

LIS326

RESEARCH AND STATISTICAL METHODOLOGY



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LIS326 Research and Statistical Methodology (2 Units)

Series 1: Foundations of Research in Library and Information Science

Series outline

- **Part 1: Nature and Purpose of Research in Library and Information Science**
 - Sub-Part 1.1: Meaning of Research
 - Sub-Part 1.2: Importance of Research in Library and Information Science
 - Sub-Part 1.3: Scope and Applications of Research
- **Part 2: Characteristics and Principles of Research**
 - Sub-Part 2.1: Features of Scientific Research
 - Sub-Part 2.2: Principles Guiding Research in Library and Information Science
- **Part 3: Ethical and Professional Considerations in Research**
 - Sub-Part 3.1: Research Integrity and Ethics
 - Sub-Part 3.2: Professional Responsibilities of Researchers

Introduction

Research is the backbone of progress in any discipline, and library and information science is no exception. In today's knowledge-driven society, libraries and information centres must rely on systematic inquiry to improve services, evaluate resources, and meet the needs of diverse users. Without research, decisions would be based on assumptions rather than evidence, which could limit the growth and relevance of the profession.

The aim of this Series is to introduce you to the foundations of research in library and information science, equipping you with the knowledge to appreciate its purpose, principles, and ethical dimensions.

We shall commence this Series by exploring the nature and purpose of research in library and information science. Next, we will examine the characteristics and guiding principles of research, highlighting what makes it systematic and reliable. Finally, we will conclude with a discussion on ethical and professional considerations, ensuring that you understand the responsibilities of researchers in maintaining integrity and credibility.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 1.1** define the concept of research in library and information science,



- **SLO 1.2** explain the importance and applications of research in library and information science,
- **SLO 1.3** describe the key characteristics and principles of scientific research, and
- **SLO 1.4** evaluate ethical and professional considerations in conducting research.

1.1 Nature And Purpose Of Research In Library And Information Science

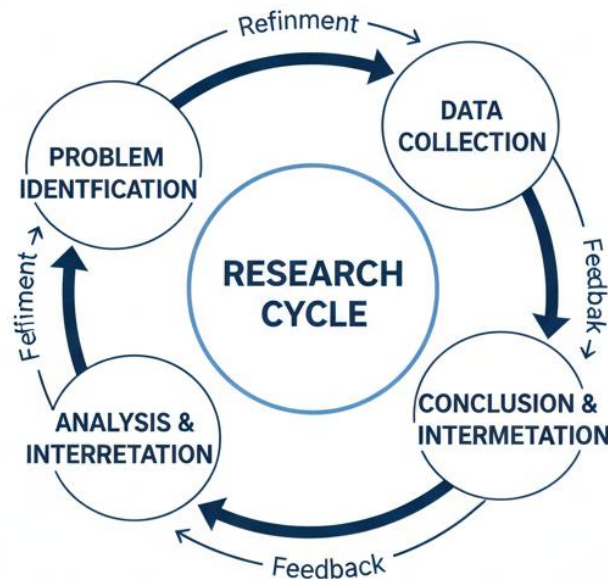
1.1.1 Meaning of research

The term **research** refers to a systematic and organised investigation carried out to discover new facts, verify existing knowledge, or solve specific problems. In library and information science, research involves careful inquiry into issues such as user needs, information retrieval systems, and the effectiveness of library services. It is not a random activity, but one that follows a structured process to ensure reliability and validity.

Fill in the blank: Research is a _____ and organised investigation carried out to discover new facts or solve problems.



Figure 1.1 Research Cycle in Library and Information Science



OER Library & Information Science

1.1.2 Importance of research in library and information science

Research is essential because it provides evidence-based solutions to challenges faced by libraries and information centres. For example, through research, librarians can evaluate whether digital catalogues improve user satisfaction compared to traditional card catalogues. It also helps in policy formulation, resource allocation, and the design of innovative services. Without research, decisions would rely on assumptions, which may not reflect the actual needs of users.

Fill in the blank: Research helps librarians to make _____ decisions rather than relying on assumptions.



Box 1.1 Importance of Research in Library and Information Science

- Improves decision-making
- Enhances service delivery
- Supports innovation
- Provides evidence for policy formulation



1.1.3 Scope and applications of research

The **scope of research** in library and information science covers diverse areas such as user behaviour, information retrieval, cataloguing systems, and digital library management. Applications of research include designing better information systems, evaluating library programmes, and improving access to knowledge resources. For instance, a study on user search behaviour can inform the design of more intuitive online catalogues.

Fill in the blank: The scope of research in library and information science includes areas such as _____ behaviour and information retrieval.



Area of Research	Application
User Behaviour	Designing user-friendly catalogues and intuitive library layouts.
Information Retrieval	Improving search algorithms and metadata standards for faster discovery.
Library Services	Evaluating programme effectiveness to ensure community needs are met.
Digital Libraries	Enhancing access to electronic resources and ensuring long-term digital preservation.

Table 1.1 Applications of research in library and information science

Pilot questions 1.1

1. Research in library and information science is a _____ and organised investigation.
2. Which of the following is NOT an importance of research in LIS? a) Enhancing service delivery b) Supporting innovation c) Promoting random decision-making d) Providing evidence for policy formulation
3. The scope of research in LIS includes studying _____ behaviour.
4. One application of research in digital libraries is _____.
5. Research helps librarians to make _____ decisions.

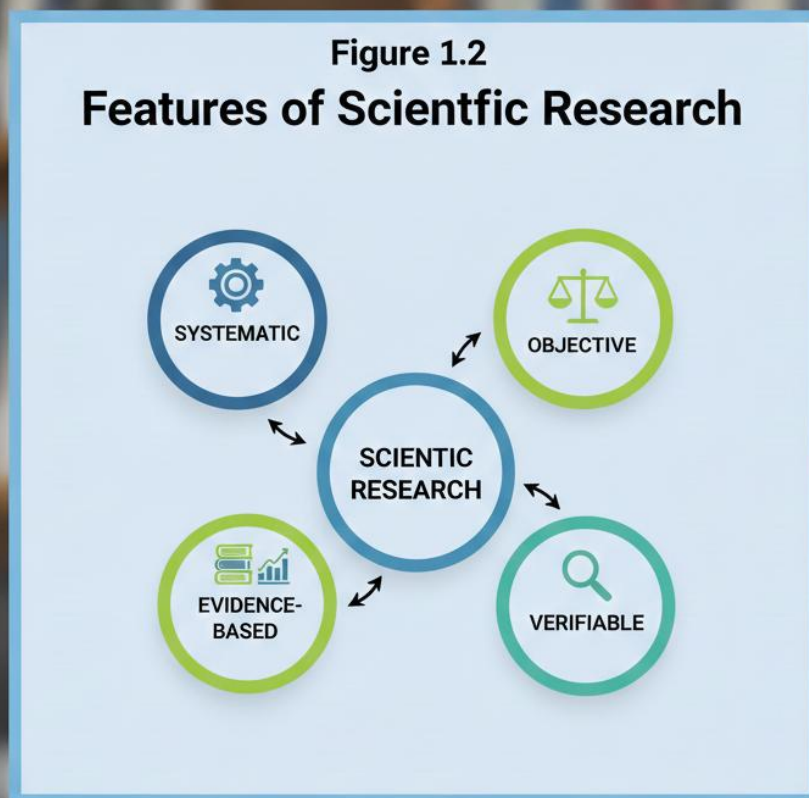
1.2 Characteristics And Principles Of Research

1.2.1 Features of scientific research

Scientific research refers to inquiry that is systematic, objective, and verifiable. In library and information science, this means that investigations must follow a clear process, avoid personal bias, and produce results that can be tested or replicated. Key features include clarity of purpose, logical organisation, and reliance on evidence rather than assumptions.



Fill in the blank: One feature of scientific research is that it must be _____, meaning free from personal bias.



1.2.2 Principles guiding research in library and information science

Principles of research are the fundamental rules that ensure investigations are credible and useful. In library and information science, these principles include relevance, accuracy, ethical responsibility, and applicability. Research must address real problems faced by libraries, use reliable data, and be conducted with integrity. For example, a study on user satisfaction should employ valid methods of data collection and analysis, ensuring that findings can guide service improvement.



Fill in the blank: One principle of research in LIS is _____, which ensures that studies address real problems faced by libraries.

Box 1.2 Principles Guiding Resarary and Information Science

- Relevance: addressing real problems
- Accuracy: ensuring reliable data
- Ethical responsiblity: maintaning integrity
- Applicabiity: producing useful outcomes



Pilot questions 1.2

1. Which of the following is NOT a feature of scientific research? a) Systematic inquiry
b) Objective analysis c) Random guesswork d) Verifiable results
2. Research must be _____ to ensure results can be tested or replicated.
3. One principle of research in LIS is _____, which ensures studies are useful in practice.
4. Accuracy in research means using _____ data.



5. Ethical responsibility in research requires maintaining _____.

1.3 Ethical And Professional Considerations In Research

1.3.1 Research integrity and ethics

Research integrity refers to the commitment to honesty, accuracy, and fairness in conducting investigations. In library and information science, this means avoiding plagiarism, reporting data truthfully, and acknowledging all sources of information. **Ethics** in research involves respecting participants' rights, ensuring confidentiality, and avoiding harm. For example, when studying user behaviour, researchers must protect the privacy of individuals and obtain consent before collecting data.

Fill in the blank: Research integrity requires that data be reported _____ and sources properly acknowledged.



Figure 1.3
Ethical Considerations
in Research



1.3.2 Professional responsibilities of researchers

Researchers in library and information science have professional responsibilities that extend beyond the research process itself. These include contributing to the advancement of knowledge, maintaining transparency, and ensuring that findings are disseminated for the benefit of the profession. They must also uphold the reputation of their institutions and act as role models for ethical behaviour. For instance, a librarian conducting a study on digital resource usage should share findings with colleagues to improve collective practice.



Fill in the blank: One professional responsibility of researchers is to _____ findings for the benefit of the profession.

Box 1.3 Professional Responsibilities of Researchers

- Contribute to knowledge advancement
- Maintain transparency in methods and results
- Disseminate findings for professional benefit
- Uphold as role models for ethical behaviour



Pilot questions 1.3

1. Research integrity requires avoiding _____.
2. Which of the following is NOT an ethical consideration in research? a) Honesty b) Confidentiality c) Consent d) Bias in reporting
3. Professional responsibilities of researchers include _____ findings for the benefit of the profession.



4. Upholding institutional reputation is part of _____ responsibilities.
5. Ethics in research involves respecting _____ rights.

Series Summary

This Series has introduced you to the foundations of research in library and information science, highlighting its purpose and relevance to the profession. We began by examining the meaning of research, its importance in guiding evidence-based decisions, and the wide scope of its applications. We then considered the characteristics and principles of scientific research, focusing on how systematic inquiry ensures credibility and usefulness. Finally, we explored ethical and professional considerations, emphasising integrity, responsibility, and the role of researchers in advancing knowledge.

By engaging with these discussions, you should now be able to define research in library and information science, explain its importance and applications, describe the features and guiding principles of scientific inquiry, and evaluate the ethical and professional responsibilities of researchers. These outcomes align directly with the Series Learning Outcomes and provide a strong foundation for the subsequent Series.

Glossary of Terms

- **Accuracy:** The principle of ensuring that data and findings in research are reliable and free from error.
- **Applicability:** The quality of research outcomes being useful and relevant to real-world problems.
- **Ethics:** Standards of conduct in research that protect participants' rights, ensure confidentiality, and promote fairness.
- **Objectivity:** The feature of research that requires freedom from personal bias or subjective influence.
- **Research:** A systematic and organised investigation carried out to discover new facts, verify existing knowledge, or solve specific problems.
- **Research integrity:** Commitment to honesty, accuracy, and fairness in conducting and reporting investigations.
- **Relevance:** The principle that research must address real and meaningful problems within its field.
- **Scientific research:** Inquiry that follows a structured, systematic, and verifiable process to produce credible results.

Concept Check Questions



Objective questions

1. Which of the following is a feature of scientific research? a) Random guesswork b) Systematic inquiry c) Subjective bias d) Unverified assumptions (Linked to SLO 1.3)
2. Research in library and information science helps librarians to make _____ decisions. (Linked to SLO 1.2)

Short-answer questions

3. Define research in library and information science. (Linked to SLO 1.1)
4. State two professional responsibilities of researchers in library and information science. (Linked to SLO 1.4)

Long-answer questions

5. Explain the importance of research in library and information science, giving examples of its applications. (Linked to SLO 1.2)
6. Evaluate the ethical and professional considerations that researchers must uphold in library and information science. (Linked to SLO 1.4)

Answers to Concept Check Questions

Objective questions

1. b) Systematic inquiry
2. Evidence-based decisions

Short-answer questions

3. Research in library and information science is a systematic and organised investigation carried out to discover new facts, verify existing knowledge, or solve specific problems.
4. Professional responsibilities include disseminating findings for professional benefit and upholding institutional reputation.

Long-answer questions

5. **Basic response:** Research is important because it improves decision-making, enhances service delivery, and supports innovation. Applications include designing user-friendly catalogues, improving search algorithms, and evaluating library programmes.
Value-added response: Beyond these, research also informs policy formulation, resource allocation, and the integration of digital technologies, ensuring libraries remain relevant in a changing information landscape.
6. **Basic response:** Ethical considerations include honesty, confidentiality, and consent, while professional responsibilities involve transparency and dissemination of



findings. **Value-added response:** Outstanding learners may add that ethical research strengthens trust between libraries and users, while professional responsibilities ensure the advancement of collective knowledge and uphold the credibility of the profession.

Answers to Pilot Questions

Pilot questions 1.1

1. Systematic
2. c) Promoting random decision-making
3. User
4. Enhancing access to electronic resources
5. Evidence-based

Pilot questions 1.2

1. c) Random guesswork
2. Objective
3. Applicability
4. Reliable
5. Integrity

Pilot questions 1.3

1. Plagiarism
2. d) Bias in reporting
3. Disseminate
4. Professional
5. Participants'

References and Attributions

- Figure 1.1 Research cycle in library and information science. Suggested AI prompt: “Generate a simple circular diagram showing stages of research: problem identification, data collection, analysis, conclusion.” Search string: “research cycle diagram open educational resource.”
- Box 1.1 Importance of research in library and information science. Suggested AI prompt: “Create a text box styled as a table with single column listing importance of research in LIS.” Search string: “importance of research in library science OER.”



- Table 1.1 Applications of research in library and information science. Suggested AI prompt: “Generate a simple table showing applications of research in LIS with two columns: area and application.” Search string: “applications of research in library science OER.”
- Figure 1.2 Features of scientific research. Suggested AI prompt: “Generate a labelled diagram showing features of scientific research: systematic, objective, verifiable, evidence-based.” Search string: “features of scientific research diagram OER.”
- Box 1.2 Principles guiding research in library and information science. Suggested AI prompt: “Create a text box styled as a table with single column listing principles of research in LIS.” Search string: “principles of research in library science OER.”
- Figure 1.3 Ethical considerations in research. Suggested AI prompt: “Generate a diagram showing ethical considerations in research: honesty, confidentiality, consent, fairness.” Search string: “ethical considerations in research diagram OER.”
- Box 1.3 Professional responsibilities of researchers. Suggested AI prompt: “Create a text box styled as a table with single column listing professional responsibilities of researchers in LIS.” Search string: “professional responsibilities of researchers in library science OER.”



LIS326 Research and Statistical Methodology (2 Units)

Series 2: Types Of Research: Survey, Historical, And Experimental Approaches

Series outline

- **Part 1: Survey Research in Library and Information Science**
 - Sub-Part 2.1.1: Meaning and characteristics of survey research
 - Sub-Part 2.1.2: Applications of survey research in LIS
 - Sub-Part 2.1.3: Strengths and limitations of survey research
- **Part 2: Historical and Documentary Research**
 - Sub-Part 2.2.1: Meaning and scope of historical/documentary research
 - Sub-Part 2.2.2: Applications in library and information science
 - Sub-Part 2.2.3: Strengths and limitations of historical/documentary research
- **Part 3: Experimental Research in Library and Information Science**
 - Sub-Part 2.3.1: Meaning and characteristics of experimental research
 - Sub-Part 2.3.2: Applications of experimental research in LIS
 - Sub-Part 2.3.3: Strengths and limitations of experimental research

Introduction

Research in library and information science can take different forms depending on the questions being asked and the problems being addressed. Each type of research provides unique insights and contributes to the growth of the profession. By understanding these approaches, learners can select the most appropriate method for their own investigations.

The aim of this Series is to introduce you to the major types of research used in library and information science, namely survey, historical/documentary, and experimental approaches.

We shall commence this Series by examining survey research, focusing on its meaning, applications, and limitations. Next, we will consider historical and documentary research, exploring how past records and documents can be studied to inform present practice. Finally, we will conclude with experimental research, highlighting its role in testing new ideas and evaluating interventions in library and information science.

Series Learning Outcomes



Upon completing this Series, you should be able to:

- **SLO 2.1** define survey research and explain its applications in library and information science,
- **SLO 2.2** analyse the strengths and limitations of survey research,
- **SLO 2.3** describe historical and documentary research and explain its relevance to library and information science,
- **SLO 2.4** evaluate the strengths and limitations of historical and documentary research,
- **SLO 2.5** define experimental research and explain its applications in library and information science, and
- **SLO 2.6** assess the strengths and limitations of experimental research.

2.1 Survey Research In Library And Information Science

2.1.1 Meaning and characteristics of survey research

Survey research is a method of collecting information from a sample of individuals through questionnaires, interviews, or observation. It is widely used in library and information science to gather data about user needs, preferences, and behaviours. The main characteristics of survey research include its reliance on structured instruments, its ability to cover large populations, and its focus on obtaining quantifiable data.

Fill in the blank: Survey research relies on _____ instruments such as questionnaires and interviews.



Figure 2.1
Process of Survey Research



2.1.2 Applications of survey research in LIS

Survey research is applied in library and information science to evaluate user satisfaction, assess information-seeking behaviour, and measure the effectiveness of library services. For example, a survey can be conducted to determine how often students use electronic resources compared to print materials. Surveys also help in planning new services, such as digital repositories, by identifying user expectations.

Fill in the blank: Surveys can be used to evaluate _____ satisfaction with library services.



Application	Example
User Satisfaction	Measuring how satisfied students are with the accessibility of electronic resources.
Information Behaviour	Studying the specific search patterns and hurdles students face when using the library discovery layer.
Service Evaluation	Assessing the effectiveness and helpfulness of reference services from the user's perspective.
Planning	Identifying user expectations and feature requirements for upcoming digital repositories.

Table 2.1 Applications of survey research in library and information science

2.1.3 Strengths and limitations of survey research

Survey research has several strengths. It allows data collection from large groups, provides quantifiable results, and can be generalised to wider populations. However, it also has limitations. Responses may be superficial, participants may provide inaccurate information, and surveys may not capture complex behaviours. For instance, while a questionnaire can reveal how often users access online catalogues, it may not explain why they prefer one system over another.

Fill in the blank: One limitation of survey research is that responses may be _____ or inaccurate.



Box 2.1 Strengths and Limitations of Survey Research

Strengths

- Covers large populations
- Produces quantifiable results
- Can be generalised



Limitations

- Responses may be superficial
- Risk of inaccurate information
- Limited in explaining complex behaviors

Pilot questions 2.1

1. Survey research relies on _____ instruments such as questionnaires.
2. Which of the following is NOT an application of survey research in LIS? a) Measuring user satisfaction b) Studying information behaviour c) Conducting laboratory experiments d) Planning digital repositories
3. One strength of survey research is that it can be _____ to wider populations.
4. A limitation of survey research is that responses may be _____.



5. Surveys are commonly used to evaluate _____ satisfaction with library services.

2.2 Historical And Documentary Research

2.2.1 Meaning and scope of historical/documentary research

Historical research refers to the study of past events, practices, and developments to understand their influence on the present. In library and information science, this often involves examining records, archives, and documents to trace the evolution of library services or information systems. **Documentary research** is closely related, focusing on the use of existing documents such as reports, catalogues, and policy papers as primary sources of data. Together, these approaches provide insights into how libraries have developed and how past practices can inform current decision-making.

Fill in the blank: Historical research in LIS often involves examining _____ and archives to trace developments.



Figure 2.2
Sources of Historical and Research



2.2.2 Applications in library and information science

Historical and documentary research is applied in library and information science to study the growth of institutions, evaluate past policies, and understand user trends over time. For example, analysing old catalogues can reveal how classification systems have evolved, while reviewing past reports can show how libraries responded to technological changes. These applications help professionals learn from past successes and mistakes, guiding future improvements.

Fill in the blank: Analysing old _____ can reveal how classification systems have evolved.



Application	Example
Institutional Growth	Studying the developmental milestones and expansion of national libraries over decades.
Policy Evaluation	Reviewing past government white papers and reports to understand shifts in library funding.
User Trends	Analysing historical borrowing records or ledger books to see how reading habits have changed.
Technological Change	Examining internal reports and manuals on the transition from card catalogues to digital systems.

Table 2.2 Applications of historical and documentary research in LIS

2.2.3 Strengths and limitations of historical/documentary research

Historical and documentary research has strengths such as providing rich contextual information, offering insights into long-term trends, and using existing sources that are often readily available. However, it also has limitations. Documents may be incomplete, biased, or outdated, and interpreting historical data requires caution. For instance, an old report may reflect the attitudes of its time rather than objective facts.

Fill in the blank: One limitation of historical research is that documents may be _____ or biased.



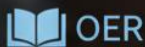
Box 2.2 Strengths and Limitations of Historical/ Documentary Research

Strengths

- Provides rich contextual information
- Offers insights into long-term trends
- Uses readily available sources

Limitations

- Documents may be incomplete or biased
- Data may be outdated
- Interpretation requires caution



Pilot questions 2.2

1. Historical research in LIS often involves examining _____ and archives.
2. Which of the following is NOT an application of historical/documentary research in LIS? a) Studying institutional growth b) Reviewing past policies c) Conducting laboratory experiments d) Analysing user trends
3. Analysing old _____ can reveal how classification systems have evolved.
4. One strength of historical research is that it provides _____ contextual information.



5. A limitation of historical research is that documents may be _____.

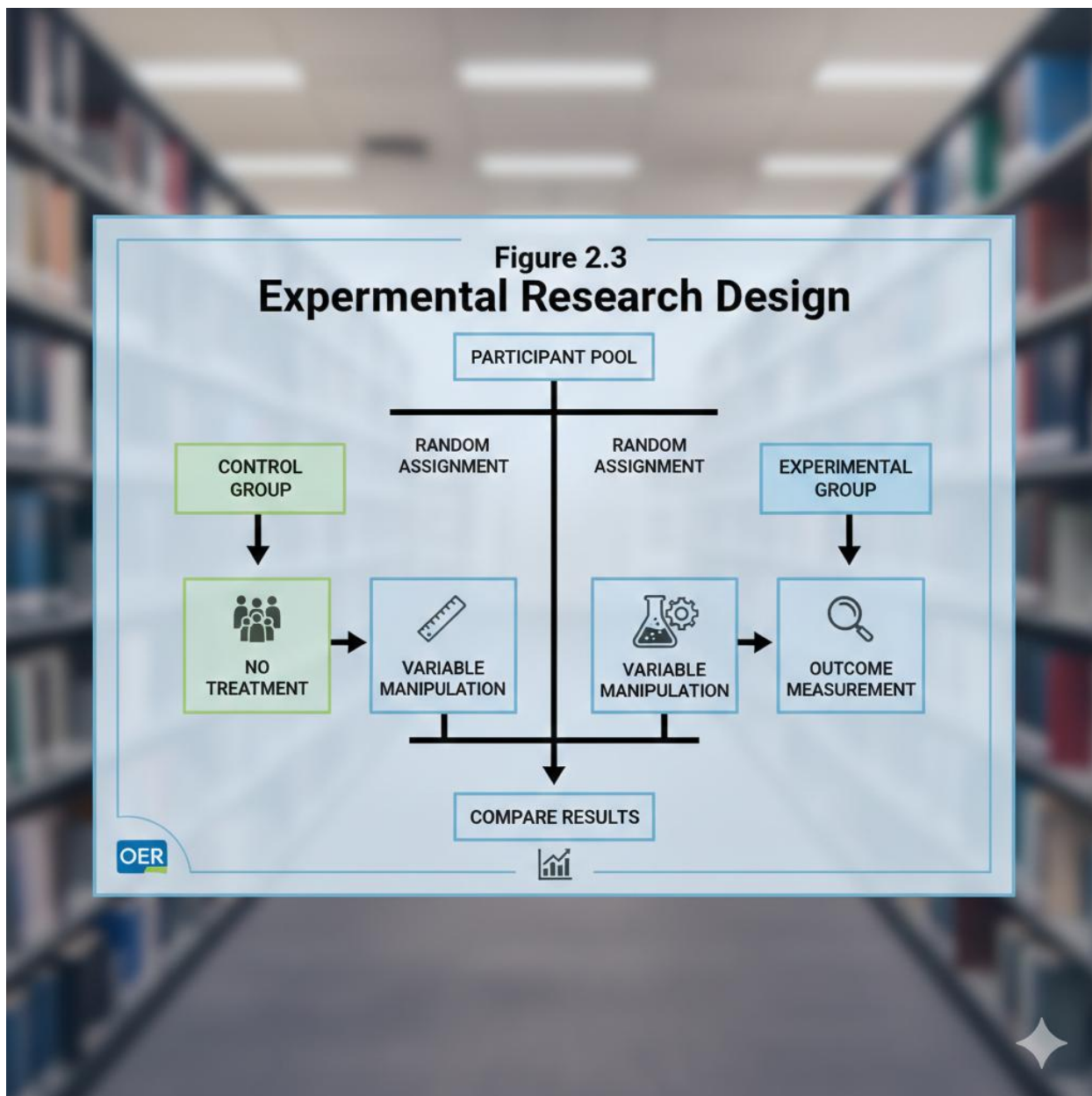
2.3 Experimental Research In Library And Information Science

2.3.1 Meaning and characteristics of experimental research

Experimental research is a type of investigation where variables are manipulated to observe their effects on outcomes. In library and information science, this often involves testing new systems, services, or methods to determine their effectiveness. The main characteristics of experimental research include control of variables, use of experimental and control groups, and reliance on measurable outcomes. For example, a library may test whether a new search interface improves retrieval speed compared to the existing system.

Fill in the blank: Experimental research involves manipulating _____ to observe their effects on outcomes.





2.3.2 Applications of experimental research in LIS

Experimental research is applied in library and information science to test innovations such as new cataloguing systems, digital platforms, or instructional methods. For instance, a study may compare the effectiveness of traditional library orientation with an interactive digital tutorial. These applications help libraries adopt evidence-based practices and improve user experiences.

Fill in the blank: Experimental research can be used to test new _____ systems in libraries.



Application	Example
Testing Cataloguing Systems	Comparing the speed and accuracy of users finding items in traditional card catalogues versus digital OPACs.
Evaluating Instructional Methods	Assessing whether students learn better through self-paced digital tutorials or traditional face-to-face lectures.
Assessing Digital Platforms	Measuring the effectiveness of different e-resource portal layouts on user "click-through" and retrieval rates.
Service Innovation	Testing a "roving reference" model against a static service desk to see which increases user engagement.

Table 2.3 Applications of experimental research in library and information science

2.3.3 Strengths and limitations of experimental research

Experimental research has strengths such as providing clear evidence of cause-and-effect relationships, allowing precise measurement, and supporting innovation. However, it also has limitations. It can be costly, time-consuming, and sometimes difficult to apply in real-world library settings. For example, controlling all variables in a busy library environment may not be feasible, which can affect the validity of results.

Fill in the blank: One strength of experimental research is that it provides clear evidence of _____ relationships.



Box 2.3 Strengths and Limitations of Experimental Research

Strengths

- Provides evidence of cause-and-effect relationships
- Allows precise measurement
- Supports innovation



Limitations

- Can be costly and time-consuming
- Difficult to control variables in real-world settings
- May not always be feasible in libraries

Pilot questions 2.3

1. Experimental research involves manipulating _____ to observe outcomes.
2. Which of the following is NOT an application of experimental research in LIS? a) Testing cataloguing systems b) Evaluating instructional methods c) Reviewing past policies d) Assessing digital platforms
3. One strength of experimental research is that it provides evidence of _____ relationships.



4. A limitation of experimental research is that it can be _____ and time-consuming.
5. Experimental research often uses _____ and control groups.

Series Summary

This Series has introduced you to three major types of research in library and information science: survey, historical/documentary, and experimental approaches. We began with survey research, exploring its meaning, applications in evaluating user satisfaction and information behaviour, and its strengths and limitations. We then moved on to historical and documentary research, considering how past records and documents can be studied to understand institutional growth, policy evaluation, and user trends, while also noting the challenges of incomplete or biased sources. Finally, we examined experimental research, focusing on its role in testing innovations, its ability to establish cause-and-effect relationships, and the practical difficulties it may encounter in real-world library settings.

By engaging with these discussions, you should now be able to define survey, historical, and experimental research, explain their applications in library and information science, analyse their strengths and limitations, and evaluate their relevance to professional practice. These outcomes align directly with the Series Learning Outcomes and provide you with a toolkit of approaches for conducting meaningful investigations in the field.

Glossary of Terms

- **Control group:** A group in experimental research that does not receive the intervention, used for comparison with the experimental group.
- **Documentary research:** A method of investigation that uses existing documents such as reports, catalogues, and policy papers as primary sources of data.
- **Experimental research:** A type of research where variables are manipulated to observe their effects on outcomes.
- **Historical research:** The study of past events, practices, and developments to understand their influence on the present.
- **Quantifiable data:** Information that can be measured and expressed numerically, often collected through surveys.
- **Survey research:** A method of collecting information from a sample of individuals through questionnaires, interviews, or observation.
- **Variable:** A factor that can be manipulated or measured in research to observe its effect on outcomes.

Concept Check Questions



Objective questions

1. Which of the following is a characteristic of survey research? a) Reliance on random guesswork b) Use of structured instruments c) Focus on subjective bias d) Dependence on outdated documents (Linked to SLO 2.1)
2. Historical research in LIS often involves examining _____ and archives. (Linked to SLO 2.3)

Short-answer questions

3. Define experimental research in library and information science. (Linked to SLO 2.5)
4. State two limitations of survey research. (Linked to SLO 2.2)

Long-answer questions

5. Analyse the applications of historical and documentary research in library and information science, giving examples. (Linked to SLO 2.3)
6. Evaluate the strengths and limitations of experimental research in library and information science. (Linked to SLO 2.6)

Answers to Concept Check Questions

Objective questions

1. b) Use of structured instruments
2. Records

Short-answer questions

3. Experimental research is a type of investigation where variables are manipulated to observe their effects on outcomes, often using control and experimental groups.
4. Limitations include superficial responses and risk of inaccurate information.

Long-answer questions

5. **Basic response:** Historical and documentary research is applied to study institutional growth, evaluate past policies, and analyse user trends. Examples include reviewing government reports on library funding and analysing borrowing records. **Value-added response:** Beyond these, such research also informs technological adoption, such as examining reports on the transition to digital catalogues, and provides lessons from past successes and failures that guide future innovations.
6. **Basic response:** Strengths of experimental research include establishing cause-and-effect relationships and supporting innovation, while limitations include cost, time, and difficulty in controlling variables. **Value-added response:** Outstanding learners may add that experimental research enhances evidence-based practice in libraries, but its



feasibility is often constrained by the complexity of real-world environments, requiring careful adaptation of methods.

Answers to Pilot Questions

Pilot questions 2.1

1. Structured
2. c) Conducting laboratory experiments
3. Generalised
4. Superficial
5. User

Pilot questions 2.2

1. Records
2. c) Conducting laboratory experiments
3. Catalogues
4. Rich
5. Incomplete

Pilot questions 2.3

1. Variables
2. c) Reviewing past policies
3. Cause-and-effect
4. Costly
5. Experimental

References and Attributions

- Figure 2.1 Process of survey research. Suggested AI prompt: “Generate a flow diagram showing stages of survey research: designing instruments, selecting sample, collecting data, analysing results.” Search string: “survey research process diagram OER.”
- Table 2.1 Applications of survey research in library and information science. Suggested AI prompt: “Generate a simple table showing applications of survey research in LIS with two columns: application and example.” Search string: “applications of survey research in library science OER.”



- Box 2.1 Strengths and limitations of survey research. Suggested AI prompt: “Create a text box styled as a table with two sections listing strengths and limitations of survey research.” Search string: “strengths and limitations of survey research OER.”
- Figure 2.2 Sources of historical and documentary research. Suggested AI prompt: “Generate a diagram showing sources of historical/documentary research: archives, reports, catalogues, policy papers.” Search string: “sources of historical research in library science OER.”
- Table 2.2 Applications of historical and documentary research in LIS. Suggested AI prompt: “Generate a simple table showing applications of historical/documentary research in LIS with two columns: application and example.” Search string: “applications of historical research in library science OER.”
- Box 2.2 Strengths and limitations of historical/documentary research. Suggested AI prompt: “Create a text box styled as a table with two sections listing strengths and limitations of historical/documentary research.” Search string: “strengths and limitations of historical research OER.”
- Figure 2.3 Experimental research design. Suggested AI prompt: “Generate a diagram showing experimental research design with control group, experimental group, variable manipulation, and outcome measurement.” Search string: “experimental research design diagram OER.”
- Table 2.3 Applications of experimental research in library and information science. Suggested AI prompt: “Generate a simple table showing applications of experimental research in LIS with two columns: application and example.” Search string: “applications of experimental research in library science OER.”
- Box 2.3 Strengths and limitations of experimental research. Suggested AI prompt: “Create a text box styled as a table with two sections listing strengths and limitations of experimental research.” Search string: “strengths and limitations of experimental research OER.”



LIS326 Research and Statistical Methodology (2 Units)

Series 3: Research Process: From Problem Statement To Recommendations

Series outline

- **Part 1: Identifying And Defining The Research Problem**
 - Sub-Part 3.1.1: Meaning of a research problem
 - Sub-Part 3.1.2: Criteria for selecting a research problem
 - Sub-Part 3.1.3: Formulating the problem statement
- **Part 2: Review Of Literature And Data Collection**
 - Sub-Part 3.2.1: Purpose and importance of literature review
 - Sub-Part 3.2.2: Sources of literature in library and information science
 - Sub-Part 3.2.3: Methods of data collection
- **Part 3: Data Analysis, Conclusion, And Recommendations**
 - Sub-Part 3.3.1: Analysing and interpreting data
 - Sub-Part 3.3.2: Drawing conclusions from findings
 - Sub-Part 3.3.3: Making recommendations and citing references

Introduction

Every meaningful research project follows a process that begins with identifying a problem and ends with making recommendations based on findings. In library and information science, this process ensures that investigations are systematic, credible, and useful for improving services and advancing knowledge.

The aim of this Series is to guide you through the stages of the research process, from defining the problem to reviewing literature, collecting data, analysing results, and finally presenting conclusions and recommendations.

We shall commence this Series by exploring how to identify and define a research problem, including the criteria for selecting a suitable topic. Next, we will consider the importance of reviewing literature and the methods of data collection available to researchers. Finally, we will conclude with data analysis, interpretation, and the presentation of conclusions and recommendations, ensuring that your research contributes meaningfully to the profession.



Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 3.1** define a research problem and formulate a clear problem statement,
- **SLO 3.2** analyse criteria for selecting a suitable research problem,
- **SLO 3.3** explain the purpose and importance of literature review in library and information science,
- **SLO 3.4** identify sources of literature and methods of data collection,
- **SLO 3.5** demonstrate how to analyse and interpret research data,
- **SLO 3.6** draw valid conclusions from findings, and
- **SLO 3.7** design appropriate recommendations and cite references accurately.

3.1 Identifying And Defining The Research Problem

3.1.1 Meaning of a research problem

A **research problem** is a clearly defined issue, question, or gap in knowledge that a researcher seeks to investigate. In library and information science, a research problem might involve questions such as how users access digital resources, or whether a new cataloguing system improves retrieval efficiency. A well-defined research problem provides direction and focus, ensuring that the study is purposeful and relevant.

Fill in the blank: A research problem is a clearly defined _____ or gap in knowledge that guides investigation.



Figure 3.1
Concept of a Research Problem



3.1.2 Criteria for selecting a research problem

Selecting a suitable research problem requires careful consideration. The problem should be relevant to the field, feasible in terms of resources and time, and significant enough to contribute to knowledge or practice. It must also be researchable, meaning that data can be collected and analysed to address it. For example, a problem such as “How do students use electronic databases?” is feasible and relevant, whereas “What is the meaning of life?” is too broad and unmanageable.

Fill in the blank: A suitable research problem must be _____, meaning that data can be collected and analysed to address it.



Box 3.1 Criteria for Selecting a Research Problem

- Relevance to the field
- Feasibility in terms of resources and time
- Significance to knowledge or practice
- Researchability (data can be collected and analysed)



3.1.3 Formulating the problem statement

A **problem statement** is a concise description of the issue to be studied, usually expressed in clear and specific terms. It sets the boundaries of the research and communicates the purpose of the study. In library and information science, a problem statement might read: “This study investigates the impact of electronic catalogues on user satisfaction in academic libraries.” A good problem statement avoids vagueness and ensures that the research remains focused.

Fill in the blank: A problem statement is a concise description of the _____ to be studied.



Research Area	Example Problem Statement
User Behaviour	Despite the availability of high-quality digital resources, many undergraduate students rely on non-academic search engines, leading to poor source selection in their assignments.
Library Services	Current user satisfaction metrics for electronic catalogues do not account for mobile accessibility, leaving a gap in our understanding of how remote users interact with library data.
Information Retrieval	Existing search algorithms in the library's online catalogue often return high-precision but low-recall results, causing users to miss significant relevant historical documents.

Table 3.1 Examples of problem statements in library and information science

Pilot questions 3.1

1. A research problem is a clearly defined _____ or gap in knowledge.
2. Which of the following is NOT a criterion for selecting a research problem? a) Relevance b) Feasibility c) Researchability d) Vagueness
3. A suitable research problem must be _____, meaning data can be collected and analysed.
4. A problem statement is a concise description of the _____ to be studied.
5. Which of the following is an example of a problem statement in LIS? a) What is the meaning of life? b) Investigating how students use electronic databases c) Why do people read books? d) How do libraries exist?

3.2 Review Of Literature And Data Collection

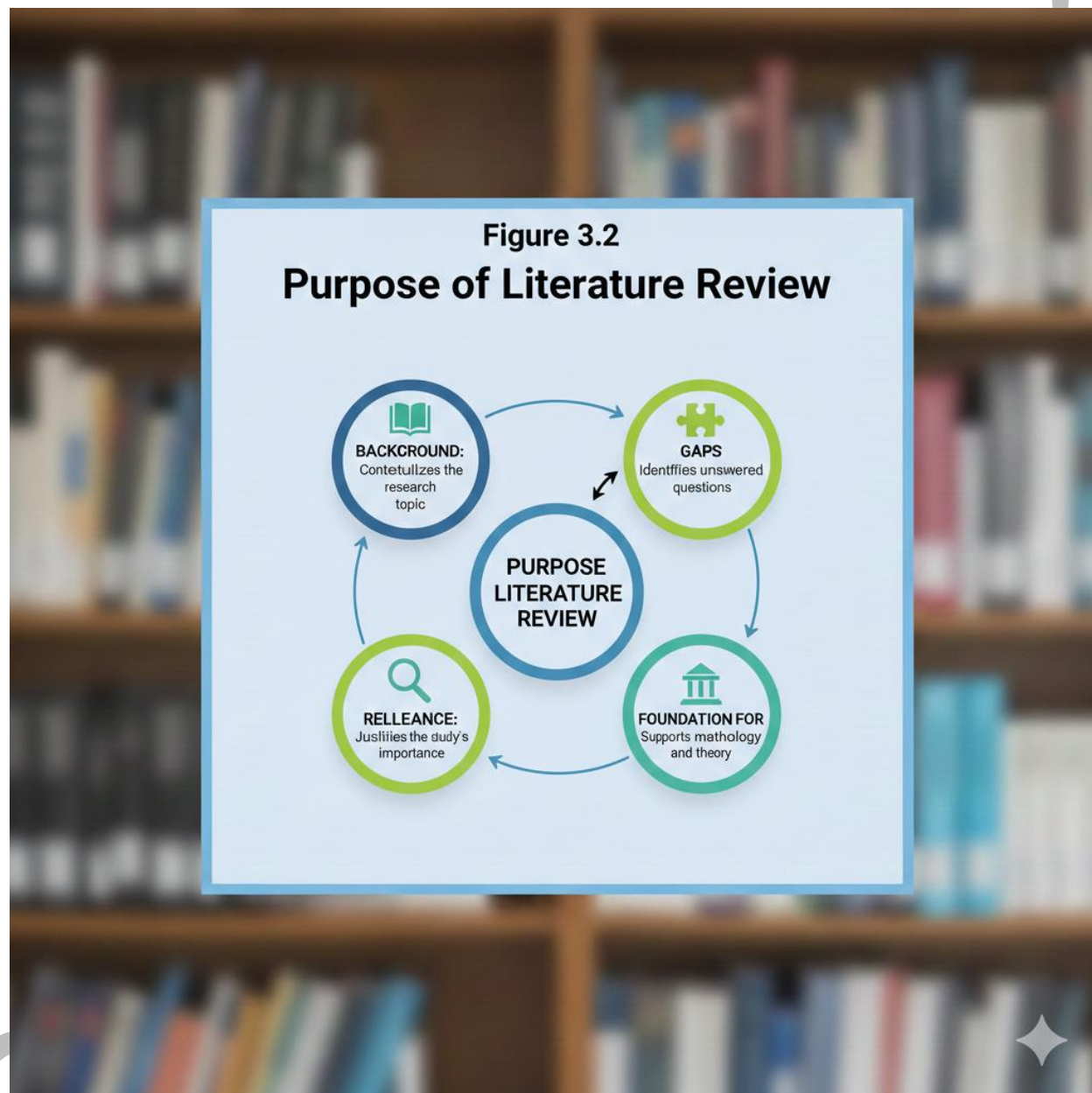
3.2.1 Purpose and importance of literature review

A **literature review** is a systematic examination of existing studies, reports, and scholarly works relevant to a research problem. Its purpose is to provide background, identify gaps in knowledge, and avoid duplication of effort. In library and information science, reviewing literature helps researchers understand what has already been studied about topics such



as user behaviour or cataloguing systems. It also ensures that new research builds upon established knowledge rather than repeating what is already known.

Fill in the blank: A literature review helps researchers to identify _____ in knowledge and avoid duplication of effort.



3.2.2 Sources of literature in library and information science

Sources of literature include books, journal articles, conference papers, theses, dissertations, and online databases. In library and information science, specialised sources such as catalogues, bibliographies, and institutional reports are also valuable. Using diverse sources ensures that the literature review is comprehensive and balanced.



For example, a researcher studying information retrieval might consult journal articles on search algorithms, conference papers on digital libraries, and reports from professional associations.

Fill in the blank: Sources of literature in LIS include books, journal articles, and _____ papers.

Source Type	Example
Books	Foundational texts on library management, organizational theory, or history of the book.
Journal Articles	Peer-reviewed studies on user behaviour, metadata standards, or information literacy.
Conference Papers	Cutting-edge presentations on emerging digital library technologies and AI in LIS.
Theses/Dissertations	In-depth academic research on specific cataloguing niche areas or local library histories.
Online Databases	Platforms like LISTA or Google Scholar that provide access to global scholarly articles.
Institutional Reports	Library annual reports, strategic plans, or government white papers on literacy.

Table 3.2 Sources of literature in library and information science

3.2.3 Methods of data collection

Data collection refers to the process of gathering information to address a research problem. Common methods in library and information science include surveys, interviews,



observation, and document analysis. Each method has strengths and limitations. Surveys provide quantifiable data, interviews offer detailed insights, observation captures real behaviour, and document analysis uses existing records. Choosing the right method depends on the research problem and objectives.

Fill in the blank: Interviews provide detailed _____ into user experiences and behaviours.

Box 3.2 Methods of Data Collection in LIS

- **Surveys:** structured questionnaires for quantifiable data
- **Interviews:** detailed insights into user experiences
- **Observation:** capturing real behaviour in natural settings
- **Document analysis:** using existing records and reports



Pilot questions 3.2

1. A literature review helps researchers to identify _____ in knowledge.



2. Which of the following is NOT a source of literature in LIS? a) Books b) Journal articles c) Conference papers d) Random gossip
3. Sources of literature in LIS include books, journal articles, and _____ papers.
4. Interviews provide detailed _____ into user experiences.
5. One method of data collection that uses existing records is _____ analysis.

3.3 Data Analysis, Conclusion, And Recommendations

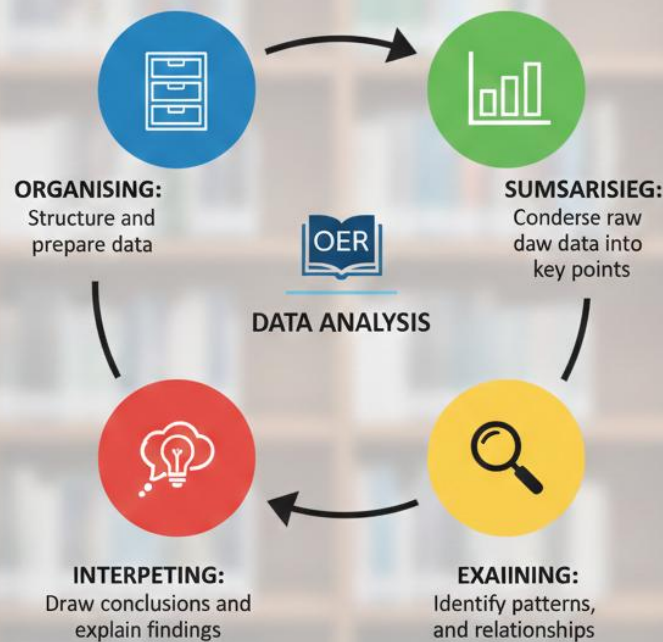
3.3.1 Analysing and interpreting data

Data analysis refers to the process of organising, summarising, and examining collected information to identify patterns and relationships. In library and information science, this may involve statistical techniques such as calculating averages, percentages, or correlations. **Interpretation** follows analysis, where the researcher explains what the results mean in relation to the research problem. For example, if survey data shows that 70 per cent of students prefer electronic resources, the interpretation might be that libraries should invest more in digital collections.

Fill in the blank: Data analysis involves organising and _____ collected information to identify patterns.



Figure 3.3 Stages of Data Analysis



3.3.2 Drawing conclusions from findings

Conclusions are statements that summarise the main results of a study and directly address the research problem. They should be clear, concise, and supported by evidence. In library and information science, conclusions might highlight trends in user behaviour, the effectiveness of services, or the impact of technology. For instance, a conclusion could state: “Electronic catalogues significantly improve user satisfaction compared to traditional systems.”

Fill in the blank: Conclusions must be _____ and supported by evidence from the study.



Box 3.3 Guidelines for Drawing Conclusions

- Ensure conclusions are clear and concise
- Base conclusions on evidence
- Relate conclusions directly to the research problem
- Avoid overgeneralization



3.3.3 Making recommendations and citing references

Recommendations are practical suggestions based on research findings, aimed at improving practice or guiding future studies. In library and information science, recommendations may include adopting new technologies, revising policies, or providing additional training for staff. **Citing references** is equally important, as it acknowledges sources used in the study and allows others to verify information. Proper citation enhances credibility and prevents plagiarism.

Fill in the blank: Recommendations are practical _____ based on research findings, aimed at improving practice.



Research Finding	Recommendation
Students prefer electronic resources over physical texts for ease of remote access.	Increase investment in digital collections and negotiate broader licensing agreements for off-campus access.
Users struggle with search interfaces due to complex Boolean logic and advanced filters.	Provide targeted training workshops and simplify the User Interface (UI) of the library's discovery layer.
Traditional card catalogues are less effective for modern users compared to keyword-searchable systems.	Adopt and integrate electronic cataloguing systems (OPACs) that support natural language processing.
Reference desk usage has declined while virtual chat inquiries have increased significantly.	Reallocate staff hours from the physical reference desk to 24/7 virtual reference support services.

Table 3.3 Examples of recommendations in library and information science

Pilot questions 3.3

1. Data analysis involves organising and _____ collected information.
2. Which of the following is NOT a guideline for drawing conclusions? a) Ensure clarity
b) Base on evidence c) Relate to research problem d) Overgeneralise findings
3. Conclusions must be _____ and supported by evidence.
4. Recommendations are practical _____ based on research findings.
5. Proper citation of references helps to prevent _____.

Series Summary



This Series has guided you through the essential stages of the research process in library and information science. We began by examining how to identify and define a research problem, including the criteria for selecting a suitable topic and the importance of formulating a clear problem statement. We then explored the role of literature review and data collection, highlighting how existing studies provide background and how different methods such as surveys, interviews, and observation can be used to gather information. Finally, we considered data analysis, interpretation, drawing conclusions, and making recommendations, emphasising the importance of evidence-based findings and proper citation of references.

By engaging with these discussions, you should now be able to define and formulate research problems, analyse criteria for selecting them, explain the purpose of literature reviews, identify sources and methods of data collection, demonstrate data analysis and interpretation, draw valid conclusions, and design appropriate recommendations. These outcomes align directly with the Series Learning Outcomes and prepare you to conduct systematic and credible research projects.

Glossary of Terms

- **Conclusion:** A statement that summarises the main results of a study and directly addresses the research problem.
- **Data analysis:** The process of organising, summarising, and examining collected information to identify patterns and relationships.
- **Data collection:** The process of gathering information to address a research problem, using methods such as surveys, interviews, and observation.
- **Literature review:** A systematic examination of existing studies, reports, and scholarly works relevant to a research problem.
- **Problem statement:** A concise description of the issue to be studied, expressed in clear and specific terms.
- **Research problem:** A clearly defined issue, question, or gap in knowledge that a researcher seeks to investigate.
- **Recommendation:** A practical suggestion based on research findings, aimed at improving practice or guiding future studies.
- **Researchability:** The quality of a problem being suitable for investigation, meaning data can be collected and analysed to address it.

Concept Check Questions

Objective questions



1. Which of the following is NOT a criterion for selecting a research problem? a) Relevance b) Feasibility c) Vagueness d) Researchability (Linked to SLO 3.2)
2. A literature review helps researchers to identify _____ in knowledge. (Linked to SLO 3.3)

Short-answer questions

3. Define a problem statement in research. (Linked to SLO 3.1)
4. State two methods of data collection in library and information science. (Linked to SLO 3.4)

Long-answer questions

5. Explain the importance of literature review in library and information science, giving examples of sources. (Linked to SLO 3.3, SLO 3.4)
6. Evaluate the process of data analysis, drawing conclusions, and making recommendations in library and information science. (Linked to SLO 3.5, SLO 3.6, SLO 3.7)

Answers to Concept Check Questions

Objective questions

1. c) Vagueness
2. Gaps

Short-answer questions

3. A problem statement is a concise description of the issue to be studied, expressed in clear and specific terms.
4. Methods include surveys and interviews.

Long-answer questions

5. **Basic response:** Literature review is important because it provides background, identifies gaps, and avoids duplication. Sources include books, journal articles, conference papers, theses, and institutional reports. **Value-added response:** Outstanding learners may add that literature reviews also establish theoretical frameworks, highlight methodological approaches, and ensure that new research builds upon established knowledge.
6. **Basic response:** Data analysis involves organising and interpreting information, conclusions summarise findings, and recommendations provide practical suggestions. Proper citation ensures credibility. **Value-added response:** Outstanding learners may add that effective analysis uses statistical tools, conclusions must be evidence-based, and recommendations should be actionable, guiding both practice and future research.



Answers to Pilot Questions

Pilot questions 3.1

1. Issue
2. d) Vagueness
3. Researchable
4. Issue
5. b) Investigating how students use electronic databases

Pilot questions 3.2

1. Gaps
2. d) Random gossip
3. Conference
4. Insights
5. Document

Pilot questions 3.3

1. Summarising
2. d) Overgeneralise findings
3. Clear
4. Suggestions
5. Plagiarism

References and Attributions

- Figure 3.1 Concept of a research problem. Suggested AI prompt: “Generate a diagram showing a research problem as issue, gap in knowledge, guiding question.” Search string: “definition of research problem diagram OER.”
- Box 3.1 Criteria for selecting a research problem. Suggested AI prompt: “Create a text box styled as a table with single column listing criteria for selecting a research problem.” Search string: “criteria for selecting research problem OER.”
- Table 3.1 Examples of problem statements in library and information science. Suggested AI prompt: “Generate a simple table showing examples of problem statements in LIS with two columns: research area and example.” Search string: “examples of problem statements in library science OER.”



- Figure 3.2 Purpose of literature review. Suggested AI prompt: “Generate a diagram showing the purpose of literature review: background, gaps, relevance, foundation for new research.” Search string: “purpose of literature review diagram OER.”
- Table 3.2 Sources of literature in library and information science. Suggested AI prompt: “Generate a simple table showing sources of literature in LIS with two columns: source type and example.” Search string: “sources of literature in library science OER.”
- Box 3.2 Methods of data collection in LIS. Suggested AI prompt: “Create a text box styled as a table with single column listing methods of data collection in LIS.” Search string: “methods of data collection in library science OER.”
- Figure 3.3 Stages of data analysis. Suggested AI prompt: “Generate a diagram showing stages of data analysis: organising, summarising, examining, interpreting.” Search string: “data analysis stages diagram OER.”
- Box 3.3 Guidelines for drawing conclusions. Suggested AI prompt: “Create a text box styled as a table with single column listing guidelines for drawing conclusions.” Search string: “guidelines for drawing conclusions in research OER.”
- Table 3.3 Examples of recommendations in library and information science. Suggested AI prompt: “Generate a simple table showing examples of recommendations in LIS with two columns: research finding and recommendation.” Search string: “examples of recommendations in library science OER.”



LIS326 Research and Statistical Methodology (2 Units)

Series 4: Descriptive Statistics And Quantitative Techniques In LIS

Series outline

- **Part 1: Basic Statistical Concepts And Descriptive Statistics**
 - Sub-Part 4.1.1: Meaning and role of statistics in LIS
 - Sub-Part 4.1.2: Measures of central tendency (mean, median, mode)
 - Sub-Part 4.1.3: Measures of dispersion (range, variance, standard deviation)
- **Part 2: Quantitative Techniques In Library And Information Science**
 - Sub-Part 4.2.1: Meaning and importance of quantitative techniques
 - Sub-Part 4.2.2: Applications of quantitative techniques in LIS
 - Sub-Part 4.2.3: Strengths and limitations of quantitative approaches
- **Part 3: Practical Use Of Descriptive Statistics And Quantitative Techniques**
 - Sub-Part 4.3.1: Applying descriptive statistics to library data
 - Sub-Part 4.3.2: Using quantitative techniques for decision-making
 - Sub-Part 4.3.3: Presenting statistical results effectively

Introduction

Statistics and quantitative techniques provide the tools needed to make sense of data collected in research. In library and information science, these methods help professionals evaluate services, understand user behaviour, and make evidence-based decisions. Without them, data would remain raw and unorganised, offering little insight into practical problems.

The aim of this Series is to introduce you to descriptive statistics and quantitative techniques, equipping you with the skills to analyse data and apply results in library and information science.

We shall commence this Series by exploring basic statistical concepts and descriptive statistics, including measures of central tendency and dispersion. Next, we will examine quantitative techniques, their importance, and their applications in library and information science. Finally, we will conclude with practical uses of descriptive statistics and quantitative techniques, focusing on how to apply them to library data, support decision-making, and present results effectively.



Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 4.1** define basic statistical concepts and explain their role in library and information science,
- **SLO 4.2** calculate measures of central tendency such as mean, median, and mode,
- **SLO 4.3** compute measures of dispersion including range, variance, and standard deviation,
- **SLO 4.4** explain the meaning and importance of quantitative techniques in library and information science,
- **SLO 4.5** analyse applications of quantitative techniques in library and information science,
- **SLO 4.6** evaluate the strengths and limitations of quantitative approaches, and
- **SLO 4.7** apply descriptive statistics and quantitative techniques to library data for decision-making and presentation of results.

4.1 Basic Statistical Concepts And Descriptive Statistics

4.1.1 Meaning and role of statistics in LIS

Statistics refers to the science of collecting, analysing, interpreting, and presenting numerical data. In library and information science, statistics play a vital role in understanding user behaviour, evaluating services, and supporting decision-making. For example, statistics can show how many users borrow books weekly, or how often electronic databases are accessed. By converting raw data into meaningful information, statistics help librarians make evidence-based improvements.

Fill in the blank: Statistics is the science of collecting, analysing, interpreting, and _____ numerical data.



Figure 4.1
Role of Statistics in
Library and Information Science



4.1.2 Measures of central tendency (mean, median, mode)

Measures of central tendency are statistical tools used to describe the centre or average of a dataset. The **mean** is the arithmetic average, calculated by dividing the sum of values by the number of values. The **median** is the middle value when data is arranged in order, and the **mode** is the most frequently occurring value. In library and information science, these measures can be used to analyse borrowing patterns, such as the average number of books borrowed per student.

Fill in the blank: The _____ is the most frequently occurring value in a dataset.



Measure	Definition	Example in LIS
Mean	The arithmetic average (sum of all values divided by the number of values).	Calculating the average number of books borrowed per student in a single semester.
Median	The middle value when all data points are arranged in numerical order.	Determining the middle borrowing rate to ensure extreme outliers (like one student borrowing 500 books) don't skew the results.
Mode	The value that occurs most frequently in a dataset.	Identifying the most borrowed book or the most popular hour for library visits.

Table 4.1 Measures of central tendency

4.1.3 Measures of dispersion (range, variance, standard deviation)

Measures of dispersion describe how spread out data values are. The **range** is the difference between the highest and lowest values. **Variance** measures the average squared deviation from the mean, while **standard deviation** is the square root of variance, showing how much values deviate from the mean. In library and information science, these measures help identify variability in user behaviour, such as differences in borrowing rates across departments.

Fill in the blank: The _____ is the difference between the highest and lowest values in a dataset.



Box 4.1 Measures of Dispersion

- **Range:** difference between highest and lowest values
- **Variance:** average squared deviation from the mean
- **Standard deviation:** square root of variance, showing spread of data



Pilot questions 4.1

1. Statistics is the science of collecting, analysing, interpreting, and _____ numerical data.
2. Which of the following is NOT a measure of central tendency? a) Mean b) Median c) Mode d) Variance
3. The _____ is the most frequently occurring value in a dataset.
4. The _____ is the difference between the highest and lowest values in a dataset.
5. Standard deviation is the square root of _____.



4.2 Quantitative Techniques In Library And Information Science

4.2.1 Meaning and importance of quantitative techniques

Quantitative techniques are methods that use numerical data and mathematical models to analyse problems and support decision-making. In library and information science, they are important because they provide objective evidence for evaluating services, allocating resources, and planning improvements. For example, circulation statistics can be analysed to determine which collections need expansion, while usage data can guide investment in electronic resources.

Fill in the blank: Quantitative techniques use _____ data and mathematical models to analyse problems.



Figure 4.2
Importance of
Quantitative Techniques in LIS



4.2.2 Applications of quantitative techniques in LIS

Quantitative techniques are applied in library and information science to measure user satisfaction, forecast demand, optimise resource allocation, and evaluate service effectiveness. For instance, regression analysis can be used to predict future borrowing trends, while statistical sampling helps in assessing user preferences. These applications ensure that decisions are based on reliable data rather than assumptions.

Fill in the blank: Regression analysis can be used to _____ future borrowing trends in libraries.



Application	Example
Measuring Satisfaction	Analysing Likert-scale survey scores (e.g., 1–5 stars) to quantify user satisfaction across different library departments.
Forecasting Demand	Using regression analysis to predict future borrowing trends or peak library hours based on historical seasonal data.
Resource Allocation	Determining the distribution of the acquisitions budget by correlating department fund usage with digital resource "click-through" rates.
Service Evaluation	Assessing the effectiveness of reference services by calculating the "success rate" of inquiries or the average wait time for chat support.

Table 4.2 Applications of quantitative techniques in LIS

4.2.3 Strengths and limitations of quantitative approaches

Quantitative approaches have strengths such as providing objective results, enabling generalisation, and supporting precise measurement. However, they also have limitations. They may overlook qualitative aspects such as user motivations, require specialised skills, and sometimes reduce complex behaviours to numbers. For example, while statistics can show how often users borrow books, they may not explain why certain books are preferred.

Fill in the blank: One limitation of quantitative approaches is that they may overlook _____ aspects such as user motivations.



Box 4.2 Strengths and Limitations of Quantitative Approaches

Strengths

- Provide objective results
- Enable generalization
- Support precise measurement



Limitations

- May overlook qualitative aspects
- Require specialized skills
- Reduce complex behaviors to numbers

Pilot questions 4.2

1. Quantitative techniques use _____ data and mathematical models.
2. Which of the following is NOT an application of quantitative techniques in LIS? a) Measuring satisfaction b) Forecasting demand c) Conducting interviews d) Resource allocation
3. Regression analysis can be used to _____ future borrowing trends.
4. One strength of quantitative approaches is that they provide _____ results.



5. A limitation of quantitative approaches is that they may overlook _____ aspects.

4.3 Practical Use Of Descriptive Statistics And Quantitative Techniques

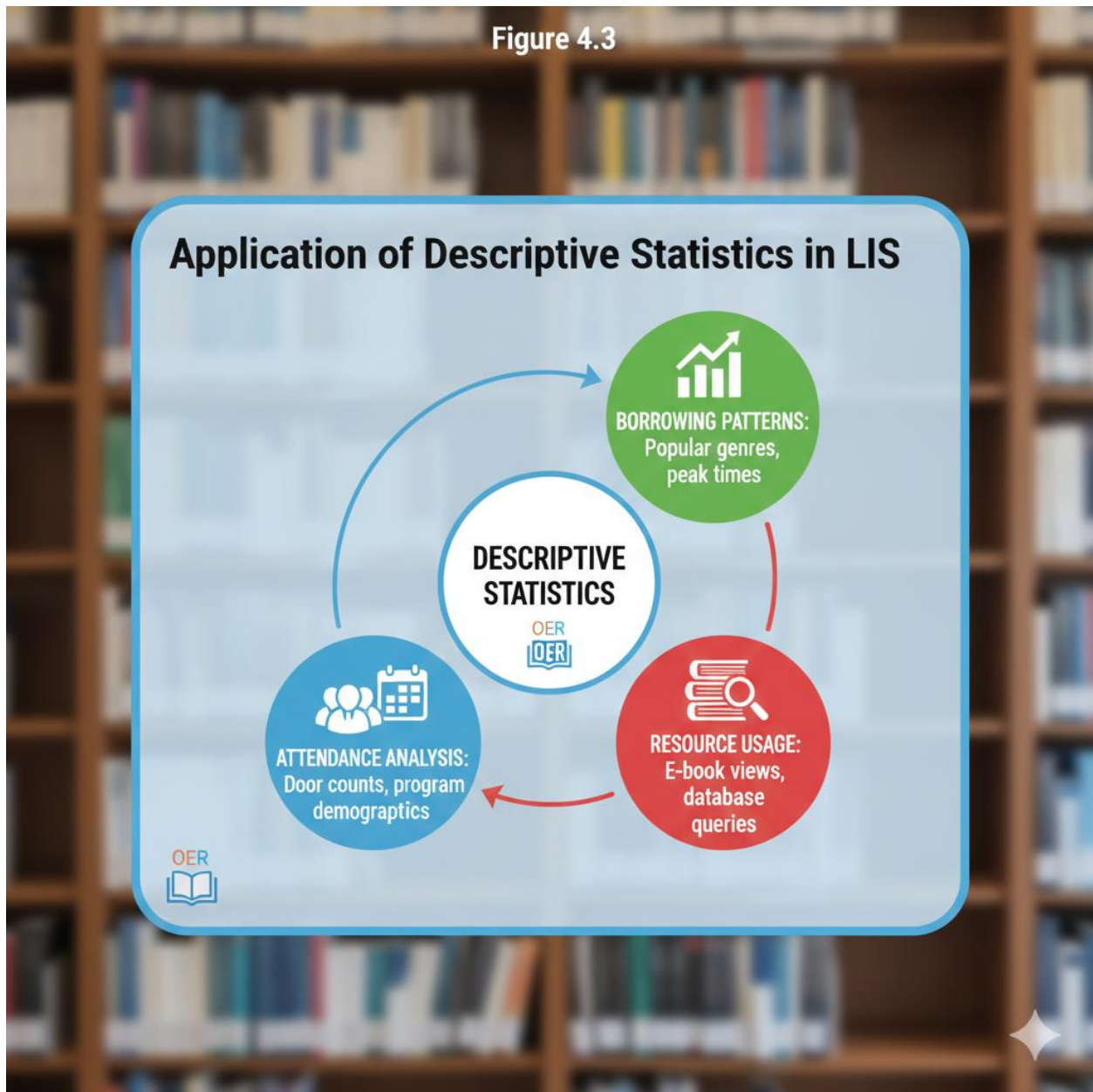
4.3.1 Applying descriptive statistics to library data

Descriptive statistics are used to summarise and present data in a meaningful way. In library and information science, they can be applied to analyse borrowing patterns, usage of electronic resources, or attendance at library programmes. For example, calculating the mean number of books borrowed per student provides insight into overall borrowing behaviour, while the mode can identify the most popular titles.

Fill in the blank: Descriptive statistics are used to _____ and present data in a meaningful way.



Figure 4.3



4.3.2 Using quantitative techniques for decision-making

Quantitative techniques support evidence-based decision-making in libraries. They can be used to forecast demand, allocate budgets, and evaluate service effectiveness. For instance, regression analysis may predict future borrowing trends, while statistical sampling can help determine user preferences. These techniques ensure that decisions are based on reliable data rather than assumptions.

Fill in the blank: Quantitative techniques support _____-based decision-making in libraries.



Decision Area	Example of Quantitative Technique
Forecasting Demand	Applying Time-Series Analysis to historical circulation data to predict which months will require additional staffing at the circulation desk.
Budget Allocation	Using Cost-Per-Use (CPU) formulas to determine which journal subscriptions provide the best value and should be prioritized for renewal.
Service Evaluation	Conducting Gap Analysis on user survey scores to identify the distance between "expected service quality" and "perceived service quality."
Resource Planning	Utilizing Cluster Analysis on search query logs to identify emerging research topics that require new collection development.

Table 4.3 Using quantitative techniques for decision-making

4.3.3 Presenting statistical results effectively

Presenting statistical results involves using tables, charts, and graphs to communicate findings clearly. Effective presentation ensures that data is easily understood by stakeholders such as librarians, administrators, and policymakers. For example, a bar chart can show borrowing rates across departments, while a pie chart can illustrate the proportion of users accessing electronic resources. Clear presentation enhances the impact of research and supports informed decision-making.

Fill in the blank: Presenting statistical results effectively involves using _____, charts, and graphs to communicate findings.



Box 4.3 Guidelines for Presenting Statistical Results

- Use tables, charts, and graphs for clarity
- Ensure accuracy and consistency
- Highlight key findings
- Tailor presentation to audience needs



Pilot questions 4.3

1. Descriptive statistics are used to _____ and present data.
2. Which of the following is NOT a decision area supported by quantitative techniques? a) Forecasting demand b) Budget allocation c) Service evaluation d) Random guessing
3. Quantitative techniques support _____-based decision-making in libraries.
4. Presenting statistical results effectively involves using _____, charts, and graphs.



5. A pie chart can illustrate the _____ of users accessing electronic resources.

Series Summary

This Series has introduced you to descriptive statistics and quantitative techniques, highlighting their role in library and information science. We began with basic statistical concepts, focusing on measures of central tendency (mean, median, mode) and measures of dispersion (range, variance, standard deviation). We then examined quantitative techniques, considering their meaning, importance, applications, and the strengths and limitations of quantitative approaches. Finally, we explored practical uses, showing how descriptive statistics and quantitative techniques can be applied to library data, support evidence-based decision-making, and be presented effectively through tables, charts, and graphs.

By engaging with these discussions, you should now be able to define statistical concepts, calculate measures of central tendency and dispersion, explain the importance of quantitative techniques, analyse their applications, evaluate their strengths and limitations, and apply them to library data for decision-making and presentation. These outcomes align directly with the Series Learning Outcomes and equip you with analytical tools for professional practice.

Glossary of Terms

- **Central tendency:** Statistical measures that describe the centre of a dataset, including mean, median, and mode.
- **Dispersion:** Statistical measures that describe the spread of data, such as range, variance, and standard deviation.
- **Mean:** The arithmetic average of a dataset, calculated by dividing the sum of values by the number of values.
- **Median:** The middle value in a dataset when arranged in order.
- **Mode:** The most frequently occurring value in a dataset.
- **Quantitative techniques:** Methods that use numerical data and mathematical models to analyse problems and support decision-making.
- **Range:** The difference between the highest and lowest values in a dataset.
- **Standard deviation:** A measure of dispersion showing how much values deviate from the mean.
- **Variance:** The average squared deviation from the mean, indicating variability in data.



Concept Check Questions

Objective questions

1. Which of the following is NOT a measure of central tendency? a) Mean b) Median c) Mode d) Variance (Linked to SLO 4.2)
2. The _____ is the difference between the highest and lowest values in a dataset. (Linked to SLO 4.3)

Short-answer questions

3. Define quantitative techniques in library and information science. (Linked to SLO 4.4)
4. State two strengths of quantitative approaches. (Linked to SLO 4.6)

Long-answer questions

5. Analyse the applications of quantitative techniques in library and information science, giving examples. (Linked to SLO 4.5)
6. Explain how descriptive statistics and quantitative techniques can be applied to library data for decision-making and presentation. (Linked to SLO 4.7)

Answers to Concept Check Questions

Objective questions

1. d) Variance
2. Range

Short-answer questions

3. Quantitative techniques are methods that use numerical data and mathematical models to analyse problems and support decision-making in library and information science.
4. Strengths include providing objective results and supporting precise measurement.

Long-answer questions

5. **Basic response:** Applications include measuring user satisfaction, forecasting demand, allocating resources, and evaluating services. Examples are regression analysis for predicting borrowing trends and statistical sampling for assessing preferences. **Value-added response:** Outstanding learners may add that quantitative techniques also support policy formulation, long-term planning, and benchmarking against standards, ensuring libraries remain responsive to changing needs.



6. **Basic response:** Descriptive statistics summarise borrowing patterns and usage data, while quantitative techniques guide decisions such as budget allocation and service evaluation. Results can be presented using tables and charts. **Value-added response:** Outstanding learners may add that effective application involves integrating statistical findings into strategic planning, using advanced tools like regression and correlation, and tailoring presentations to stakeholders for maximum impact.

Answers to Pilot Questions

Pilot questions 4.1

1. Presenting
2. d) Variance
3. Mode
4. Range
5. Variance

Pilot questions 4.2

1. Numerical
2. c) Conducting interviews
3. Predict
4. Objective
5. Qualitative

Pilot questions 4.3

1. Summarise
2. d) Random guessing
3. Evidence
4. Tables
5. Proportion

References and Attributions

- Figure 4.1 Role of statistics in library and information science. Suggested AI prompt: “Generate a diagram showing the role of statistics in LIS: data collection, analysis, interpretation, decision-making.” Search string: “role of statistics in library science diagram OER.”



- Table 4.1 Measures of central tendency. Suggested AI prompt: “Generate a simple table showing measures of central tendency with three columns: measure, definition, example in LIS.” Search string: “measures of central tendency in library science OER.”
- Box 4.1 Measures of dispersion. Suggested AI prompt: “Create a text box styled as a table with single column listing measures of dispersion and their definitions.” Search string: “measures of dispersion statistics OER.”
- Figure 4.2 Importance of quantitative techniques in LIS. Suggested AI prompt: “Generate a diagram showing importance of quantitative techniques in LIS: objective evidence, resource allocation, service evaluation, planning improvements.” Search string: “importance of quantitative techniques in library science OER.”
- Table 4.2 Applications of quantitative techniques in LIS. Suggested AI prompt: “Generate a simple table showing applications of quantitative techniques in LIS with two columns: application and example.” Search string: “applications of quantitative techniques in library science OER.”
- Box 4.2 Strengths and limitations of quantitative approaches. Suggested AI prompt: “Create a text box styled as a table with two sections listing strengths and limitations of quantitative approaches.” Search string: “strengths and limitations of quantitative research OER.”
- Figure 4.3 Application of descriptive statistics in LIS. Suggested AI prompt: “Generate a diagram showing application of descriptive statistics in LIS: borrowing patterns, resource usage, attendance analysis.” Search string: “application of descriptive statistics in library science OER.”
- Table 4.3 Using quantitative techniques for decision-making. Suggested AI prompt: “Generate a simple table showing decision areas and examples of quantitative techniques in LIS.” Search string: “quantitative techniques for decision-making in library science OER.”
- Box 4.3 Guidelines for presenting statistical results. Suggested AI prompt: “Create a text box styled as a table with single column listing guidelines for presenting statistical results.” Search string: “guidelines for presenting statistical results OER.”



LIS326 Research and Statistical Methodology (2 Units)

Series 5: Application Of Statistical Packages For Data Analysis

Series outline

- **Part 1: Introduction To Statistical Packages**
 - Sub-Part 5.1.1: Meaning and role of statistical packages
 - Sub-Part 5.1.2: Commonly used statistical packages (SPSS, R, Excel, etc.)
 - Sub-Part 5.1.3: Advantages of using statistical packages in LIS research
- **Part 2: Applying Statistical Packages To Data Analysis**
 - Sub-Part 5.2.1: Data entry and management in statistical packages
 - Sub-Part 5.2.2: Performing descriptive statistics (mean, median, mode, dispersion)
 - Sub-Part 5.2.3: Conducting inferential analysis (correlation, regression, hypothesis testing)
- **Part 3: Presenting And Interpreting Results With Statistical Packages**
 - Sub-Part 5.3.1: Generating tables, charts, and graphs
 - Sub-Part 5.3.2: Interpreting statistical outputs for LIS research
 - Sub-Part 5.3.3: Reporting findings and ensuring accuracy

Introduction

Statistical packages are software tools designed to simplify the process of analysing data. In library and information science, they are essential for handling large datasets, performing complex calculations, and presenting results in clear formats. Without these tools, researchers would struggle to manage data efficiently or apply advanced statistical techniques.

The aim of this Series is to introduce you to the application of statistical packages for data analysis, focusing on their role, practical use, and how they enhance research in library and information science.

We shall commence this Series by exploring the meaning and role of statistical packages, identifying commonly used tools such as SPSS, R, and Excel, and considering their advantages. Next, we will examine how to apply these packages to data analysis, including data entry, descriptive statistics, and inferential techniques. Finally, we will conclude with presenting and interpreting results, highlighting how statistical packages generate tables, charts, and outputs that support accurate reporting.



Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 5.1** define statistical packages and explain their role in library and information science research,
- **SLO 5.2** identify commonly used statistical packages and their features,
- **SLO 5.3** analyse the advantages of using statistical packages in LIS research,
- **SLO 5.4** demonstrate how to enter and manage data in statistical packages,
- **SLO 5.5** apply descriptive and inferential statistical techniques using packages,
- **SLO 5.6** generate tables, charts, and graphs with statistical packages, and
- **SLO 5.7** interpret and report statistical outputs accurately in LIS research.

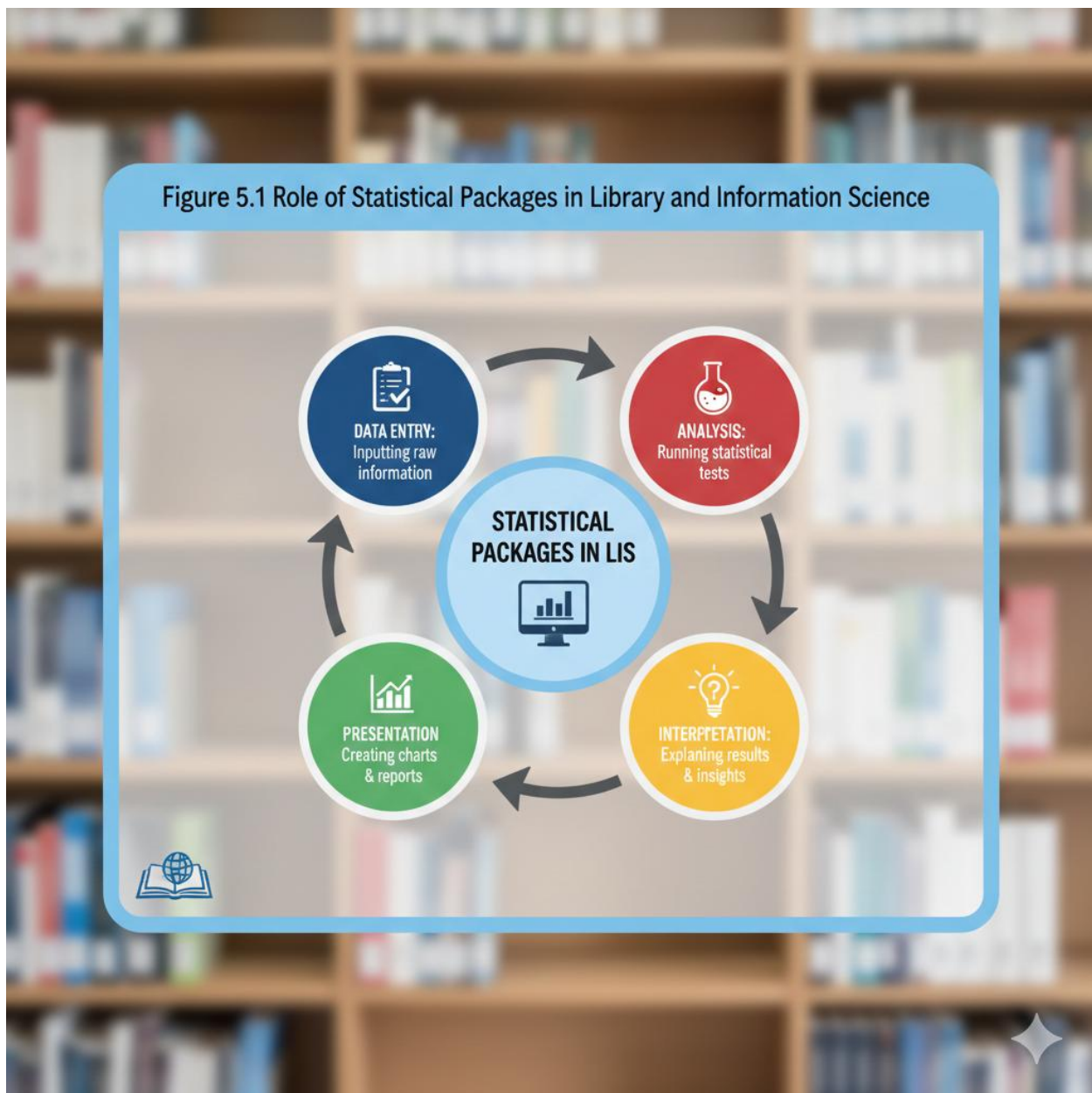
5.1 Introduction To Statistical Packages

5.1.1 Meaning and role of statistical packages

Statistical packages are software tools designed to simplify the process of analysing data. They provide built-in functions for performing calculations, generating charts, and interpreting results. In library and information science, statistical packages are used to handle large datasets, evaluate services, and support evidence-based decision-making. For example, a librarian may use SPSS to analyse survey responses about user satisfaction.

Fill in the blank: Statistical packages are software tools designed to simplify the process of _____ data.





5.1.2 Commonly used statistical packages (SPSS, R, Excel, etc.)

Several statistical packages are widely used in research. **SPSS** (Statistical Package for the Social Sciences) is popular for social science research due to its user-friendly interface. **R** is a powerful open-source tool that supports advanced statistical modelling and programming. **Excel** is widely available and useful for basic statistical analysis and visualisation. Each package has unique strengths, and the choice depends on the complexity of the research and available resources.

Fill in the blank: _____ is an open-source statistical package widely used for advanced modelling and programming.



Package	Features	Example Use in LIS
SPSS	User-friendly "point-and-click" interface; robust support for both descriptive and inferential statistics.	Analyzing Likert-scale survey data to determine if there is a significant difference in satisfaction between faculty and students.
R	Open-source and free; high programming flexibility; superior for advanced modeling and high-quality data visualization.	Predicting future borrowing trends using regression analysis or performing text mining on open-ended user feedback.
Excel	Universally available; excellent for data entry, cleaning, and basic descriptive statistics (mean, median, mode).	Summarizing monthly circulation patterns, creating basic bar charts for annual reports, and tracking budget expenditures.

Table 5.1 Commonly used statistical packages

5.1.3 Advantages of using statistical packages in LIS research

Statistical packages offer several advantages. They save time by automating calculations, reduce errors compared to manual computation, and provide clear visualisations such as charts and graphs. They also allow researchers to perform complex analyses that would be difficult manually. In library and information science, these advantages make research more efficient and results more reliable.

Fill in the blank: Statistical packages reduce _____ compared to manual computation.



Box 5.1 Advantages of Using Statistical Packages

- Save time by automating calculations
- Reduce errors compared to manual computation
- Provide clear visualisations (charts, graphs)
- Support complex analyses



Pilot questions 5.1

1. Statistical packages are software tools designed to simplify the process of _____ data.
2. Which of the following is NOT a statistical package? a) SPSS b) R c) Excel d) Word
3. _____ is an open-source statistical package widely used for advanced modelling.
4. Statistical packages reduce _____ compared to manual computation.



5. One advantage of statistical packages is that they provide clear _____ such as charts and graphs.

5.2 Applying Statistical Packages To Data Analysis

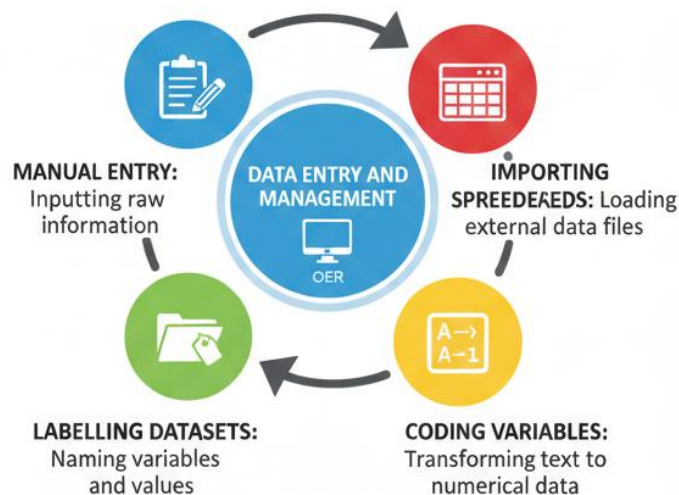
5.2.1 Data entry and management in statistical packages

Statistical packages allow researchers to enter, organise, and manage data efficiently. Data can be input manually, imported from spreadsheets, or collected directly from surveys. Features such as variable naming, coding, and labelling make datasets easier to handle. In library and information science, proper data management ensures accuracy when analysing user surveys, borrowing records, or electronic resource usage.

Fill in the blank: Statistical packages allow researchers to enter, organise, and _____ data efficiently.



Figure 5.2
Data Entry and Management in Statistical Packages



5.2.2 Performing descriptive statistics (mean, median, mode, dispersion)

Statistical packages simplify the calculation of descriptive statistics. With a few commands, researchers can compute measures of central tendency (mean, median, mode) and measures of dispersion (range, variance, standard deviation). In library and information science, descriptive statistics can summarise borrowing patterns, average attendance at programmes, or frequency of database use.

Fill in the blank: Statistical packages simplify the calculation of _____ statistics such as mean and median.



Statistic	Function in Package (Generic)	Example in LIS
Mean	AVERAGE (Excel), mean() (R), DESCRIPTIVES (SPSS)	Calculating the average number of physical books borrowed per student per year.
Median	MEDIAN (Excel), median() (R), FREQUENCIES (SPSS)	Finding the middle borrowing rate to understand "typical" use without being skewed by a few extreme "power users."
Mode	MODE (Excel), table() (R), FREQUENCIES (SPSS)	Identifying the most frequently borrowed title or the most popular hour for library visits.
Standard Deviation	STDEV (Excel), sd() (R), DESCRIPTIVES (SPSS)	Measuring the variability in borrowing habits across different academic departments to see which groups have the most diverse needs.

Table 5.2 Performing descriptive statistics in LIS

5.2.3 Conducting inferential analysis (correlation, regression, hypothesis testing)

Inferential analysis goes beyond description to test relationships and predictions. Statistical packages provide tools for correlation (examining relationships between variables), regression (predicting outcomes), and hypothesis testing (evaluating assumptions). In library and information science, correlation might reveal links between database use and academic performance, while regression could predict borrowing trends based on student enrolment.

Fill in the blank: Inferential analysis includes correlation, regression, and _____ testing.



Box 5.2 Inferential Analysis in Statistical Packages

-  **Correlation:** examining relationships between variables
-  **Regression:** predicting outcomes based to data
-  **Hypotchsis testing:** evaluating evaluations assumptions with statistical evidence



Pilot questions 5.2

1. Statistical packages allow researchers to enter, organise, and _____ data efficiently.
2. Which of the following is NOT a descriptive statistic? a) Mean b) Median c) Mode d) Hypothesis testing
3. Statistical packages simplify the calculation of _____ statistics such as mean and median.



4. Inferential analysis includes correlation, regression, and _____ testing.
5. Regression analysis can be used to _____ borrowing trends based on student enrolment.

5.3 Presenting And Interpreting Results With Statistical Packages

5.3.1 Generating tables, charts, and graphs

Statistical packages make it easy to generate tables, charts, and graphs that summarise data visually. These outputs help researchers communicate findings clearly to stakeholders. For example, a bar chart can show borrowing rates across faculties, while a pie chart can illustrate the proportion of users accessing electronic resources. Such visualisations enhance understanding and make results more persuasive.

Fill in the blank: Statistical packages make it easy to generate _____, charts, and graphs that summarise data visually.



Figure 5.3 Outputs Generated by Statistical Packages



5.3.2 Interpreting statistical outputs for LIS research

Interpreting outputs involves explaining what the numbers and charts mean in relation to the research problem. For instance, if a regression analysis shows a strong positive relationship between database use and academic performance, the interpretation is that increased use of databases may contribute to better results. In library and information science, interpretation ensures that statistical findings are connected to practical issues.

Fill in the blank: Interpreting outputs involves explaining what the _____ and charts mean in relation to the research problem.



Box 5.3 Guidelines for Interpreting Statistical Outputs

-  • Relate results to the research problem
-  • Avoid misinterpretation of statistical terms
-  • Highlight practical implications
-  • Ensure clarity for non-specialist audiences



5.3.3 Reporting findings and ensuring accuracy

Reporting findings requires presenting results in a structured format, often including tables, charts, and narrative explanations. Accuracy is critical, as errors in reporting can mislead decision-makers. Statistical packages help ensure accuracy by automating calculations and reducing human error. In library and information science, accurate reporting supports evidence-based decisions, such as resource allocation or service improvement.

Fill in the blank: Reporting findings requires presenting results in a structured format and ensuring_____.



Reporting Element	Example in LIS
Tables	A detailed breakdown of borrowing rates by department, allowing for precise comparison of physical collection usage.
Charts	A pie chart illustrating the distribution of electronic resource usage (e.g., JSTOR vs. Elsevier) to visualize budget impact.
Narrative	A written explanation describing an upward trend in user satisfaction after the implementation of 24/7 library access.

Table 5.3 Reporting findings in LIS research

Pilot questions 5.3

1. Statistical packages make it easy to generate _____, charts, and graphs.
2. Interpreting outputs involves explaining what the _____ and charts mean in relation to the research problem.
3. Which of the following is NOT a guideline for interpreting statistical outputs? a) Relate results to the research problem b) Avoid misinterpretation c) Highlight practical implications d) Ignore clarity for audiences
4. Reporting findings requires presenting results in a structured format and ensuring _____.
5. A pie chart can illustrate the _____ of users accessing electronic resources.

Series Summary

This Series has introduced you to the application of statistical packages for data analysis in library and information science. We began with an overview of statistical packages, their role, commonly used tools such as SPSS, R, and Excel, and their advantages. We then explored how to apply these packages to data analysis, including data entry and management, performing descriptive statistics, and conducting inferential analysis such as correlation, regression, and hypothesis testing. Finally, we examined how to present



and interpret results, focusing on generating tables, charts, and graphs, interpreting outputs, and reporting findings accurately.

By engaging with these discussions, you should now be able to define statistical packages, identify commonly used tools, analyse their advantages, manage data within them, apply descriptive and inferential techniques, generate outputs, interpret results, and report findings accurately. These outcomes align directly with the Series Learning Outcomes and equip you with practical skills for conducting and presenting research in library and information science.

Glossary of Terms

- **Correlation:** A statistical technique used to measure the relationship between two variables.
- **Data entry:** The process of inputting data into a statistical package for analysis.
- **Descriptive statistics:** Statistical methods used to summarise data, including mean, median, mode, and dispersion.
- **Inferential analysis:** Statistical methods used to test hypotheses and make predictions, such as regression and hypothesis testing.
- **Regression analysis:** A technique used to predict outcomes based on relationships between variables.
- **SPSS:** Statistical Package for the Social Sciences, widely used for social science research.
- **R:** An open-source statistical software used for advanced modelling and programming.
- **Excel:** A spreadsheet tool that supports basic statistical analysis and visualisation.
- **Statistical package:** Software designed to simplify data analysis by automating calculations and generating outputs.

Concept Check Questions

Objective questions

1. Which of the following is NOT a statistical package? a) SPSS b) R c) Excel d) Word (Linked to SLO 5.2)
2. Inferential analysis includes correlation, regression, and _____ testing. (Linked to SLO 5.5)

Short-answer questions

3. Define a statistical package in research. (Linked to SLO 5.1)



4. State two advantages of using statistical packages in LIS research. (Linked to SLO 5.3)

Long-answer questions

5. Explain how descriptive statistics can be performed using statistical packages, giving examples in LIS. (Linked to SLO 5.5)
6. Discuss how statistical packages help in presenting and interpreting results, highlighting their importance in LIS research. (Linked to SLO 5.6, SLO 5.7)

Answers to Concept Check Questions

Objective questions

1. d) Word
2. Hypothesis

Short-answer questions

3. A statistical package is software designed to simplify data analysis by automating calculations, generating outputs, and supporting interpretation.
4. Advantages include saving time and reducing errors compared to manual computation.

Long-answer questions

5. **Basic response:** Descriptive statistics such as mean, median, mode, and standard deviation can be calculated easily using functions in SPSS, R, or Excel. For example, the mean can summarise average borrowing rates. **Value-added response:** Outstanding learners may add that packages also allow quick comparison across groups, graphical representation of data, and integration with inferential techniques for deeper insights.
6. **Basic response:** Statistical packages generate tables, charts, and graphs that make results clear. They also provide outputs that can be interpreted in relation to research problems. **Value-added response:** Outstanding learners may add that packages enhance credibility by ensuring accuracy, support communication with non-specialist audiences, and help link statistical findings to practical recommendations in LIS.

Answers to Pilot Questions

Pilot questions 5.1

1. Analysing
2. d) Word
3. R



4. Errors
5. Visualisations

Pilot questions 5.2

1. Manage
2. d) Hypothesis testing
3. Descriptive
4. Hypothesis
5. Predict

Pilot questions 5.3

1. Tables
2. Numbers
3. d) Ignore clarity for audiences
4. Accuracy
5. Proportion

References and Attributions

- Figure 5.1 Role of statistical packages in LIS. Suggested AI prompt: “Generate a diagram showing the role of statistical packages in LIS: data entry, analysis, interpretation, presentation.” Search string: “role of statistical packages in library science OER.”
- Table 5.1 Commonly used statistical packages. Suggested AI prompt: “Generate a simple table showing commonly used statistical packages with three columns: package, features, example use in LIS.” Search string: “common statistical packages SPSS R Excel OER.”
- Box 5.1 Advantages of using statistical packages. Suggested AI prompt: “Create a text box styled as a table with single column listing advantages of using statistical packages.” Search string: “advantages of statistical packages in LIS OER.”
- Figure 5.2 Data entry and management in statistical packages. Suggested AI prompt: “Generate a diagram showing data entry and management in statistical packages: manual entry, importing spreadsheets, coding variables, labelling datasets.” Search string: “data entry and management in statistical packages OER.”



- Table 5.2 Performing descriptive statistics in LIS. Suggested AI prompt: “Generate a simple table showing descriptive statistics functions in packages with three columns: statistic, function, example in LIS.” Search string: “descriptive statistics in SPSS Excel R OER.”
- Box 5.2 Inferential analysis in statistical packages. Suggested AI prompt: “Create a text box styled as a table with single column listing inferential analysis techniques in statistical packages.” Search string: “inferential analysis correlation regression hypothesis testing OER.”
- Figure 5.3 Outputs generated by statistical packages. Suggested AI prompt: “Generate a diagram showing outputs from statistical packages: tables, bar charts, pie charts.” Search string: “outputs of statistical packages tables charts graphs OER.”
- Box 5.3 Guidelines for interpreting statistical outputs. Suggested AI prompt: “Create a text box styled as a table with single column listing guidelines for interpreting statistical outputs.” Search string: “guidelines for interpreting statistical outputs OER.”
- Table 5.3 Reporting findings in LIS research. Suggested AI prompt: “Generate a simple table showing reporting elements with examples in LIS research.” Search string: “reporting findings in library science OER.”

