following sections cover the scientific community's way of assuring scientific quality of published papers and the central stages of the editing, reviewing and publishing process. The selective focus here is on journal articles and conference papers, since in most disciplines – particularly those with relevance for technology-enhanced learning – either (or both) of these publications is what gets researchers promoted.

Scientific quality management

Peer review is the main mechanism of scientific quality management. Submitted papers are reviewed by peers of the authors in the respective field's scientific community prior to publication; hence, this process is referred to as peer review. It was conceived to ensure publishable quality of research papers (Day, 1983). Some argue that it should continue to do so in the future (Pullinger, 1996), while others are sceptical. For most publication media, the review process is quite similar, with some distinguishing differences. These concern mainly the roles of people involved and the outcome of the process. Common to serious peer reviewing practices is the fact that authors do not know the identity of their reviewers (blind review); depending on the editorial policy, it is also common practice that reviewers should not know the name(s) of the author(s) of the paper (double-blind review).

Journal publications
A journal paper reports on a finished piece of research or some significant achievement or discovery in a certain field of science.

Roles involved

1) **Reviewer.** Each journal has an editorial board that includes a number of reviewers who are responsible for reviewing submitted manuscripts assigned to them by an editor (see below). Having reviewed a paper, each reviewer independently advises the editor whether to accept or reject the paper. It is common practice that editors assign external reviewers to submissions, for example, when the reviewers of the editorial board do not have appropriate expertise to make constructive comments on a particular paper.

2) **Editor-in-chief.** The most important function of an editor-in-chief (can also be a group of persons) is to make the final decision whether to accept or reject a submitted paper. Typically, they base their decisions on recommendations from reviewers or associates (see below). If there is agreement in the recommendations on acceptance or rejection, the editor's life will be easy. It becomes difficult only when there is significant disagreement in the recommendations. In such a case, the editor may make a final decision based on the own opinion or after consulting additional reviewers.

3) **Editor-in-chief** is assisted by several associate editors (Cormode, 2013). Associate editor. In case a journal has a board of associate editors, then for each submission an associate editor is assigned as an intermediary between the authors, the reviewers and the editor-in-chief. Associate editors handle the communication with the corresponding authors and they control the reviewing process, including the selection of reviewers and processing of revisions. Based on the reviewers' recommendations, they make a recommendation to the editor whether to accept or reject a submitted manuscript.

4) **Managing editor**. Many journals have managing editors, in particular those with a large number of submissions or frequent issues. Their job is to relieve the editor-in-chief from administrative and other day-to-day tasks in producing a journal (National Institute for Regional and Spatial Analysis, 2003), e.g. coping with publishers. Generally, the difference between editors and managing editors is that the review process (dealing with the author and reviewers) is mostly within the realm of the editors, whereas postacceptance issues are then taken care of by managing editors

5) **Publisher.** Publishers print accepted papers in (periodical) journal issues. Most journals appear quarterly, but there are also journals which appear in shorter or longer intervals. After the publisher has received the final version of an accepted paper, the paper is prepared for printing. A preview of the typeset paper to be published is then sent to authors, who check the so-called 'page proofs' for any errors that survived the editing and typesetting stages. This process is called proof reading, and it is typically not allowed to make any modifications to the paper other than correcting errors introduced during typesetting; after the author is finished with proof reading, the paper is finally ready to go to print. Most journals offer the scientific community the possibility of publishing special issues.

   A special issue is often proposed by senior researchers who have extensive knowledge in the field and access to a network of expert peers in a specialised field of relevance to the journal's theme. In such a case, the persons who propose the special issue take on the role of guest editors and may provide their own special issue editorial board. For instance,

conference chairs might invite authors of papers presented at their conference with outstanding peer review scores to submit extended versions to a special issue of a journal related to the conference theme.

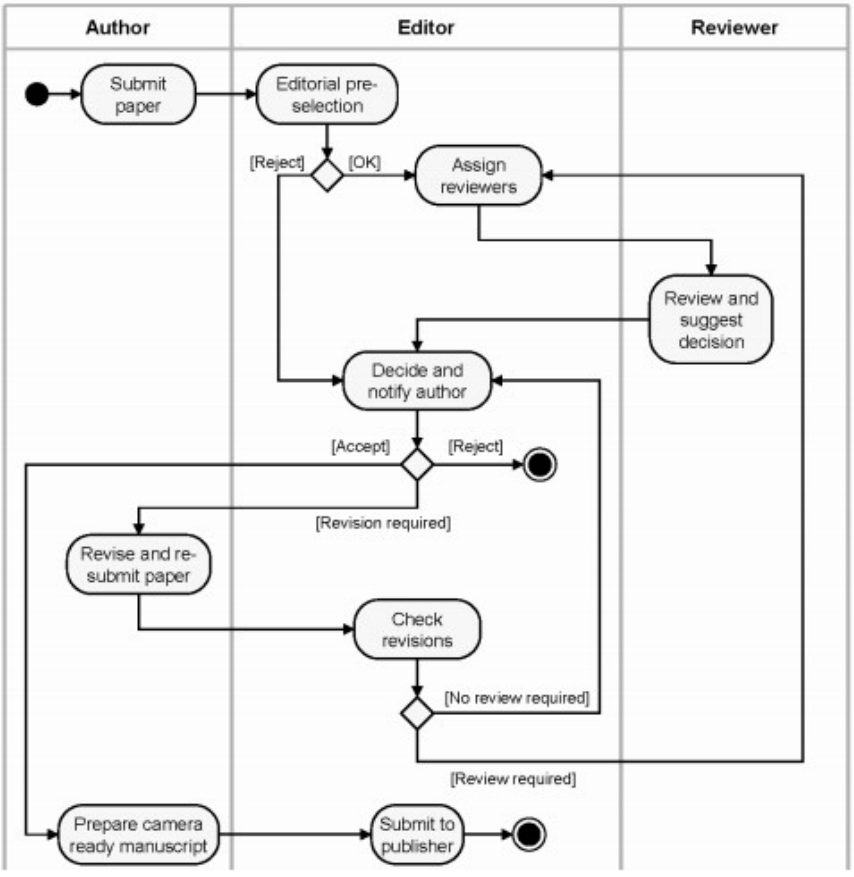
Publication process

A simplified view of important stages and roles in the publishing process of journal papers is given in the activity diagram in Figure 3. The vertical swim lanes separate the areas of responsibility of the main actors in the process. Note that for simplicity all editorial roles are subsumed under one swim lane.
The first step is to be taken by the author. After choosing an appropriate journal for submission, the author has to submit the paper according to the instructions issued by the journal editor.

Most journals today offer the opportunity to submit the paper via the journal's web site or a submission management system. At this stage, it is very important that the author follows the instructions, because submitted papers that do not adhere to (parts of) the instructions can be rejected without taking into account the paper's actual content. Some common authors' mistakes at this stage include:

- not adhering to the journal's paper formatting and layout guidelines (e.g. using the• wrong font size, line spacing, page numbering, referencing style, figure and table placement and visual guidelines);
- exceeding maximum paper length (word count, page count)
- the paper's thematic focus not being within the scope of the journal's subject areas.• If any of the above is evident when the editor does the preliminary review, the paper is likely to be immediately rejected regardless of its scientific contribution and quality.

Figure 3 Simplified activity diagram of the process of publishing a paper in a journal



The next step the editor takes is to select reviewers for peer reviewing the paper. The number of reviewers involved in the review process may vary from journal to journal, but usually the editor forwards the paper to at least three reviewers who are experts in the topic that is covered by the paper. Besides making comments and suggestions for improvements to the authors, reviewers generally support the editor in making a decision by providing information on the following general issues, which may vary in importance among different journals

- thematic relevance to the journal's scope of subjects; significance of contribution (does the paper contribute new findings to the body of knowledge in the field?);
- Basics of research paper writing and publishing
- originality of the work (is similar research already published elsewhere?);
- coverage of relevant literature (did the authors report related work?).
- Focusing more on the writing style of the paper, the following aspects are relevant to reviewers and might influence their recommended decision: clarity of writing: readability, organisation, conciseness and technical quality of the paper;
- appropriate title and abstract;
- appropriate use of well-designed (cf. Day, 1983) figures and tables
- sound conclusion and discussion;
- length of the paper relative to its usefulness.
- Also increasing the likelihood of acceptance are the following characteristics of submitted papers
- strong reputation of the author;
- successful test of the proposed theory;
- different content from that usually published in the journal

Accept. The paper is accepted as it was submitted. The paper will be published in one of the journal's forthcoming issues This outcome is very unlikely upon initial submission. Only in very rare cases will the paper be accepted right away. It is more likely that the paper has to be revised.

Revision. The editor requests a revision of (certain parts of) the paper. The authors have to modify the paper according to the suggestions and comments of the reviewers and the editor in order to be further considered for publication. After revising the paper accordingly, the author may submit the revised manuscript to the editor. This typically requires the authors to enclose a letter to the editor where they outline in detail how the reviewer and editorial comments were addressed in the revised version. After receiving the revised version, the editor either makes an accept/reject recommendation or, if required, forwards the paper for another round of reviewing, which usually involves those reviewers who were most critical about the original submission

Reject. The editor does not see any chance for the paper to be published in the journal. This is the most frequent outcome of the review process of a journal. The editor usually encloses the reviewer comments. Typically, one or more reviewers had serious objections to one of the preconditions relevant to reviewers mentioned above;

- found the paper to be out of the journal's scope, lacking relevance or significance
- fundamental flaws in the paper's argument, data or methodology;
- did not see any improvement with regard to previous submissions of the same paper.
- If a revision is required and the author feels unable to comply with the editor's recommendations, the author may either inform the editor about the disagreement or, alternatively, the paper may be sent to another appropriate journal in the field. The same applies to rejected papers.

Reference list:

- A reference list contains details only of those works cited in the text of the document. (e.g. book, journal article, pamphlet, internet site, cassette tape or film). These details must include sufficient detail so that others may locate and consult your references.
- A reference list should appear at the end of your essay/report with the entries listed numerically and in the same order that they have been cited in the text.

Bibliography:

- A bibliography is a separate list from the reference list and should be arranged alphabetically by author or title (where no author is given) in the Vancouver style.
- A bibliography lists sources not cited in the text but which are relevant to the subject and were used for background reading.

What is the difference between a reference list and a bibliography?

A reference list, generally, contains only sources you have cited in-text in your assignment.
A bibliography, generally, is a list of all the sources you used to generate your ideas about the topic including those cited in your assignment as well as those you did not cite.
However, the terms reference list and bibliography are sometimes used interchangeably so it is very important to check with your lecturer to make sure you know what is required for your assignment.

The most commonly used referencing systems are variations of the following:

- Name and year system. References are cited by their respective authors and the year of publication, e.g. 'Chuck and Norris (2003) define …'. This system is very convenient for authors, as the citation does not have to be changed when adding or removing references from the list. The fact that sentences become hard to read when subsequently citing many references in one single parenthesis this way is one negative aspect for readers.

- Alphabet-number system. This system lists the references in alphabetical order and cites them by their respective number in parentheses or (square) brackets, e.g. 'As reported in [4], …'. This system is relatively convenient for readers, as it does not break the flow of words while reading a sentence with many citations. On the other hand, the author has to keep an eye on the references cited in the text as their numbers may change when the reference list is updated.

- Citation order system. This system is similar to the alphabet-number system with one major difference: the reference list is not sorted alphabetically, but in the order of appearance (citation by number) in the text

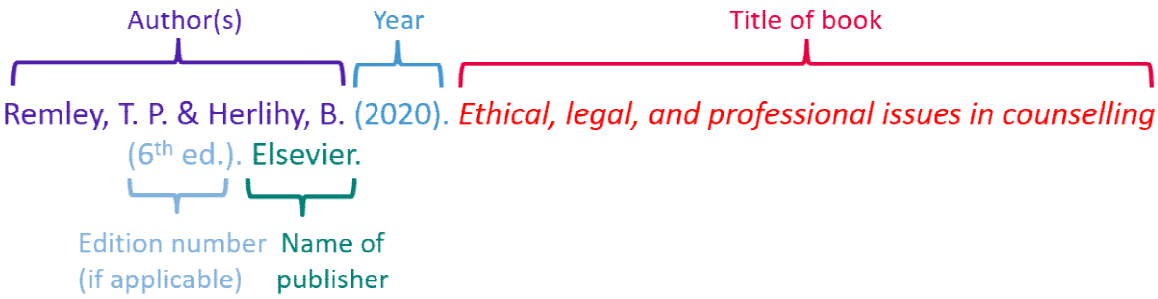
There are several different styles of referencing:

- APA (American Psychological Association)
- MLA (Modern Language Association)
- Oxford
- Harvard
- Chicago

Each style has its own rules for properly citing sources.

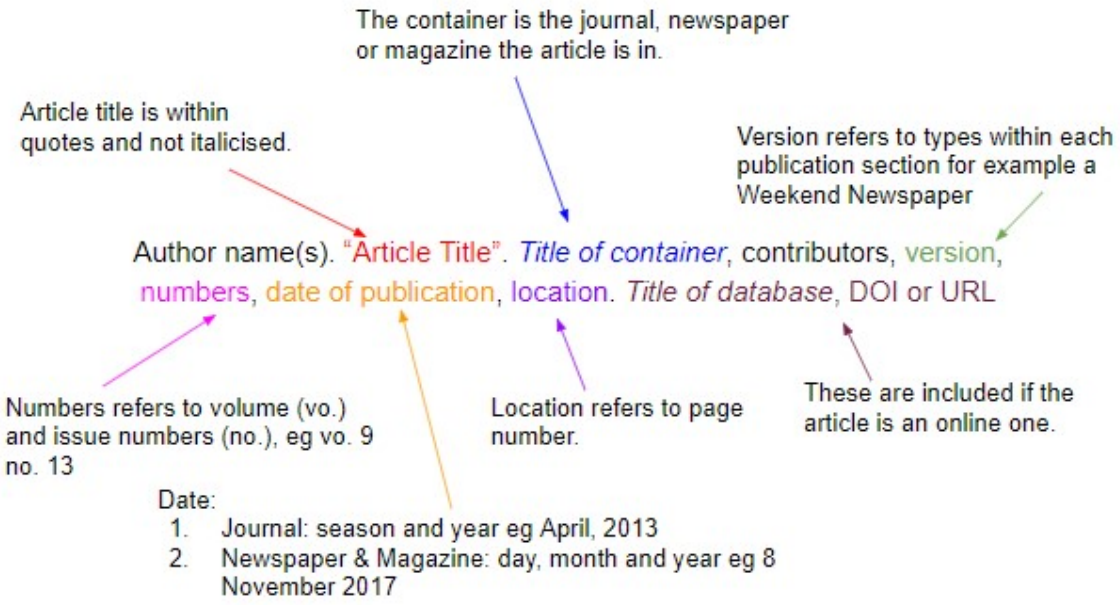
Author-date styles (e.g., APA, MLA, and Harvard) put the author's name inside the text of the assignment
Documentary-note styles (e.g., Chicago and Oxford) put the author's name in a footnote at the bottom of each page, or in an endnote at the end of the assignment

The **APA referencing style** is an "author-date" **style**, so the citation in the text consists of the author(s) and the year of publication given wholly or partly in round brackets. Use only the surname of the author(s) followed by a comma and the year of publication



Harvard style

MLA



Vancouver style

- Number all **references**.
- Arrange your list in the order in which the **references** appear in your text.
- If there are more than 6 authors, list the first 6 authors followed by "et al."
- Use official abbreviations for titles of journals (if available).

Citation styles

There are two basic approaches to citation:

In-text citations + a list of references at the end of the paper

Endnotes or footnotes +/- a bibliography at the end of the paper

Scholars writing in the sciences and social sciences typically use in-text citations, while humanities scholars utilize endnotes/footnotes.

While the two basic approaches to citations are simple, there are many different citation styles.