

ICT AND RESEARCH METHODOLOGY



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INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) AND RESEARCH METHODOLOGY

Introduction

The course, ICT and Research Methodology, is a core course for students studying towards acquiring a Postgraduate (MSc. or PhD) Degree in any of the Departments and Faculty in Federal University of Lafia. In this course you will study about Information and Communication Technology (ICT) and Research Methodology as an important aspect of Research in the University. Various aspects of ICT as applied to Research Methodology are discussed in this course.

The aim of this course is to guide and equip every postgraduate student of this University with the techniques of doing research irrespective of the discipline. In structuring this course, we commence with a general introduction of Research and Research Methodology followed by ICT Tools that are applicable to research. These ICT tools are used to aid and enhance the research process and finally to the Ethical Issues in Research.

There are Fifteen Modules in this course, you are expected to complete each Module topic in 3 hours. The Fifteen Modules and their units are listed below:

Module One: Meaning, Characteristics And Types Of Research;
Module Two: Thesis and Article Writing: Format and Style of Referencing;
Module Three: Steps of Research Process;
Module Four: Research Methods: Experimental, Descriptive and Historical Methods;
Module Five: Research Ethics;
Module Six: Application of ICT in Research, Role and Tools of ICT;
Module Seven: ICT Tools: Microsoft Office in Research;
Module Eight: Bibliographic citation and referencing in Microsoft office word;
Module Nine: Microsoft word Citation Manager: EndNote;
Module Ten: Referencing and Citation Manager: Mendeley;
Module Eleven: Mendeley Guide;
Module Twelve: Statistics in Research: Precision and Accuracy of Estimates;
Module Thirteen: Statistics in Research: The Concept of Hypothesis Testing and Error;
Module Fourteen: Statistics in Research: Analysis of Variance;
Module Fifteen: Statistics in Research: Data Analysis using SPSS.

What you will learn in this course

The aim and objectives of this course is to provide direction on what you should be achieving in the course of your postgraduate studies. Each unit also has its own unit objectives which state specifically what you should be achieving in the corresponding unit. It is expected that you continuously evaluate your achievement by constantly referring to aim and objectives of the course as well as the corresponding unit objectives upon the completion of each.

Course aims

The aims of this course are to:

1. Improve your knowledge and understanding of the concept of Research, Research Methodology and Statistics;
2. Build up your capacity on ICT;
3. Develop your competence in the use of ICT Tools in Research Methodology and processes.

Course objectives

Upon completion of the course, you should be able to:

1. Describe the concepts of Research;
2. Explain the various types of Research;
3. Understand Research Process and Ethics;
4. Explain the meaning of ICT;
5. Identify various ICT Research Tools and Techniques.

Working through this course

This course is systematically designed, so you need to work through it from Module one, through to Module Fifteen. This will enable you appreciate the course better. Notwithstanding, it could also serve as a reference manual. In this case, you could easily and quickly lookup any confusing idea and how to fix it as you engage in your research activity. In this case, you don't need to read everything serially rather, just go to the topic and subtopic that directly address your need.

Course materials

In this course, we made use of textbooks and online materials. You are expected to search for more literature and web references for further understanding.

MODULE ONE

1.0 MEANING, CHARACTERISTICS AND TYPES OF RESEARCH

1.1 Meaning of Research

We begin this study with the fundamental question of what is research and what does it mean to undertake a research study to find answers to a question? Providing a generally accepted answer to this question may be difficult since different disciplines have different view and approach to research. As a result, we present qualities that defines research irrespective of discipline or domain where such research is being carried out. Undertaking a research implies that the process:

- a. Is being undertaken within a framework of a set of approaches (philosophies);
- b. Uses methods, procedures, and techniques that have been tested for their validity and reliability;
- c. Is designed to be objective and unbiased.

Hence, this four qualities defines a research. Let us take a close look at these qualities individually for a better understanding of what they really mean.

Approaches

Approaches means philosophies, for example quantitative, qualitative, and the academic discipline in which you have been trained.

Reliability

Reliability refers to the quality of a measurement procedure that provides repeatability and accuracy.

Validity

Validity means that correct procedure have been applied to find answers to a question.

Objective and unbiased

Objective and unbiased means that you have taken each step in an unbiased manner and drawn each conclusion to the best of your ability and without introducing your own vested interest. Bias is a deliberate attempt to either conceal or highlight something. Adherence to the three conditions pointed out above qualifies the process to be called 'research'.

However, the degree to which these conditions are expected to be fulfilled varies from discipline to discipline and so the meaning of 'research' differs from one academic discipline to another. The difference between research and non-research activity is in the way we find answers; this is to say, the process must meet certain requirements to qualify as research. We can identify these requirements as taking a close look at some definitions of research.

The word research is made up of two syllables; "re" which is a prefix meaning again, a new or over again and "search" which is a verb that means to closely and carefully examine, to probe or to try and test. These two syllables together form a noun describing a systematic, careful, patient investigation and study in some field of study undertaken to establish facts or principles. This provide us sufficient background to properly define research as follows:

Research is a structured enquiry that utilizes acceptable scientific methodology to solve problems and create new knowledge that is generally applicable.

In the light of the above definition, the term scientific methodology consist of systematic observation, classification and interpretation of data.

1.2 Characteristics of Research

Research is a process of collecting, analysing and interpreting information to answer questions. But for any work to qualify as research, the process must have certain characteristics. It must, as far as possible, be:

- i. Controlled;
- ii. Rigorous;
- iii. Systematic;
- iv. Valid and Verifiable;
- v. Empirical and
- vi. Critical

i. Controlled

There are many factors that affect result or an outcome in real life. This is where the concept of control becomes important. The concept of control implies that, in exploring causality in relation to two or more variables or factors, you need to set up your study in a way that minimizes the effects of other factors affecting the relationship. This can be largely achieved in the physical sciences as most of the researches are done in the laboratory. However, in the social sciences, it is very difficult as researches are carried out on issues related to human beings living in society where such controls are not possible. Therefore, in social sciences, you cannot control external factors but rather, you attempt to quantify their impact.

ii. Rigorous

You must be careful in ensuring that the procedures followed to find answers to questions are not only appropriate and relevant, but justified. You must understand again that the degree of rigour varies significantly from one discipline to another.

iii. Systematic

This research characteristic suggests that the procedure adopted to undertake an investigation follows some logical sequence. The steps involved must be chronological and well defined to avoid ambiguity.

iv. Valid and Verifiable

Research is universal and repeatable hence, the concept of validity and verifiability implies that whatever you conclude on the basis of your findings is correct and can be verified by you and others.

v. Empirical

This means that conclusions that you derived are based on evidence obtained from information gathered from real-life observations or experiences.

vi. Critical

The process of investigation must be fool proof and free from drawbacks therefore, critical scrutiny of the procedures and the methods used is important to a research enquiry. The process adopted and the procedures used must be able to withstand critical scrutiny.

For any process to be accepted or called research, it is imperative that it has the above listed and explained characteristics.

1.3 Types of Research

Research can be categorized or classified from three viewpoints or perspectives namely:

1. Inquiry mode employed;
2. Objectives in undertaking the research and
3. Application of the research study.

1.3.1 Research based on Inquiry Mode

Considering the process adopted to find answers to research questions, research can be classified into two approaches namely;

- i. Structured approach and
- ii. Unstructured approach

i. Structured Approach

The structured approach to investigation is normally referred to as ***quantitative research***. Everything that make up the research process; objectives, design, sample, and the questions that you intend to ask respondents is predetermined. It is therefore appropriate to determine the extent of a problem, phenomenon or issues by quantifying the variations. For example, the question as to how many people hold a particular belief? How many people have a particular problem?

ii. Unstructured Approach

The unstructured approach to investigation is normally referred to as ***qualitative research***. This approach provides flexibility in all aspects of the research process. In this approach, it is more appropriate to explore the ***nature*** of a problem, phenomenon or issue without quantifying it. The main objective is to describe the ***variation*** in a phenomenon, attitude or situation. For example, an account of different opinions different people have about an issue, description of working condition in a particular organization, description of an observed situation, the historical enumeration of events etc.

Both approaches (structured and unstructured approaches) have their strengths and weaknesses hence, both have their place in research. Sometimes and in many cases, there is a combination of both qualitative and quantitative approaches. For instance, suppose you have to find the types of Hotels available in a town and the extent of their popularity. The types of Hotels are the qualitative aspect of the study as finding out about them entails a description of the nature of the Hotel. The extent of their popularity is the quantitative aspect as it involves estimating the number of people who visits or patronizes such Hotels and calculating the other indicators that reflect the extent of popularity.

1.3.2. Research based on Objectives

From the perspective of objectives, research can be categorized as

- a. Descriptive
- b. Correlational
- c. Explanatory and
- d. Exploratory

a. Descriptive Research

This type of research attempt to describe systematically a phenomenon, situation, problem, programme, or service or provides information about, say, the living condition of students on campus, or describes attitudes towards an issue, say, attitude of ABC towards girl child education.

b. Correlational Research

This type of research attempt to discover or establish the existence of a relationship or interdependence between two or more aspects of a phenomenon or situation.

c. Explanatory Research

This type of research attempt to clarify why and how there is a relationship between two or more aspects of a situation or phenomenon.

d. Exploratory Research

This type of research is undertaken to explore an area where little or nothing is known or to investigate the possibilities of undertaking a particular research study (feasibility study/pilot study). In practice, most studies are a combination of the first three categories.

1.3.3. Research based on Application

There are two main categories of research from the perspective of the application.

- i. Pure Research
- ii. Applied Research

i. Pure Research

This type of research involves developing and testing theories and hypotheses that are intellectually challenging to the researchers but may or may not have a practical application at the present or in the future. The knowledge produced through pure research is sought in order to add to the existing body of knowledge.

ii. Applied Research

This type of research is undertaken to solve some specific, practical problems. They addresses specific practical questions; for policy formulation, administration and understanding of a problem or phenomenon. It can be exploratory but is usually descriptive. It is almost always done on the bases of basic research.

Applied research can be undertaken by industrial or academic institutions such as a university will have a specific applied research program funded by an industrial partner interested in that programme.

MODULE TWO

2.0

THESIS AND ARTICLE WRITING: FORMAT AND STYLE OF REFERENCING

The term ‘thesis’ is a treatise that represents the fulfilment of the scholarly aspiration of the student. A good thesis should be clear and unambiguous and have a logical structure that should assist the reader’s understanding of the argument being presented and not obscure it. In order to achieve this objective, the layout and physical appearance of the thesis should conform to a set pattern.

Note:

The following format of thesis writing is the general standard and accepted format. But, universities and institutions have their own prescribed formats. It is therefore advised that you check up with your university’s school of postgraduate studies for the approved format acceptable to them with this core structure of thesis writing. Please consider the specific format suggested by your institution, organisation, and university.

2.1 Thesis and Article Writing

The generally accepted format of thesis or report writing tend to be produced in the following way.

2.1.1 Title Page

- Title of the Research project
- Name of the researcher
- Purpose of the research project, e.g.
“A Research Project Submitted to the Department of Information and Communication Technology (ICT) in Partial Fulfilment of the Requirements for the Award of Ph.D. Degree in Communication Technology”
- Date of publication

2.1.2 Table of Contents

This section consist of the contents of the report, either in chapters or in subheadings.

2.1.3 List of Tables

This section includes title and page number of all tables

2.1.4 List of Figures

This section contains the title and page number of all graphs, pie chart, etc.

2.1.5 Acknowledgement

Here, the researcher may acknowledge University principal, Faculty Guide, both research guide and technical guide, research participants, friends, family etc.

2.1.6 Introduction

This section introduces the research; setting out aims and objectives. It includes a rationale for the research.

2.1.7 Theoretical Frame and Review of Literature

This section is included all your background research, which may be obtained from the literature review. You must indicate where all the information has come, so remember to keep a complete record of everything you read. If you do not do this, you could be accused of plagiarism which is a

form of intellectual theft. When you are referring to a particular book or journal article, use the Harvard system.

2.1.8 Research Design

This section includes all practical details you followed in the course of the research. Any interested party should be able to replicate the research study after reading this section. The method used for data collection, how many people took part, how they were chosen, what tool was used for data collection, how the data was analysed etc.

2.1.9 Data Analysis and Interpretation

If you have conducted a large quantitative survey, this section may contain tables, graphs, pie charts, and associated statistics. If you have conducted a qualitative piece of research, this section may be descriptive prose.

2.1.10 Summary and Conclusion

In this section, you sum up your findings and draw conclusions from them, perhaps in relation to other research or literatures.

2.1.11 Recommendation

If you have conducted a piece of research for a hotel or any other client organisation, this section could be the most important part of the report. A list of clear recommendations that have been developed from the research is included at the beginning of the report.

2.1.12 Suggestion for Further Research

It is useful in both academic reports and work-related reports to include a section that shows how the research can be continued. Perhaps some results are inconclusive, or perhaps the research has thrown up many more research questions that need to be addressed. It is useful to include this section because it shows that you are aware of the wider picture and that you are not trying to cover up something which you feel may be lacking in your own work.

2.1.13 List of References/Bibliography

- List of references contains details only of those works cited in the text.
- A bibliography includes sources not cited in the text, but which are relevant to the subject (larger dissertation or thesis).
- Small research project will need only a reference section. It includes all the literature to which you have referred in your report.

2.1.14 Annexures

List of publications: list of publications obtained by the student from the Ph.D. work should be included in the Thesis. Student are strongly encourage to place the accepted versions of the manuscripts (maximum two), which were an integral part of thesis work.

Curriculum Vitae (optional): provide one-page giving academic qualifications, academic achievements and list of publications.

Appendices (optional): Appendices may include the formulas, diagrams, protocols, or any similar data that are not contained in the body of the thesis. The number can be given as A-1, A-2 and listed as such in the table of contents.

2.2 Format of Citations/References

2.2.1 Citations or in-text citations are similar to references but occur in the body of the text with direct quotes and paraphrases to identify the author/publication for the material you have used. Citations are used:

- i. To show which reference supports a particular statement.
- ii. For direct quotes; when you repeat a passage from a text (or speech, video, etc.) in your assignment without changing any words.
- iii. When you paraphrase; this is when you use your own words to restate the meaning of a text in your work.

One of the most important things to remember is that every citation should also have a corresponding entry in your reference list. That is, reference all citations and cite all references.

Reference all Citations and cite all References

2.2.2 A reference list is a list of the resources that you used when writing your thesis or doing your research.

- i. Books, including electronic books, journals (online and paper-based)
- ii. Online sources including websites, blogs, and forums
- iii. Speeches
- iv. Conference paper, proceedings, and theses
- v. Other sources of information such as film, television, video, etc.

Reference list come at the end of the report and are arranged in alphabetic order, usually by author or editor. If there is not an author or an editor, the title is used.

2.2.3 Comparison between Citation and Reference

Table 1.0 shows a comparison between citation and reference.

Table 1.0: Comparison between Citation and Reference

Basis for Comparison	Citation	Reference
Meaning	Citation is a way of disclosing within the main body of the report, that the quote, image, chart, statistics, etc. are taken from an outside source.	Reference is a list that contains all the sources which have been sought or cited while writing the article or report.
Use	It informs the readers, the basic source of information.	It informs the reader, the complete source of information.
Purpose	To indicate the source of the material taken.	To support or criticize an argument or point.
Placement	Presented in the bracket.	Presented as endnote or end of the document.
Information	It contains information like publication year and last name of the author.	It contains information like publication date, title of Book/Journal, author's name, page number.

2.2.4 Types of Citation/Reference Styles

The following are a few important styles of citation or referencing during thesis and article writing:

i. MLA (Modern Language Association) Style

The MLA is most commonly used to write papers and cite sources within the liberal arts and humanities. For instance;

Book:

Abah, Ojodomo Joshua. ICT Research methodology: Issues and Challenges. Golden Gate Publishers, 2015.

Journal:

Abah, Josh. "Micro-finance and Rural Poverty in Nigeria Micro-Finance Bank Linkage Programme."

ii. APA (American Psychological Association)

APA is most commonly used to cite sources within the health sciences and social sciences fields.

Book:

Abah, O. J. (2015). ICT Research methodology: Issues and Challenges. Golden Gate Publishers.

Journals:

Abah, J. (2015). Micro-finance and Rural Poverty in Nigeria Micro-Finance Bank Linkage Programme. Journal of Agricultural Development, 6(2), 40-48.

iii. Chicago Manual of Style (CMS)

The CMS are quite flexible and cover both parenthetical and note citation systems.

Book:

Abah, Ojodomo Joshua. ICT Research methodology: Issues and Challenges. Golden Gate Publishers, 2015.

Journals:

Abah, J. (2015). Micro-finance and Rural Poverty in Nigeria Micro-Finance Bank Linkage Programme. Journal of Agricultural Development, 6(2), pp.40-48.

iv. The Vancouver System

The Vancouver System is also known as Vancouver Reference Style or the author-number system. This is a citation style that uses numbers within the text that refer to numbered entries in the reference list.

Book:

Abah, OJ. ICT Research methodology: Issues and Challenges. Golden Gate Publishers, 2015.

Journals:

Abah, J. (2015). Micro-finance and Rural Poverty in Nigeria Micro-Finance Bank Linkage Programme. Journal of Agricultural Development, 2015 Oct 1;31 (2):40-48.

2.2.5 Standard Format for printing a Report

Table 2.0 provide a standard format for printing a report except where specified otherwise.

Table 2.0: Standard Format for Printing a Report

Paper	Bond Paper	
Size:	8.5 inches x 11 inches	
Margin:	Left - Top – Bottom – Right -	1.5 inch 1 inch 1 inch 1 inch
Font:	Times New Roman	
Font size:	12	
Spacing:	Double	
Binding:	BlackRexin	
Gold Embossing on Cover	Research Title Student Name Name of Institute Year of Submission	

Note:

The format of thesis and article writing, mentioned above, is a general and standard format. Please follow your universities or institutions' approved template for writing theses and articles.

MODULE THREE

3.0

STEPS OF RESEARCH PROCESS

The research process is like undertaking a journey. For a research journey, there are two crucial decisions to make:

1. What you want to find out about or what research questions (problems) you want to find answers to;
2. How to go about finding their answers?

There are practical steps through which you must pass on your research journey to find answers to your research questions. The path to finding answers to your research questions constitutes *research methodology*. At each operational stage in the research process, you are required to choose from a multiplicity of methods, procedures, and models of research methodology, which will help you to best achieve your objectives.

3.1 Steps in Research Process

The following steps in research process are identified;

1. Formulating the research problem
2. Extensive literature review
3. Formulating the objectives
4. Preparing the research design including sample design
5. Data collection
6. Processing and analysis of data
7. Preparation of the Report or Presentation of Results (formal write-ups of conclusions reached)

3.1.1 Formulating Research Problem

This is the first and most crucial step in the research process. The main function is to decide what you want to find out or investigate.

3.1.1.1 Sources of research problems

This, in most cases, depends on discipline. Research in social sciences revolves around four **Ps**:

- i. **People:** a group of individuals;
- ii. **Problems:** examine the existence of certain issues or problems relating to their lives to ascertain the attitude of a group of people towards an issue;
- iii. **Programs:** to evaluate the effectiveness of an intervention;
- iv. **Phenomena:** to establish the existence of regularity.

In practice, most research studies are based upon at least a combination of two Ps. Every research study has two aspects:

a. **Study population**

This is the first source of research problems identified in 3.1.1.1; **people:** individuals, organizations, groups, communities (they provide you with the information or you collect information about them).

b. **Subject area**

The subject area is one or a combination of two or three of the remaining three sources of research problems itemised in 3.1.1.1 which are;

- i. **Problems:** issues, situation, associations, needs, profiles.

- ii. **Program:** content, structure, outcomes, attributes, satisfactions, consumers, service providers, etc.
- iii. **Phenomenon:** cause-and-effect relationships, the study of a phenomenon itself (information that you need to collect to find answer to your research questions).

You can examine the professional field of your choice in the context of the four Ps in order to identify anything that looks interesting.

3.1.1.2 Considerations in selecting a research problem

These are factors which help to ensure that your study will remain manageable and that you will remain motivated all through the period of your research. These include;

- i. **Interest:** a research endeavour is usually time-consuming and involves hard work and possibly unforeseen problems. You are therefore advised to select a topic of great interest to sustain the required motivation.
- ii. **Magnitude:** it is extremely important to select a topic that you can manage within the time and resources at your disposal. Narrow the topic down to something manageable, specific and clear.
- iii. **Measurement of concept:** make sure that you are clear about the indicators and measurement of concepts (if used) in your study.
- iv. **Level of expertise:** make sure that you have an adequate level of expertise on the topic you are proposing since you need to do the work yourself.
- v. **Relevance:** ensure that your study adds to the existing body of knowledge, bridges current gaps and is useful in policy formulation. This will help you to sustain interest in the study.
- vi. **Availability of data:** before finalizing the topic, make sure that data are available and the sources of data are identified.
- vii. **Ethical issues:** how ethical issues can affect the study population and how ethical problems can be overcome should be thoroughly examined at the problem formulation stage.

3.1.1.3 Steps in Formulation of a Research Problem

Working through these steps presupposes a reasonable level of knowledge in the broad subject area within which the study is to be undertaken. Without such knowledge, it is difficult to clearly and adequately 'dissect' a subject area. The following steps are advised;

- Step 1:** Identify a broad field or subject area of interest to you
- Step 2:** Dissect the broad area into subareas
- Step 3:** Select what is of most interest to you
- Step 4:** Raise research questions
- Step 5:** Formulate objectives
- Step 6:** Assess your objectives
- Step 7:** Double check

So far, we have focused on the basis of your study, the research problem. But every study in social sciences has a second element, the study population from whom the required information to find answers to your research questions is obtained. As you narrow the research problem, similarly, you need to decide very specifically, who constitutes your study population, in order to select the appropriate respondents.

3.1.2 Reviewing the Literature

Literature review is an essential preliminary task in order to acquaint yourself with the available body of knowledge in your area of interest. It is an integral part of the entire research process and makes valuable contribution to every operational step. This process can be time-consuming, daunting and frustrating, but also rewarding.

3.1.2.1 Purposes of Literature Review

Literature review serves the following purposes;

i. ***It brings clarity and focus to the research problem:***

The process of reviewing the literature helps you to understand the subject area better and thus help you to conceptualise your research problem and the body of knowledge in the area.

ii. ***It improves methodology:***

A literature review tells you if others have used procedures and methods similar to the one that you are proposing, which procedures and methods have worked well for them, and what problems they have faced with them. Thus, you will be better positioned to select a methodology that is capable of providing a valid answer to your research question.

iii. ***It broadens knowledge:***

It ensures you to read widely around the subject area in which you intend to conduct your research study. As you are expected to be an expert in your area of study, it helps fulfil this expectation. It also helps you to understand how the findings of your study fit into the existing body of knowledge.

iv. ***It contextualises findings:***

Literature review assist you to answer questions like; how do answer to your research questions compare with what others have found? What contribution have you been able to make into the existing body of knowledge? How are your findings different from those of others? For you to be able to answer these questions, you need to go back to your literature review. It is important to place your findings in the context of what is already known in your field of enquiry.

3.1.2.2 Procedure for reviewing the literature

- i. Search for existing literature in your area of study;
- ii. Review the literature selected;
- iii. Develop a theoretical framework;
- iv. Develop a conceptual framework.

3.1.3 Formulation of Objectives (Hypothesis)

Objectives are the goals you set out to attain in your study. They inform a reader what you want to attain through the study hence, it is extremely important to word them clearly and specifically. Objectives should be listed under two headings:

1. Main objective or Aim;
2. Sub-objectives.

The **main objective** popularly known as the **Aim** is an overall statement of the thrust of your study. It is also a statement of the main associations and relationships that you seek to discover or establish.

The **sub-objectives** simply referred to as **objectives** are the specific aspect of the topic that you want to investigate within the main framework of your study.

In formulating and stating your objectives;

- a. They should be numerically listed.
- b. The wording should clearly, completely and specifically communicate to readers.
- c. Each objective should contain only one aspect of the study.
- d. Use action-oriented words or verbs when writing objectives.

3.1.3.1 Identifying Variables

In research, it is important that the concepts used should be operationalised in measurable terms so that the extent of variations in respondents' understanding is reduced if not eliminated. Techniques on how to operationalise concepts, and knowledge about variables, play an important role in reducing this variability. Their knowledge, therefore, is important in tuning your research problem. For example

- i. 'British Airways' is a perfect example of quality cabin service.
- ii. Leather products in this days stores is great
- iii. The lower class in Nigeria is getting less

When people express these feeling or preferences, they do so on the basis of certain criteria in their minds. Their judgement is based upon indicators that lead them to conclude and express that opinion. These are judgments that require a sound basis on which to proclaim. This warrant the use of measuring mechanism and it is the process of measurement that knowledge about variables play an important role.

Variable

A variable is an image, perception or concept that can be measured; hence capable of taking on different values.

Concept

Concept are mental image or perception, and therefore, their meaning varies from one individual to another.

3.1.3.2 Difference between Variable and Concept

A variable can be measured either by refined/crude or objective/subjective units of measurement whereas, a concept cannot be measured. It is therefore important for the concept to be converted into variables. Table 3.0 provides a clear comparison between concept and variable.

Table 3.0: Concept vs. Variable

Concept	Variable
<ul style="list-style-type: none"> • Subjective impression; • No uniformity as to its understanding among different people; • As such cannot be measured. 	<ul style="list-style-type: none"> • Measurable though the degree of precision varies from scale to scale and from variable to variable (e.g. Attitude- subjective, Income- objective)
<p style="text-align: center;">Examples:</p> <ul style="list-style-type: none"> • Satisfaction • Effectiveness • Excellent • Impact • Rich • Extent and pattern of alcohol consumption, etc. • High achiever • Domestic violence • Self-esteem 	<p style="text-align: center;">Examples:</p> <ul style="list-style-type: none"> • Attitude (negative/positive) • Gender (male/female) • Religion (Catholic, protestant, Jew, Muslim) etc. • Age (x years, y months) • Weight (kg) • Income (N per year) • Height (cm)

3.1.3.3 Types of Data (Measurement of Scales)

There are four types of data that may be gathered in social research, each one adding more to the next. Thus ordinal data is also nominal, and so on.

Nominal or Categorical

A nominal scale allows the classification of objects, individuals, or responses into subcategory based on a common or shared property or characteristic. A variable measured on a nominal scale may have one, two, or more subcategories depending upon the degree of variation. For instance, ‘water or ‘tree’ has only one subcategory, whereas the variable ‘gender’ can be classified into two sub-categories: male and female. ‘Weather’ can be classified into subcategories.

The order in which subcategories are enumerated makes no difference as there is no relationship among subcategories. Nominal items are usually categorical, in that they belong to a definable category, such as ‘students’.

Ordinal or Ranking Scale

Besides categorizing objects, individuals, responses or property into subcategory on the basis of common characteristic, it ranks the subcategories in a certain order. They are arranged either in ascending or descending order according to the extent a subcategory reflects the magnitude of variation in the variable. For instance, ‘income’ can be measured either quantitatively (in Naira and Kobo) or qualitatively using such subcategories as: ‘low’, ‘average’ and ‘high’. The ‘distance’ between these subcategories are not equal as there is no quantitative unit of measurement. ‘Socioeconomic status’ and ‘attitude’ are other variables that can be measured on an ordinal scale.

Interval Scale

An interval scale has all the characteristics of an ordinal scale. In addition, it uses a unit of measurement with an arbitrary starting and terminating points. For instance,

Celsius scale: 0°C to 100°C

Fahrenheit scale: 32°F to 212°F

Attitudinal scales: 10-20, 21-30, 31-40 etc.

Ratio Scale

A ratio scale has all the properties of nominal, ordinal, and interval scales plus its own property: the zero point of a ratio scale is fixed, which means it has a fixed starting point. Since the difference between intervals is always measured from a zero point, this scale can be used for mathematical operations.

The measurement of variables like income, age, height, and weight are examples of this scale. A person who is 40 years old is twice as old as one who is 20 years old.

Parametric vs. Non-parametric

Interval and ratio data are parametric and are used with parametric tools in which distributions are predictable (and often Normal).

Nominal and ordinal data are non-parametric and do not assume any particular distribution. They are used with non-parametric tools such as the ***Histogram***.

3.1.3.4 Discrete and Continuous Variables

Continuous Variables are measured along a continuous scale, which can be divided into fractions, such as temperature. Continuous variables allow for infinitely fine sub-division, which means if you can measure sufficiently accurately, you can compare two items and determine the difference.

Discrete variables are measured across a set of fixed values, such as age in years (not microseconds.) These are commonly used on arbitrary scales, such as scoring your level of happiness, although such scales can also be continuous.

3.1.3.5 Constructing Hypotheses

As a researcher, you do not know about a phenomenon, but you do have a premonition to form the basis of certain assumptions or guesses. You test these by collecting information that will enable you to conclude if your notion was right. The verification process can have one of the three outcomes. Your hunch may prove to be:

1. Right;
2. Partially right; or
3. Wrong.

Without this process of verification, you cannot conclude anything about the validity of your assumption.

Hence, a hypothesis is an intelligent guess, assumption, assertion, hunch, suspicion, or an idea about a situation, phenomenon, relationship, truth, or the reality of which you do not know. A researcher calls these assumptions hypotheses, and they become the basis of an inquiry. In most studies, the hypotheses will be based upon your own or someone else's observation.

A hypothesis is an intelligent guess, assumption, assertion, hunch, suspicion, or an idea about a situation, phenomenon, relationship, truth, or the reality of which you do not know.

Hypotheses bring specificity, clarity, and focus on a research problem, but are not essential for a study. You can conduct a valid investigation without constructing formal hypotheses.

Functions of Hypotheses

Although hypotheses are not essential in all research study, it serves the following purposes:

- i. A hypothesis tells you what data to collect and what not to collect, thereby providing focus to the study.
- ii. The formulation of the hypothesis provides a study with focus. It tells you what specific aspects of a research problem to investigate.
- iii. As it provides a focus, the construction of a hypothesis enhances objectivity in a study.
- iv. A hypothesis may enable you do add to the formulation of a theory. It allows you to conclude what is true or what is false accurately.

Types of Hypotheses

- a. Null Hypotheses
- b. Alternative Hypotheses

Null Hypotheses: a null hypothesis is a type of hypothesis used in statistics that proposes that no statistical significance exists in a set or given observation. The null hypothesis attempts to show that no variation exists between variables or that a single variables is no different than its mean. It is presumed to be true until statistical evidence nullifies is for an alternative hypothesis.

Alternative Hypotheses: the alternate hypothesis is just an alternative to the null. For instance, in a lottery scheme if your null is “Joe is going to win up to N1,000,000” then your alternate is “Joe is going to win more than N1,000,000.” Basically, you’re looking at whether there’s enough change (with the alternate hypothesis) to be able to reject the null hypothesis.

3.1.4 Preparing Research Design

Research design is the conceptual structure within which research would be conducted. The function of the research design is to provide for the collection of relevant information with minimal expenditure of effort, time and money.

The preparation of research design, appropriate for particular research problem, involves the consideration of the following:

1. Objectives of the research study
2. Method of Data collection to be adopted
3. Source of information (Sample Design)
4. Tool for Data collection
5. Data analysis; qualitative and quantitative

3.1.4.1 Objectives of the Research Study

The objectives identified to answer the research questions have to be listed, making sure that they are:

1. Numbered, and
2. The statement begins with an action verb, normally the use of the word “To”.

3.1.4.2 Methods of Data Collection

There are two types of data;

- a. Primary Data: these are data collected for the first time directly from the source.
- b. Secondary Data: these are data which have already been collected and analysed by someone else.

Methods of Primary Data Collection

The following are the methods of primary data collection;

- a. **Observation Method:** This method is commonly used in behavioural sciences. It is the gathering of primary data by the investigator's own direct observation of relevant people, actions and situations without asking from the respondent.
- b. **Survey Method:** Survey method is most suited for gathering descriptive information.
- c. **Contact Methods:** Information may be collected by one or a combination of the following means:
 - i. Mail
 - ii. Telephone
 - iii. Personal interview
- d. **Experiment Methods:** This method is also called ***Empirical Research or Cause and Effect method***, it is data-based research, coming up with conclusions that are capable of being verified with Observation or experiment.

Experimental research is appropriate when the proof is sought that certain variables affect other variables in some ways. e.g.

- i. Type of preservatives used (independent variable) affect shelf life and texture of bread (dependant variable)
- ii. The effect of substituting one ingredient in whole or in part for another such as wheat flour to cassava flour for making high protein bread.
- iii. Develop recipes to use products.

3.1.4.3 Source of Information (Determining Sample Design)

Researchers usually draw conclusions about large groups by taking a sample. A sample is a segment of the population selected to represent the population as a whole. Ideally, the sample should be representative and allow the researcher to make accurate estimate of the thoughts and behaviour of the larger population.

Types of Sampling

There are basically two sampling techniques; probability and non-probability sampling techniques.

- i. **Probability sampling:** a sampling procedure in which each element of the population has a fixed probabilistic chance of being selected for the sample.
- ii. **Non-probability sampling:** Sampling techniques that do not use chance selection procedures but rather rely on the personal judgement of the researcher.

Probability sampling is further divided into the following:

1. **Simple Random Sample:** a probability sampling technique in which each element has a known and equal probability of selection. Every element is selected independently of every other element, and the sample is drawn by a random procedure from a sampling frame. This method is equivalent to a lottery system in which names are placed in a container, the container is shaken, and the names of the winners are then drawn out in an unbiased manner. To draw a simple random sample, the researcher first complies a sampling frame in which each element is assigned to unique identification number. Then random numbers are generated to determine which elements to include in the sample.
2. **Systematic Sampling:** in systematic sampling, the sample is chosen by selecting a random starting point and then picking every i th element in succession from the sampling frame. The sampling interval, I , is determined by dividing the population size N by the sample size n and rounding to the nearest whole number. For example, there are 100,000 elements in the population, and sample of 1,000 is desired. In this case, the sampling interval, I , is 100. A random number between 1 and 100 is selected. If, for example, this number is 23, the sample consists of elements, 23, 123, 223, 323, 423, 523, and so on.
3. **Stratified Random Sample:** population is divided into mutually exclusive (heterogeneous) groups (strata) then random sampling is drawn from each group (stratum). It is a two-step process in which the population is partitioned into subpopulations or strata. The strata should be mutually exclusive and collectively exhaustive in that every population element should be assigned to one and only one stratum and no population elements should be omitted. Next, elements are selected from each stratum by a random procedure, usually Simple Random Sampling.
4. **Cluster (area) sample:** The population is divided into mutually exclusive groups (Homogeneous) such as blocks, and the researcher draws a sample of the group to interview. A two-step probability sampling technique whereas the target population is first divided into mutually exclusive and collectively exhaustive sub-populations called clusters, and then a random sample of clusters is selected based on a probability sampling technique such as SRS. For each selected cluster, either all the elements are included in the sample, or a sample of elements drawn probabilistically. Table 3.1 highlights the differences between stratified sampling and cluster sampling.

Table 3.1: Differences between Stratified Sampling and Cluster Sampling

Factor	Stratified Sampling	Cluster Sampling (one stage)
Objective	Increase precision	Decrease cost
Subpopulations	All strata are included	A sample of clusters is chosen
Within subpopulations	Each stratum should be homogeneous	Each cluster should be heterogeneous
Across subpopulations	Strata should be heterogeneous	Clusters should be homogeneous
Sampling frame	Needed for the entire population	Needed only for the selected cluster
Selection of elements	Elements selected from stratum randomly	All elements from each selected cluster are included

Non-Probability Sampling is further divided into the following:

1. **Convenience sampling:** Convenience sampling attempts to obtain a sample of convenient elements. The selection of sampling units is left primarily to the interviewer. Often, participants are selected because they happen to be in the right place at the right time.

2. **Judgemental sampling:** it is a form of convenience sampling in which the population elements are selected based on the judgement of the researcher. The researcher, exercising judgement or expertise, chooses the elements to be included in the sample because it is believed that they are representative of the population of interest, or are otherwise appropriate.
3. **Quota sampling:** it is a two-stage restricted judgemental sampling. The first stage consist of developing control categories or quotas of population elements. In the second stage, sample elements are selected based on convenience or judgement.
4. **Snowball Sampling:** a strategy used to gather a sample for research study, in which study participants give the researcher referrals to other individuals who fit the study criteria. Snowball samples are usually used to investigate groups that have some unique, rare, or unusual quality and groups in which members know each other through an organization or common experience. For example, snowball samples might be used to identify marathon runners or cancers survivors who attend support groups.

3.1.5 Collection of Data

Having formulated the research problem, developed a study design, constructed a research instrument, and selected a sample, then collect data from which you will draw inferences and conclusions for the study. Depending upon your plans, you might commence interviews, mail out a questionnaire, conduct experiments and/or make observations.

3.1.5.1 Tools for Data Collection (Research Instruments)

The construction of a research instrument or tool for data collection is the most important aspect of a research project because anything you say by way of findings or conclusion is based up the type of information you collect, and the data you collect is entirely dependent upon the questions that you ask your respondents. The famous saying about computers- “garbage in garbage out” is also applicable for data collection. The research tool provides the input into study, and therefore, the quality and validity of the output (the findings), are solely dependent on it.

3.1.5.2 Guidelines to Construct a Research Tool

The underlying principle behind the guidelines suggested below is to ensure the validity of your instrument by making sure that your questions relate to the objectives of your study.

- Step I: Clearly define and individually list all the specific objectives or research Questions for your study.
- Step II: For each objectives or research questions, list all the associated questions that you want to answer through your study.
- Step III: Take each research question listed in step II and list the information required to answer it.
- Step IV: Formulate question(s) to obtain this information.

3.1.5.3 Questionnaire

A questionnaire consists of a set of questions presented to a respondent for answer. The respondents read the questions, interpret what is expected and then write down the answer themselves.

Interview Schedule: It is called an interview Schedule when the researcher asks the questions (and if necessary explain them) and record the respondent's reply on the interview schedule. Because there are many ways to ask a question, the questionnaire is very flexible. The questionnaire should be developed and tested carefully before being used on a large scale. There are three basic types of a questionnaire:

- i. Closed-ended
- ii. Open-ended
- iii. Combination of both

3.1.6 Processing and Analysing Data

Processing and analysing data involves a number of closely related operations which are performed with the purpose of summarizing the collected data and organizing these manner that they answer the research questions (objectives). The Data Processing operations are:

1. **Editing:** This is a process of examining the collected raw data to detect errors and omissions and to correct these when possible.
2. **Classification:** This is a process of arranging data in groups or classes on the basis of common characteristics. Depending on the nature of the phenomenon involved.
3. **Tabulation:** This is the process of summarizing raw data and displaying the same in compact form for further analysis. It is an orderly arrangement of data in columns and rows.

Tabulation is essential because;

1. It conserves space and reduce explanatory and descriptive statements to a minimum.
2. It facilitates the process of comparison
3. It facilitates the summation of items and the detection of errors and omissions.
4. It provides the basis for various statistical computations.

Tabulation may also be classified as simple and complex tabulation. Simple tabulation generally results in one way tables that supply answers to questions about one characteristic of data only. Complex tabulation usually results to two- way tables (which give information about two inter-related characteristics of data), three-way tables or still higher-order tables, also known as manifold tables.

3.1.6.1 Data Analysis methods

Data analysis methods include both qualitative and quantitative approaches which may involve the usage of the computer.

Qualitative Data Analysis: This is a very personal process with few rigid rules and procedures. For this purpose, the researcher needs to go through a process called Content Analysis.

Content Analysis means analysis of the contents of an interview in order to identify the main themes that emerge from the responses given by the respondents.

Quantitative Data Analysis: This approach is most suitable for large well designed and well-administered surveys using a properly constructed and worded questionnaire. Data can be analysed either manually or with the help of a computer.

Data Analysis using a Computer: if you want to analyse data using a computer, you should be familiar with the appropriate program. In this area, knowledge of computers and statistics plays an important role. The most common software is SPSS (refer to Module Six for detail note on ICT applications and SPSS). However, data input can be a long and laborious process, and if data is entered incorrectly, it will influence the final results.

3.1.7 Reporting the Findings

Writing the report is the last, and for many, the most challenging stage of the research process. The report informs the world what you have done, what you have discovered, and what conclusions you have drawn from your findings. The report should be written in an academic style. Language should be formal and not journalistic.

MODULE FOUR

4.0 RESEARCH METHODS: EXPERIMENTAL, DESCRIPTIVE AND HISTORICAL METHODS

4.1 Research Methods and Design

As in any other project management task, civil construction for instance, when constructing a building there is no need buying materials or setting completion dates of various stages of the project until we know what sort of building is being constructed. The remaining decision is whether we need a bungalow, high-rise office building, a factory for the manufacturing of machineries, a school, a residential home or an apartment block. Until this is done, we cannot draw a plan, obtain permits, prepare a work schedule or buy materials. Likewise, social research needs a design or a structure before data collection or analysis can commence. A research design is not just a work plan. A work plan details what has to be done to complete the project but the work plan will flow from the projects' research design.

4.2 Research Design and Research Method

The role of a research design is to ensure that the evidence obtained enables us to answer the initial question as clearly as possible. Obtaining relevant entails specifically the type of evidence needed to answer the research question, to test a theory, to evaluate a programme or to accurately describe some phenomenon. In other words, when designing research, we need to ask; given this research question (or theory), what type of evidence is needed to answer the question (or test the theory) in a convincing way?

Research design deals with a logical problem and not a logistical problem.

Before a builder or architect can develop a work plan or order materials, they must establish the type of building required, its uses and the needs of the occupants. The work plan flows from this. Similarly, in social research, the issues of sampling, method of data collection (e.g. questionnaire, observation, document analysis), design of questions is all subsidiary to the matter of what evidence do I need to collect? So we can define research design as;

Research Design is a framework or plan for conducting a research project. It details the procedures necessary for obtaining the information needed to structure or solve research problems.

4.3 Types of Research Design

Figure 4.0 provides a summary of types of research design.

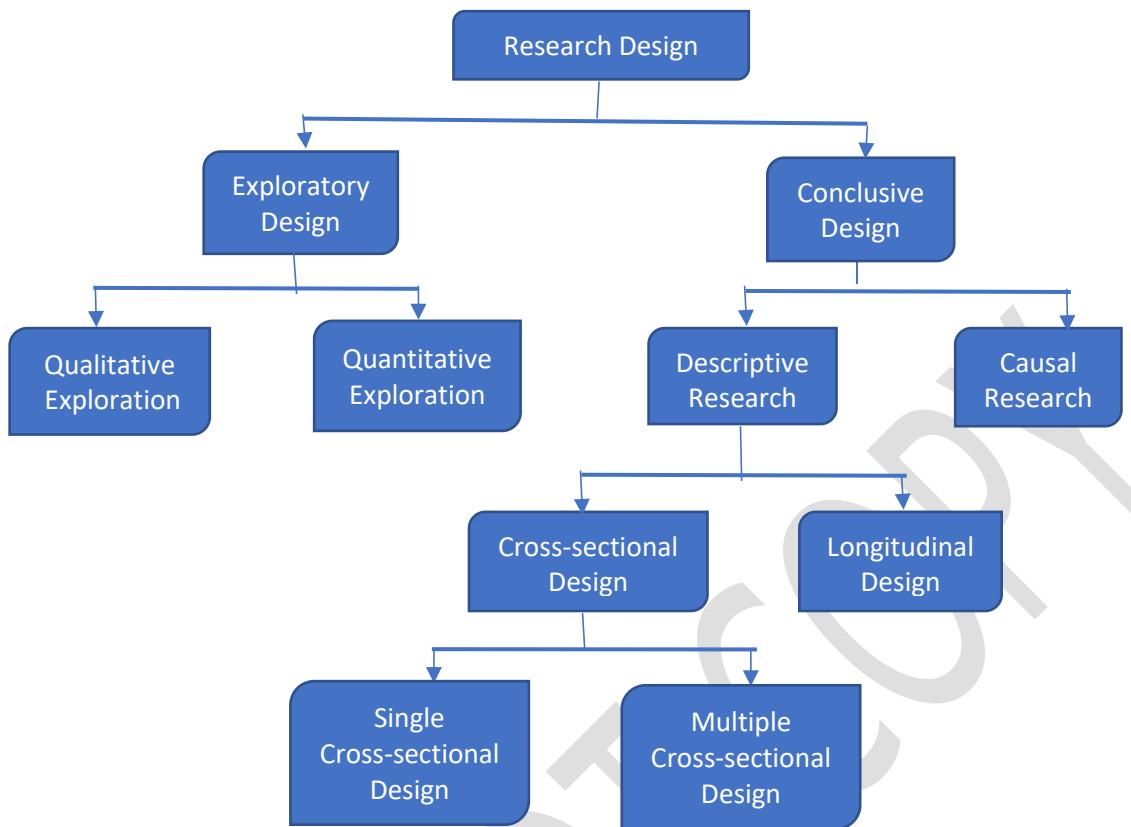


Figure 4.0: Types of Research Design

4.4 Research Methods

Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis in order to uncover new information or create a better understanding of a topic. Figure 4.1 compares research methods and research design.

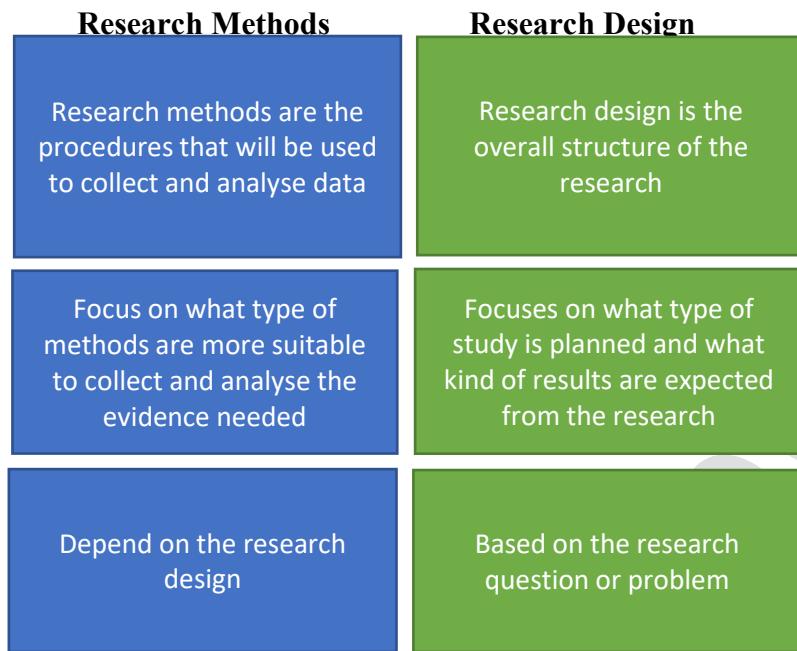


Figure 4.0: Research Methods vs. Research Design

4.4.1 Types of Research Methods

According to George J. Mouly, research method is classified into three basic types:

- i. Experimental Method
- ii. Descriptive or Survey Method, and
- iii. Historical method

4.4.1.1 Experimental Method

Experimental research method is oriented towards the discovery of basic relationship among phenomenon as means of predicting and eventually, controlling their occurrence into four types as given below;

1. Simple experimental design
2. Multivariate analysis
3. Case study
4. Predictive or correlation

4.4.1.2 Qualitative Methods and Quantitative methods

Qualitative research (QR)

QR is a way to gain a deeper understanding of an organization, culture, or event. Depending on what type of phenomenon you are studying, QR can give you a broad understanding of events, data about human groups, and broad patterns behind events and people. While traditional lab-based research look for a specific “something” in the testing environment, qualitative research allows the meaning themes, or data to emerge from the study.

Qualitative research uses **non-statistical methods** to gain an understanding of a population.

Types of Qualitative Research Methods

- i. Anthropological
- ii. Ethical Inquiry
- iii. Face-to-face interviewing
- iv. Participant observation

Qualitative research is about collecting and analysing data to explain phenomena.

Information from a sample is used to make generalizations or predictions about a population. Some questions that are easily answered using information from samples include:

- a. What percentage of primary school teachers in Nasarawa State are from the rural areas?
- b. How many females from Nasarawa State study ICT in the University compared to males?
- c. Has the secondary school graduation rate in Lafia Local Government Area of Nasarawa State increased over time?

However, data doesn't always naturally happen in a numerical way. You may want to answer questions like:

- i. What do secondary school students think of their Mathematics teachers?
- ii. What is the general opinion of secondary school students on Mathematics?
- iii. What do Shoprite customers in Abuja think of customer service?

Methods for Quantitative Research

These include;

- i. Experiment
- ii. Panel
- iii. Secondary data/ databases
- iv. Structured Observation
- v. Survey

Table 4.0: Differences between Qualitative method and Quantitative Methods

Qualitative Methods	Quantitative Methods
Methods include focus group, in-depth interviews, and reviews of documents for types of themes	surveys, structured interviews & observations, and reviews or records or documents for numeric information
Primarily inductive process used to formulate theory or hypothesis	Primarily deductive process used to test pre-specified concepts, constructs, and hypotheses that make up a theory
More subjective: describes a problem or condition from the point of view of those experiencing it	More objective: provides observed effects (interpreted by researchers) of a program on a problem or condition
Text-based	Number-based
More in-depth information on few cases	Less in-depth but more breadth of information across a large number of cases
Unstructured or semi-structured response option	Fixed response option
No statistical tests	Statistical tests are used for analysis
Can be valid and reliable: largely depends on the skill and rigour of the researcher	Can be valid reliable: largely depends on the measurement device or instrument used
Time expenditure lighter on the planning end and heavier during the analysis phase	Time expenditure heavier on the planning phase and lighter on the analysis phase
Less generalizable	More generalizable

Descriptive or Survey method

This is concerned with the present and attempts to determine the status of the phenomenon under investigation. This method has been further classified into four categories namely;

- i. Analytical
- ii. Descriptive or Normative
- iii. Genetic and
- iv. School survey

i. Analytical survey is of five types

- a. Critical incident,
- b. Documentary frequency,
- c. Factor analysis
- d. Observation survey,
- e. Rating survey,

ii. Descriptive survey is of four types

- a. Interview survey method,
- b. Questionnaire survey method,
- c. Testing survey method.

4.4.1.3 Historical Method

Historical method is concerned with the past and which attempts to trace the past as a means for seeing the present perspective. The historical method collects facts by going to the past in different periods. The sources of information include written records, newspaper, diaries, letters, traveller's account, etc. social researchers generally confine themselves to three major sources of historical information namely;

1. Documents and various historical sources to which historians have access
2. Materials of cultural history and of analytical history and
3. Personal sources of authentic observers and witnesses.

Historical method can be classified into three types:

- i. Documentary,
- ii. Historical and
- iii. Legal.

Moreover, the documents which you may study maybe personal documents like biographies, diaries, letters, and memoirs or maybe public documents like magazine and newspapers, and other published data.

MODULE FIVE

5.0

RESEARCH ETHICS

Research ethics is the application of moral rules and professional codes of conduct to the research processes which include the collection, analysis, reporting, and publication of information about research subjects, in particular active acceptance of subject right to privacy, confidentiality, and informed consent. In research, collecting data through any of the methods may involve some ethical issues (which may require some ethical clearance) concerning the researcher and the participants such as:

- a. Anyone who collects information for a specific purpose, adhering to the accepted code of conduct, is a researcher.
- b. Those from whom information is collected or those who are studied by a researcher become participants of the study.

5.1 Research Ethics related to the Researcher

5.1.1 Inappropriate use of Information

The use of information in a way that adversely affects the respondents directly or indirectly is unethical. If so, then the study population needs to be protected. At times it is possible to harm individuals in the process of achieving benefits for the organization. An example would be a study to examine the feasibility of restructuring an organization. The restructuring may be beneficial to the organization as a whole but may be harmful to some individuals.

5.1.2 Avoiding Bias

Bias is a deliberate attempt to either hide what you have found in your study or highlight something disproportionately to its actual existence. Bias on the part of the researcher is unethical.

5.1.3 Using Inappropriate Research Methodology

It is unethical to use a method or procedure you know to be inappropriate, e.g., selecting a highly biased sample, using an invalid instrument, or drawing wrong conclusions.

5.1.4 Provision or Deprivation of a Treatment

Both the provision and denial of a treatment or intervention may pose an ethical dilemma for you as a researcher. Is it ethical to provide a study population with a treatment or an intervention that has not been conclusively proven effective or beneficial? But if you do not test, how can you prove or disprove its effectiveness or benefits? There are no simple answers to these posers. Ensuring informed consent, 'minimum risk,' and frank discussion as to the implications of participation in the study will help to resolve ethical issues.

5.1.5 Incorrect Reporting

To report the findings in a way that changes or slants them to serve your own or someone else's interest is unethical.

5.2 Research Ethics related to research Participants

There are many ethical issues in relation to participants of research activity. These issues relating to the participants are discussed next.

5.2.1 Collecting Information

As a researcher, your request for information may put pressure or create anxiety on a respondent. Is it ethical?

Research is required to improve conditions. Provided any piece of research is likely to help society directly or indirectly, it is acceptable to ask questions if you first obtain the respondents' informed consent.

If you cannot justify the relevance of the research you are conducting, you are wasting your respondents' time, which is unethical.

5.2.2 Seeking Consent

In every discipline or field of study, it is considered unethical to collect information without the knowledge of the participant and their expressed willingness and informed consent.

5.2.3 Informed Consent

Informed consent implies that subjects are made adequately aware of the type of information you want from them, why the information is being sought, what purpose it will be put to, how they are expected to participate in the study, and how it will directly or indirectly affect them. It is important that the consent should be voluntary and without the pressure of any kind.

5.2.4 Providing Incentives

Most people do not participate in a study because of incentives, but because they realize the importance of the study. Is it ethical to provide incentives to respondents to share information with you because they are giving their time?

Giving a gift or present before data collection is unethical.

5.2.5 Seeking Sensitive Information

Certain types of information can be regarded as confidential or sensitive by some people and thus an invasion of their privacy, asking for such information may upset or embarrass a respondent. For most people, questions on the use of drug, age, income, marital status, etc. are considered as a bridge of their privacy or intrusive. Therefore in collecting data, you need to be careful about the sensitivities of your respondents.

It is not unethical to ask such questions provided that you tell your respondents the type of information you are going to ask clearly and frankly, and give them sufficient time to decide if they want to participate, without any significant inducement.

5.2.6 The Possibility of Causing Harm to Participant

As a researcher, when you collect data from respondents or involve subjects in an experiment, you need to observe carefully whether their involvement is likely to harm them in any way. Harm in this context includes research that might consist of hazardous experiments, harassment, anxiety, discomfort, demeaning or dehumanizing procedures, or invasion of privacy. If their involvement is likely to cause harm, you must make sure that the risk is minimal, i.e., the extent of harm or discomfort is not greater than that ordinarily encountered in daily life. If the way information is sought creates anxiety or harassment, you need to take steps to prevent such harm.

5.2.7 Maintaining Confidentiality

Confidentiality is an important factor to consider in data collection. Sharing information about a respondent with others for purposes other than research is unethical. Sometimes you need to identify your study population to put your findings into context. In such situation, you need to make sure that at least the information provided by the respondents are anonymized. It is unethical to identify an individual's responses. Therefore you need to ensure that after the information has been collected, the source cannot be known.

Apart from the above mentioned ethical issues, anything that will adversely affect the research project can be considered against the research ethics.

DO NOT COPY

MODULE SIX

6.0 APPLICATION OF ICT IN RESEARCH, ROLE AND TOOLS OF ICT

Information and Communication Technology (ICT) refers to technologies that provides access to information through telecommunications. It is similar to Information Technology (IT) but focuses primarily on communication technologies. This includes the internet, wireless networks, cell phones, and other communication medium.

ICT has provided the society with a vast array of new communication capabilities. For instance, people can communicate in real-time with others in different geopolitical locations using technologies such as video conferencing, Voice over IP (VoIP), Instant messaging. Social Networking websites like Twitter, LinkedIn, Facebook, allow users from all over the world to remain in contact and communicate regularly.

Information and Communication Technology (or Technologies) (ICT) is the infrastructure and component that enable modern computing.

Although there is no single definition of ICT, the term is generally accepted to mean all devices, networking components, application and systems that combined to allow people and organizations (non-profit organizations, businesses, government, etc.) to interact in a digital world.

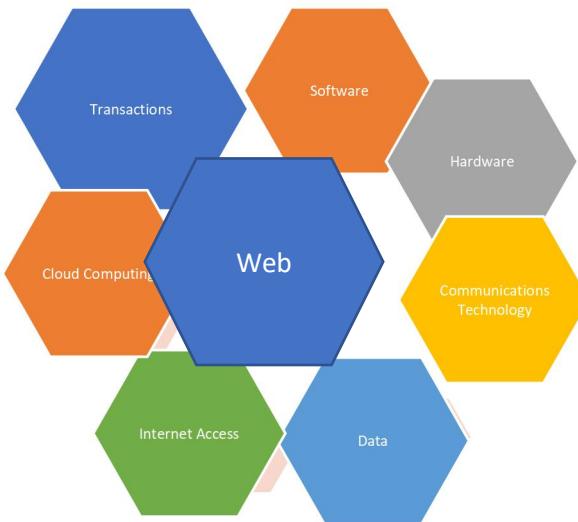
6.1 Components of an ICT System

ICT encompasses both the internet enabled sphere as well as the mobile one powered by wireless networks. It also include antiquated technologies such as radio, and television broadcast, and landline telephones all of which are still widely used today alongside cutting-edge ICT pieces such as artificial intelligence and robotics.

The list of ICT components is exhaustive, and it continues to grow. Some components, such as computers and telephones, have existed for decades. Others, such as smartphones, digital TVs and robots, are more recent entries.

6.1.1 Components of ICT

The term information and communications technology (ICT) is generally accepted to mean all technologies that, combined, allow people and organizations to interact in the digital world.



(Source: searchcio.techtarget.com)

6.2 Application of ICT in Research

Applications of ICT are mainly used by researchers for its ability to ease the knowledge-gathering process and to enhance resource development. Researchers in general values creativity and originality. Thus the ICT tools which provide with the most open situations with great autonomy to the researcher can really help in identifying and solving research problems in the most creative ways. The use of ICT is based on the individual's logical assessment of how various applications increase their effectiveness and efficiency in work and provide ease in communication with peers.

Use of ICT tools or application for making research data and information available are ubiquitous but the best use of ICT tools would be to improve cognitive skills and thus help discriminate, analyse, and create information rather than simply accumulate. Usually, research process deals with a large amount of complex information and requires a lot of skills to properly analyse and organize these, any ICT tools which helps the researcher gives meaning and precision along with adding values to the information generated would be preferred to the ones which help in just gathering information.

Generally, the applications of ICT help the researcher in the following research-related tasks:

- i. Identify appropriate information source;
- ii. Critically analyse information;
- iii. Research effectively;
- iv. Manage information;
- v. Use the information to extend and communicate knowledge across subject fields;
- vi. Search multiple databases and electronic resources simultaneously;
- vii. Receive results in a common format;
- viii. Link to individual databases for more specialised searching and
- ix. Select favourite resources and e-journals, save searches and records, and set up email alerts.

Applications of ICT have many effects on research. They can be classified into three (3) categories which include:

1. Applications of ICT in pre-data analysis
2. Applications of ICT in data analysis, and
3. Applications of ICT in post-data analysis

6.2.1 Application of ICT in pre-data analysis

Applications of ICT in pre-data analysis refers to the activities how ICTs are applied on activities of social science research before reaching the stage of data analysis.

ICT application in pre-data analysis includes:

- a. Literature Search, Article Availability, Thesis and Dissertation Availability
- b. Content Search
- c. Literature Tracking
- d. Data Collection

a. Literature Search

Previously, researchers need to perform a manual search on hard copies of literatures in libraries whereby this is a tedious effort and the search results were limited. On the contrary, a lot of research materials, literatures and artefacts today can be searched using internet search engines and databases. Below are some examples:

- i. **Google Scholar:** Provides a way to broadly search for scholarly literatures across disciplines and sources.
- ii. **Mendeley:** A unique platform comprising a social network, reference manager, article visualization tools.
- iii. **Microsoft Academic Search:** Find information about academic papers, authors, conferences, journals, and organizations from multiple sources.
- iv. **SSRN:** Multi-disciplinary online repository of scholarly research and related materials in social sciences.

Some other famous Database for Research Articles and literatures include:

- i. AMS
- ii. Annual Reviews
- iii. ASME Digital Collection
- iv. Cambridge Core
- v. Chemical Abstract Service (CAS)
- vi. Cochrane Library
- vii. eBook Academic Collection
- viii. EBSCO Databases, Discovery Service, eBooks, Point of Care Products, DynaMed and Journal Collections
- ix. EBSCO Information Services
- x. Economic and Political Weekly
- xi. Elsevier
- xii. Emerald eJournals
- xiii. Encyclopaedia Britannica
- xiv. IEEE Xplore
- xv. Indian Citation Index
- xvi. Indian Journals
- xvii. IOPscience
- xviii. JSTOR
- xix. Portland Press
- xx. Project Euclid

- xxi. Project MUSE
- xxii. ProQuest Databases
- xxiii. Royal Society of Chemistry Journals
- xxiv. Royal Society of Chemistry Publications Online
- xxv. Sage Online Journals
- xxvi. Science Mag
- xxvii. Scitation
- xxviii. SIAM Journals Online
- xxix. Springer Link
- xxx. Supreme Court Cases Online
- xxxi. Taylor & Francis Online
- xxxii. Web of Knowledge
- xxxiii. Wiley Online Library

b. Content Search

Researchers in today's world of research can utilize the softcopy literature's search or find function (also known as content search) to search for specific keywords or phrases in which this is more effective and productive. This observation is also supported what Sekaran (2003) had stated that online search using technology is inexpensive and can improve the identification of relevant sources of literature. Such content search also enables a researcher to evaluate quickly whether a particular article or thesis et al. is worthy for their deeper review. Moreover, the content search also helps a qualitative researcher to count the frequency of certain keywords appears in an interviewed transcript more effectively.

c. Literature Tracking

Previously, researchers have to sort, classify and store all their literature or artefacts that they had reviewed into computer folders or physical folders/place holders. They also need to create their own tracking mechanism for example, in a word document or spreadsheet format to track and manage their reviewed literature so that they can re-use or refer to in the future. Doing these manually can be daunting tasks.

With the advancement of ICT, researchers instead of using the old approaches are now using software like Mendeley which can help manage, share and discover the literature contents and contacts that they had reviewed. Using software like Mendeley to track a researcher's literature is saving time and effort as well as capable to manage lots of literature that the researcher was not possible to manage in the past.

d. Data Collection

With the help of application of ICT, Data collection can be collected via online, web-based or internet survey. Using this purpose-built software and internet technology which are greener technology in data collection can reduce the time and cost to collect surveyed responses from the respondents. Not only an online survey can be administered more effectively, but the data collected in its original format can also be input directly into the statistical software. Some important Data Collection Application of ICT include:

- i. Google Forms
- ii. SurveyMonkey

6.2.2 Applications of ICT in Data Analysis

Application of ICT in data analysis includes the ICTs that are applied on activities during the stage of data analysis and can be divided into:

- a. Quantitative Data Analysis
- b. Qualitative Data Analysis

a. Quantitative Data Analysis

The exploratory factor analysis, multiple regression, t-test and Analysis of Variance (ANOVA) are some common data analysis techniques used among researchers conducting quantitative research. There are also some advanced and popular data analysis techniques like path analysis, covariance-based Structure Equation Modelling (SEM), variance-based SEM (partial least squares), hierarchical regression analysis, hierarchical linear modelling etc. Examples of ICT tools for this kind of analysis include:

- i. R (R Foundation for Statistical Computing)
- ii. MATLAB (The Mathworks)
- iii. Microsoft Excel
- iv. SAS (Statistical Analysis Software)
- v. GraphPad Prism
- vi. Minitab

b. Qualitative Data Analysis

The following statistical software packages are for qualitative data analysis:

- i. NVivo
- ii. ATLAS.ti
- iii. MAXQDA
- iv. SPSS Text Analytics
- v. Transana can be used for video transcribing in certain qualitative research.

6.2.3 Application of ICT in Post-data Analysis

Application of ICT in post-data analysis refers to the ICTs that are applied on activities of research after completing the stage of data analysis which covers:

- i. References and Bibliography Compilation
- ii. Article and Thesis/Dissertation's Discussion among Researchers, Supervisors, Supervisees etc.
- iii. Plagiarism Detection
- iv. Journal Manuscripts Submission

i. References and Bibliography Compilation

Previously, researchers tends to compile references and bibliography manually. They literally type in to build the entire section of the references or bibliography then followed by sorting them in ascending order. In recent times with the help of ICT tools, while researchers are writing, they can use citation or reference manager software to help select citations and populate the references or bibliography automatically. This type of software can improve researchers' efficiency and accuracy while preparing their articles or theses. The following software are used for referencing and bibliography compilation:

- a. EndNote
- b. Zotero
- c. Mendeley

ii. Article and Thesis/Dissertation's Discussion

In the course of producing an article, thesis or dissertation, there are needs for discussions or communications among researchers, supervisors, supervisees or during the viva voce. Now, we have the advanced application of ICT to facilitate sharing of research materials, seeking comments from subject matter experts, enable analytics to monitor papers published, as well as following some scholarly works.

There are online platforms or websites which can be used for such discussion, examples include:

- a. Academia.edu

- b. ResearchGate

iii. Plagiarism Detection

In the past, plagiarism acts were slow and hard to detect as the authority of universities or journals depended on readers to identify them manually while they were reading through the submitted articles or theses/dissertations. With the advancement of ICT, readers or researchers can use plagiarism checker software available in the market like:

- a. Article Checker
- b. Turnitin
- c. Grammarly
- d. DupliChecker etc.

iv. Journal Manuscripts Submission

In the past, journal manuscript submission used to be by email communications between researchers or authors and journal's editors or coordinators. Now web-based journal manuscripts management and peer-review software, electronic manuscript submission or management systems are now commonly used among the community of researchers and journal/publishers. Using such system will not only reduce their time of submission but also checking the status of publishing. Moreover, using such systems can greatly improve the productivity and quality of work to administer the submission as well as the peer-review management in which miscommunication, lost or delay of communication can be minimized. The following are the application of ICT for Manuscripts Submission and Publishing:

- a. Elsevier
- b. Wiley
- c. Sage Publications
- d. Journal of Nigerian Society of Physical Sciences
- e. FUDMA Journal of Science etc.

Apart from the above-mentioned ICT tools for research, there is a long list of ICT applications which can be used for quality research papers and theses.

MODULE SEVEN

7.0 ICT TOOLS: MICROSOFT OFFICE IN RESEARCH

Microsoft Office is a suite of applications for office or personal use of which Microsoft Word and PowerPoint are part. Since the focus of this book is on ICT Tool in research, we will not be looking at all there is to this Software suite rather, we will focus only on those tools that basically enhances and support research. Although other tools like Microsoft Visio could be helpful especially in design and diagrams, our focus is on creating, editing, reviewing and presentation of research documents and articles among other things. Students of Engineering and Engineering related disciplines, Science, Technology, Computing and other related fields may wish to take a personal look at these other Applications shipped along in the Office Suite for their personal work but for this book, our emphasis is on Microsoft Word (MS Word or simply Word) and Microsoft PowerPoint (MS PowerPoint or simply PowerPoint).

The aim here is not to teach you from scratch how to use these applications but rather, to point out the features in these applications that support and enhances research work. So, if you do not know how to use these applications at all, you are advised to quickly take a course in Computer Appreciation or access some online resources that could help you bridge the knowledge gap.

7.1 Microsoft Word

Microsoft Word includes features that allow you to track the changes made by multiple users, as well as a review function that allows reviewers (e.g. your project supervisor) to insert their comments within a document. These features are very useful when you are part of a peer (or research) group assigned to work on a project together. They also provide a means for instructors or supervisors to comment on your work. It allows either your supervisors, a peer editor or the instructor to keep track of the comments and changes made by various reviewers.

Please note that tracking and reviewing features may vary between different versions of Word. For additional help with your specific version of Microsoft Word, we recommend you visit the [Microsoft Office Word support site](#).

What do you want to do?

- i. If you are a student who is creating a document for others to review, you need to know how to begin your document.
- ii. If you are an instructor or peer reviewer working with an existing document, you need to know how to track changes while you edit and add review comments.
- iii. If you are a student or author who will decide the final outcome of a document, you need to know how to accept or reject changes and delete comments.
- iv. If you are a student or author who must work with multiple versions of the same document, you need to know how to compare and merge documents.

Note that from this module forward, there is no particular order for studying this and subsequent modules except if you are totally a novice to Microsoft Office or Statistics. In that case, you may wish to read everything in sequence otherwise, you can quickly look up any Module that addresses your need in the course of your work quickly without having to read everything from the start.

Beginning your Document

If you want to set up a document for a peer editor or an instructor or supervisor to review after you've completed it, you must prepare your document for review. By enabling the Protect

Document feature, any changes or comments made by those who will be reviewing your document will be marked within the document.

After creating a document, you can enable the Protect Document feature as follows:

1. Open the document to be reviewed.
2. In the *Tools* menu, click *Protect Document*. (In Word 2013 and earlier versions, check *Review Menu*).
3. Select one of the following options as appropriate for your project:
 - i. Select *Track Changes* to allow other team members to change the document by inserting comments and track changes.
 - ii. Click *Comments* to allow other team members to only add their comments.
 - iii. Type an optional password to allow only authorized reviewers to add comments and changes.



If you need to type a document, there's a very strong chance you'll be using Microsoft Word. Every article, review, and tutorial that I write for Qwerty Articles is written in Microsoft Word. This word processor is the world's go-to software for document creation.

Microsoft has expanded its popular Office productivity suite into a modern-day subscription known as Office 365 or O365. With control of the market and providing access to everyone through a subscription, it has become a must-have for most writers.

We all use Microsoft Word, whether it be for personal use, work use, or school use. You can create anything your heart desires in this word processor, and it does its best at making it look professional and accurate.

With the latest version of Office 2016, Word received some serious features like automatically updating content for graphics if the information was gathered from an online source, but did you know that, introduced back in Word 2013, Word comes with an abundance of powerful editing tools?

When you create a document, you tend to make your own mistakes. You have already typed it, and therefore you know what it should say. You can misspell words or make grammar mistakes because your mind just assumes it's all correct. This is known as a typoglycemia.

If you are typing a document, your mind can think faster than your fingers can type and your eyes can miss even the most obvious mistakes. That is why it's always best to have someone peer review your content before printing or distributing it. That's why it is advised to get a friend or an editor to check your articles before you publish them.

Peer reviewing and editing allow someone who has never read the content to come in and make changes. Something may not make sense to them, or they may notice a run-on sentence. They can then bring this to the attention of the document creator. Even if the peer reviewer does not have a background in editing, their comments will still help to improve the document.

The objective of editing is not just to catch mistakes, but to allow you to learn from your mistakes. If you don't know what the reviewer/editor changed, you will continue to make that same mistake.

over and over again. They need to be able to inform you of what they changed. This is where Word's reviewing tools come in to play.

Word offers the ability to show and track all changes made by multiple contributors to the document. There's the ability to communicate within the document itself and ask questions through the built-in commenting system.

Whether you are writing a school paper, project reports, thesis/dissertation, or creating a résumé, drafting a business proposal, have someone use the Review Tab in Word to go over it. Join me as we dive into each button in the Word 2016 Review Ribbon tab. We will be going through each section and explaining its use. Lastly, follow along to learn about simple, yet easy to miss typing mistakes. If you have an older version of Word, you may check the *Review* menu or try to find out how to do stuff in that version as it is practically impossible for us to cover all versions of Word.

The Basics

The first section in the Review tab is the proofing section. By default, Word automatically applies these tools for you. Proofing consists of spelling and grammar, thesaurus, and word count. You've all seen when Word will inform us of a misspelt word or when you use the wrong form of 'its' or 'it's'. Misspelt words will receive a red squiggly line where you can right-click the word for MS Word to offer suggestions on what it thought you meant to type. The way this works is that MS Word has a local dictionary database installed on your computer. When a word is completed with a trailing space, it checks the typed string against this database. If the word matches a string in the database, it's often correct. If not, it will take the typed letters and attempt to find similar words with similar meanings.

If MS Word tells you that your last name is incorrect, you can add it to Word's dictionary. You can do this for any word that MS Word suggests is incorrect. When a word is underlined by the red squiggly line, right-click the word and select *Add to Dictionary*. When you add words to dictionary, just be warned that Word will always accept those words as valid words for all current and future documents. When you find yourself relying on Word's local dictionary to make spelling adjustments for you, you need to consider taking the time to fix the mistake yourself. It's easy to right-click the red underlined word and select the correct option, but you won't fix your mistake for the next time. Instead, look at how the incorrect word is meant to be spelt. Then, instead of autocorrecting the word, retype the word. Speak the letters aloud as you type them and over time you will efficiently and easily avoid misspelling those words.

Now, just because MS Word isn't putting a red squiggly line under the word, doesn't mean it's correct. Often words may sound the same when you say them aloud, but they could have two totally different meanings. Something to take note of with MS Word's spell checker is that it does not spellcheck uppercase words by default. To adjust this, you can go to the **File, Options** menu in MS Word. Select **Proofing** and untick the box that is labelled **Ignore words in UPPERCASE**.

Next, punctuation can make or break a sentence in your writing. It's important to use the correct usage for commas, periods, explanation marks, semicolons, and the many other punctuation marks that are available to us. Introductory clauses should be followed by a comma, to have a follow up of the beginning sentence. Recently, the gamers chatting system, Discord, introduced a spellchecker into their application. Amusingly to inform you of their new feature, they published the following change log:

Weave added a spell checker two Discord sew you can no when you've spelt things wrong.

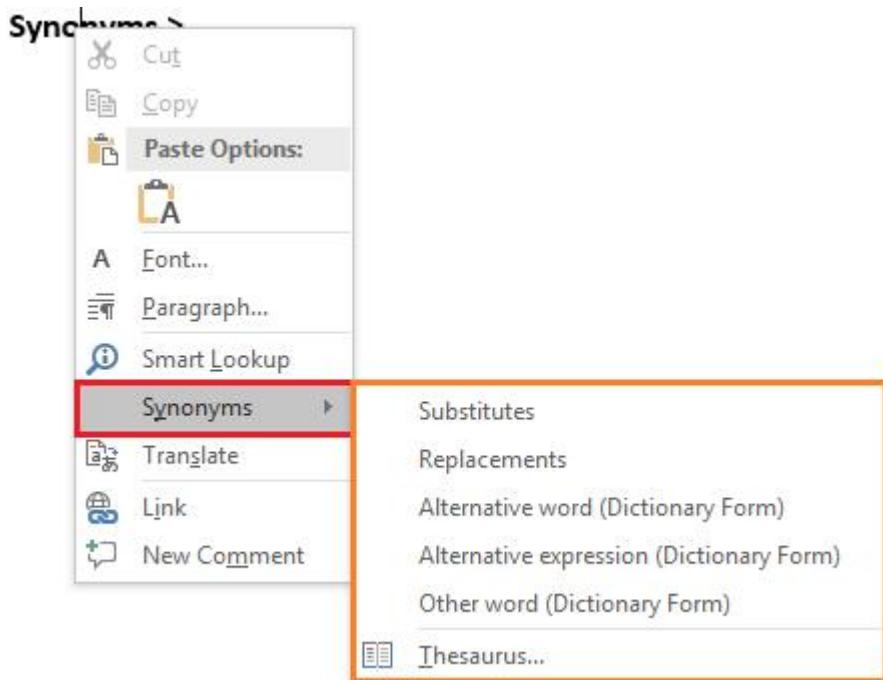
If someone read that sentence to you, it would sound correct because your brain assumes the correct spellings have been used. When you read through it yourself, your brain can pick up on the misspellings. MS Word's proofing is above average, but it's nowhere near perfect. In the above

sentence, it only caught two of five mistakes, disregarding the fact that the sentence doesn't flow properly. Underlined in blue, MS Word understands that people may mistake 'we've' for 'weave' and 'know' with 'no and offers suggestions to correct these. Blue underlined words are suggestions offered by MS Word, whereas red unlined words are errors.

The words 'two' and 'sew' go unnoticed. If you weren't to reread your own content or you brush over this sentence, people will notice your mistake after you've published it. MS Word does not have machine learning. Its static information is all it has to go on and so, common mistakes for misusing 'to', 'too', and 'two', go unnoticed. Even websites that are meant to check for grammar completely miss this sort of thing.

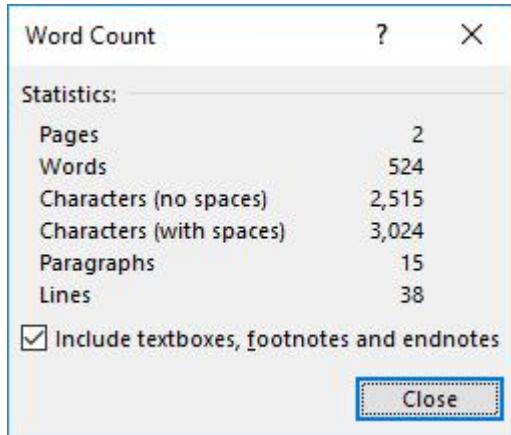
Next in the proofing section is MS Word's thesaurus. This feature is one of my favourite things about Word's proofing tools. At times, it may not provide the best solution, but it does help prevent repetition of the same word. If you find yourself using the same word over and over again in a document, you may want to find a slightly different word to help break up the sentence.

You can access the thesaurus in the *Review* tab at the top of MS Word, but it can be accessed quickly by right-clicking on a word and selecting *Synonyms* > as shown below for the word 'synonyms'.



The last and final section in the proofing category is about word count. Most personal and work-related documents won't have much call for this section, but it's useful for school papers or other items which have a word minimum or maximum (for instance, in Abstract where it is required not to be more than 400 words or so).

In the bottom left of MS Word, you will notice how many words are currently shown in the document. In fact, you can also find the number of pages and whether or not there are spelling and grammar issues down there too. Did you know that you can click on the word counter or access it in the *Review* tab? Clicking on the word counter will reveal additional facts about your document. These include number of pages, number of words, number of characters (no spaces), number of characters (with spaces), number of paragraphs, and number of lines contained within the document. This is illustrated below:



If you are a student trying to figure out how to get your latest homework assignment to be a certain page count, don't try to use the 'period increase' trick. Doing so only gives the falsehood that the document looks longer. If the teacher opens the document and checks the word count, they'll know something isn't right.

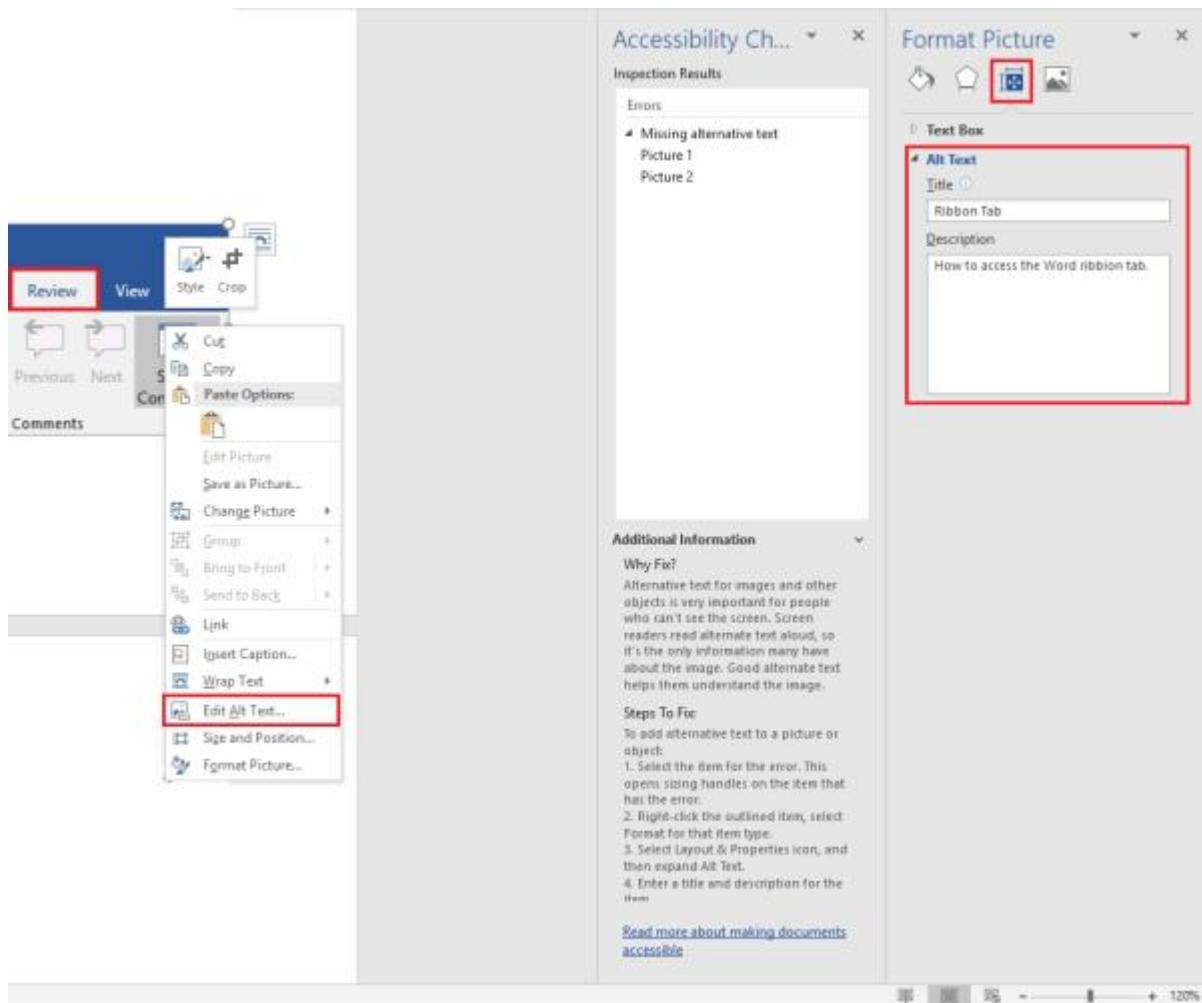
One fun fact that is now shown here is the amount of time you have spent using a document. In the File menu found at the top left of MS Word, you can see your total time editing a document in minutes. This document took a little over 500 minutes or 8.3 hours to create.

Assisting those who need Assistance (Physically Challenged)

Often accessibility is overlooked in MS Word. Many of us type our documents for school or personal use, and when typing for work it's often for an internal document. In the rare case you are sending a MS Word document to the masses, you may want to consider adding accessibility to the document. Accessibility is providing additional information to those with vision or comprehension issues. Word can scan for accessibility faults within the document to better assist those with vision and hearing problems. These faults include: missing alternative text for pictures, missing headers, or large open sections of nothingness.

Adding alternative text or alt text to a picture can help inform a reader what the image is trying to show. This is useful in two ways. With alt text, you can briefly explain what the image is attempting to say or add additional meaning to the image. If a picture is worth 1,000 words, help narrow it down to one meaning. Furthermore, alt text can be displayed if an image is not yet loading. This is common for web pages where alt text will be shown in place of a missing picture. This way, the reader understands what should have been there. The image below shows how to do this.





This document contains purple headers. We use purple headers which help to organize the content into sections. By doing this, a reader will understand when the document has moved on to the next section or that what they are reading is different from the past few paragraphs. Think of headers as chapters in a book. Often, headers should be emboldened or highlighted in a different colour or font. MS Word includes header tags under the *Home* tab and then within the *Styles* menu. Adding these to a work document is simple but adds a lot of professionalism.



The Art of Language

Much like accessibility, changing your language settings in MS Word is going to be one of those buttons that you rarely use, but as in-depth as this book is, it must be mentioned. Let's say that you work for an international company and need to send a message to all company employees. Word can translate a document to a bunch of different languages on the fly. You can opt to choose partial text or an entire document. If you are bilingual, you can also adjust your language *proofing* settings. Let's say you are trying to learn Arabic or French and want to practice writing. You can change your MS Word *proofing* language to Arabic or French and watch as it does as we mentioned before and puts red and blue squiggly lines under incorrect words. The below example is for Italian. Potrebbe non essere perfetta, quella di un madrelingua, ma hai metà otterrà almeno là!



Express your Thoughts

The next two subtopics are going to be the meat and potatoes of this topic. These two subtopics are the part that a supervisor, instructor, reviewer or editor should know well and understand how it all works.

Adding Review Comments

If you have received a document from someone else and want to make annotations or review comments within the document that do not change the text, you can add in review comments. Review comments can appear in one of two ways, depending on the layout view you have chosen. To add a review comment:

1. Put your mouse on the text for which you want to insert a comment.
2. Using the *Review* tool/menu bar, click on the insert comment  icon and begin typing your comment. Word will insert brackets in a unique colour and create a balloon "call out" in which you type in your comments.
3. Type your comment.

If you prefer to use the menu bar:

1. Put your mouse on the text for which you want to insert a comment.
2. From the *Insert* menu, click on *Comment*.
3. Type your comment.

As with the revision marks, MS Word uses a different colour for each user to distinguish among their comments.

When the user scrolls over the comment balloon, a ScreenTip appears that contains the commenter's name and the date and time the comment was made, just as occurs when tracking changes in a document.

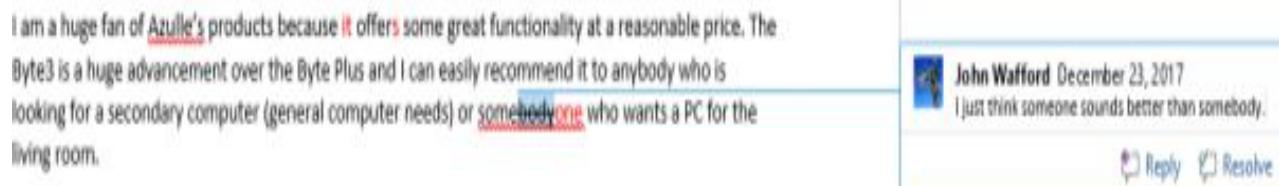
You can also see all the changes made to the document in one long list by activating the *Reviewing pane*. This feature can be activated by clicking on the *Reviewing Pane* icon  on the *Review* tool/menu bar.

If you wish, you can insert a voice comment as a sound object with the document. (This type of comment cannot be created without a sound card and microphone.) To do this, click on the arrow to the right of the Insert Comment icon. From the dropdown menu, choose Voice Comment. A Sound object box will appear. Click on the red dot to begin recording your voice comment.

Multiple comments can be added for the same text. Highlight the text again and the coloured brackets still appear. Click on New Comment and repeat the steps for adding a review comment. Another balloon with additional comments will branch off from the same text.

When editing a document, you want the content creator to understand why you are making a change, or if you have a 'to-do' document, you can comment on actions that you've taken to complete that certain task.

Under the commenting section, you can add comments to a document and write clear and concise information about why a change was made. Alternatively, if a sentence does not make sense, have the content creator adjust it for you; it will help them correct their own mistakes. An editor should be reading through the document with an unbiased view and reading it as if they have no understanding of the content. This will prompt questions and allow the content creator to make adjustments before final publication. For example, a comment is the perfect way of asking the content creator to explain what an abbreviation means, or when they feel that one word works better than another. In a recent review on the AzulleTech Byte3 Mini PC, someone had used the term 'somebody' as it is common to do when speaking aloud. However, it was pointed out that 'someone' may be better for writing documents, as shown below.



The distinction between 'everybody' and 'everyone' is subtle. While dictionaries often show them as interchangeable 'everybody' implies 'all of you' whereas 'everyone' implies 'each of you'.

The content creator and other peer reviewers/editors can reply to comments in the comment field in the right-hand pane. This offers extensive communication without the need to mark up the document and clearly identifies who is talking.

If you do not see comments in your Word document, access the *Review* tab in the ribbon. Under the **Comments** section, select the **Show Comments** button to activate it. When the button is greyed out, any available comments will show in their own panel.

Lastly, comments can be marked as '*Resolved*'. Going back to the to-do list, marking a comment as resolved could indicate that the commented task has been completed.



Editing the Document

Up until now, each section in this book has been paired with a subtopic in the *Review* tab within MS Word 2016. Here, we will be going into how to edit and Markup a document for the content creator to then accept or reject the changes. This will go into Tracking and Changes. As a supervisor or peer reviewer or an editor, it's important to Markup a document with spelling and grammar mistakes made by the content creator. The content creator will almost certainly miss something, and there will always be something to correct. They wrote it, they will think it's written correctly, and they will make mistakes because of that.

Tracking Changes while you edit

Before you begin making any changes to a MS Word document, select the **Track Changes** button in the *Review* Tab. Alternatively, as a content creator, you can *lock Track Changes* and force it to be on for all reviewers/editors rather than giving them the option to turn it *on* and *off*. When *Track Changes* is *on*, each change you, as a peer reviewer/editor, make in the document will be marked in the document. Pressing backspace on a word, space, or paragraph will add a strikethrough through that word, space or paragraph. Adding or editing words will automatically put them in coloured text. If you are a peer editor, supervisor, or an instructor who is going to revise a document that has not been prepared for review, you must first enable the *Track Changes* feature. This will ensure that any changes or comments that you add are tracked by MS Word. To do this,

1. Open the document you want to revise.
2. Click the *Track Changes* icon .
3. Begin editing the document, adding and deleting text as necessary.

If you prefer, you can use the menu to track changes:

1. Open the document you want to revise.
2. Click on the *Tools* menu.
3. Click on *Track Changes*.
4. Begin editing the document, adding or deleting text as necessary.

A major difference in the *Track changes* feature for MS Word is that changes and comments within a document will appear differently depending on which view you choose from the *View* menu. Because of this, it is important to note the view that has been chosen from the *View* menu. If you have chosen the *Normal view*, added text will appear in a colour unique to that particular user and be underscored. Deleted text will appear in colour and with a strike-through.

When a user rests the mouse on a change, a ScreenTip appears that contains the reviewer's or editor's name, the date and time the change was made, and the type of change (for example, Inserted.). Below is an example of what the ScreenTip looks like.

- Does the author have the authority to prese
- Does the au **Instructor, 2/8/2002 4:24 PM:** ha
- information **Deleted**
- **When was the site created and updated?**

MS Word automatically assigns unique colours to the first eight reviewers of a document. Word distinguishes among the different users according to the *User Information* tab usually, your name is automatically entered when the MS Word application is installed on your computer. To confirm that the information provided there is correct, follow these steps:

1. From the *Tools* menu, select *Options*.
2. Click on the *User Information* tab.
3. Ensure that the information is correct and click **OK**.

If you have chosen the *Web Layout* or *Print Layout* view from the *View* menu, added text will be underscored and in a unique colour. Deleted text will be indicated by a small arrow and a broken line that leads to a balloon containing the text that has been deleted. Below is an example of what deleted text looks like in the *Web Layout* or *Print Layout* view. Here, the word ‘sound’ was deleted from between ‘contrary’ and ‘opinions’.

contrary, opinions based
e. However, to be an alert Deleted: sound

Another way to display the marked up text is to use the *Show* menu that appears on the *Review* tool/menu bar. By clicking on *Show*, you can choose to display comments, insertions and deletions, and formatting. Again, this feature allows you to control which types of changes you want to view.

There are four views or versions of marked up text. They are:

- Original, which displays the document with all changes rejected
- Original Showing Markup, which displays inserted text as balloons and deleted text as underscored
- Final, which displays the document as it would appear with all the changes accepted
- Final Showing Markup, which displays the marked up deleted text in balloons and inserted text as underscored

Another way to view your Markup changes is to click on *View* and select *Markup*. This technique also allows you to display balloons and underscoring. Let’s return to the Discord change log statement and make edits to it using Track Changes.

~~Weave added a spell checker two Discord sew you can no when you've spelt things wrong.~~

With Track Changes turned on as we begin to correct the above statement, we should see the following:

~~Weave~~ We've added a spell checker ~~two~~ to Discord, ~~sew~~ so you can ~~ne~~ know when you've spelt things wrong.

Do not make this common mistake when using *Track Changes*: When deleting a word, do not add a space to your change, otherwise, when using the “*accept changes*” feature in MS Word, you would be accidentally adding spaces to the content creators document, thereby introducing grammatical mistakes.

In the above edit, notice how all of the red words are words that I’ve added, and they butt up against the old word. If I had written them with a trailing space after each word, it would be incorrect. Also, notice how the words that I have deleted receive a *strikethrough* through them. This indicates deletion, and they will be removed.

When editing a document using ***Track Changes***, ensure that you have ***Simple Markup*** turned *on* in the *Tracking* menu found in the *Review* tab. For the document owner, a red vertical bar on the left side of the document will appear next to edited content indicating something was changed, as shown below.

We've added a spell checker to Discord, so you can know when you've spelt things wrong.

Simple Markup is what is shown in the image above, and its best used by editors as it will avoid the common mistake of adding a space to inserted words. They can also see it in its correct simple form. When the content creator receives their document, all Markup lets them see the changes that have been made.

Before diving into the *accepting or rejecting changes and deleting comments subtopic*, understand, as a content creator, why a change was made. Prevent mistakes in the future by rereading your content aloud or take notes of why the change was made.

Accepting or Rejecting Changes and Deleting Comments

You can choose to accept or reject changes or you can delete comments made by your peer editor, instructor or supervisor. To do this, you must first ensure that you are able to view the comments and Markup changes. To view all changes and comments from the *View* menu, click on *Markup*. You can then review each item separately, accept all changes at once, or delete comments and reject changes all at once.

To review each item in sequence, click on the *Next* icon . This action will highlight the next change or comment. At this point, you can reject or accept a change or delete a comment.

To accept each change individually, click on the small down arrow that indicates where a change has been made. Clicking on the down arrow will cause the dashed line that displays the type of change made to become solid and bold. To accept the change, click on the *Accept Change* icon . This action incorporates the change into the document; it is no longer a marked change.

To reject each change individually, click on the change as described above. *Next*, click on the *Reject Change* or *Delete Comment* icon  as the case may be. This step will delete the change and revert that particular bit of text to the original version.

To delete a comment, click anywhere within the coloured brackets and click on the *Reject Change/Delete Comment* icon. This step will delete the comment and it will no longer appear in the document.

If you prefer, you can also print the review comments with the document. To do this, make sure that you have chosen *Print Layout* from the *View* menu. Make sure the comments and track changes are displaying in the format that you want them to display in your printed document. On the *file* menu, click *Print*. Under the *Print what* list, choose *Document showing Markup*, and then click *OK*. This procedure will ensure that the document prints any tracked changes or comments in your document. Once you've looked at all of the changes to the documents, as a content creator, you can accept them one-by-one or take the easy route and accept them all at once. Likewise, you can choose to reject some or all changes.

With *All Markup* turned on, use the *Accept* or *Reject* buttons to go one by one or use their respective drop-down menus to select all accepts/rejects. Moreover, you can review changes by using the *Previous* and *Next* buttons within this same section.



Track Changes in MS Word (II)

Turning on Track Changes gives you and your team a way to make changes that are easy to spot. The changes are like suggestions that you can review, and then remove them or make them permanent.

WindowsmacOS NewermacOS 2011WebOffice for iOS

To turn Track Changes on and off, do these;

- On the **Review** tab, go to **Tracking** and select **Track Changes**.



- When Track Changes is on, deletions are marked with a strikethrough, and additions are marked with an underline. Different authors' changes are indicated with different colours.
- When Track Changes is off, MS Word stops marking changes, but the coloured underlines and strikethrough from your changes remain in the document until they're accepted or rejected.

Note: If the **Track Changes** feature is unavailable, you might need to turn off document protection. Go to **Review > Restrict Editing**, and then select **Stop Protection**. (You might need to provide the document password.)

Show or hide comments or tracked changes

Display all changes inline

The default in MS Word is to display deletions and comments in balloons in the margins of the document. However, you can change the display to show comments inline and all deletions with strikethroughs instead of inside balloons.

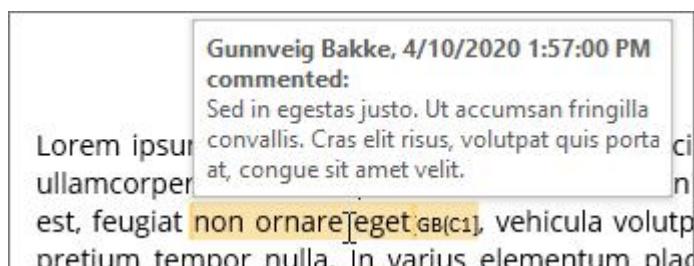
1. On the **Review** tab, go to **Tracking**.
2. Select **Show Markup**.



3. Point to **Balloons** and select **Show All Revisions Inline**.

View inline comments as ScreenTips.

- Rest the pointer on a comment in the document. The comment appears in a ScreenTip.



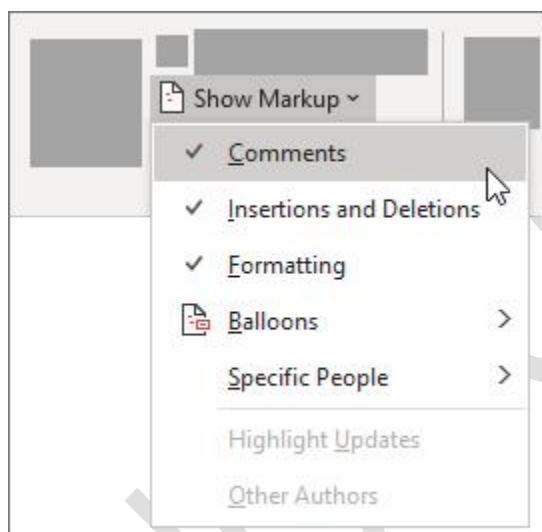
Display changes by type of edit or by reviewer

1. On the Review tab, go to **Tracking** and select **Show Markup**.
- 2.



3. Do one of the following:
 - Select the type of change that you want to display.

For example, select **Comments**, **Insertions and Deletions**, or **Formatting**. The check mark next to the item indicates that the item is selected.



Important: Even if you hide a type of Markup by clearing it on the **Show Markup** menu, the Markup automatically appears each time the document is opened by you or a reviewer.

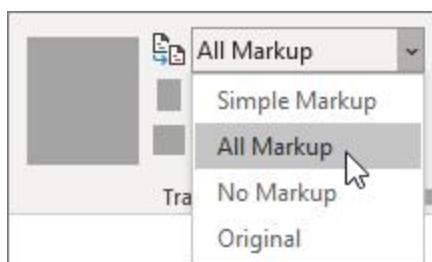
- Point to **Specific People**, and then clear all check boxes except the ones next to the names of the reviewers whose changes and comments you want to show.

Note: To select or clear all check boxes for all reviewers in the list, select **All Reviewers**.

Display changes and comments for specific reviewers

An editor or reviewer usually wants to view a document as it will appear after their changes are incorporated. This procedure gives an editor or reviewer the opportunity to see how the document will look with the changes.

1. Go to **Review > Tracking > Display for Review**.

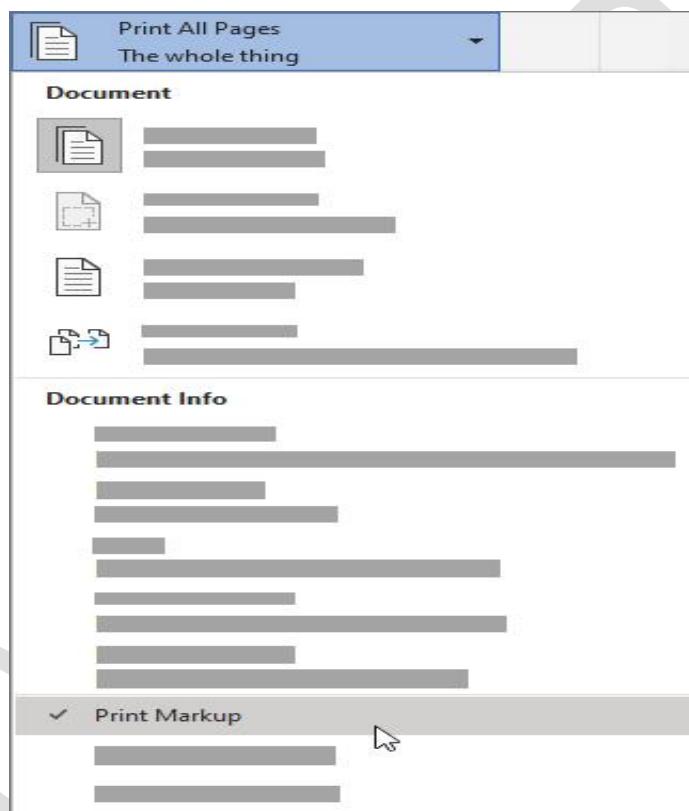


- Choose the option you want:
 - To review the changes, indicated by a red line in the margin, choose **Simple Markup**.
 - For a detailed view of the changes, choose **All Markup**.
 - For a preview of how the document will look if you make all the suggested changes permanent, choose **No Markup**.
 - To view the original document as if all the suggested changes were removed, choose **Original**.

Hide tracked changes and comments when printing

Hiding changes does not remove changes from the document. To remove Markup from your document, use the **Accept** and **Reject** commands in the **Changes** group. To do this:

- Go to **File > Print > Settings > Print All Pages**.
- Under **Document Info**, select **Print Markup** to clear the check mark.



Review, accept, reject, and hide tracked changes

Review a summary of tracked changes

Using the *Reviewing Pane* you can quickly ensure that all tracked changes have been removed from your document. The summary section at the top of the *Reviewing Pane* displays the exact number of tracked changes and comments that remain in your document. The *Reviewing Pane* also allows you to read long comments that don't fit within a comment bubble.

Note: The *Reviewing Pane*, unlike the document or the comment bubbles, is not the best tool for making changes to your document. Instead of deleting text or comments or making other changes in the *Reviewing Pane*, make all editorial changes in the document. The changes will then be visible in the *Reviewing Pane*.

1. On the Review tab, go to **Tracking** and select **Reviewing Pane**.



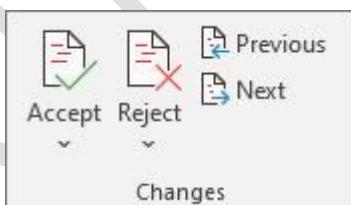
2. Do one of the following:
 - To view the summary at the side of your screen, select **Reviewing Pane Vertical**.
 - To view the summary across the bottom of your screen, select **Reviewing Pane Horizontal**.

By default, the Reviewing Pane shows at the top how many total revisions are in the document. To see the number and type of the changes, select the carat next to the number of revisions.



To Review each tracked change in sequence

1. Click or tap at the beginning of the document.
2. On the Review tab, go to **Changes**.
3. Select **Accept** or **Reject**. As you accept or reject changes, Word will move to the next change.



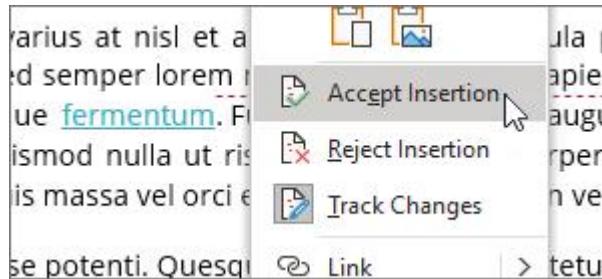
4. Repeat until there are no more tracked changes or comments in your document.

Tip: To review changes in the document without accepting or rejecting them, select **Next** or **Previous**.

Accept or reject a single change

Rather than move through changes in sequence, you can accept or reject a single change. When you accept or reject the change, Word will not move to the next change in the document.

- Right-click the change and select the option to accept or reject it.



Review changes by type of edit or by a specific reviewer

- Click or tap at the beginning of the document.
- On the **Review** tab, go to **Tracking**.



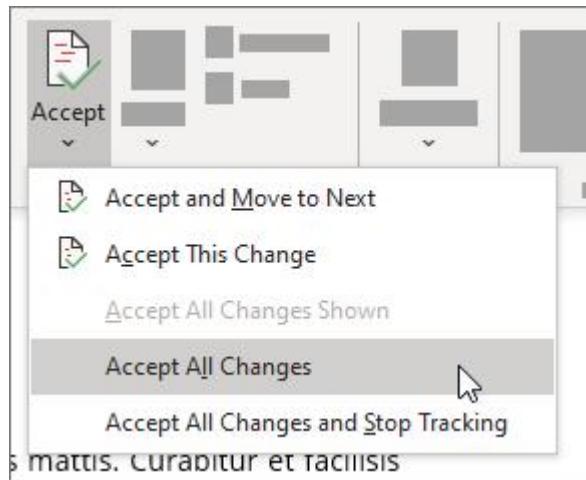
- In the **Show Markup** list, do one of the following:
 - Clear all check boxes except for those next to the types of changes that you want to review.
 - Point to **Specific People**, and then clear all check boxes except those next to the names of the reviewers whose changes you want to see or choose **All Reviewers** to select or clear the check boxes for all reviewers in the list.
- On the **Review** tab, go to **Changes**.
- Select **Accept** or **Reject**. As you accept or reject changes, Word will move to the next change.



- Repeat until you've reviewed all of the changes in your document.

Accept all changes at the same time

- Go to **Review > Changes**.
- In the **Accept** list, select **Accept All Changes** or **Accept All Changes and Stop Tracking**.



Accept or reject all changes at the same time

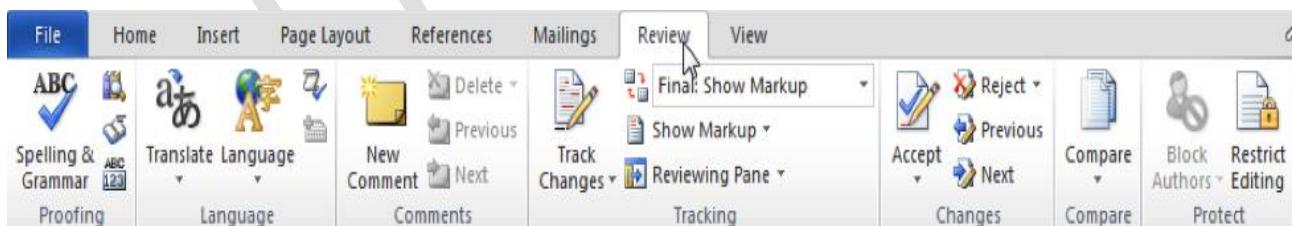
1. On the **Review** tab, go to **Changes**.
2. Do one of the following:
 - In the **Accept** drop-down list, select **Accept All Changes**.
 - In the **Reject** drop-down list, select **Reject All Changes**.

Commenting and Reviewing

You will be sending your documents back and forth with your faculty advisors throughout your writing process. Before you send your document, you should enable the *Track Changes* feature. Any changes your advisors make to your document will be recorded, so you can approve or reject that change later.

On the Review Ribbon in the **Tracking Group**, click on the Track Changes icon to highlight it and enable it. Then, just type in your document as normal, and any change you make will be tracked. Different colors will represent different people commenting on the same document. The colors will change automatically with the different users. To disable track changes, repeat this step.

- Use **Comments** if you have a general comment rather than a specific suggestion.
- To turn off the balloons, click on the Balloon's icon, under *Show Markup* and choose *Show All Revisions Inline*.



Using Tracked Changes

With *balloons* turned *on*, all changes (except added text) display in the right margin, including comments. This includes formatting changes such as bold, italic, etc. as shown below.

Introduction

Technology is becoming ~~more~~ pervasive in all aspects of **faculty** members' lives, and many busy faculty ~~members~~ don't have the skills they need to use these new tools efficiently in their work. While the "early adopters" of ~~technology~~^{LAS1} at the University of Michigan (<http://www.umich.edu>) were ~~served by~~ served by existing facilities and programs, there were no facilities and few programs designed for the large number of less computer savvy faculty. Two years ago, as the University began to explore distance learning ~~opportunities~~, it became ~~obvious~~ that far too few faculty members possessed the technology skills that would enable sizable distance learning programs in the near future. In response to this, the Office of Academic Outreach built the Faculty Exploratory (<http://www.exploratory.lib.umich.edu>), a computer facility specifically designed to assist large numbers of faculty in learning to use computer technology. To date, a unique approach toward programs and outreach efforts have attracted over 700 "mainstream" professors to use the Exploratory, averaging almost 120 faculty members served each month.

A program as well as a facility, the Faculty Exploratory provides a combination of "just in case"

Deleted: increasingly
Formatted: Font: Bold
Comment [LAS1]: This is a general comment, not a specifically suggested change.
Deleted: well
Deleted: clear

Comment [LAS2]: Sure you want to say "mainstream" here?
Formatted: Font: Bold

Without *balloons* turned *on*, all changes are right in the text as shown below. Move your cursor over a comment to see a popup box of the comment.

Introduction

Technology is becoming ~~increasingly~~^{more} pervasive in all aspects of **faculty** members' lives, and many busy faculty ~~members~~ don't have the skills they need to use these new tools efficiently in their work. While the "early adopters" of ~~technology~~^{LAS1} at the University of Michigan (<http://www.umich.edu>) were ~~well~~ served by existing facilities and programs, there were no facilities and few programs designed for the large number of less computer savvy faculty. Two years ago, as the University began to explore distance learning ~~opportunities~~, it became ~~clear~~ ~~obvious~~ that far too few faculty members possessed the technology skills that would enable sizable distance learning programs in the near future. In response to this, the Office of Academic Outreach (<http://www.exploratory.lib.umich.edu>), a computer facility specifically designed to assist large numbers of faculty in learning to use computer technology, over 700 "mainstream"^{LAS2} professors to use the Exploratory, averaging almost 120 faculty members served each month.

Laurie Sutch, 3/10/2008 11:45:00 AM /www.exploratory.lib.umich.edu), a computer facility specifically designed to assist large numbers of faculty in learning to use computer technology, over 700 "mainstream"^{LAS2} professors to use the Exploratory, averaging almost 120 faculty members served each month.

Comparing and Merging Documents

If you have begun to make changes to a document and forgot to prepare it to track your changes, you can still record the changes that you made using the Compare and Merge Documents command or, if a reviewer working on your document has edited it without tracking the changes, you can compare the edited document with your original to see what changes were made. To do this;

1. Locate and open the document that contains the changes that weren't tracked.
2. On the *Tools* menu, select *Compare and Merge Documents*. The Compare and Merge Documents dialog box appears.
3. Open the original document (or the document with which you want to compare changes).
4. Click the Merge down arrow, and then click *Merge into current document* if you want to add the changes into this document. By performing this step, deletions and changes from the document will be displayed in the current document. If you want to merge the changes into a new document, click on *Merge into new document*. As it implies, this step will create a new document in which all the changes and deletions are marked up.

You can reject or accept changes in this merged document as explained previously.

Opps!

Did someone save your document with a different name and make changes in it without using Track Changes?

Did somebody write a similar document that they need to compare to yours?

With the **Compare** option, Word can take two Word documents and compare one with the other for any changes. It will line them up side-by-side and show you similarities between them. This is excellent for legal or work documents that may have slight, but crucial alterations.

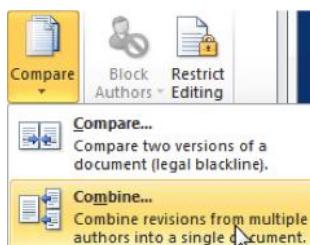
For example, students are fond of returning reports claiming to have made corrections without actually making them. In this case, supervisors can compare the old report with the new report to check if corrections were actually made. Similarly, if you were reviewing a contract as a lawyer and they ask you to sign an updated copy, you could choose to compare the updated copy with the previous to see the changes made.

Additionally, the compare section will allow you to combine two documents into one. Either replacing words or appending them to the bottom of a document.

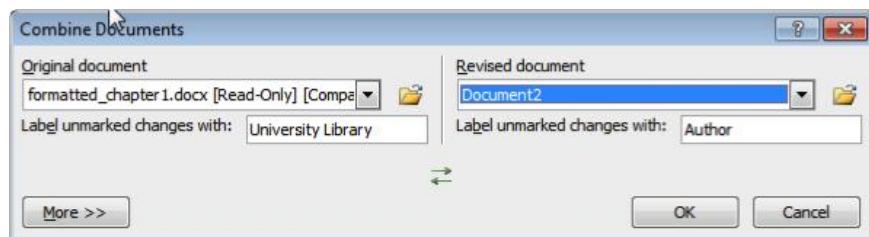
Merging Comments and Changes into One Document

Once everyone has made their changes and comments, you may need to combine everyone's documents into one final document for review. To do this;

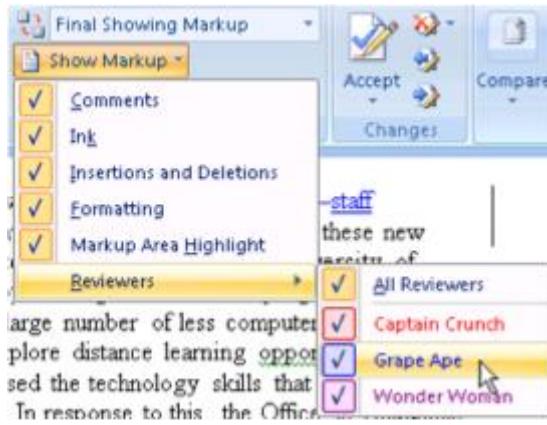
1. On the Review Ribbon, in the **Compare Group**, click on the Compare icon and choose *Combine*.



2. In the resulting dialog box, choose your original document on left side and the revised document on the right side (click on the Folder icon to browse through your files).
3. Click *OK* to exit the dialog box.
4. Repeat as needed until everyone's documents are combined into one. Notice that a new, combined document is created each time – you only need to save the one that has everyone's changes together.



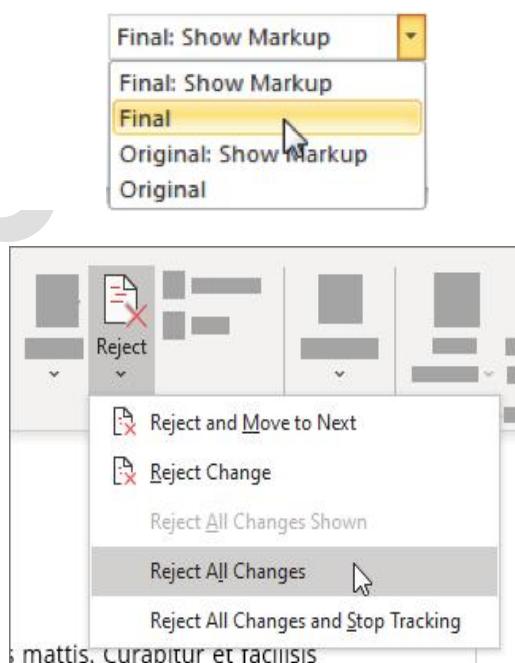
Each person's changes will appear in a different color, so you can easily see who said what. To look at the changes by a single individual, click on the arrow to the right of the Show Markup icon (in the **Tracking Group**), go down to *Reviewers*, and choose the single person you want to look at.



Accepting and Rejecting Changes

Once you have all of the documents combined into one, you need to accept or reject all of the changes and comments. Normally, you will reject all comments—after you address the issue! Use the Next and Previous icons in the **Changes Group** of the *Review* Ribbon to move back and forth to the various changes.

- To accept a change, click on the changed text (or use the arrow to get to the change), and then click the Accept icon in the **Changes Group** of the Review Ribbon. You can accept all changes at once by clicking on the pulldown below the Accept icon and selecting *Accept All Changes in Document*.
- To reject a change, click on the changed text, and then click the Reject icon in the **Changes Group** of the Review Ribbon. You can reject all changes at once by clicking on the pulldown below the Reject icon and selecting *Reject All Changes in Document*.
- To view what your document would look like with all changes accepted, click on the top-most pulldown on the right side of the **Tracking Group** and select *Final*. Note that you will still need to accept or reject all the changes; this is just for viewing, you still need to accept or reject all of the changes before your document is complete.



Delete comments

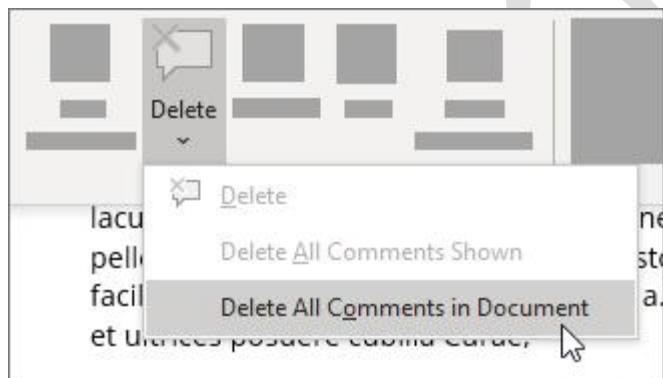
1. Select a comment.
2. On the **Review** tab, go to **Comments**, and select **Delete**.



3. Click **Next** or **Previous** to move to another comment.

Delete all comments

1. Select a comment.
2. On the **Review** tab, go to **Comments**.
3. In the **Delete** drop-down list, select **Delete All Comments in Document**.



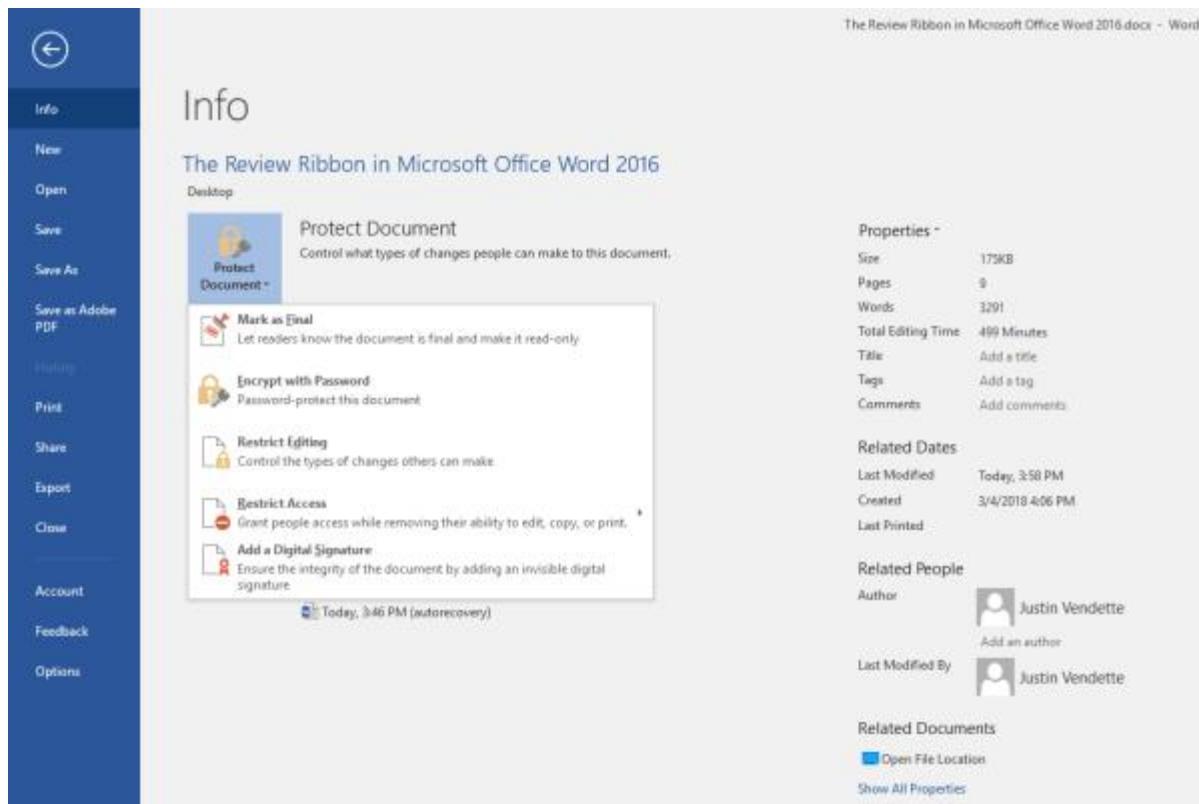
Lockdown

Let's say you've spent a long time editing a document and you like the look and feel of it. This document uses purple headers, and I like the look and feel of that. So, I would like to protect my document from editing those headers. Within the **Protect** section and under **Restrict Editing**, I can opt to choose certain formatting restrictions as well as force editors to edit only certain areas of the document. With editing restrictions turned on, I can force them to always use **Track Changes**, only be able to read the document, or only have access to commenting.

Additionally, I can select certain users to have an override permission that allows certain people to ignore the enforcement put in place by the restrict editor. When **Restrict Editing** is turned on, the content creator will be asked to create a password which will prevent other people from turning it off. Don't forget or lose this password as once placed it is needed again to turn off the restriction.

Not found in the Review tab, there are a few other lockdown permissions that can be put in place to protect your document.

Copyrighting your document is automatic. If you typed it in your own time, it's yours. Nobody can take this document and legally put it on their website for any reason without your consent. Alas, that doesn't stop people from doing that. If you are sharing a Word document with people and you want to lock down your content MS Word has you covered! Open the **File** menu from the upper Ribbon. Under the **Info** menu, select the dropdown for **Protect Document**.



Here, we have a few protection options. The first is to mark a document as a final copy, indicating that no further changes are necessary, yet you still wish to have people read it before publication. Next, you can encrypt this document with a password. Password encryption means only those with the password can open or even view the document. Don't forget the password as forgetting it would mean the document can never be opened again.

Restrict Editing follows on from what we have just talked about. You can further restrict editing by restricting access. Permit and Deny access for opening, reading, editing, copying, or printing can be made here.

Adding a digital signature to your document means you've signed the document. Nobody will be able to change this signature, and it permanently locks the document to your name. Similarly, you should be marked as the author of this document. Much like a book, you can add authors to the Word document if multiple people helped write the document.



Modern Technology, Preceding Markup

The last and final section in Word's **Review** tab is the **Ink** section. If a peer reviewer or editor wants to stick with their old fashion pen for editing, they can use a touchscreen computer and their finger/electronic pen to write on the screen. With the Microsoft Ink setting enabled, they can write on the document as if it were actual paper. Multiple colours and pen styles are available for different writing and Markup styles.

MODULE EIGHT

8.0

BIBLIOGRAPHIC CITATION AND REFERENCING IN MICROSOFT OFFICE WORD

Academic institutions and scientific publications demand references for all sources used in the course of writing articles, reports or thesis. Students and researchers often view this as a complicated process that requires too much time and effort. The complexity of this exercise, to the students, increases as there are various types of information materials consulted in the course of writing their research paper and related assignments (term papers, essays, articles, research projects, etc.). Information materials that could be cited or referenced to such research writings include all print and non-print materials such as books, journals, magazines, newspapers, reports, students' projects (like theses and dissertations), dictionaries, encyclopaedia, letters, lecture notes, posters, manuals, brochure, directories and, photographs. Other electronic resources include web pages, social network text, archived e-mails and messages, online audio and video files.

In this Module, citation and referencing process in MS Word is set out in detail. Students and researchers are reminded of the importance of citation and referencing. And, the four major or leading methods in the Nigerian academic milieu are given, namely; the Harvard, the American Psychological Association (APA), the Vancouver and the Modern Language Association (MLA) methods. They shall be fully analysed in this Module. But, before we proceed to the methods, let us keep note of some important issues that students and researchers will like to know.

8.1 Importance of Citation and Referencing

Although we gave explanations on Citation and Referencing earlier in Module Two, Section 2.2 is necessary to emphasize this again and to provide explanations on how to achieve this in MS Word. The followings are valid reasons why a student or researcher must refer to, quote and cite sources in his or her research writing:

- i. It is a proof that research is substantial and is based on facts.
- ii. It shows the theoretical foundation of the research.
- iii. It justifies the dependability, reliability and/or credibility of the research findings and conclusion.
- iv. It allows interested readers to track and follow the cited works for furtherance of knowledge.
- v. It is the only valid way to avoid plagiarism— an academic offence that attracts academic punishments such as denial of grade, certificate, qualification and other similar punishments.

8.2 Determining Citation and Referencing Method to Use

Different academic departments and faculties require different referencing method. This is also the case with scientific Journals and other professional publications. What the student or researcher should do first is to determine the requirement of his or her department, faculty or professional body (as per Journal publishing). Elaborately, and in the ambit of this Module, some of the academic departments or disciplines and the referencing method they usually subscribe to are presented in table 8.0.

Table 8.0: Distribution of Academic Departments and their likely Referencing Methods

Methods	The Subscribing Departments/Disciplines
Harvard Method	All Language Studies, History, Arts, and Literary studies, Theology, Sociology, Criminology, etc.
APA Method	Social and Behavioural sciences, Education, Library and Information Science, Management Sciences, Nursing.
Vancouver Method	Medicine, Computer Science, Mathematics, Statistics, Physics, Zoology, Plant and Biotechnology Departments, etc.
MLA Method	Linguistics and Literary Subjects

8.3 Where Does the Referencing Process Begin?

Accurate citation and referencing begin from noting down the materials that has potential for use from the start. In the course of searching for information in materials, the student or researcher should take note of the page(s), and if photocopies are made, the front and title pages of the material should also be photocopied so as to capture the bibliographic details of the information material that is being consulted. Most students and researchers photocopy book pages for their research writings and in the end discover that the author or source they have cited in the text cannot be described in the reference list. Hence, it should be noted now that the remedy to such experience is to keep record of all bibliographic records (discussed later in this chapter as essential components of every reference entry) as the searching and use of the information goes on.

8.4 Citation Approaches in the Text

There are four means according to which a student or researcher can cite a source or reference during scientific writing, these are:

- i. Source Referencing: This is done by placing the citation in brackets in the text at the precise place where the borrowed information occurs.
- ii. Secondary Referencing: This is done by citing to a particular citation (primary source) that is referenced in another given information material (the secondary source). That is to say that the student is making reference to a citation contained in, for instance, the book he is reading from. Thus, while the citation he has culled from the book is the primary source, the book he is directly reading from is the secondary source to that information he may have drawn. Both the primary and the secondary sources must be mentioned in the text, for example;

(Men are stronger than women (Uzuegbu, 2012, cited in Ibegwam, 2014).

But, only the secondary source should be listed in the reference/bibliography or in the list of “Works cited”. Thus, in the above example, Uzuegbu’s work is the primary source and is the major citation at the moment even though it was sourced from the book written by Ibegwam. Whereas, Ibegwam’s work is the secondary source, being the book that the student is presently reading and thereon stumbled on the citation made to Uzuegbu’s work. Hence, this kind of citation is known as secondary referencing.

- iii. Cross-Referencing: Any reference within a text to a specific item, for example a chapter, section, table, paragraph, etc., is a cross-reference. Such referencing must be as specific as possible. It must refer to the specific number of the item, rather than to the number of the page on which it appears, for example;

(see Table A.), (see Figure 2.1), (see Chapter 6)

Where the cross-reference is to a specific sentence, it must form part of that sentence, for example;

.... is called a killer (see Chapter 10).

Notice that the “see” above began with a lowercase. But where the cross-referencing is to an entire paragraph, it must be placed after the last sentence, and the “see” will start with a capital letter, for example;

.... is called a killer. (See Chapter 10.)

Study the two immediate examples to observe the difference between them. Moreover, note that the cross-referenced item is written with a capital letter.

- iv. Content Referencing: Content referencing is used within the text to provide additional explanation or discussion. According to Burger (1992), content referencing is used to:
- Refer the reader to other sources that can offer more information on a specific topic;
 - Clarify information in the text, for example by providing more information on people or places, explain foreign words, etc.;
 - Provide extra information that, although important, cannot be included in the text without disrupting its flow;
 - Expand on a standpoint; and,
 - Provide the original wording (in a foreign language) of a freely translated passage in a text.

Nonetheless, content referencing is comprised of two methods: endnotes and footnotes.

Endnotes appear on a separate page at the end of the write-up (before the reference/bibliography list and must be provided with a title such as ENDNOTES or NOTES. They are indicated in the text by means of superscript (raised Arabic numerals). Endnotes are more cumbersome than footnotes because the reader has to page back and forth to obtain the information.

Footnotes appear at the bottom of a page and are separated from the last line of text by additional space and/or a line, and/or a smaller font. They are also indicated in the text by means of superscript, which are preferably placed at the end of the sentence and usually after the punctuation mark, for example;

.... guinea worms¹ are not what human beings think they are.

¹ Guinea worms are silky organisms that produce life protection enzymes than poisons.

The above is a fiction statement to demonstrate the placement of a sample superscript and its corresponding footnote.

Summarizing this subsection, it is important to note that citations in a write-up could be in the form of direct quotation (lifting the information verbatim and indicated with quotation signs “ ”) or in the form of paraphrase (presenting another author’s information in one’s own language).

8.5 Essential Components of Every Reference

Generally, references to all kinds of information sources have to contain some essential components (bibliographic records). The essence is to give all the information as completely as possible to allow the reader to trace the correct sources. There are two main types of information sources: print and non-print sources.

Print Sources

The components that constitute each reference entry for print sources include:

- b. Author (it could be: a person as self-author(s) or as Editor(s), a corporate body, a government, a conference, etc.).
- c. The date of publication (the year of publication, which to some kinds of material includes day and month. But, where the year of publication is not seen, the copyright year is used but with a “c” sign before the date (e.g. c2014). Where there is no date, the abbreviation “n.d”, for no date, may be used.
- d. Title
- e. Edition
- f. Place of publication
- g. Publisher
- h. Volume, number and/or page numbers

Non-print Sources (Electronic Materials)

To accurately cite and reference electronic sources of information, the following basic information (which must appear in every likely credible electronic material) must be clearly visible where available;

- i. Name of the Author or Editor (if available)
- ii. Title of the page/article
- iii. Title of the web page (look on the site’s home page)
- iv. Type of medium (for example electronic journal, online)
- v. Date in which the website was updated or the copyright date
- vi. full internet address (URL) (for example <http://www...>)
- vii. Date on which the website was accessed

Now, we have shown the essential components of every single reference entry. But, it is also important to note that each referencing method (Harvard, APA, Vancouver, MLA) has its own unique style for inserting the components to form a reference entry. So, what constitute each method’s entry and how the entries are made and/or arranged is dependent on the referencing method. This chapter is set to demonstrate each method. Each of the methods shall be demonstrated to cover all the likely used information materials by students and researchers and also to show the entry difference in print and non-print sources.

8.6 Referencing Methods

As stated earlier, the referencing methods that constitute the focus of this section are: the Harvard, the American Psychological Association (APA), the Vancouver and the Modern Language Association (MLA) methods. They are treated one after the other in the subheadings below.

8.6.1 Harvard Method

This method is also known as the “author-date method”. It is used primarily in the humanities (see Table 8.0). Students and researchers in the academic departments and disciplines of the humanities faculty are compulsorily requested to write and format their term papers, essays, articles, projects and other researches on the Harvard method. This method has as general characteristics, the following:

- i. Cite the author(s) name(s), date of publication and page in the text (e.g. Uzuegbu, 2012:21). For more than one authors (Uzuegbu, 2012:21; Ibegwam, 2014:14). etc.
- ii. If author's name(s) forms part of the sentence, put the date and page in bracket.
- iii. Page(s) is necessary only in paginated works.
- iv. Use comma to separate author from date but use colon to separate date from page number(s).
- v. Quotations that are less than 40 words are integrated into a grammatically correct sentence and should fit into a well-structured paragraph.
- vi. If the quotation forms part of the sentence, the final punctuation mark follows the closing bracket of its accompanying citation.
- vii. Words omitted in the quotations are indicated with ellipses (...).
- viii. Quotations that are more than 40 words are placed in an indented paragraph without quotation marks.
- ix. Citations made in the text are listed systematically (as we shall see later on) as references at the last page of the write-up or as bibliography if it contains the list of other relevant materials not consulted and/or cited.
- x. Entries on the reference or bibliography are arranged alphabetically.
- xi. Only titles (for published works only) are italicized. Titles of non-published works are not italicized.
- xii. In the case of no identified author, the title of the work is used as author in text and reference list.

Now, several examples of the in-text citation and referencing formats are presented below. For the purpose of this book, “C” denotes citation while “R” denotes Reference.

Print Sources

Books: One author

C: Amina (2006:211) argues that women are wicked

R: Amina, C.A. 2006. *Women and their character*. Minna: Johnson Press

Books: Several books by one author

C: his claims have been rejected in research (Nnadozie, 2000:61; 2001:1; 2008:117).

R: These entries will be listed separately in the reference list/bibliography and arranged chronologically.

Books: Two authors

C: The study (Udo & Kennedy, 1993:14) show that

R: Udo, N. & Kennedy, V. 1993. *Modelling*. Singapore: McGraw Hill

Note that ampersand (&) is used as a conjuncture when the authors do not form part of the sentence. So, where the authors form part of the sentence, “and” is used for example;

C: Udo and Kennedy (1993:14) has shown that

R: Udo, N. & Kennedy, V. 1993. *Modelling*. Singapore: McGraw Hill

Books: More than two authors

C: a study has been conducted (Akin, Umeh, Obi, & Ogali, 2012: 21) which show

R: Akin, U. M., Umeh, M., Obi, F. U. & Ogali, C. 2012. *Screening in mammals*. Umuahia: Zeh Communications

In the citation, provide all the authors (no matter the number) and if reference is made to them again, present the first and represent others with *et al*. Yet, in the reference list/bibliography, all of them must be listed.

Books: Corporate bodies

C: ... has been proven by market research (Nigerian Ports Authority, 1998:44)R: Nigerian Ports Authority. 1998. *The Nigerian market*. Lagos.

Books: Unpublished conference paper

C: (Abokina, 1999:11)

R: Abokina, M. (1999). Weaving in traditional settings. Paper presented at the Nigerian Home Economists Conference. 12 February, Abuja.

Books: Conference paper in published proceedings

C: (Akidi, 2000:14)

R: Akidi, J. O. 2000. Teaching the use of library to undergraduates: issues and theme, in A. Ibegwam & U. Anago (ed.). *Issues and themes in use of library education in Nigeria: proceedings of NLA Umudike maiden conference*. Umudike: Michael Okpara University of Agric: 121-134.

Books: A translated work

C: (Serardi, 2004)

R: Sergardi, L. 2004. *The Satire*. R.E. Pepin (tr.). New York: P. Lang

Books: Work in press

C: (Abah, 2003)

R: Abah, J. 2003. The evolution of man (in press).

Books: A chapter in edited book

C: Ahanene, 2009:13)

R: Ahanene, M.M. 2009. Introduction to Physics, in C. Omekara (ed.). *Physics text for Africa*. Ibadan: Macmillian. 21-45.

Books: Unpublished Thesis and Dissertation

C: (Amadi, 2004:55)

R: Amadi, E. N. 2004. ICT use by drivers in Imo State. MSc thesis. Nsukka: University of Nigeria Nsukka.

Books: Sacred books like the Bible

C: (Genesis 3:19)

R: Genesis. 1998. *The Bible*. Benin: Bible Society of Nigeria

Journals: article in journal (italicize the title of the journal and not the title of article)

C: (Henry, 2009:11)

R: Henry, F. 2009. Animal breeding in hot climate. *Journal of Animal Society of Nigeria*, 4(2):1-18.

Weekly or daily periodicals (newspapers and some magazines)

C: (Jones, 2009:31)

R: Jones, K. 2009. Chinua Achebe's life style. *The Punch*, 24 June: 3.

Dictionaries and Encyclopaedia

C: Encyclopaedia Britannica, 1945)

R: Encyclopaedia Britannica. 1945. s.V. "PUNCK". London: Benton

Electronic references

C: (Department of Health, 2001)

R: Department of Health, Nigeria. 2001. HIV campaign [Online]. Available: <http://www.hiv.campagne/html/2001>, 12 October].

8.6.2 American Psychological Association (APA) Method

This method is used primarily in the social and behavioural science faculties (see Table 8.0). Students and researchers belonging to departments and disciplines in the behavioural sciences are required to write and format their term papers, essays, articles, projects and other researches on the APA method. Sample presentations and guides in this section is strictly in accordance with the 6th edition (2nd printing) rules of APA, although the 7th edition APA Manual, published in October 2019, is the most current edition of APA. Essentially, not much has changed to the way citations are formatted in APA 7th, so if you are comfortable with writing citations according to the 6th edition rules then it should be a smooth transition into the 7th edition and any other subsequent editions. This method has as general rules the following:

- i. Cite the author(s) name(s) and date of publication only. (Page number(s) is only required in direct quotations and subsequent citing for paginated works.)
- ii. For cases that require inserting page, the page number is written for example as “p.5” or “pp.12-17”.
- iii. If author’s name(s) forms part of the sentence, put only the date in bracket.
- iv. Use comma to separate author from date and page (for where page number is required) for example: (Uzuegbu, 2012, p.5).
- v. Quotations that are less than 40 words are integrated, grammatically, into the sentence, as a paraphrase or as quotation that must fit into a well-structured paragraph.
- vi. If the quotation forms part of the sentence, the final punctuation mark follows the closing bracket of its accompanying citation.
- vii. Words omitted in the quotations are indicated with ellipses (. . .)
- viii. Quotations that are more than 40 words are placed in an indented paragraph without quotation marks and not italicized.
- ix. If authors to a work are two, three, four or five in number, at first citation the names (surnames) of all authors should be stated and subsequently, the first author’s name should be used followed by word “et al.” written out without italicizing it.
- x. When there are six or more authors, use the last name of the first author followed by “et al” for the first citation in the text, as well as subsequent citations.
- xi. In the reference list, authors’ names are listed complete up to the seventh name but where they are more than seven, the ellipses sign (. . .) is used after the sixth author and afterwards insert the name of the last author.
- xii. The conjunction letter “&” is used for joining authors in the reference list were required but “and” is used for same purpose in the in-text citations.
- xiii. Citations made in the text are listed systematically (as we shall see later on) as references at the last page of the write-up or as bibliography if it contains the list other relevant works not consulted and/or cited in the write-up.

- xiv. Entries on the reference or bibliography are arranged alphabetically.
- xv. At the reference entries, only titles of works are italicized.

At this time, several examples of the in-text citation and referencing formats are presented below. As indicated earlier, “C” denotes citation while “R” signifies Reference.

Print Sources

Books

C: Dessler (2008) agree with United Nations (2003) that ...
R: Dessler, G. (2008). <i>Human Resource Management</i> (11 th ed.). London: PearsonPrentice Hall.
R: United Nations (2003). <i>Indicators for monitoring the millennium development goals: Definitions, rationale, concepts and sources</i> . New York: United Nations.

Chapter from an Edited Book

C: Uzuegbu and Aniedu (2012) opine that ...
R: Uzuegbu, C.P. & Aniedu, O.N. (2012). Information search and retrieval in the internet age: Is there any need for the librarian? In R.U. Ononogbo, A.N. Uhegbu, M.C. Nwosu and C.P. Uzuegbu (Eds.), <i>personnel issues in the 21st century librarianship</i> (pp. 91-101). Umuahia, Nigeria: Zeh Communications.

Dictionaries

C: The Webster Universal Dictionary and Thesaurus defines legumes as ...
R: <i>Webster Universal Dictionary and Thesaurus</i> (2007). New Lanak, Scotland: Geddes and Grosset.

Encyclopedia

C: Hanegraaff (2005) is of the view that the behaviour theories ...
R: Hanegraaff, W. (2005). New age movement. In L. Jones (Ed.), <i>Encyclopaedia of religion</i> (2nd ed., Vol. 10, pp. 6495-6500).

Journals

- C: Toxins are dangerous to rabbits (Shaffril and Uli, 2010).
- R: Shaffril, H. & Uli, J. (2010). The influence of socio-demographic factors on work performance among employees of Government agriculture agencies in Malaysia. *The Journal of International Social Research*, 3 (10), 459-469.

Magazines

- C: Allan (2004) agrees with the findings of ...
- R: Allan, B. (2004, March). The food fight. *Consumer*, 438, 8-11.

Newspapers

- C: Poultry meat in Nigeria is . . .
- R: Akinwumi, H. (2013, July 14). The future of animal food production. *The Guardian*, p.B2,B14.

Technical Reports

- C: The working document of Nurses in Afikpo (National League for Nursing, 1990) . . .
- R: National League for Nursing. (1990). *Self-study report for community health organizations* (Pub. No. 21-2329). New York, NY: Author.

Brochures/Pamphlets

- C: Probation students in MOUAU have the right to shop for departments ...
- R: Michael Okpara University of Agriculture, Umudike. (2004). *Students handbook* [Pamphlet]. Author.

Published conference proceeding

- C: Ezeani, Eke and Ugwu (2012) submit that professionals are those ...
- R: Ezeani, C. N., Eke, N. E. & Ugwu, F. (2012). Professionalism in library and information science: Trends, needs and opportunities in academic libraries in South East. In *Proceedings of the Nigerian Library Association 50th conference and annual general meeting held at International Conference Centre, Abuja from July 15-19, 2012*.

NB: Observing that “C” can always come in any of the formats as shown in previous examples let us focus on “R” which the students need to understand how it is entered, learning from series of such models vis-à-vis the type work concerned.

Unpublished conference or workshop paper

R: Oketunji, I. (1998). *Relevance of AACR2 to automated cataloguing*. Paper presented at the 18th NLA Cataloguing, Classification and Indexing Workshop held at the Kwara State Library Board, Ilorin, 26th to 30th October.

Thesis and Dissertations

R: Amanze, K. C. (2010). *Nursing management of the rheumatic fever secondary prophylaxis programme* (Unpublished master's thesis). University of Nigeria, Nsukka, Nigeria.

Abstract Only

R: Woolf, N. J., Young, S. F., Fanselow, M. S., & Butcher, L. L. (1991). MAP-2 expression in cholinceptive pyramidal cells of rodent cortex and hippocampus is altered by Pavlovian conditioning [Abstract]. *Society for Neuroscience Abstracts*, 17, 480

Poster Presented at Conferences and at other Learned Meetings

R: Ibegwam, A., Anasi, S.N.I., & Uzuegbu, C.P. (2013, July). *The role of agricultural libraries in literacy education as a prelude to capacity building among rural farmers in Nigeria*. A poster presentation at the Conference of the International Association of Agricultural Information Specialists (IAALD) held in Cornell University, Ithaca, NY USA from July 21 to 24, 2013.

Lecture Notes

R: Imo, C. (2007, February 27). *Primary care for desktop computers*. Unpublished lecture notes, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

NB: If the lecture does not have a title, provide a brief description of the lecture resource within square brackets (not in italics).

Non-Print Sources

Intranet

- R: Lopez, J. (2005). *Characteristics of selected multilingual education programs from around the world: A review of the literature* (Unpublished master's thesis). Dominican University of California, Retrieved from ERIC database. (ED491402)
- R: Brewster, C., & Railsback, J. (2002). *Full-day kindergarten: Exploring an option for extended learning*. Retrieved from ERIC database. (ED472733)

Internet: from a commercial database

- R: Gonzalez-Mena, J. (2007). *Diversity in early care and education: Honoring differences*. Available from <http://findarticles.com/product.php?isbn=007722289X>
- R: Saarivirta-Kolpack, M. (2006). *A history of early teacher training practices at Northern (Michigan University), 1899-1953* (Master's thesis). Available from ProQuestDissertations & Theses database. (UMI No. 1439820)

Internet: from non-commercial sites

- R: Vogel, C. G. (1999). *Legends of landforms: Native American lore and the geology of the land* [Adobe Reader version]. Retrieved from <http://www.netlibrary.com/>

NB: for other types of works, as shown in the print categories, follow same pattern with the print but include “Retrieved from” or “Available from” as the case may be.

e- Mail Messages [Archived]: Note that titles for this category of resources are not italicized.

- R: Opara, U. (2011a, February 24). Freedom of information bill [Electronic mailing list message]. Retrieved from The Nigerian Library Association (NLA) Online Forum, <http://us.mg2.mail.yahoo.com/dc/launch?.gx=1&.rand=e9kdo0lcl4aes>

e- Audio-Video (Internet): Note that titles are not italicised

- R: Goyen, A. (2007, February 22). Downtown Marquette dog sled races [Video file]. Retrieved from <http://www.youtube.com/watch?v=gW3CNCGGgTY>

8.6.3 The Vancouver Method

The Vancouver method is a type of numerical referencing method that is used primarily in medicine, computer science and mathematics (see Table 8.0). The followings are common with the Vancouver method:

- i. A number is allocated to a source when it is referred to for the first time.
- ii. The allocated number appears in the text in superscript or in square brackets.
- iii. The number identifies the specific source and is used throughout the text to refer to the specific source.
- iv. In the case where the researcher still mentions the name of authors, the allocated number is still used.
- v. The complete reference to sources is placed at the end of the writing in a list that is ordered numerically. This list is known as the reference list and contains only the sources cited in the text.
- vi. In the reference list no lines are indented, but one line is left open between the entries.
- vii. Unlike in Harvard and APA methods, titles of works are not italicized and the year of publication is placed at the very end of each entry.
- viii. The titles of journals are abbreviated as prescribed by Index Medicus. For example, the *African Journal for Health Science* is abbreviated to *Afr J Health Sci*.
- ix. The Index Medicus list can be downloaded from <http://www.nlm.nih.gov/pubs/libprog.html>.
- x. For punctuations in the reference list, the surname and initials of the authors are written without any punctuation, for example Abiodun KE. The names of two or more authors are simply separated by a comma and not by an ampersand.
- xi. A citation that contains several authors will also require the allocation of more than one number accordingly.
- xii. If the in-text numbering style is the square bracket system (contrary to the superscript style), page numbers to cited works can also (though not compulsory) be added, for example [2:45].
- xiii. Quotations are dealt with in the same manner with Harvard and APA methods.

As a matter of fact, the advantages of the Vancouver method are that:

- a. It is easier to read the main text;
- b. There are no references in the text that distract the readers' attention or distract the flow of the text;
- c. The sequence in which the references occur in the text is the same as their order in the reference list, hence, the reader does not have to search for the authors in the alphabetical list.

However, the disadvantage of the Vancouver method is that the reader has to page back to reference list overtime to find the name of the author being cited.

Examples of the Vancouver method are thus presented below.

Books: One author

C: This is in fact, the case as informed by Akidi² in

or

C: This is in fact, the case as informed by Akidi [2] in ...

R: Akidi JO. An introduction to maths. 2nd edition. Umuahia: Zeh Communications; 2014.

In the above example, the author formed part of the sentence. But, a reference to a group of sentences is made after the full stop of the final sentence, for example:

C: ... This is the reason why cattle grow thin after six months of weaning. [2]

Books: Two to six authors

C: The studies of men in the North [1]...

R: Edeoga HO, Nwokocha, AD, Anozie PN, Ugah AD. Simulation modeling. Aba: S-Press; 2009.

Books: More than six authors

If there are more than six authors only the first three are listed in the reference list, followed by et al. (“et al” is not italicized in this method).

R: Huggs BM, Uzuegbu CP, Nnadozie CO et al. Introduction to Library Use. New York: McGraw; 2013.

Books: Corporate bodies

R: Tertiary Education Trust Fund. Funding of Nigerian academics to conferences. Abuja: TETFUND Press; 2008.

Books: Unpublished conference paper

R: Maritz ME. Queuing theory: Worked examples and problems. Paper presented at the Lagos Mathematics Conference. Abuja; 1999.

Books: Conference papers in published proceedings

R: Ezeani CN, Eke NE, Ugwu F. Professionalism in library and information science: Trends, needs and opportunities in academic libraries in South East. In: Aina LO, editor. Proceedings of the Nigerian Library Association 50th conference and annual general meeting. International Conference Centre, Abuja; 2012. pp. 15-19.

Books: A chapter in an edited book

R: Robberts RA. An introduction to applied probability. In: Harris J, editor. A first course in probability. New York: Macmillan; 1992. pp.44-55

Books: A chapter in a book (no author)

R: Citation and referencing method. In: Ibegwam A, Ogbonna U, editors. Use of library education. Enugu: City Press; pp. 22-44.

Books: Unpublished thesis and dissertation

R: McAlbert FU. Testing library users' behaviour towards books [unpublished dissertation]. Imo State University, Owerri; 1995.

Journals: Articles in journals

R: Alamba OB. Artificial intelligence. Machine Learning; 1993; 31 (1): 43-51.

Class notes

C: ... as proposed by Duvie [4].

R: Duvie VN. Teachers' ethics in rural sociology. Unpublished class notes. Sociology education 212. MOUAU; 2009.

Electronic references: CD-Rom and commercial online databases

R: Obinyan FU, Unegbu VN. Digital libraries [CD-ROM] 2000 [retrieved 2009, June 24];

If in the case that the author cannot be determined, the title takes the place of the author.

Electronic references: Journal articles in electronic database

R: Uzuegbu CP. Using the library effectively. Library Philosophy and Practice [Electronic] 2007 [retrieved 2009, May 26]; 7(2); Available: <http://www.webpages.com>

Electronic references: www page

R: Oliver R. Streamlining the Omega 3 fatty acid in the mammals [Online]. 1999 [retrieved 2011, August 11]; Available: <http://www.mammals-world.com>

Electronic references: www page (with no author)

R: Streamlining the Omega 3 fatty acid in the mammals [Online]. 1999 [retrieved 2011, August 11]; Available: <http://www.mammals-world.com>

Example of a references list according to the Vancouver method:

- [1] Uzuegbu CP. Citation and referencing method. In: Ibegwam A, Ogbonna U, editors. Use of library education. Enugu: City Press; pp. 22-44.
- [2] Robberts RA. An introduction to applied probability. In: Harris J, editor. A first course in probability. New York: Macmillan; 1992. pp.44-55.
- [3] Alamba OB. Artificial intelligence. Machine Learning; 1993; 31 (1): 43-51.
- [4] McAlbert FU. Testing library users' behaviour towards books [unpublished dissertation]. Imo State University, Owerri; 1995.

8.6.4 The MLA Method

This method of referencing is prescribed by the *Modern Language Association*. It is used primarily in the humanities (linguistics and literary subjects). The followings are the features of MLA method:

- a. The name of the author and the page numbers appear in brackets in the text.
- b. The date is of lesser importance in this referencing method and is not indicated in the text.
- c. The titles of the works play an important role and must be indicated in the text where possible. Some long titles can be abridged with the ellipses sign (...).
- d. All citations in the text are supplemented by a list of work at the end of the work. The list is called "Works cited".
- e. The list of Works cited is arranged alphabetically according to the surnames of the author or titles of the sources.
- f. In the list of "Works cited", the second and subsequent lines are indented and one line is left open between entries.
- g. In MLA method, the names of the authors are written out in full in the "Works cited" list and no initials are used.

- h. With regards to punctuations, the surname of the first author is written first followed by his or her full names. The second author's name(s) and surname are given in the normal order (first the name(s), followed by the surname) and a comma is placed before the "and", for example Uzuegbu, Chimezie, and Cletus Okafor.
- i. In the MLA method, quotations are dealt with in the same way as in the Harvard, APA and Vancouver methods. Thus, quotations of up to 40 words form part of the sentence and placed within the punctuation marks of the sentence, while quotations of 40 words or more are placed without quotation marks in an indented paragraph.

Examples of the MLA method

Books: One author

Remember that where possible, the author and the title of the work should be indicated in the text, for example:

C: In the book, *Things fall apart*, Chinua Achebe describes the state of (21)

The reference could also be indicated as follows:

C: as proposed by Achebe (21) or

C: as has been documented (Achebe 21)

R: Achebe, Chinua. *Things fall apart*. 2nd edition. New York: John Wiley, 1997.

Books: Two or more authors

C: *She stoops to conquer* is an example this (Crooner & Beniss).

R: Crooner, Wills Dennis, and Michael Beniss. *She stoops to conquer*. Free Town: Sun Press, 2001.

If there are more than three authors, only the first author should be indicated, followed by "et al." ("et al" is not italicized). This is applicable both at in text citation and at list of Works cited.

C: is not an issue (Norton et al. 21)

R: Norton, John, et al. *Teaching young children*. New York: Addison-Wesley, 2001.

Books: Corporate bodies

C: ... has been proven by market research (Abia State Government Press 344)

R: Abia State Government Press. *Style manual for editors*. Umuahia, 1991.

Books: A book by an anonymous author (in works without author the title serve as author)

R: *Bibliography*. London: Wordsworth, 2009.

Books: A chapter in edited book

C: ... (Uzuegbu 13)

R: Uzuegbu, Chimezie Patrick. "Turning point." *The stories of Africa*. Ed. Udo Nwokocha. Okigwe: Heineman Press, 1999. 211-151.

Notice that there is no "in" as an introduction to the collection. MLA does not use "in" but rather keep to the principle of italicizing the title of material (the collection in this case). Thus, the difference between the chapter title and entire work's title is that the former is put in quotation marks while the latter is italicized. So will it be for articles in journal publications.

Books: Introduction, foreword, preface, etc.

R: Umeh, Daniel. Foreword. *The errors of signaling theory*. By Abdul Mamud. Kano:Harpers, 2000.

Books: Unpublished thesis or dissertation

C: ... (Jones 21)

R: Jones, Mary. "Studies on rats with HIV inducements." Dissertation, University of Ibadan, 1988.

Books: Sacred books

C: According to the readings in *The Bible*

R: *The Bible*, Genesis 3:18. Cape Town: Bible Society of South Africa, 1988.

Journals: An article in a journal

C: (Amosun 23)

R: Amosu, Kenneth. "Aging in young women: Studies with Chinese rats." *Journal of LabResults* 20.2 (1998): 24-28.

If it is only the volume number that is available it goes thus:

R: Amosu, Kenneth. "Aging in young women: Studies with Chinese rats." *Journal of Lab Results* 20 (1998): 24-28.

But, if only the issue number is known it goes thus:

R: Amosu, Kenneth. "Aging in young women: Studies with Chinese rats." *Journal of LabResults* No.2 (1998): 24-28.

In the case where the instructor or Department wants the month or season of publication to be shown (MLA allows it), it goes thus:

Magazines: Monthly magazines

R: Amosu, Kenneth. "Aging in young women: Studies with Chinese rats." *Journal of Lab Results* 20.2 (Dec. OR Spring 1998): 24-28.

If the article is not place on consecutive pages, the number of the first page must be indicated, followed by a plus sign. The volume and issue numbers are not indicated.

R: Fedrick, Samuel. "Craft making." *LifeStyle* Apr. 2001: 23+

Note that if the magazine appears more than once a month, the complete date must be provided, for example 21 Apr. 2001.

Weekly or daily periodicals

C: (Agabi 3)

R: Agabi, Emmanuel. "Annotated bibliography." *Students News* 24 Jun. 2003:3.

Dictionaries

C: ... as has been clearly defined (Hepatitis)

R: "Hepatitis." Oxford Learners Dictionary. Essex: Longman, 1995.

Encyclopaedia

R: Akumadu, Clifford." Linguistics approaches." *Routledge encyclopaedia of translationstudies*. Ed. Mona Baker. London: Routledge, 1998.

Electronic references: Journal articles from an electronic database

C: (Akin)

R: Akin, Mathew. "Teaching and learning among school children." *Journal of Teachers* 4(2). <http://www.teachers-association.com>

Electronic reference: www page

C: (Oliver 1999)

R: Oliver, Richard. 1999. *MSN Gaming Zone* [Online]. Available: <http://www.zone.com> [2001, May 3].

Electronic reference: www page (no author)

C: (MSN Gaming Zone 1999)

R: *MSN Gaming Zone* [Online]. 1999, Available: <http://www.zone.com> [2001, May 3].

8.7 Conclusion

This chapter has clearly outlined the most regularly used and popular referencing and citation methods. The Harvard, APA, Vancouver and MLA methods constituted the focus of this chapter. Any academic department and/or subject discipline, as observed, can use any of the methods. No single method is tied to a given department rather the preference given to the various methods by users have informed the distribution in Table 1 of this chapter. So, students and researchers are still expected to comply fully with the prescription of their department or scholarly group. Hence, it is believed that students and researcher shall find this chapter rewarding in as they undertake various academic research writings as are characteristic with scholarship.

MODULE NINE

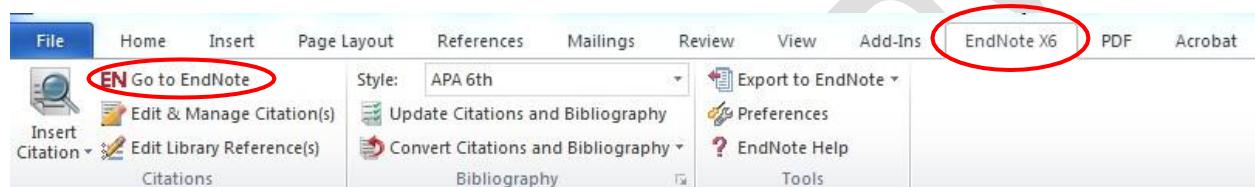
9.0

MICROSOFT WORD CITATION MANAGER: EndNote

EndNote is software for managing citations and references in academic publications. As noted earlier in Module Eight, we use APA 6th edition to illustrate but then, you can always transit to the latest edition whenever available without much difficulty. This Module provides a step-by-step procedure for using EndNote software for managing your citations and references as you journey in your research project and publication activities.

Step 1: Creating a Library when you first use EndNote

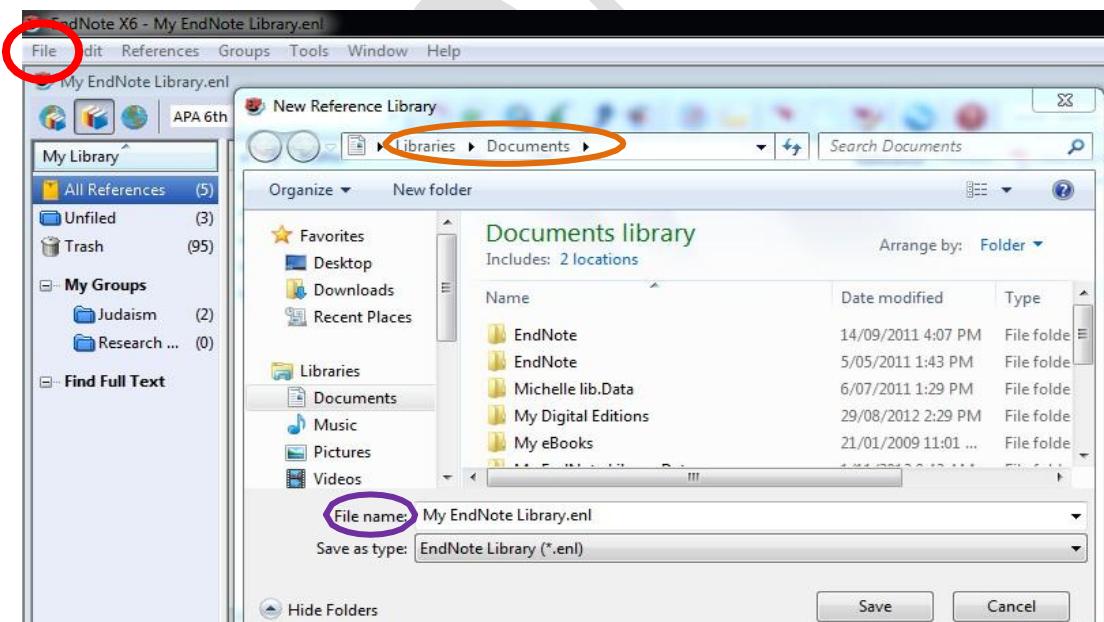
Reference information is stored in a file called a library. To create a library, open a Word document. Click on *EndNote* and then *Go to EndNote* as illustrated below.



Click on **File** and then click **New**

Give your library a name in **File Name**

Choose where you want to store it in the **address bar** (ie under My Documents on your laptop or desktop) as shown.

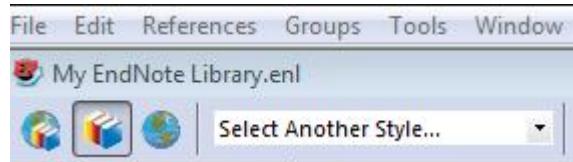


Important: Once you have created your library, you will not need to create another one. From now on, when you open EndNote, you will go:

File – Open then click on your library name to open your existing library.

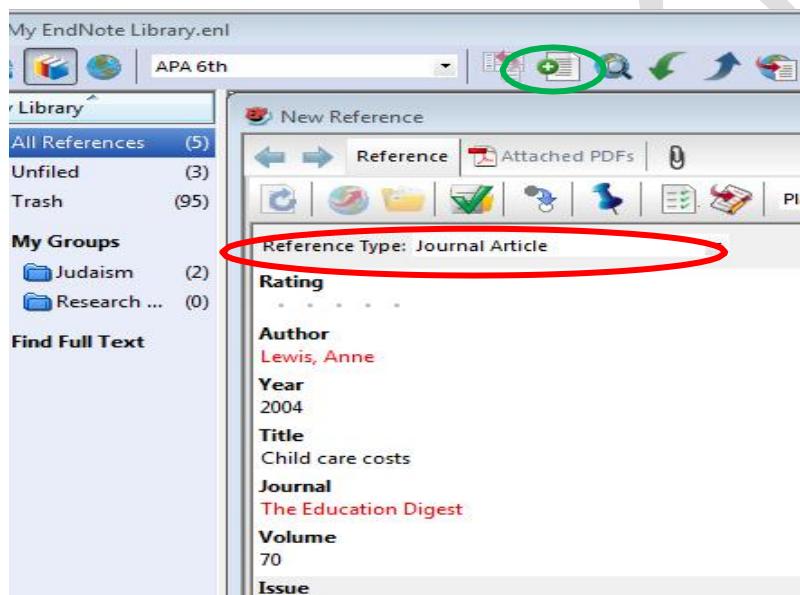
Choosing a style

When you first open your library, choose your **style** (e.g. APA 6th or Turabian Bibliography) by clicking **select another file** and then choosing your style. All references will now be saved in the style chosen. You will not need to do this again as your option will be saved.

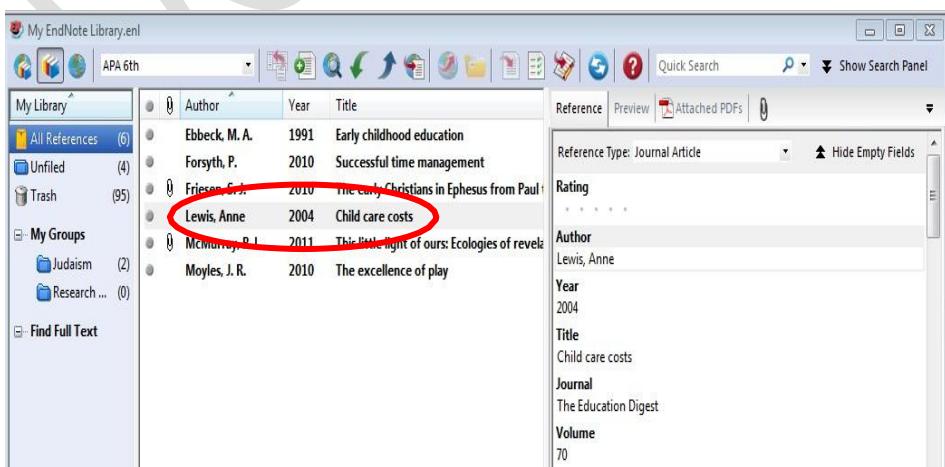


Step 2: Adding a New Reference

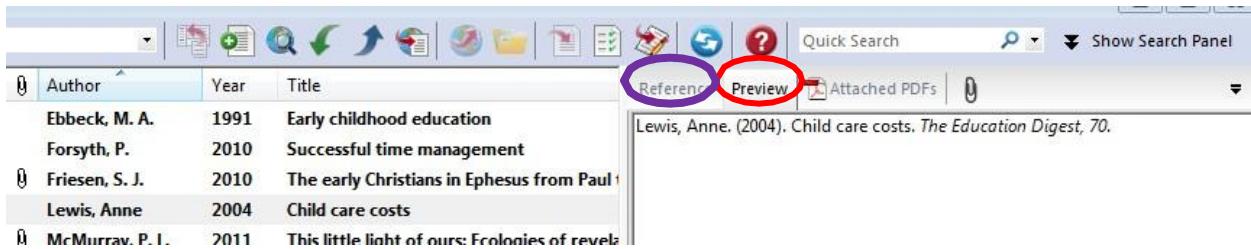
Once you have created your library you will want to add the details for books, articles etc that you have used in your assignment. Open EndNote and open your library in EndNote. In EndNote, click on the green plus sign **New Reference** Select **Reference Type** (from the drop-down list – Book, Journal article etc). Type in details ie Author, Title etc. Refer to the notes on p. 3 for guidance in what fields to use for each reference type. Press Ctrl W to save the reference or simply click the X on the top right of the box to close it. Be careful you don't close the X on EndNote!



You can now see your completed record entered into EndNote.



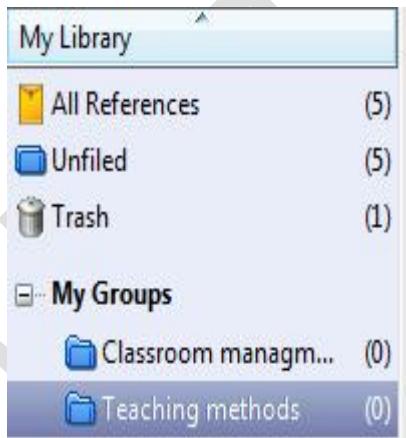
Click the **Preview** button to see what it will look like in your assignment. If you see mistakes, go back to **Reference** and correct your mistakes. You may need to double click on your Reference to get formatting fields.



9.1 Groups

You can create **Groups** for organising your references e.g. to file items according to your assignment or Subject code. Right click on **My Groups** and create as many groups as needed. Give them a name e.g. CSTD14300 or Classroom Management and save it. Once you have a number of references in your library you can sort them into the groups you have created. Just drag and drop them into the various groups or right click on the reference and *Add references to...*

The original reference stays in the main library and a count is kept of your “unfiled” references. You can also create Smart Groups to automatically add references from books in the University library **catalogue** or from the University **databases**.



9.2 Required Fields for Publications

More fields (Title, Author, etc) are given than are actually required for a complete reference. Some of the fields are useful; for example, you can add notes to the entry to remind you why you included it in the reference database, or add files to your record. You could add the ISBN or the call number for your item. They won't show up in your reference list.

The list below shows the format and fields for the 5 most commonly used publications types. When you are entering information into the database you should try to fill most of the fields listed for each type.

Journal Article: Author. (Year). Title. Journal, Volume(Issue), Pages.

Book: Author. (Year). Title. City: Publisher.

Conference Proceedings: Author. (Year of Conference, Date). Title. Paper presented at the Conference Name, Conference Location|.

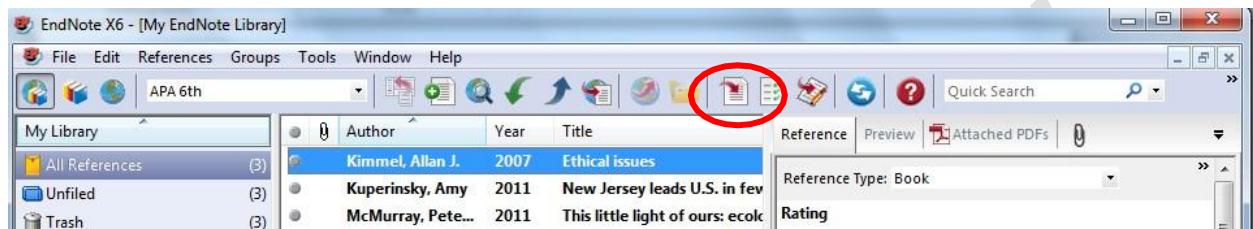
Magazine Article: Author. (Year, Date). Title. Magazine, Volume, Pages.

Electronic Source (website etc): Author. (Year, Last Update Date). Title. Series Title Edition URL

Step 3: Adding Citations to a Paper

Once you have added all your references to your library, you are able to insert them into your project.

- i. Position your cursor in your assignment at the place where you wish to add a citation
- ii. Open EndNote and highlight the item from which you have quoted (just one click)
- iii. Click the red arrow **Insert Citation**
- iv. Your citation will now be in front of your cursor and a reference appears at the end of your document for your Reference List.



For example:

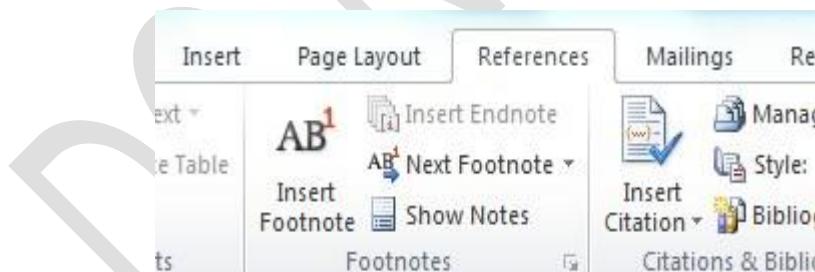
Citation (Fisher, 2008)

Reference Fisher, C. (2008). *Fishing as a hobby*. Sydney: ABC.

9.3 Important note when using Turabian style

If you are using the Turabian style, you will need to insert a footnote each time you want to add a reference.

In MS Word, go to **References > Insert Footnote** THEN insert your reference from EndNote as in the instructions above. You will need to do this each time you wish to add a footnote.



For example:

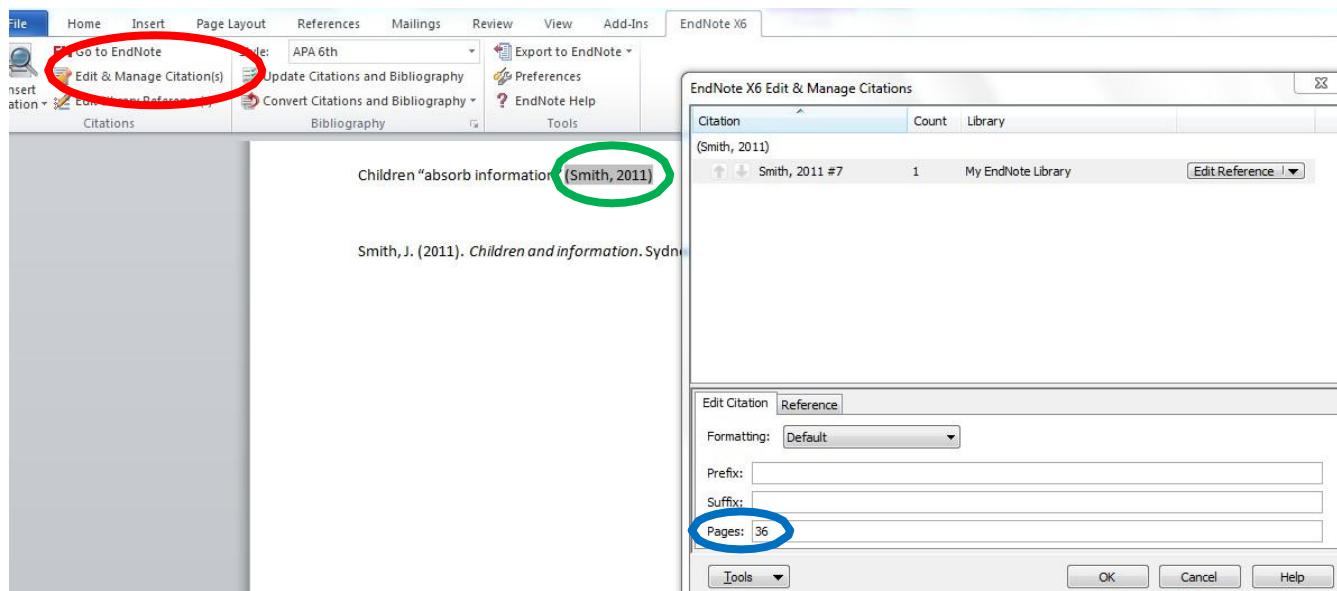
Footnote¹ S.J. Friesen, “The Early Christians in Ephesus from Paul to Ignatius,” *Catholic Biblical Quarterly* 72, no. 3 (2010).

Reference Friesen, S. J. “The Early Christians in Ephesus from Paul to Ignatius,” *Catholic Biblical Quarterly* 72, no. 3 (2010): 617-619.

Adding page numbers to a citation

When you add a citation to a document it usually looks something like this: (Savitch, 2005). To add page numbers to your citation:

- v. **Highlight** the citation
- vi. **Click Edit & Manage Citations**
- vii. Type in **page** numbers (do not add p. or pp.)



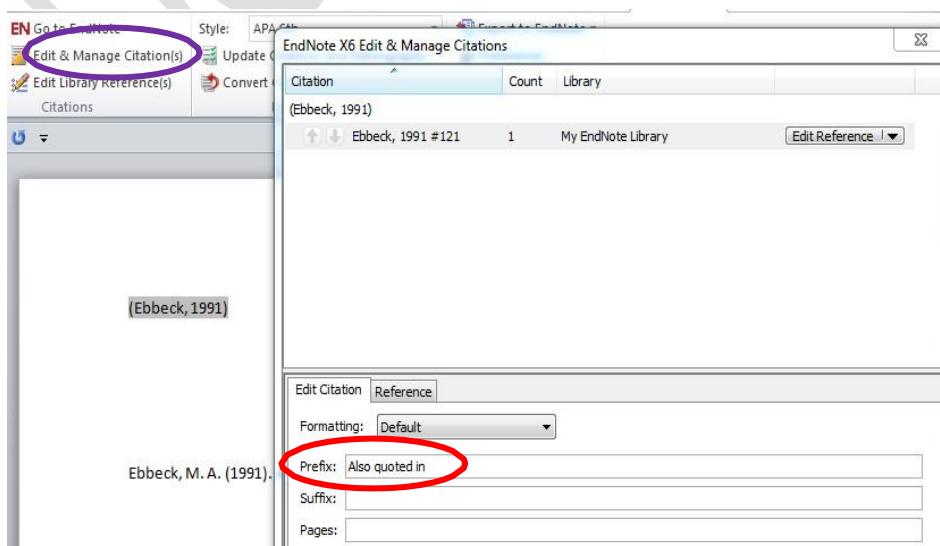
Putting two authors in the one citation

If you have quoted from two authors, insert one author, then leave your cursor in the middle of the citation and insert the second author e.g. (Saville, 2009; Veitch, 2011)

Adding words before or after the citation

Let's say you want to put the words (also quoted in Ebbeck, 1991).

Add your citation as normal, then highlight the citation and click **Edit & Manage Citations**. Add the words "Also quoted in" in the **Prefix field**. Words you want at the end of the citation would be entered in the suffix field.

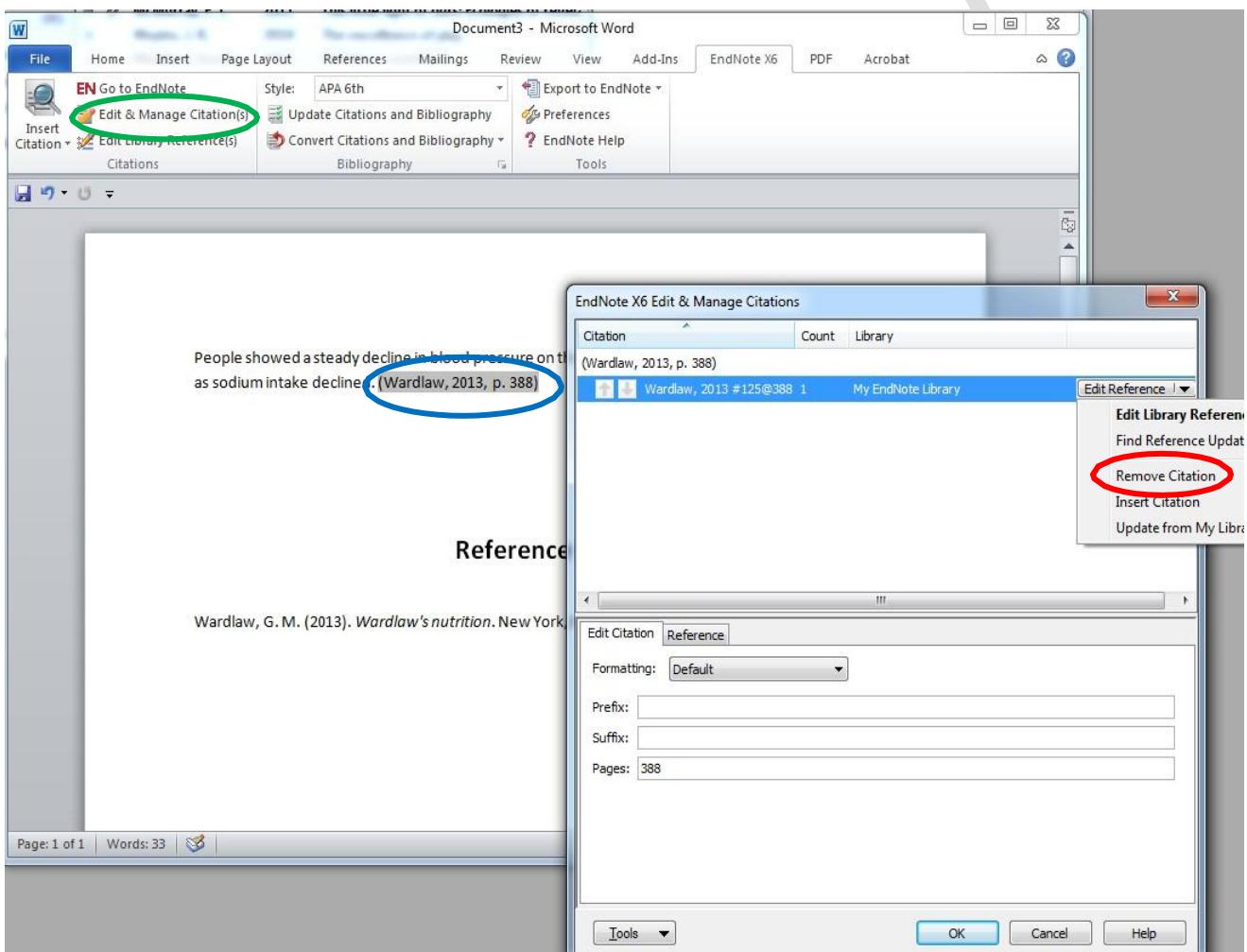


Deleting an EndNote reference inserted into Word

Warning: Do NOT do this by simply deleting the citation or reference within Word as this has implications.

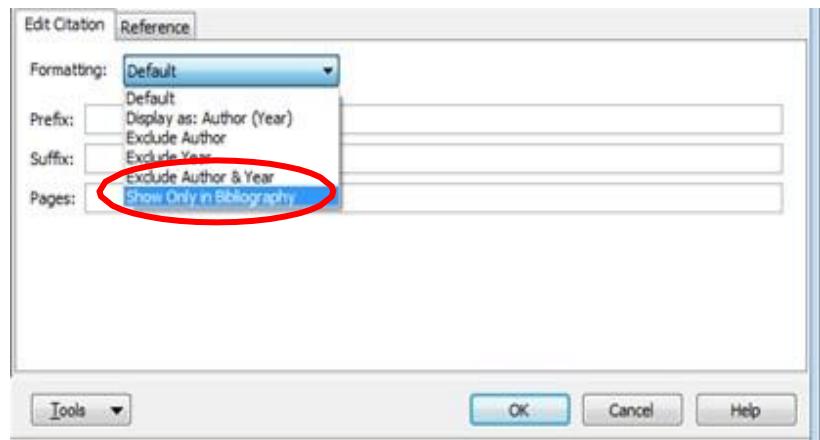
EndNote's invisible formatting codes will remain in the background. (This means that the reference you have deleted may corrupt your Word document and you will have lots of problems!)

To remove a reference correctly from a Microsoft Word document, **highlight** the citation, then go to **EndNote > Edit & Manage Citations** on the Word toolbar, select the citation you wish to remove and click the little arrow beside **Edit Reference** and then **Remove Citation**. This will remove **both** the citation AND your reference.



If you just want the reference without the citation, **highlight** the citation, then go to **EndNote > Edit & Manage Citations > Default > Show only in bibliography.**

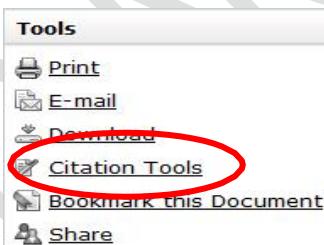
If you just want the citation, you would probably do the citation manually.



9.4 Importing Bibliographic Data from other Sources

1. Importing data from ACADEMIC ONEFILE - GALE

- i. Double click on title of article you want
- ii. In the box on the right click **Citation Tools**
- iii. Tick **EndNote**
- iv. **Export**
- v. **Open**



2. Importing data from EBSCO Databases (ATLA, Cinahl, ANZ Reference Centre, Medline, Religion and Philosophy Collection and Teacher Reference Centre)

- i. Find an article and add selected results to folder. Open **Folder** and tick the items you wish to save 
- ii. Tick **Export**
- iii. Tick **Direct Export in RIS format**
- iv. **Save**
- v. Items will download straight into EndNote. Make sure you check that the format is correct.

3. Importing data from GOOGLE SCHOLAR

- i. Go to the Google Scholar home page at <http://scholar.google.com>
- ii. Click on **Settings** at the top of the page and select Library links
- iii. Type Avondale College in the search bar and click search. Tick Avondale College boxes and save your settings.
- iv. Not all references are full text. Many give you the abstract only and invite you to purchase the article!
- v. The link to Import into EndNote is at the bottom of the Google record

[CITATION] Hypoglycemia in the **diabetes** control and complications trial
Diabetes Control and Complications Trial Research ... - Diabetes, 1997
 Cited by 513 Related articles [Import into EndNote](#) More ▾

4. Importing data from Informit

- i. Tick the box beside the articles you wish to reference
- ii. At the top of the page click **Save**
- iii. Click **Save Records**

Citation [Save](#) | Print | Email Text size A | A | A

5. Importing data from OVID Nursing full text plus

- i. Tick the box beside the articles you wish to reference and select **Export**
- ii. In the next box select EndNote > Citation (Title, Author, Source) > Include URL.
- iii. From the box *Choose an Import Filter* select **Ovid SP**
- iv. Click **Choose** and the item will download into EndNote

Print Email [Export](#)

Note: Check details carefully in EndNote as fields are often incorrect e.g. journal articles are referenced as a book; journal details are under Publisher, authors have credentials listed etc.

6. Importing data from PROQUEST Central

- i. Select articles by ticking the box on the left
- ii. Select **Export/Save** and then select EndNote
- iii. Click **Continue** and then **Open**. File will download into EndNote



7. Importing data from SAGE

- i. Tick box beside **Check Item**
- ii. On the right, under *My Marked Citations* click **Add citations**
- iii. Click Save/Print/Email/Download
- iv. Select **Download to Citation Manager**
- v. Select **EndNote** and then **Open**



8. Importing data from ScienceDirect

- i. Tick the box beside the article you wish to reference. **NOTE** Only articles with a **green** box are full text. Articles with a black box are not full text, even though the PDF link is there.
- ii. Click on **Export citations** to download into EndNote.

A screenshot of a ScienceDirect search results page. At the top, there are buttons for 'E-mail articles', 'Export citations' (circled in red), 'Download multiple PDFs', and 'Open all previews'. A 'Sort by: Relevance | Date' dropdown is on the right. The results list two articles:
1. **Increasing prevalence and low awareness, treatment and control of diabetes mellitus among Chinese adults: The InterASIA study** (Original Research Article). It shows a green checkmark icon and a PDF link (253 K).
2. **The prevalence of diabetes mellitus in the adult population of Guadeloupe as estimated by history or fasting hyperglycemia** (Diabetes Research and Clinical Practice, Volume 12, Issue 3, July 1991, Pages 209-216). It shows a black square icon and a PDF link (686 K). Both articles have 'Show preview' and 'Related articles' links.

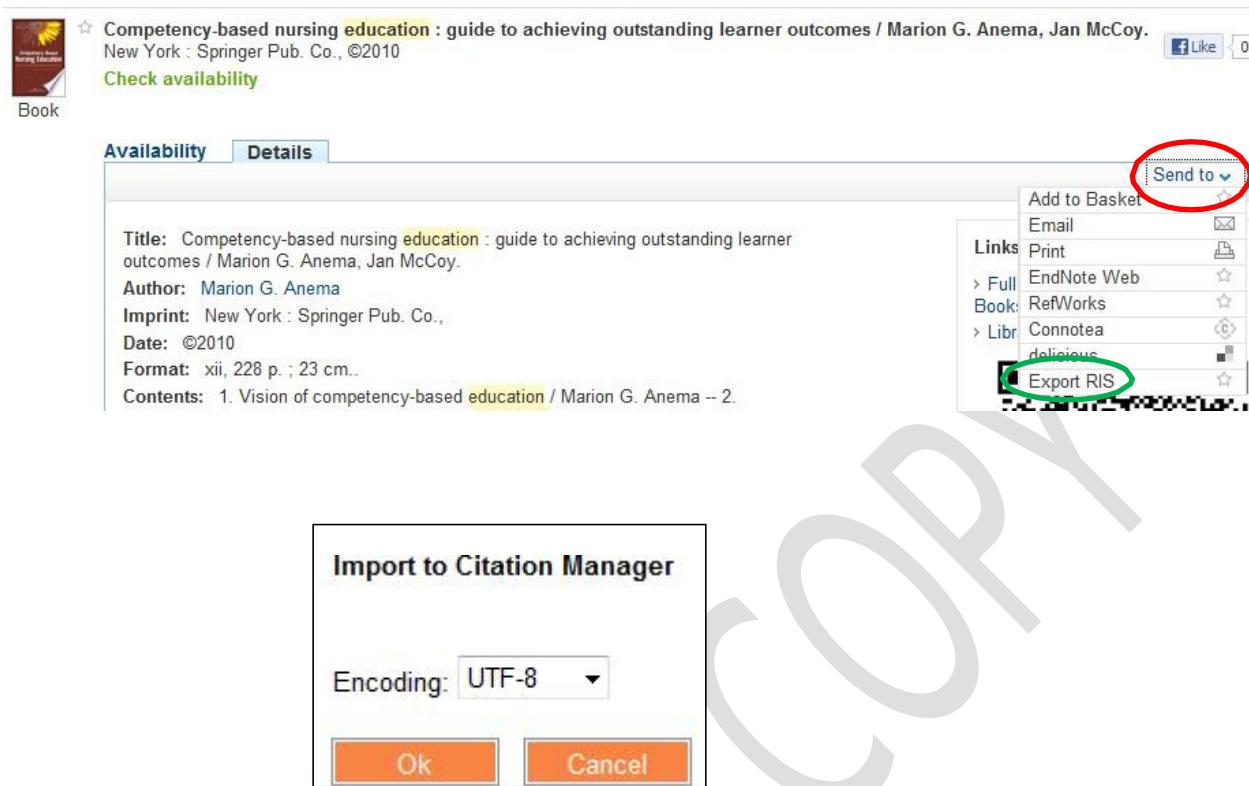
9. Importing data from Taylor and Francis

- i. Click on the title of the article you wish to reference. Only articles with the green Full access, or blue Free access are available full text. If you wish to limit your search to only full text material, do an advanced search and tick **Only content I have full access to**
- ii. Once you have ticked on the title, click on **Download citation** and then **Open**.



10. Importing book records from PrimoSearch

Find the book you want and click **Details** and then **Send to > Export RIS**



The screenshot shows a PrimoSearch book record for 'Competency-based nursing education : guide to achieving outstanding learner outcomes / Marion G. Anema, Jan McCoy.' The 'Details' tab is active. A context menu is open on the right, with 'Send to' circled in red and 'Export RIS' circled in green. A 'COPY' watermark is overlaid on the page. A small 'Import to Citation Manager' dialog box is visible in the center.

Import to Citation Manager

Encoding: UTF-8

Ok Cancel

This box will pop up. Click **OK** and then **Open**.

The record will download straight into EndNote. In EndNote, **ALWAYS** click the **Preview** button to check your record as there will be mistakes. For instance, in the above example the place of publication and publisher is listed as New York : Springer Pub. Co. According to APA 6th rules this should be New York, NY: Springer.

In EndNote, simply click on the Reference button and make the necessary changes. You will need to click out of your record and then back in again to see the changes.

Errors you will need to watch out for:

Make sure the record is for a book (the record usually downloads as Generic. Change this to Book) Check the author's name (The author's name is often repeated. Delete the duplicated name) Delete everything after the / in the title Check place and publisher (The place of publication is usually repeated in the name of the Publisher. Just delete this. Check that the Publisher and Place Published comply with APA rules)

Notes for Entering Data

Anonymous Works

If a reference has no author, you should leave the Author field blank. Do not enter "Anonymous."

If a work is published with "Anonymous" printed on the title page, then enter "Anonymous" as the author.

Author and Editor Names

Always enter author and editor names one name per line. If you are entering initials instead of full names, be sure to type a period or a space between initials, (for example “Fisher, J.O.”) otherwise EndNote puts initials as a single name: “Jo.”

Complex Author Names

For multiple-word last names, like Charles de Gaulle, enter the name with the last name first e.g. **de Gaulle, Charles**. Enter authors with titles, such as “Jr.” or “III”, as Last, First, Title. For example, “Alfred Smith Jr.” will be entered as **Smith, Alfred, Jr.**

Corporate Authors

When entering corporate authors, put a comma after the name: U.S. Department of Agriculture, Do not use commas within the name, as all text before the comma is interpreted as a last name.

Dates

Enter dates as you want them to appear in the final reference. EndNote does not reformat dates.

- i. Use date of copyright or date of edition if it is an edition other than the first
- ii. Dates must be entered in “Month day” format, with the month spelled out in full e.g. Turabian: March 16, 2012. APA: 2012, March 16. The APA citation will only include the year (Black, 2012).
- iii. If there is no date of publication use the abbreviation (n.d.). Use this in your citation as well.
- iv. Revised edition should be abbreviated to “Rev. ed.” and “Abridged edition” to “Abr. ed.” “Second edition, revised and enlarged would be “2nd ed.”

Edition numbers

Edition numbers are entered in full e.g. 3rd not 3. Do not add the words “ed.” or “edition”.

Attaching figures in EndNote

You can only attach one image file at a time. If you are using multiple figures then you will need to add a new reference for each figure you wish to store.

To add a figure to EndNote, in EndNote select **References – New Reference** and change the Reference Type to **Figure**. Fill in the following fields:

- i. Created by (Author or creator’s name)
- ii. Year
- iii. Title (of the image)
- iv. Publisher
- v. Description

Close the file but make sure it is highlighted, then click the pin  at the top of the page and browse to the image you have saved.

Highlight the figure in EndNote and then click Insert Citation. A numbered figure citation will appear in-text at the location you placed the cursor and the figure will be displayed with caption.

You may include an in-text citation to the figure source by inserting a standard citation next to your figure.

9.5 Manually correcting your reference list

If there are some things that need changing in your reference list that can't be done in EndNote, you can manually make corrections - but if you do an Update Citations and Bibliography all those changes will be lost! You can convert the EndNote references into plain text and make the changes then. Do this when you finish your assignment as you CANNOT change back to EndNote format.

- i. Open Word and choose *Convert Citations and Bibliography* from the EndNote tab
- ii. Select the option *Convert to Plain Text*. You can now make changes as you would in a normal Word document.

Hint: OR you could highlight references that need changing with a note as to the changes that need to be made and then make the changes just before printing out your assignment.

e.g. 2. Huang and Smith, eds. (Take out the eds before handing in assignment)

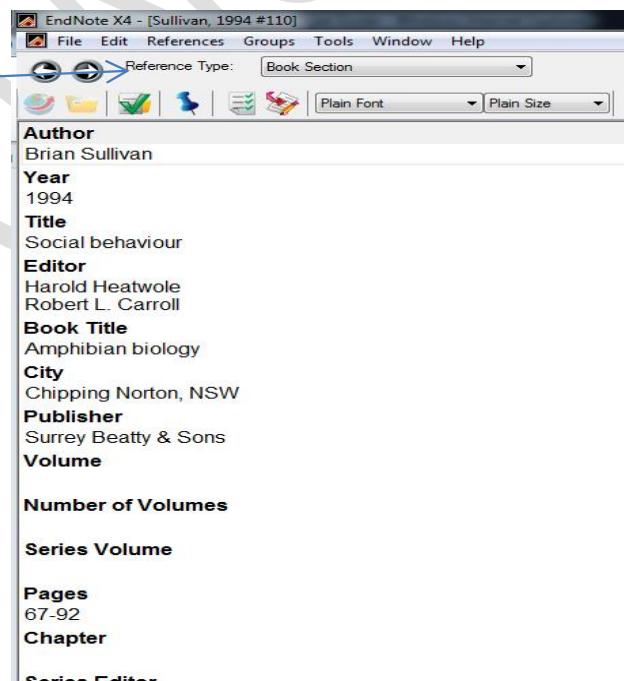
Referencing an Article or Chapter in an Edited Book

1. Select Book Section as your Reference Type
2. The first three fields (Author, Year and Title) are for the chapter details
3. The Editor, Book Title, City, Publisher and Pages are for the book itself.
4. Fill in the details. Your citation and reference will look like this:

Citation: (Sullivan, 1994)

Reference

Sullivan, B. (1994). Social behaviour. In H. Heatwole & R.L. Carroll (Eds.), *Amphibian biology* (pp. 67-92). Chipping Norton, NSW: Surrey Beatty & Sons.



Citing a source within a source (secondary sources)

For sources that you have not actually seen but which are referred to in another work, list the secondary source (the source you have read) in the Reference List. For the citation, name the original work and give a citation for the secondary source. For example, if Bennett's work is cited in a book by Rudman and you didn't read Bennett's original work, list the source you did read (in this case the Rudman reference) in the Reference List.

Your In-text citation should look like this: Bennett (as cited in Rudman, 1999) defined ... To add the words "as cited in" to your citation:

1. Enter the details for the Rudman book into EndNote
2. Insert a citation from the Rudman entry
3. Highlight the citation (Rudman, 1999) and click *Edit & Manage Citations*
4. Add the words "as cited in" to the prefix and click

OK Your Reference List entry will look like this:

Rudman, R. (1999). *Human resources management in New Zealand*. (3rd ed.). Auckland, New Zealand: Addison Wesley Longman.

FAQs

★ I downloaded a record and it didn't drop into EndNote. All I got was a text file.

1. Go to *File* in the browser menu bar at top and choose *Save Page As*
2. Choose *Save as Plain Text* and save it (e.g. To your desktop)
3. File will have a name like: ulc0155648.ris
4. Open EndNote Library and click *File > Import*
5. Select the text file you saved and tick the following options:
 - a. Import Options: Reference Manager (RIS)
 - b. Duplicates: Discard duplicates
 - c. Text translation: No translation
6. The references should now appear as normal in the EndNote library.



I need to edit my citation. How do I do that?

Highlight the citation and right click OR in Word click on EndNote then *Edit and Manage Citations*. Exclude author, date or both, and add details to either Prefix or Suffix to get the required citation details. Or you can choose *Show only in Bibliography* to remove the citation entirely and write the citation in your Word document manually.



I've made changes to the references in my library, but the references in my essay haven't changed.

Simple. Click **Update Citations and Bibliography** and the changes will be seen in your document.



I can't make EndNote enter the reference correctly

If there are some things that need changing in your references or citations that can't be done in EndNote, you can manually make corrections - but if you do an Update Citations and Bibliography all those changes will be lost! You can convert the EndNote references into plain text and make the changes then. Do this when you finish your assignment as you CANNOT change back to EndNote format.

- i. Open Word and choose *Convert Citations and Bibliography* from the EndNote tab
- ii. Select the option *Convert to Plain Text*. You can now make changes as you would in a normal Word document.

Hint: OR you could highlight references that need changing with a note as to the changes that need to be made and then make the changes just before printing out your assignment.

e.g. **2. Huang and Smith, eds. (Take out the eds before handing in assignment)**



I had the EndNote tools in Word, but now they are missing.

In Word, select **File > Options > Add-ins**. Change the “Manage” options to “Disabled Items” and click Go. Highlight any EndNote items and click “Enable” and then OK.



How do I duplicate a reference in my library?

If you quote from more than one chapter in the same book, with different authors, you have to reference each chapter. This is easy to do in EndNote. Right click on the highlighted book and select ‘Copy’. Now right click anywhere in EndNote and select ‘paste’. A duplicate copy of the reference will appear. Simply change the author and chapter title.



I put my citation/footnote in the wrong place. How do I delete it?

Don't just press delete!! You will have problems with codes if you do this. It is essential to use the **Edit & Manage Citation(s)** command in Word whenever you want to delete, move or merge citations. Never use the delete or backspace keys to remove citations, and never cut and

paste citations to move them to another position. Follow the instructions on p. 7 if you are not sure of how to do this.



Weird things are happening in my document. The cursor is jumping around or citations are not appearing right.

The problem is probably those pesky field codes again. Some are still hidden in your document and you will need to reformat them.

1. Make a backup of your document.
2. In **Word 2010 with Endnote X4 or later**, go to the EndNote tab and choose the "Convert Citations and Bibliography > Convert to Unformatted Citations" command. This will remove the reference list and revert the citations. Your citations will now look like {Jones, #2001}
3. Press [Ctrl] A (or [Apple] A on a Mac) to highlight everything.
4. Press [Ctrl] 6 (above the "T" and "Y" key) to remove any additional hidden field codes.
5. Press [Ctrl] C to copy the highlighted text.
6. Open a new document and press [Ctrl] V to paste.

Note: If you have footnotes, you will need to click in the footnotes section and repeat steps 3- 6.

Click *Update citations and bibliography*. You should now be able to work with this cleaned up version of the document without running into problems.

Please note that you may get the "EndNote Select Matching Reference" dialog box when formatting the bibliography. This may be because you have modified the author name or the year in one of the references.

DON'T Cut and paste until you have unformatted your citations

Here's why.

Every citation has field codes. This citation (**Marschark & Spencer, 2003**) includes the following field codes:

```
{ADDIN EN.CITE
<EndNote><Cite><Author>Marschark</Author><Year>2003</Year><RecNum>146
</RecNum><record><rec-number>146</rec-number><foreign-keys><key app="EN" db-
id="aad9ta2xlzf994esfwsprawzf9202ts05frv">146</key><key app="ENWeb" db-
id="RYOlkQrtmCYAACy2Gw">232</key></foreign-keys><ref-type
name="Book">6</ref-type><contributors><authors><author>Marschark,
Marc</author><author>Spencer, Patricia
Elizabeth</author></authors></contributors><titles><title>Oxford handbook of deaf studies,
language, and education</title></titles><pages>xvi, 505
p.</pages><keywords><keyword>Deaf Social conditions.</keyword><keyword>Deaf
Education.</keyword><keyword>Deaf Means of communication.</keyword><keyword>Sign
language</keyword></keywords><dates><year>2003</year></dates>
<pub-
location>Oxford ; New York</pub-location><publisher>Oxford University
Press</publisher><isbn>0195149971 (cloth alk. paper)</isbn><call-num>HV2380 .O88 2003
```

362.4/2</call-num><urls><related-urls><url>http://ezproxy.csu.edu.au/login?url=http://gateway.ovid.com/ovidweb.cgi?T=JS&NEWS=N&PAGE=booktext&D=books&AN=01253222/1st_Edition/2&XPATH=/OVIDBOOK%5b1%5d/METADATA%5b1%5d/TBY%5b1%5d/EDITORS%5b1%5d</url></related-urls></urls></record></Cite></EndNote>}

Got it? When you copy and paste you could easily leave some of those codes behind! You must take out the codes BEFORE you start altering things in your assignment. Make it a habit to unformat your document before cutting and pasting.

See below for more instructions.



I need to change a few things in my essay. Can I copy and paste sentences with EndNote citations/footnotes in them?

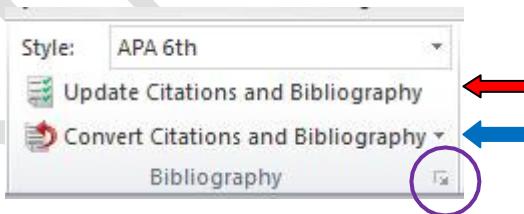
NO!!! If you want to copy and paste and alter things in your assignment turn off formatting first.

Every EndNote citation in your Word document includes a large number of field codes which you cannot see. The grey text that you can see when you click on a citation alerts you to the presence of the field codes. These field codes can easily become corrupted. Here's what to do before you start changing things in your essay:

In Word, click on EndNote and then **Convert Citations and Bibliography** and select **Convert to Unformatted Citations**. Your Reference list will disappear and your citations will look like this: {Black, 2011, #142}

Make your changes and then click on **Update Citations and Bibliography**. Your reference list will be restored and citations will be in the correct parentheses.

You may also need to enable instant formatting again. Click on the small **arrow** beside Bibliography and turn on the Instant Formatting.



Funny code has appeared in my document. How do I get rid of them?

<EndNote><Cite><Author>Arbour</Author><Year>2012</Year><RecNum>128</RecNum><DisplayText>.....

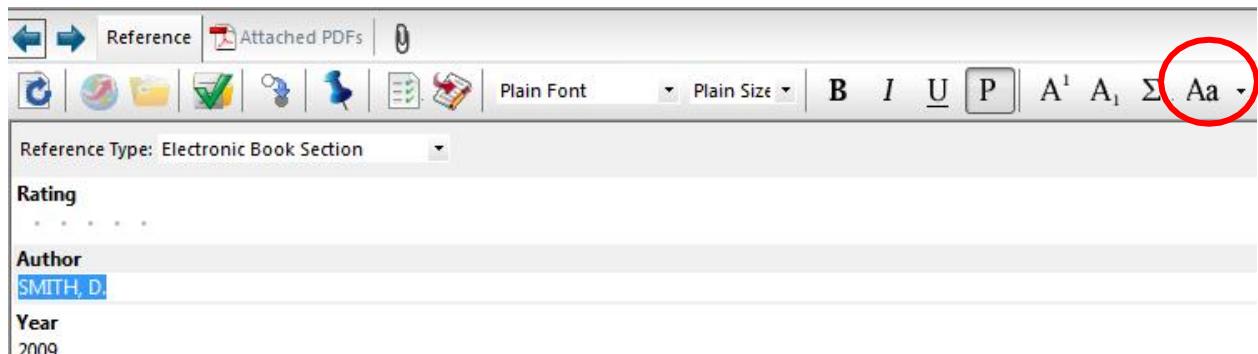
These are the field codes. Hit **Alt F9** and you will toggle back to your document without the fields showing.



My record has downloaded with most of the words in capitals. Is there an easy way to change to lower case?

Yes. You will need to double click the entry in your library and highlight the words you want changed. Now click on the options at **Aa** to change to lower case.

Use this row of buttons to italicise, underline, change the font, spell check etc.



My records are not downloading properly from the databases or from PrimoSearch

Here are some things to check:

- i. Use **Internet Explorer**, not **Mozilla Firefox**
- ii. Check your version of EndNote is compatible with your version of Word. Upgrade if necessary
- iii. If they are still not downloading properly, save the files as a text document to your desktop. Go to EndNote and then **File > Import > File** and select the text document you have saved. Choose these options:
Import Options: Reference
Manager (RIS) Duplicates:
Discard Duplicates
Text Translation: No Translation
Now click **Import** and the file should download into EndNote.



How do I import references from a typed document into EndNote?

There is no easy way to do this! It will have to be a laborious cut and paste. Here's the easiest way:

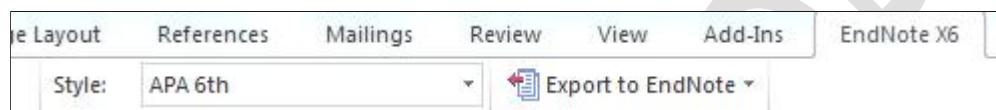
- i. Open the list of references in Word and copy a reference
- ii. Open your EndNote Library and choose **New Reference** and paste the reference into the title field
- iii. Now drag-and-drop (or cut and paste) the individual pieces of data into their proper field.

Be sure to remove extraneous punctuation and make sure author names are underneath each other.

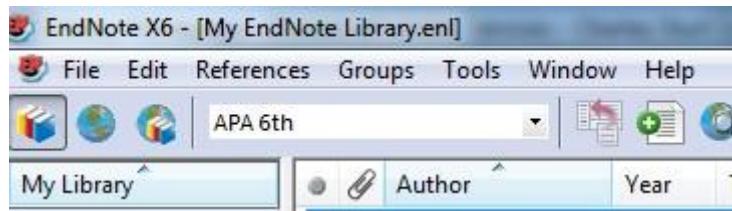


The bibliography is appearing, but no citations are appearing in my document

A reference list is generated when you “insert selected citation,” but no citation appears. What’s wrong? This is easily fixed as it is probably just a matter of selecting the correct style. Check that you have APA 6th (or whatever style you are using) selected both in EndNote and in Word. In **MS Word**, click on the EndNote button, and select your style.



In **EndNote**, select your style in the same way.

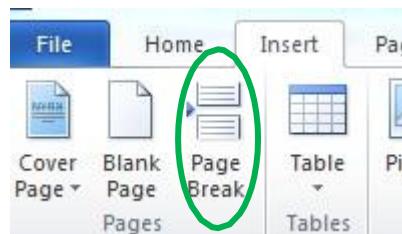


FAQs for Turabian



How can I make the footnote numbering start again from "1" when I begin a new chapter?

At the beginning of each chapter, select **Insert** and then click **Page break** so that each chapter is a separate Section.



When you insert your first footnote in a new chapter, click on **References**, and then the **arrow** in the corner.

Check the option **Restart Each Page** in the Numbering section. MS Word will now begin numbering the footnotes at 1 in the new chapter.



Why are the repeated citations abbreviated?

Turabian requires footnotes to be abbreviated if they have already been cited once. If the reference is cited again in the following footnote, EndNote will normally insert **Ibid**.

If the reference is cited again, but not in the immediately following footnote, EndNote will put just the name of the author as the footnote.



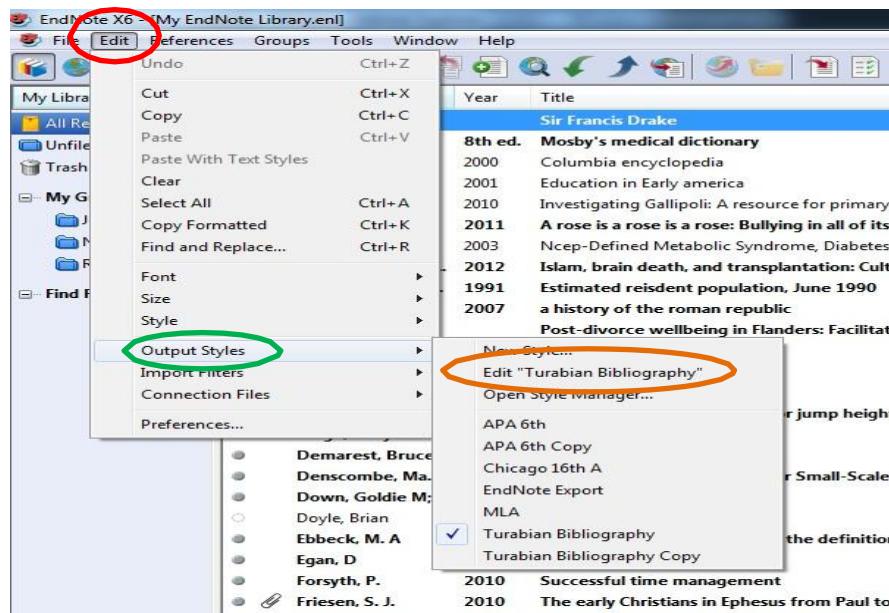
I want to delete the author from my footnotes. Can I do that?

Previous versions of EndNote would not allow this, but EndNote X6 can now edit your footnotes. Do this through the *Edit & Manage Citations* button OR right click on the footnote and select *Edit Citation*.

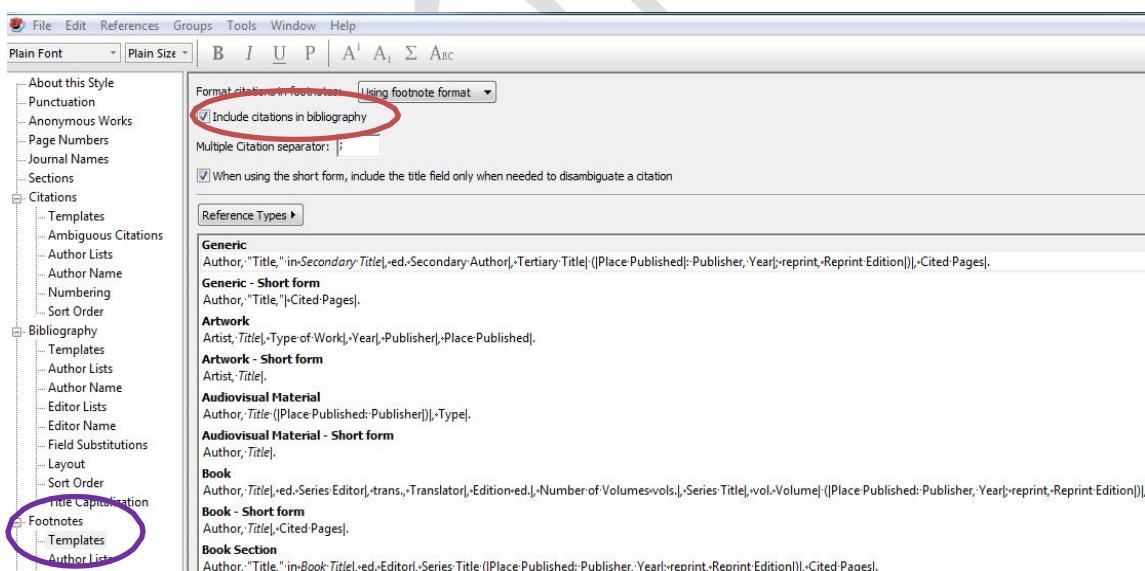


My endnote automatically creates a list of references used in footnotes at the end of each document. How do I stop it doing this as I don't want a reference list?

In endnote, go to **Edit** (on the top menu), then down to **Output Style** (near the bottom), then across to **Edit** [whatever your output style is, in this case Turabian].



This will open the style controls. In the left panel of this box, go down to Footnotes, then click on **'Templates'**. At the top of the Footnotes templates you'll see a tick box marked **'Include citations in bibliography'**. Untick that box. Close and save the style (with the same style name) or you could create a new style, say, 'Turabian no bib' so that you have one version of the style with the bibliography, and one without.



9.6 Abbreviations for American States and Territories

Add two-letter abbreviations for the names of American states when entering place of publication details for American books in your references list (e.g. New York, NY; Washington, DC; Springfield, IL; Hillsdale, NJ;)

In APA style, when the place of publication is a country other than America, write the name of the city and the country (Birmingham, United Kingdom; Toronto, Canada; Sydney, Australia etc.)

NOTE: Turabian style does not require states, unless the place of publication is little known. It also does not require countries to be listed.

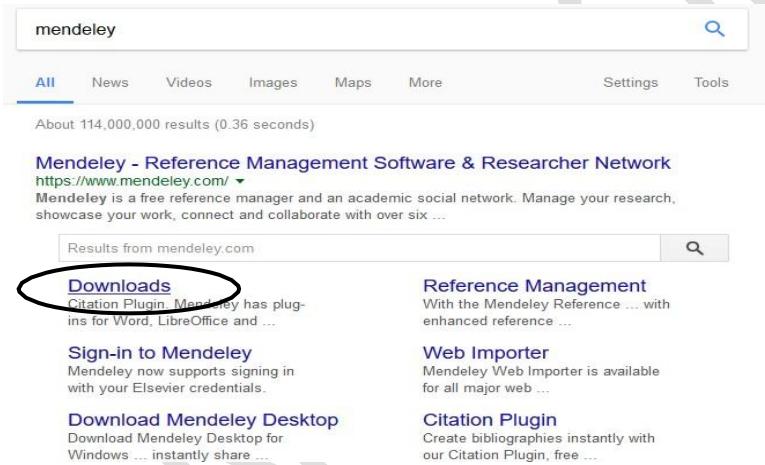
MODULE TEN

10.0 REFERENCING AND CITATION MANAGER: MENDELEY

Research requires reading, citing and referencing both primary and secondary sources of literature. The process of referencing can be a nightmare if done by hand, but it can be relatively simple and straight-forward when taking advantage of certain applications. Here we present a relatively easy-to-understand and free application known as Mendeley which can help you with referencing in your thesis and dissertation. Mendeley is a trademark of Elsevier Limited but can easily be added to MS Word as a plug in application. Mendeley comes in handy during referencing any research you might be doing now and in the future. For that reason, we have made this step-by-step guide on how to use Mendeley and we hope you find it useful.

How to Download and Install Mendeley

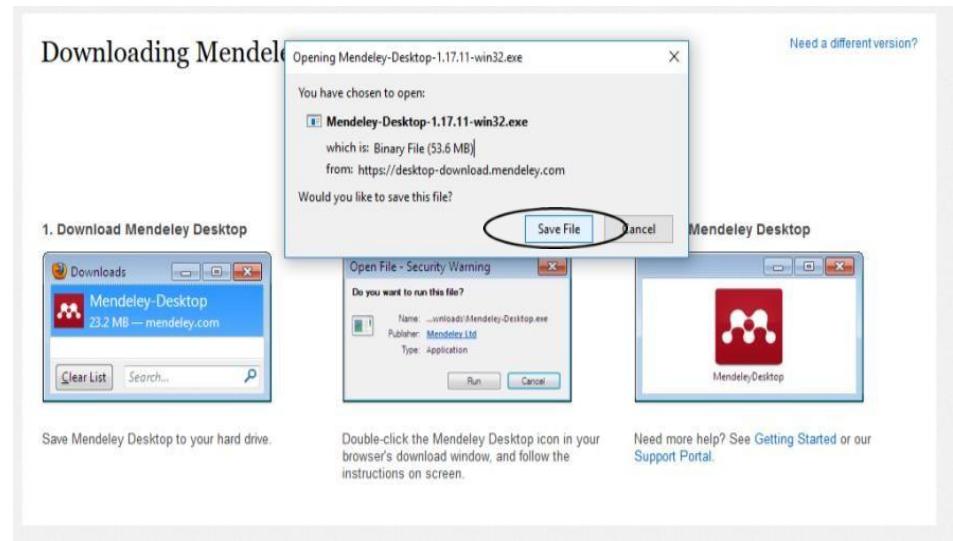
1. Type “Mendeley” in google and click on the “download” hyperlink:



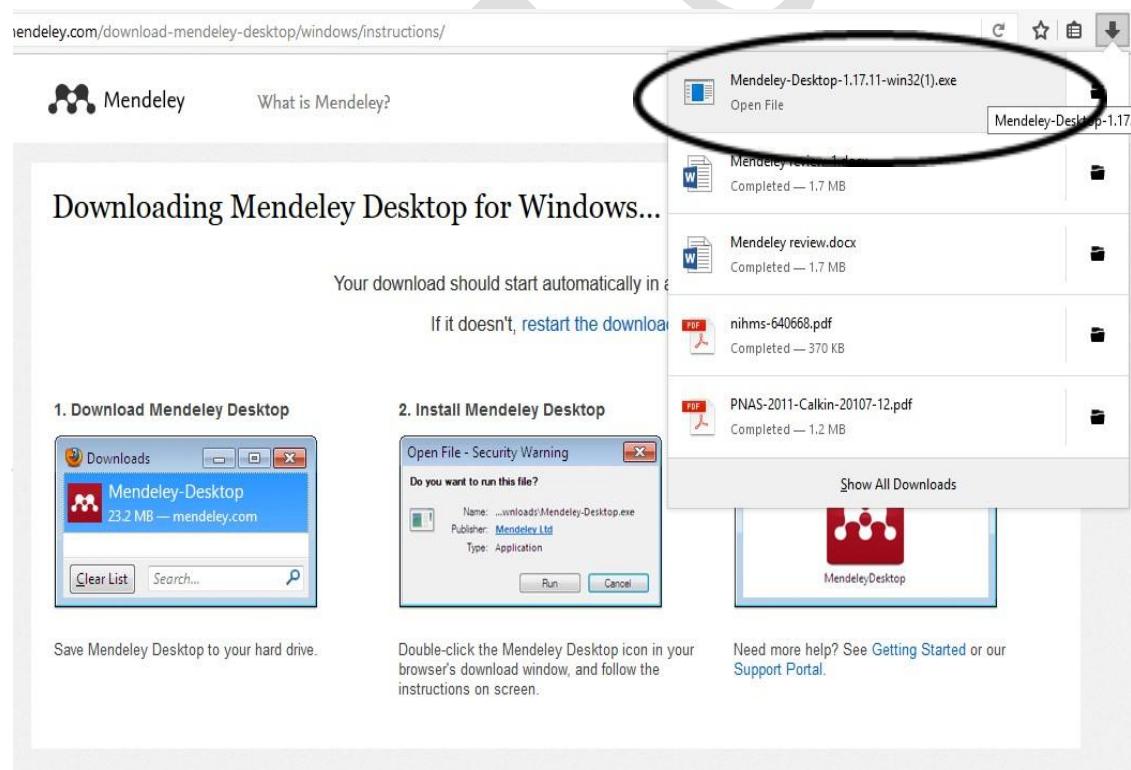
2. Click “download Mendeley desktop”



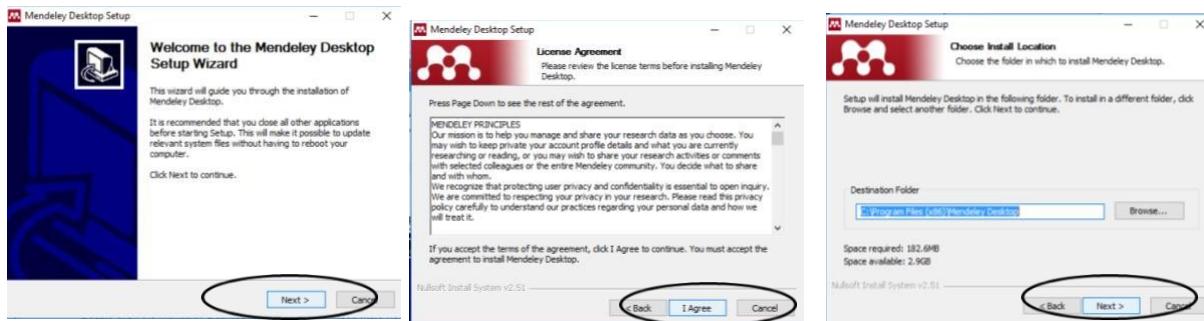
3. Click “save File” on the pop-up that appears:



4. Go to the top right-hand corner of your browser and click on the download button. This opens a list of applications that you have downloaded from the internet. Click on the “Mendeley-Desktop-1.17.11-win32.exe”.

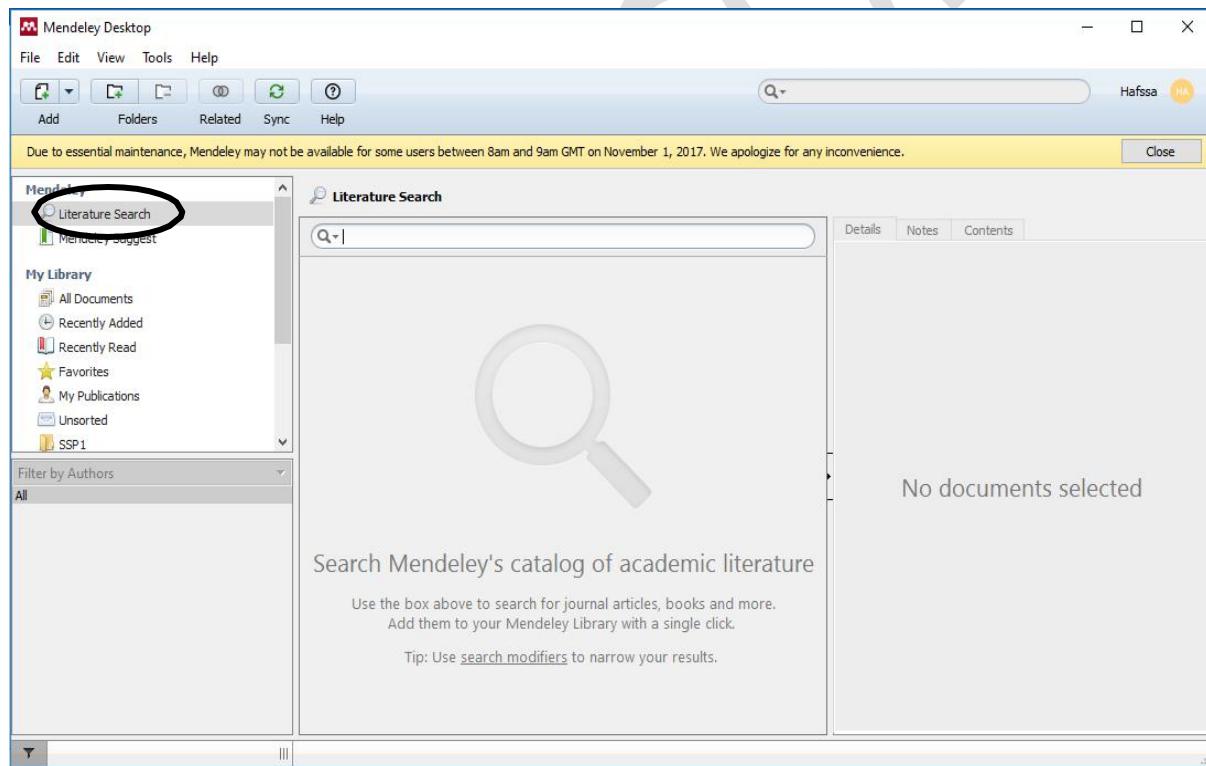


5. A pop-up appears on the monitor. Click “yes” which will lead to a Wizard Setup to also come up. If you follow the instructions, it’ll eventually allow you to install the application shown the different dialog windows shown below.



How Mendeley works

1. The application will look like this when you open it:



- The “literature search” allows you to find some pieces of literature and gives you the relevant pieces of information about the piece – an example if you enter the term “lysosome”:
- This allows you to see where the article/chapters are from, their year of publication, volume number, abstract and name of authors (as well as other details).

Literature Search

Search Results

Lysosomes

Lena Wartosch; NA Bright; JP Luzio - 2015 - Current Biology

Lysosomes: fusion and function

J. Paul Luzio; PR Pryor; NA Bright - 2007 - Nature Reviews Molecular Cell Biology

Secretory lysosomes

E J Blott; GM Griffiths - 2002 - Nat Rev Mol Cell Biol

Lysosomes

Volkmar Giesemann; T Bräukle - 2009 - Biochimica et biophysica acta

Lysosomes revisited

Christian de Duve - 1983 - European Journal of Biochemistry

Regulating secretory lysosomes

Oliver J. Holt; F Gallo; GM Griffiths - 2006 - Journal of Biochemistry

Lipids and Lysosomes

Isabelle Hamer; G Van Beersel; T Arnould - 2012 - Current Drug Metabolism

Lysosomes in cell death

Maria Eugenia Guicciardi; M Leist; GJ... - 2004 - Oncogene

The Biogenesis of Lysosomes

Stuart Kornfeld; I Mellman - 1989 - Annual Review of Cell Biology

Relationship between endosomes and lysosomes.

JP Luzio; BM Mullock; PR Pryor; MR L... - 2001 - Biochemical Society transactions

Lysosomes relax in the cellular suburbs

Swetha Gowrishankar; SM Ferguson - 2016 - Journal of Cell Biology

The proteome of lysosomes

Bernd A. Schröder; C Wroclawie; A Has... - 2010 - Proteomics

When lysosomes get old

Ana Maria Cuervo; JF Dice - 2000 - Experimental Gerontology

Details Notes Contents

This document is not in your library Save Reference

Type: Journal Article

Lysosomes

Authors: L. Wartosch, N. Bright, J. Luzio

Journal: *Current Biology*

Year: 2015

Volume: 25

Issue: 8

Pages: R315-R316

Abstract:
In this Quick guide, Wartosch et al. summarise what we know about lysosomes, the degradative organelles of...

Tags:

Author Keywords:

How to Reference and Cite on Mendeley

1. Click on “tools” on the top left-hand corner of the application and select the option “install WS word Plugin” as shown.

File Edit View Tools Help

Invite Colleagues

Install MS Word Plugin

Check for Duplicates

Options

Literature Search

Search Results

Lysosomes

Lena Wartosch; NA Bright; JP Luzio - 2015 - Current Biology

Lysosomes: fusion and function

J. Paul Luzio; PR Pryor; NA Bright - 2007 - Nature Reviews Molecular Cell Biology

Secretory lysosomes

E J Blott; GM Griffiths - 2002 - Nat Rev Mol Cell Biol

Lysosomes

Volkmar Giesemann; T Bräukle - 2009 - Biochimica et biophysica acta

Lysosomes revisited

Christian de Duve - 1983 - European Journal of Biochemistry

Regulating secretory lysosomes

Oliver J. Holt; F Gallo; GM Griffiths - 2006 - Journal of Biochemistry

Lipids and Lysosomes

Isabelle Hamer; G Van Beersel; T Arnould - 2012 - Current Drug Metabolism

Lysosomes in cell death

Maria Eugenia Guicciardi; M Leist; GJ... - 2004 - Oncogene

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Stuart Kornfeld; I Mellman - 1989 - Annual Review of Cell Biology

Relationship between endosomes and lysosomes.

JP Luzio; BM Mullock; PR Pryor; MR L... - 2001 - Biochemical Society transactions

Lysosomes relax in the cellular suburbs

Swetha Gowrishankar; SM Ferguson - 2016 - Journal of Cell Biology

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Details Notes Contents

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Type: Journal Article

Lysosomes

Authors: L. Wartosch, N. Bright, J. Luzio

Journal: *Current Biology*

Year: 2015

Volume: 25

Issue: 8

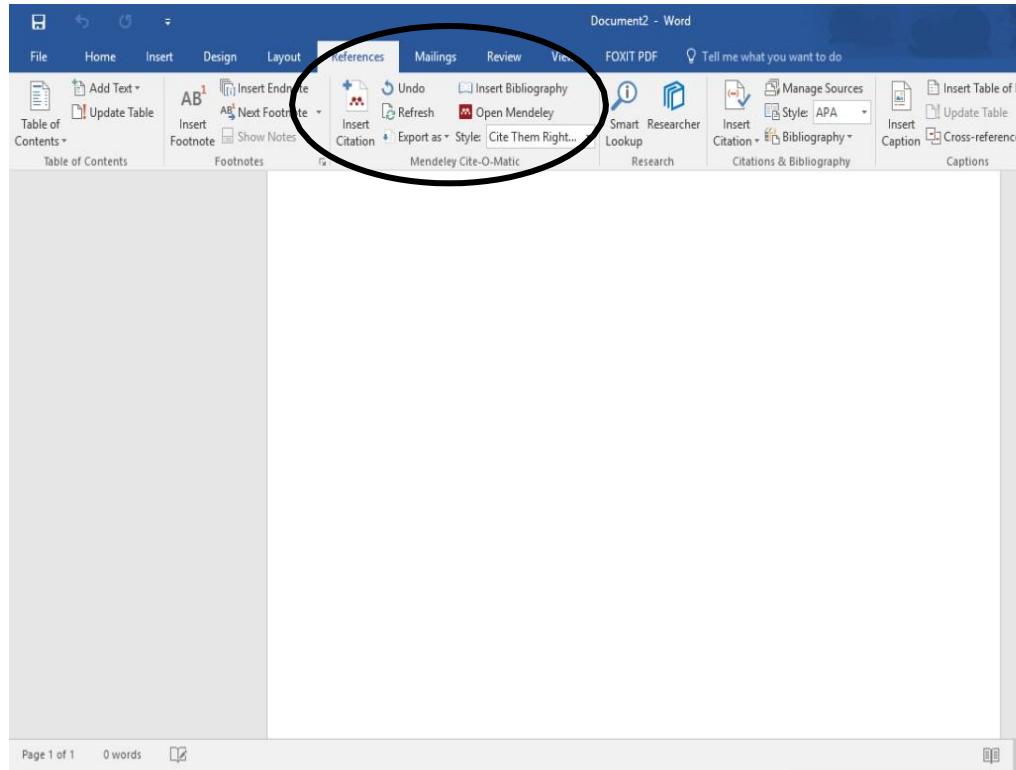
Pages: R315-R316

Abstract:
In this Quick guide, Wartosch et al. summarise what we know about lysosomes, the degradative organelles of...

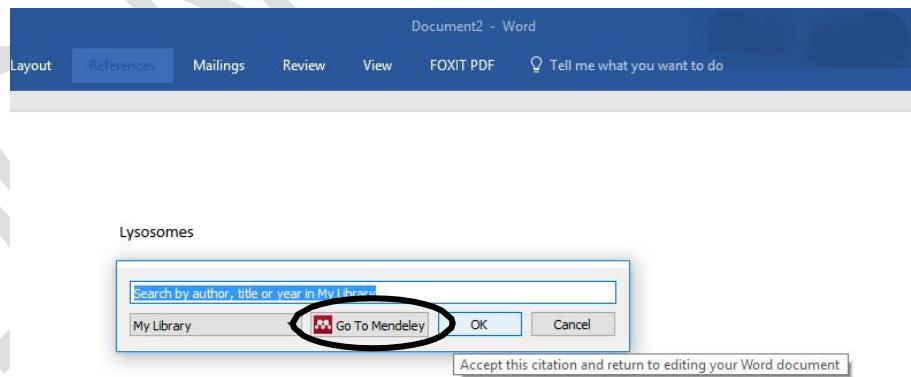
Tags:

Author Keywords:

2. Open your document in Word. Let's use a blank document as an example; on the toolbar, Select “reference”- directly beneath it, you'll see “insert citation”.



3. When you want to cite, select “insert citation” and a pop up will appear. Click on “Go to Mendeley”:



4. This will open your “library” of saved references on your Mendeley application. Click on the relevant document and select “Cite” – this will transfer the citation directly onto your word document.

The screenshot shows the Mendeley desktop application interface. At the top, there are buttons for 'Related', 'Sync', 'Cite', and 'Send citation to plugin' (which is circled in red). Below the toolbar, a message states: 'Mendeley may not be available for some users between 8am and 9am GMT on November 1, 2017. We apologize for any inconvenience.' The main window displays a list of documents. One document is selected, showing the authors 'Wartosch, Lena; Bright, Nicholas A.; Luzio, J. Paul' and the title 'Lysosomes'.

- Once you have completed your work on the document, you can insert a bibliography simply by clicking on “insert bibliography” under “references” on the toolbar.

The screenshot shows the Microsoft Word ribbon with the 'References' tab selected. The 'Insert Bibliography' button is highlighted with a red circle. A tooltip 'Insert Bibliography' is visible above the button. The 'Style' dropdown is set to 'Cite Them Right...'. The 'Bibliography' button is also visible in the ribbon.

- This will insert a list of all the references you have used when writing the document.

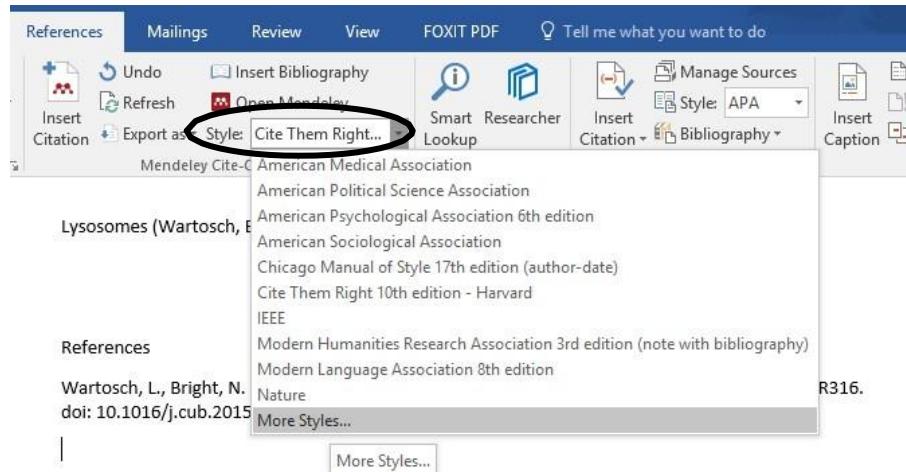
Lysosomes (Wartosch, Bright and Luzio, 2015)

References

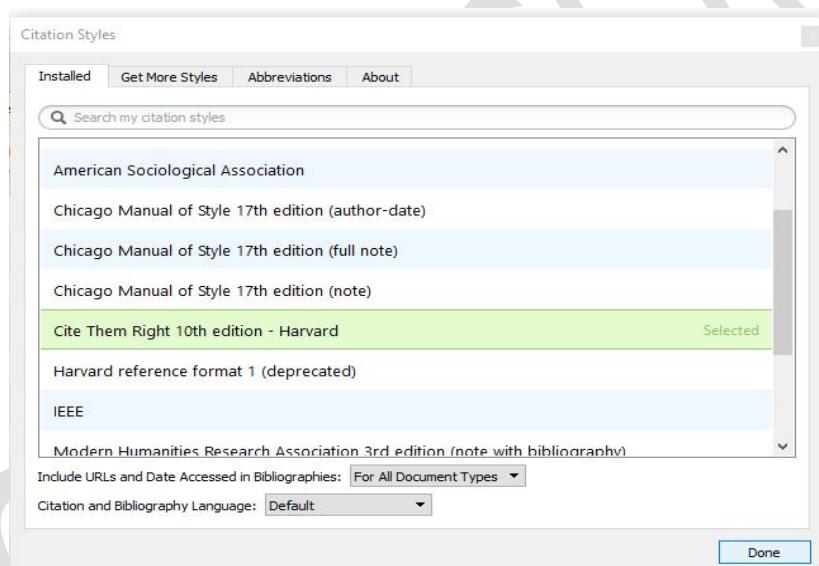
Wartosch, L., Bright, N. A. and Luzio, J. P. (2015) 'Lysosomes', *Current Biology*, 25(8), pp. R315–R316.
doi: 10.1016/j.cub.2015.02.027.

Changing the Reference Type

- Sometimes, you are required to cite using a specific referencing style. You can change the referencing type using Mendeley. You can do this by clicking on “styles” under “referencing” and choosing “more styles...”



2. This will open the Mendeley application and a window called “citation styles”. You can choose from the installed styles. If your style is not there, you can check “get more styles”. Once you select your preferred style, select “done” and that will automatically change the type of style on your word document.



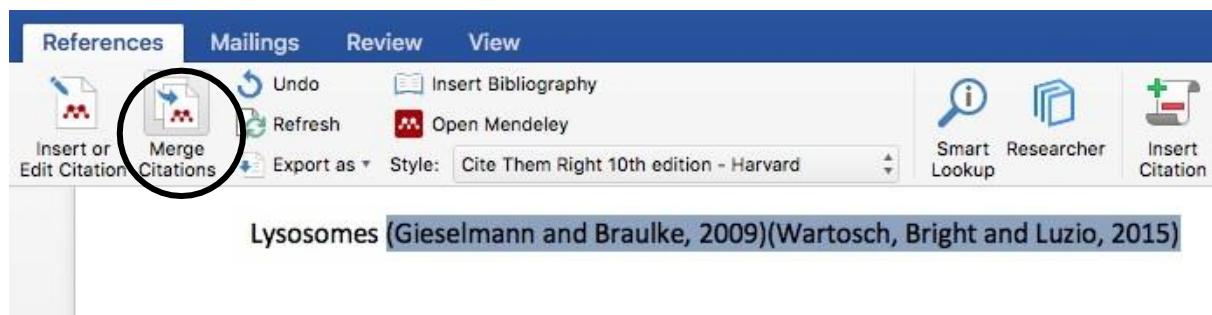
How to Merge Citation

Sometimes when writing, more than one citation is used. These citations can be merged using Mendeley. The principle is similar to citing as mentioned above but there is an addition to the process.

1. Cite both sources as illustrated

Lysosomes (Gieselmann and Braulke, 2009)(Wartosch, Bright and Luzio, 2015)

Highlight the citations and click on the “merge” option in the reference toolbar



2. The citations merge together. This can be done with as many citations present.

Lysosomes (Gieselmann and Braulke, 2009; Wartosch, Bright and Luzio, 2015)

How to add more Literature Pieces to Mendeley

Although Mendeley is a great application which contains many literature pieces, it is limited, and you may not find the literature piece that you want on it.

If that's the case, no need to worry as Mendeley accommodates for the situation in two ways and you are able to use whichever way is more convenient for you to cite the literature piece that you want.

1. Drag and drop
2. Web importer Drag and drop

This works exactly the same way that it sounds. You need to download the document that you want and drop it into Mendeley as illustrated below:

1. Let us assume that this document isn't found on Mendeley's "Literature search"

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Autophagic-Lysosomal Inhibition Compromises Ubiquitin-Proteasome System Performance in a p62 Dependent Manner in Cardiomyocytes

Zongwen Tian, Changhua Wang, Chengjun Hu, Yihao Tian, Jinbao Liu, Xuejun Wang

Published: June 24, 2014 • <https://doi.org/10.1371/journal.pone.0100715>

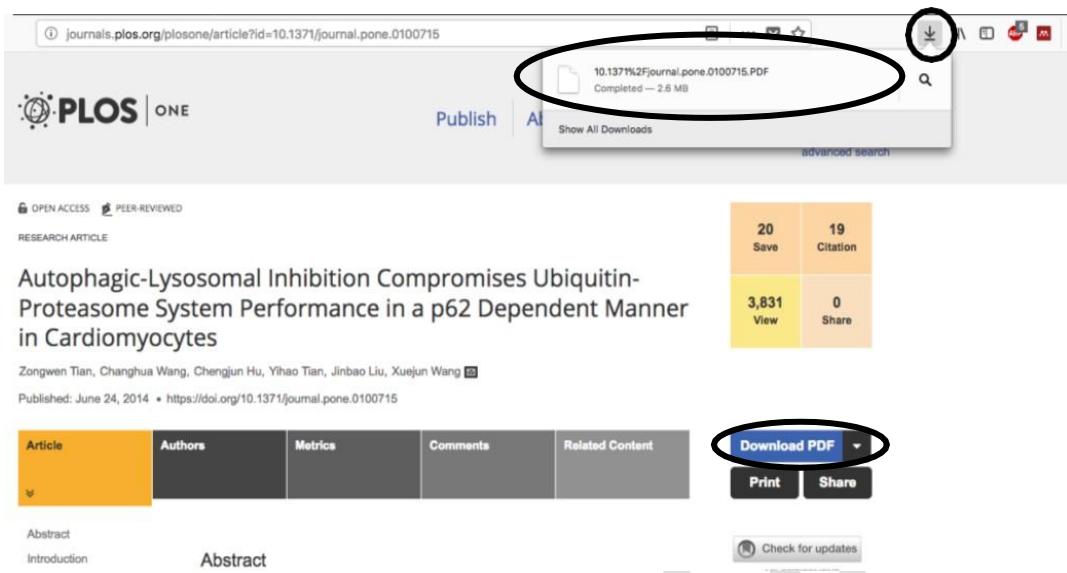
20 Save	19 Citation
3,831 View	0 Share

Download PDF

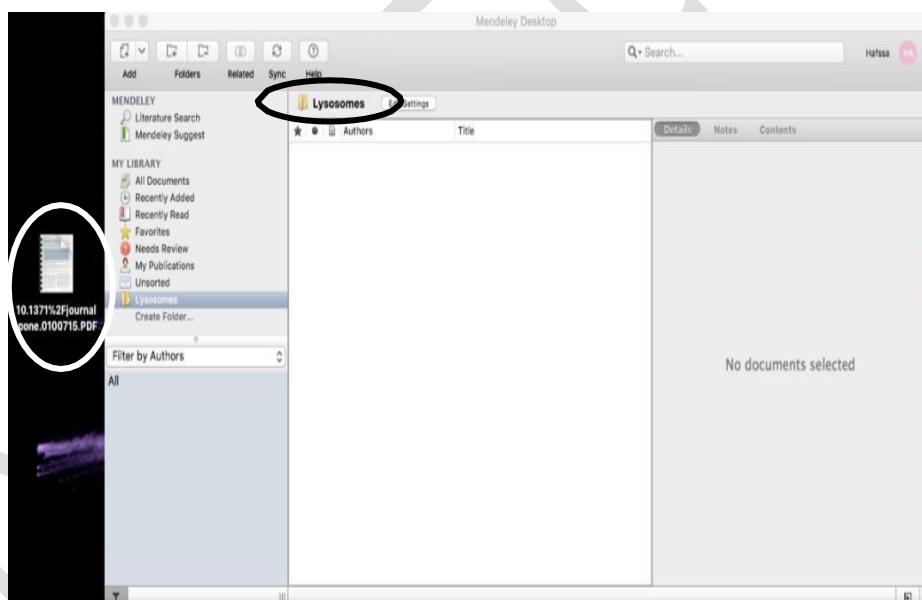
Print Share

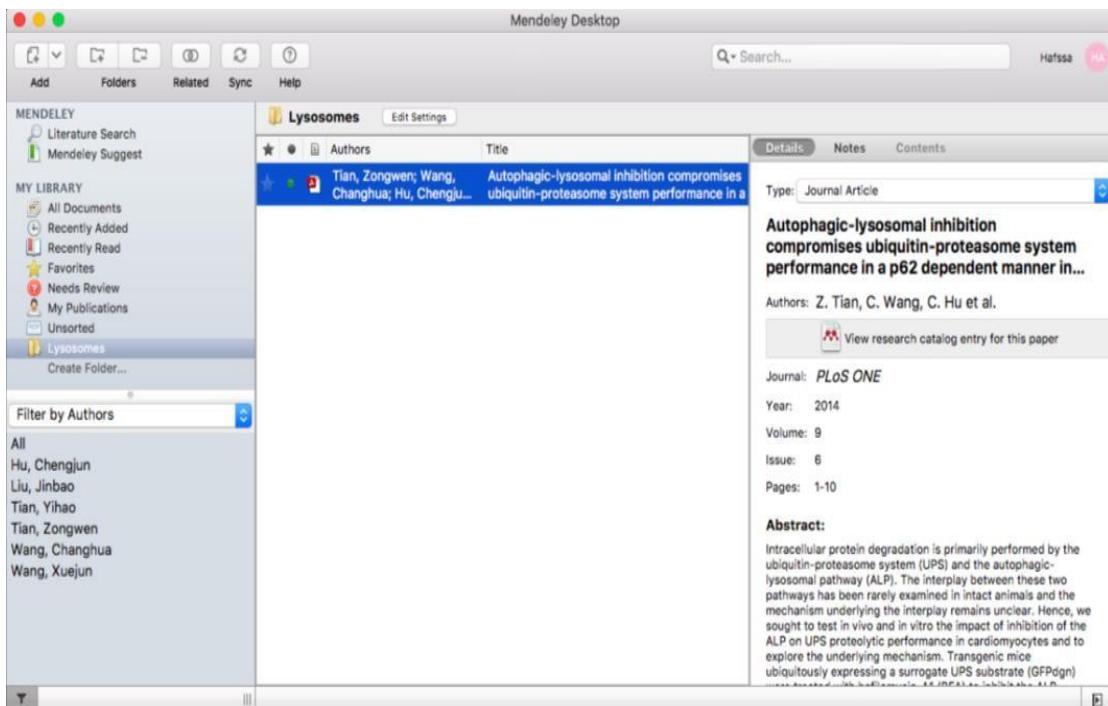
Check for updates

2. Download the article on the device



3. Open the Mendeley folder that you want the literature piece to be a part of and drag the downloaded document into it as seen below



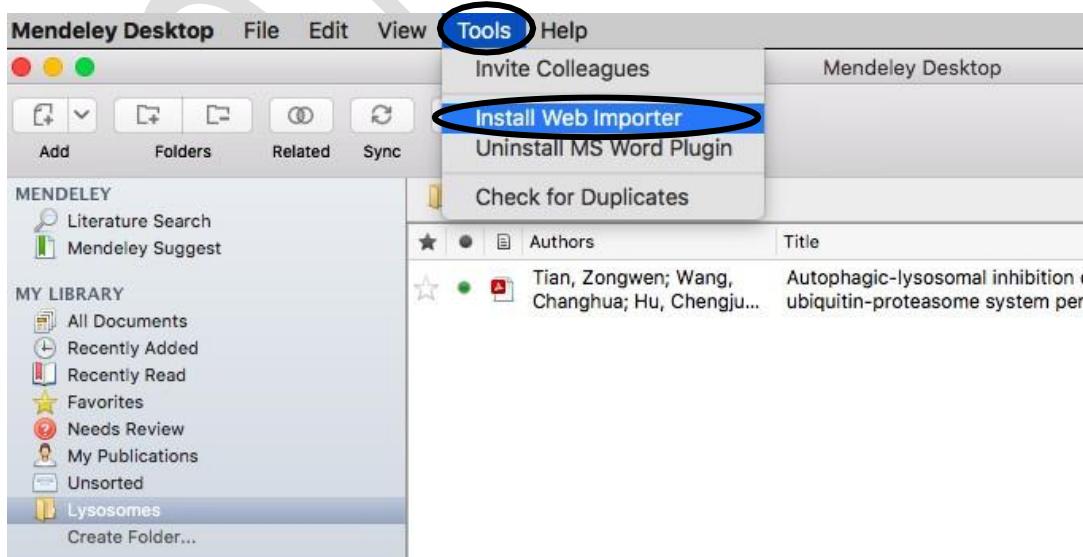


The literature piece gets uploaded to Mendeley and is ready to get used for citation as shown earlier. This is the first way of citing a document which isn't found in the literature search.

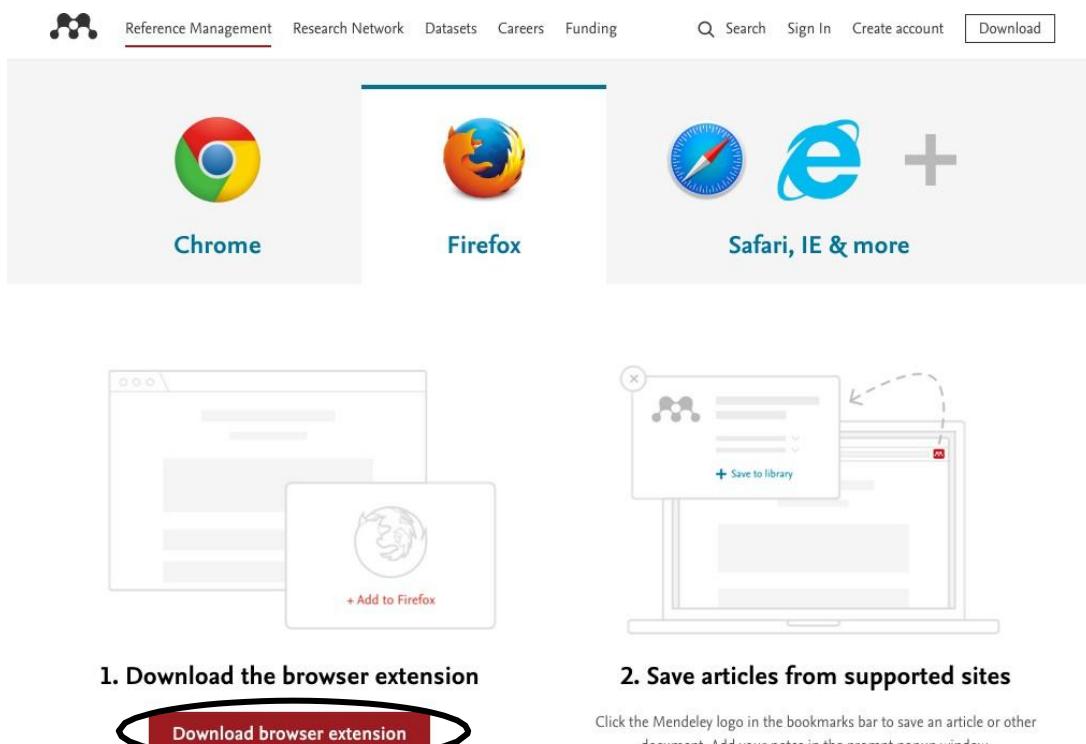
Web Importer

Web importer is an application located on browsers toolbar. It allows the user to import documents/literature pieces directly from the search engine to the Mendeley application reference library.

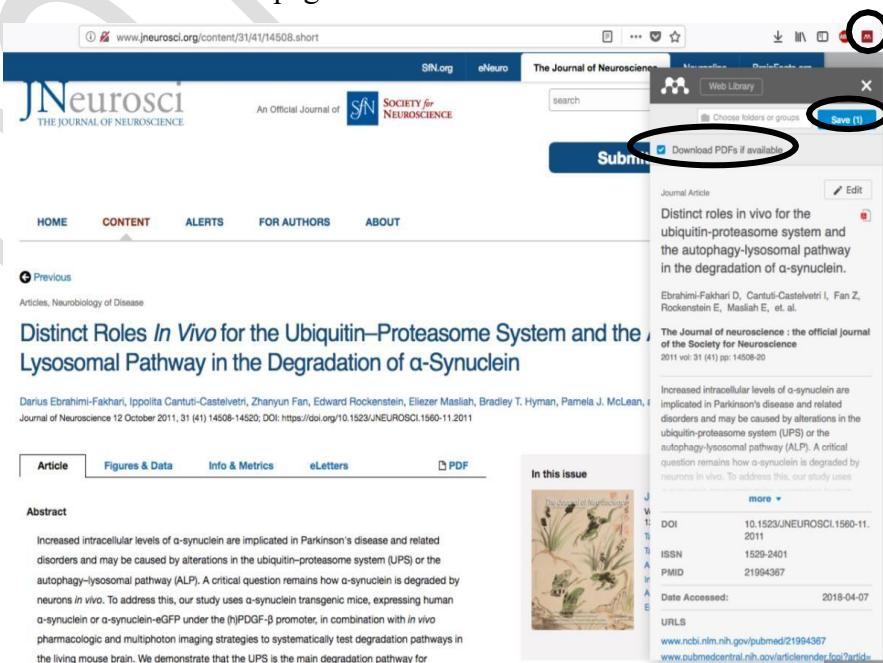
1. To install the web-importer, click on “tools” at the top of the page and select “Install web importer”.



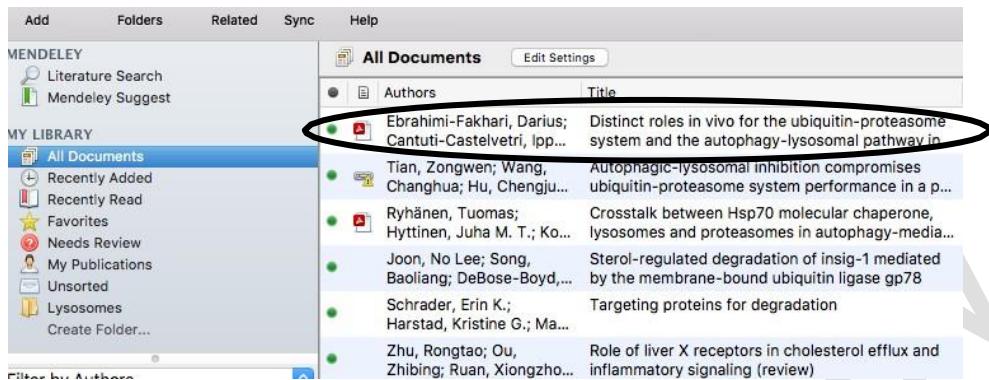
2. A webpage opens up. Scroll down and select which browser you would like to add the web importer extension to. Complete the process by “downloading the browser extension”.



3. Once you have signed in using the same email used in the desktop Mendeley application you are able to import any documents directly from the webpage to any folder in your account. You also have the option of downloading the PDF if it is available for free on the webpage.



4. Once you have saved it, you can access it in the library of the desktop application.



All the documents that are saved on your library on the Mendeley desktop application can also be accessed on the Mendeley webpage if you sign into your account and click on “library”.

The screenshot shows the Mendeley web interface. The top navigation bar includes 'All Documents', 'New Tab', and a search bar with the URL 'https://www.mendeley.com/library/'. The 'Library' tab is highlighted with a black oval. The main content area is titled 'MY LIBRARY' and shows a list of documents. The first document in the list is circled with a black oval. The document details are: 'Distinct roles in vivo for the ubiquitin-proteasome system and the autophagy-lysosomal pathway in' by Ebrahimi-Fakhari, Darius; Cantuti-Castelvetri, Ipp... The rest of the list includes: 'Autophagic-lysosomal inhibition compromises ubiquitin-proteasome system performance in a p62 dependent...', 'Crosstalk between Hsp70 molecular chaperone, lysosomes and proteasomes in autophagy-mediated prote...', 'Sterol-regulated degradation of insig-1 mediated by the membrane-bound ubiquitin ligase gp78', 'Targeting proteins for degradation', 'Role of liver X receptors in cholesterol efflux and inflammatory signaling (review)', 'LXR, a nuclear receptor that defines a distinct retinoid response pathway', 'The LXRs: A new class of oxysterol receptors', 'Mechanism of action of sterol regulatory element binding proteins (SREBPs) in cholesterol and fatty-acid bi...', 'Chapter 17 – Lipoprotein Receptors', 'Biological membranes', and 'Regulation of low-density lipoprotein receptors: Implications for pathogenesis and therapy of hypercholester...'. The bottom of the page shows 'No document selected' and a page footer with '1 to 50 of 66'.

MODULE ELEVEN

11.0

MENDELEY GUIDE



Mendeley Reference Manager

A guide for new users

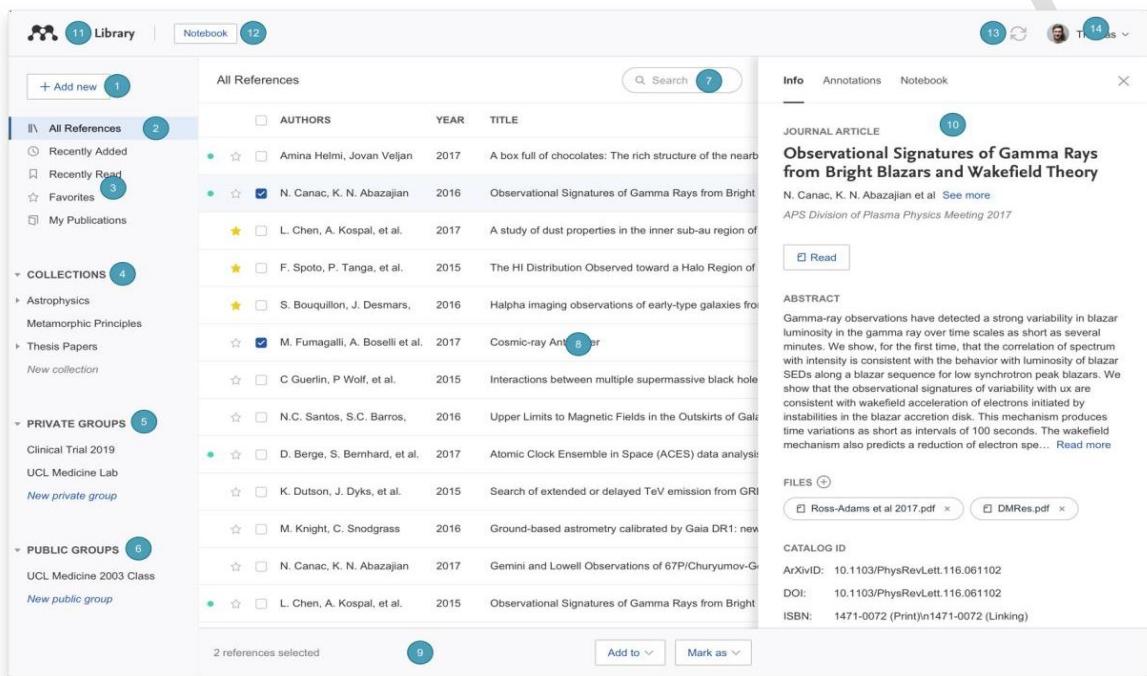
October 2019

ELSEVIER

Simplify your Research Workflow

Considerable time and effort can be spent building and organising your reference library, finding your references and notes when you need them and formatting citations correctly. The new Mendeley Reference Manager helps simplify these tasks, leaving you time to focus on achieving goals.

Navigate Mendeley Reference Manager



The screenshot shows the Mendeley Reference Manager interface. On the left, the library sidebar includes sections for 'Add new' (1), 'All References' (2), 'Recently Added' (3), 'Favorites' (4), 'Collections' (5), 'Private Groups' (6), and 'Public Groups' (7). The main area displays a table of 'All References' with columns for 'AUTHORS', 'YEAR', and 'TITLE'. A selected reference is shown in the 'Info' panel on the right, titled 'JOURNAL ARTICLE' (10) with the title 'Observational Signatures of Gamma Rays from Bright Blazars and Wakefield Theory' by N. Canac, K. N. Abazajian et al. (11). The 'ABSTRACT' section (12) discusses gamma-ray observations of blazars. The 'FILES' section (13) lists PDF files: 'Ross-Adams et al 2017.pdf' and 'DMRes.pdf'. The 'CATALOG ID' section (14) provides ArXivID, DOI, and ISBN. At the bottom, there are buttons for 'Add to' (15) and 'Mark as' (16).

1. Add new- Add new references to your library
2. All References- Return to your library
3. Smart Collections- Mendeley reference Manager automatically organizes aspects of your library into smart collections
4. Custom collections- keep your references organized in custom collections
5. Private Groups- The private groups you have created or joined
6. Public Groups- The public groups you have created or joined
7. Search- Search your library
8. Library table- All of the references in your selected collection or group
9. Action panel- Select the check box next to a references in the library table to bring up the action panel
10. Info panel- select a reference in the library table to view the metadata in the info panel
11. Library- Return to the main library view
12. Notebook- Keep all your thoughts in one place
13. Sync- Mendeley Reference Manager automatically syncs any changes you make to the cloud
14. Profile- Access your online profile page, access support or sign out of your account.

Build your Mendeley Library

Build a library to keep all your references in one place, where you can easily organize and find them. To get started with your mendeley library, import references using a variety of methods:

- A. Drag and drop PDF's from your computer Mendeley automatically captures author, title and publisher information.
- B. Import files from your computer
 - Select and add locally stored references.
 - Import locally stored RIS, BibTex or EndNote XML files.
- C. Manually create an entry: if you enter the DOI into the appropriate field Mendeley automatically looks up the details for you.
- D. Import content from the internet using Mendeley Web, Install mendeley Web Importer from the [Chrome Web Store](#).

Mendeley Web importer detects article identifiers on the page you are viewing and automatically retrieves metadata and PDF full texts (where available) for you to add to your library.

Screenshot A: Mendeley Library interface showing a list of references. A red box highlights the 'All References' table, which includes columns for AUTHORS, YEAR, TITLE, SOURCE, ADDED, and FILE. A tooltip 'Drop files to add them to All References' is shown above the table.

Screenshot B: Mendeley Library interface showing a list of references. A red box highlights the 'My Publications' section. A tooltip 'File(s) from computer' is shown above the section.

Screenshot C: Mendeley 'Add entry manually' dialog box. A red box highlights the 'DOI' field. The dialog includes fields for REFERENCE TYPE (set to 'Journal Article'), TITLE, and AUTHORS.

Screenshot D: Mendeley 'Web Importer' dialog box. A red box highlights the 'Select all' checkbox. The dialog shows two references detected on the page: 'October research deadlines end of January' and 'Fetal growth velocity: the NICHD fetal growth studies conducted in 2019 Q1'.

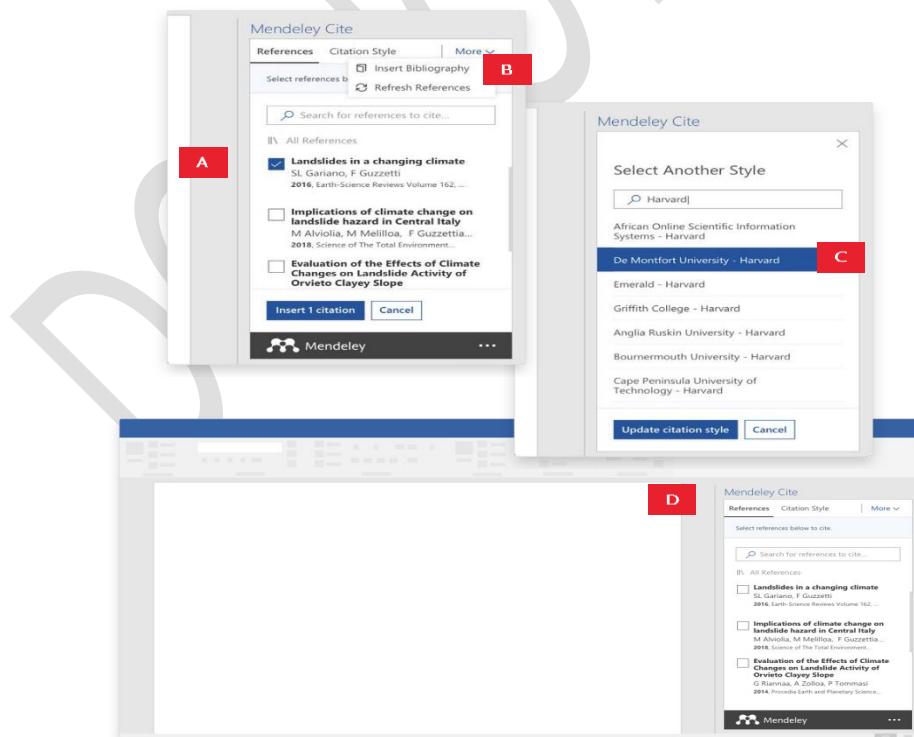
Insert Citations into your Microsoft Word Document

Add citations and bibliographies to a Microsoft Word document you're writing. Use the Mendeley Cite add-in for Microsoft Word to generate citations and bibliographies in just a few clicks:

- A. **Choose your preferred citation style:** select from thousands of different citation styles. Search and select your preferred style to automatically update your references and bibliography.
- B. **Cite Seamlessly:** have your mendeley library and Microsoft Word document open side by side. You can also use mendeley Cite without Mendeley Reference manager being open or even installed.
- C. **Find and insert individual or multiple references into your document:** search for references in your Mendeley library and insert them into your document with a single click. You can do this for individual or multiple references.
- D. **Generate a bibliography:** generate a bibliography from the references you've cited.

Get Mendeley Cite BETA at www.mendeley.com/cite/word/install

Mendeley Cite is compatible with Microsoft Word versions 2016 and above, with the Microsoft Word app for iPad and with Microsoft Word Online.

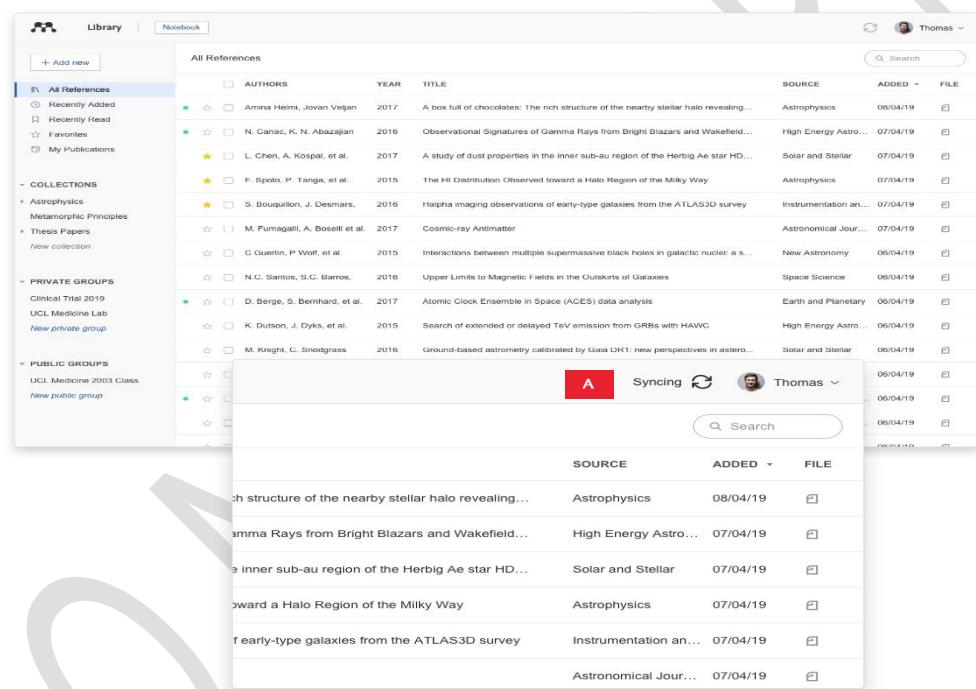


Access your Mendeley Library Anywhere

Continue your research work whenever you need, wherever you are. You can securely access documents in your Mendeley library using the desktop application or any internet browser. Real-time sync automatically saves any changes:

A. Know you're up to date

your library automatically syncs with its backup in the cloud whenever you add references or make changes, seamlessly keeping everything up to date. This means you see the same library through the desktop and browser versions of Mendeley.



Organize and find references in your Mendeley library

Keep your library organized and quickly find the references you need. Save time when looking for references by organizing them into Collections and using the search tool in your Mendeley library:

A. Organize your references

Use Mendeley's smart collections or create your own custom collections of references to keep your research interests separate.

B. Search your references

Enter a search term into the search field and Mendeley will return the appropriate results, Mendeley searches by author, title, year and source.

A

B

AUTHORS	YEAR	TITLE	SOURCE	ADDED	FILE
Amina Helmi, Jovan Veljan	2017	A box full of chocolates: The rich structure of the nearby stellar halo revealing...	Astrophysics	08/04/19	
N. Canac, K. N. Abazajian	2016	Observational Signatures of Gamma Rays from Bright Blazars and Wakefield...	High Energy Astro...	07/04/19	
L. Chen, A. Kospal, et al.	2017	A study of dust properties in the inner sub-au region of the Herbig Ae star HD...	Solar and Stellar	07/04/19	
F. Spoto, P. Tanga, et al.	2015	The HI Distribution Observed toward a Halo Region of the Milky Way	Astrophysics	07/04/19	
S. Bouquillon, J. Desmars,	2016	Halpah imaging observations of early-type galaxies from the ATLAS3D survey	Instrumentation an...	07/04/19	
M. Fumagalli, A. Boselli et al.	2017	Cosmic-ray Antimatter	Astronomical Jour...	07/04/19	
C. Guerlin, P. Wolf, et al.	2015	Interactions between multiple supermassive black holes in galactic nuclei: a s...	New Astronomy	06/04/19	
N.C. Santos, S.C. Barros,	2016	Upper Limits to Magnetic Fields in the Outskirts of Galaxies	Space Science	06/04/19	
D. Berge, S. Bernhard, et al.	2017	Atomic Clock Ensemble in Space (ACES) data analysis	Earth and Planetary	06/04/19	
K. Duson, J. Dyks, et al.	2015	Search of extended or delayed TeV emission from GRBs with HAWC	High Energy Astro...	06/04/19	
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C. Guerlin, P. Wolf, et al.	2015	Interactions between multiple supermassive black holes in galactic nuclei: a s...	New Astronomy	06/04/19	
N.C. Santos, S.C. Barros,	2016	Upper Limits to Magnetic Fields in the Outskirts of Galaxies	Space Science	06/04/19	
D. Berge, S. Bernhard, et al.	2017	Atomic Clock Ensemble in Space (ACES) data analysis	Earth and Planetary	06/04/19	

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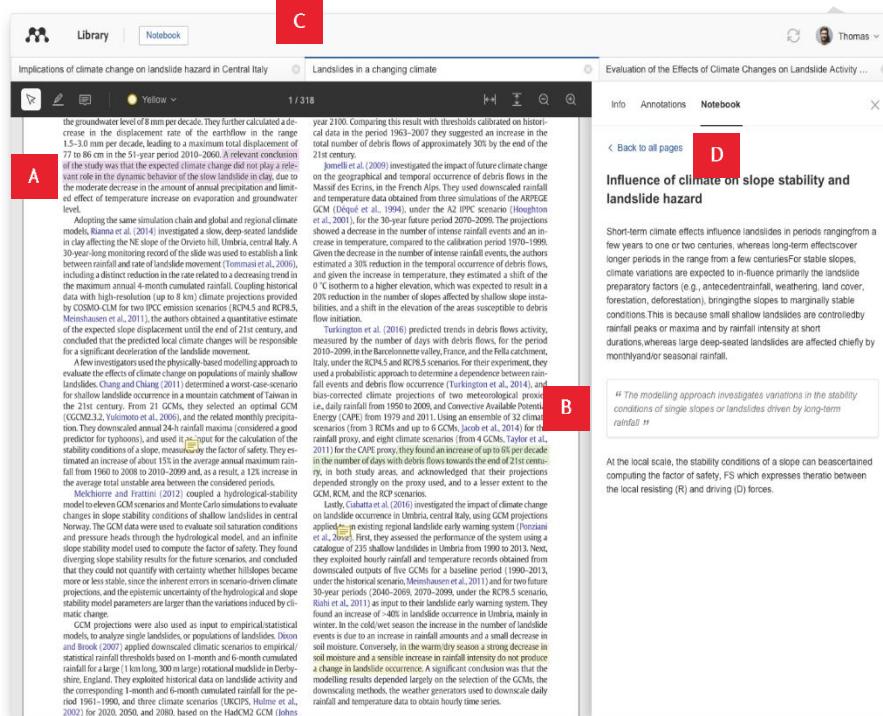
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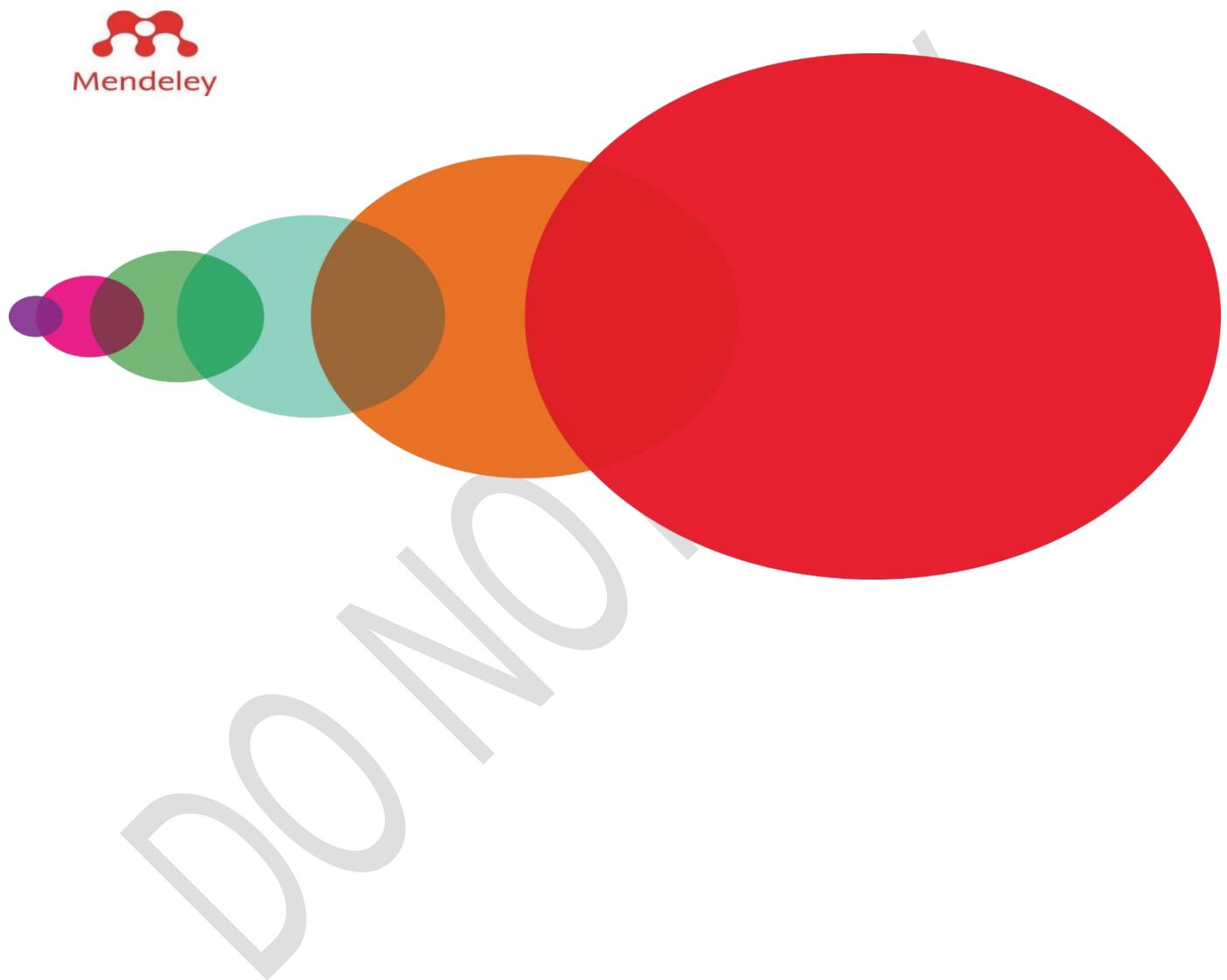
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MODULE TWELVE

12.0

STATISTICS IN RESEARCH: PRECISION AND ACCURACY OF ESTIMATES

12.1 Accuracy and Precision in Sampling

In sampling procedures *accuracy* and *precision* are two different statistical indicators and it is perhaps worth clarifying their meaning.

12.1.1 Sampling Accuracy

Sampling accuracy is usually expressed as a relative index in percentage form (i.e. between 0 and 100%) and indicates the closeness of a sample-based parameter estimator to the true data population value. When expressed as a relative index, sampling accuracy is independent of the variability of the data population, i.e. data population parameters of high variability can still be estimated with good accuracy. When sample size increases, sampling accuracy also increases.

12.1.2 Sampling Precision

Sampling precision is related to the variability of the samples used. It is measured, in reverse sense, by the coefficient of variation (CV), a relative index of variability that utilizes the sample variance and the sample mean. The Sampling precision also determines the confidence limits of the estimates that is, the range of values that are expected to contain the true data population values at a given probability.

Estimates can be of high precision (that is with narrow confidence limits), but of low accuracy. This occurs when samples are not representative and the resulting estimates are lower or higher than the true data population value.

The figure 12.0 illustrates the meaning of accuracy and precision. They are both important statistical indicators and regularly used for assessing the effectiveness of sampling operations. Their correct interpretation can greatly assist in identifying problem areas and applying appropriate corrective actions as necessary.

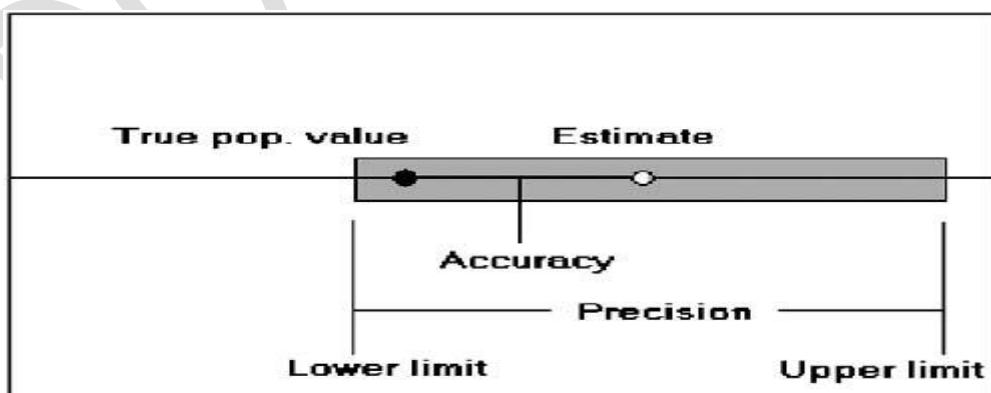


Figure 8.0: Accuracy vs. Precision

12.2 Accuracy as a Function of Sample Size

The following diagram illustrates the pattern of accuracy growth when sample size increases (see also table 4.5).

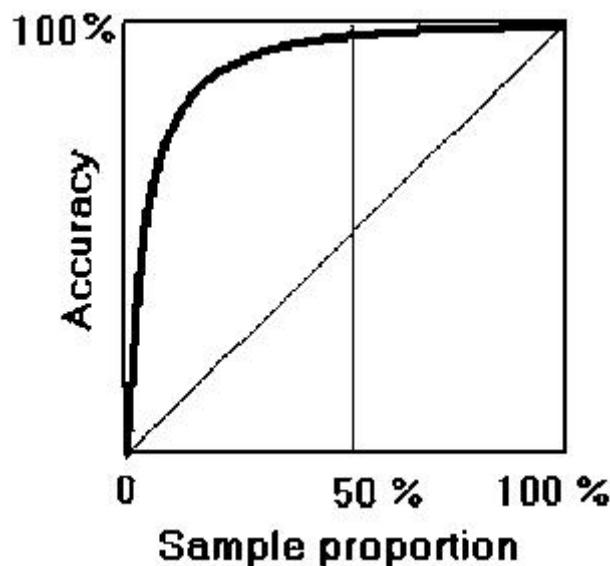


Figure 12.1: Accuracy vs. Sample Size

To be noted that:

- i. Accuracy is 100% when the entire population has been examined (as in the case of a census).
- ii. The pattern of accuracy growth is not linear. The accuracy of a sample equal to half the data population size is not 50% but very near to 100%.
- iii. Good accuracy levels can be achieved at relatively small sample sizes, provided that the samples are representative.
- iv. The result of this relationship is that beyond a certain sample size the gains in accuracy are negligible, while sampling costs increase significantly.

12.3 How to use Precision Descriptively

Precision is usually estimated using a standard error, that is, the amount of chance fluctuation (or lack of precision) we can expect in sample estimates. We can use the *standard error* as an estimate of the precision of a statistic in two ways: descriptively or inferentially (for more on these two ways of looking at the standard error).

Descriptively, when precision is estimated using a *standard error*, it is thought of as the amount of fluctuation from the population parameter that we can expect by chance alone in sample estimates. For example, for a sample mean (M), we can calculate the standard error of the mean (SEM), which provides an estimate of how much fluctuation from the population parameter that we can expect in sample estimates of M . Since standard errors are distributed normally, we can expect sample means to vary by chance $\pm 1 SEM$ 68% of the time, $\pm 2 SEM$ 95% of the time, and $\pm 3 SEM$ 98% of the time.

$$SE_{\bar{x}}(\sigma_{\bar{x}}) = \sqrt{\frac{\sigma^2}{n}} = \frac{\sigma}{\sqrt{n}}, \text{ if sample is taken with replacement}$$

$$SE_{\bar{x}}(\sigma_{\bar{x}}) = \sqrt{\frac{\sigma^2(N-n)}{n(n-1)}}$$

For difference between two means

$$SE_{(\bar{x}_1 - \bar{x}_2)} = (\sigma_{(\bar{x}_1 - \bar{x}_2)}) = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

For Proportion

$$SE(p) = \sqrt{\frac{p(1-p)}{n}}$$

For example,

In a group of 30 students with a mean of 50 and a standard deviation of 10 would be 1.83 as follows:

$$SE_{\bar{x}}(\sigma_{\bar{x}}) = \frac{10}{\sqrt{30}} = 1.83$$

12.4 Confidence Intervals: General Procedure for finding a Confidence Interval

If the sampling distribution is normally distributed with sample size $n \geq 30$:

1. Find the mean of the random sample.

2. Compute the standard error of the mean (standard deviation of the sampling distribution of means). If N is either finite or infinite and sampling is without replacement, we have

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}, N > 30$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}, N \leq 30$$

3. Determine the Z values from the given confidence level. The most frequently used are

Confidence level (%)	68.3	90	95	98	99	99.7
Z	± 1.00	± 1.64	± 1.96	± 2.33	± 2.58	± 3.00

$$Z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}}$$

4. Compute the confidence limit, solve for μ .

12.4.1 Confidence Interval for the Population Mean

In order to construct a $100\delta\%$ confidence interval for the population mean, μ , a random sample of size n is drawn from the population. The sample mean, \bar{x} and the standard deviation, s , are computed.

Case 1:

For a large sample size, $n > 30$, it is assumed to have a normal distribution with mean μ and standard deviation $\sigma_{\bar{x}}$, so that the precision is computed as follows. $Z_c \sigma_{\bar{x}}$

Where:

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}, N > 30$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}, N \leq 30$$

for infinite population and finite population of size N respectively. The value of Z_c is obtained from the standard normal table as, therefore, the $100\delta\%$ confidence interval for mean is

$$\bar{x} - Z_c \sigma_{\bar{x}} < \mu < \bar{x} + Z_c \sigma_{\bar{x}}$$

Case 2:

For a small sample of size $n < 30$, \bar{x} is assumed to have a t-distribution with $(n-1)$ degrees of freedom. The $100\delta\%$ confidence interval for μ is given by

$$\bar{x} - t_c S_{\bar{x}} < \mu < \bar{x} + t_c S_{\bar{x}}$$

where the value of t_c is obtained from the t-table with $(n-1)$ degrees of freedom

For Example

The mean and standard deviation of a sample of 250 items drawn from an infinite population are 7.2642 and 0.0058. Find the 90% confidence interval for the population mean.

Solution

$$n = 250, \bar{x} = 7.2642, \sigma = 0.0058, \delta = 90\%, = 0.9$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{0.0058}{\sqrt{250}} = 0.000367$$

$$p(0 \leq Z \leq Z_c) = 0.45, \quad Z_c = 1.6$$

Therefore, the 90% confidence interval for μ is $7.2636 < \mu < 7.2648$.

Exercises:

1. The mean and standard deviation of 50 FULAFIA students in SCI811 examination are 65% and 12% respectively. What is the estimate of the mean marks of 300 students who took the examination with 90% confidence?
2. A sample of 17 electric bulbs from a consignment has average life of 310 hours and standard deviation of 35 hours. Find the 95% confidence interval for all electric bulbs in the consignments.
3. Dunlop manufacturing company knows that the life in kilometres of its tire is normally distributed with a standard deviation of 6000km. From a test sample of 144 tires, the company calculated its mean as 31000km; find a 99% confidence interval estimate for μ , the unknown mean life of tires.

12.4.2 Confidence Interval for difference of two Populations Means

Let $x_{11}, x_{12}, \dots, x_{1n}$ be a RS (n) from $N(\mu_1, \sigma_1^2)$ and Let $x_{21}, x_{22}, \dots, x_{2n}$ be a RS (n) from $N(\mu_2, \sigma_2^2)$.

In order to construct a $100\delta\%$ confidence interval for the difference of two populations' means

(μ_1, μ_2) random samples of sizes (n_1, n_2) are drawn from the two populations respectively. The sample means, (\bar{x}_1, \bar{x}_2) and the sample standard deviations, (s_1, s_2) are computed.

Case 1:

For large sample sizes, $n_1, n_2 > 30$ $\bar{x}_1 - \bar{x}_2$ assumed to have a normal distribution with mean $\mu_1 - \mu_2$ and standard deviation so that the precision is computed as:

$$precision = Z_c \sigma_{\bar{x}_1 - \bar{x}_2} \quad \text{Where}$$

$$\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

If the population standard deviations are assumed to be unequal and unknown or

$$\sigma_{\bar{x}_1 - \bar{x}_2} = S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

If the population standard deviations are assumed to be equal and unknown

$$S_p^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

is the pooled sample variance.

The $100\delta\%$ confidence interval for $\mu_1 - \mu_2$ is therefore given by

$$(\bar{x}_1 - \bar{x}_2) - Z_c \sigma_{\bar{x}_1 - \bar{x}_2} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + Z_c \sigma_{\bar{x}_1 - \bar{x}_2}$$

Case 2:

In a small sample case, the $100\delta\%$ confidence interval for $\mu_1 - \mu_2$ is given by

$$(\bar{x}_1 - \bar{x}_2) - t_c \sigma_{\bar{x}_1 - \bar{x}_2} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + t_c \sigma_{\bar{x}_1 - \bar{x}_2}$$

When the population variances are assumed equal and unknown, the value of t_c is obtained from the t-table with $n_1 + n_2 - 2$ degrees of freedom. But when the population variances assumed unequal and unknown, the value of t_c is obtained from the t-table with the degrees of freedom computed as follows:

For example:

SCI811 examination was given to two groups of students A and B. 75 and 50 students were selected at random from group A and group B respectively. The group A student in the sample made an average mark of 52% with standard deviation of 4%, while group B students in the sample made an average mark of 75% with standard deviation of 8%. Construct a 96% confidence interval for the difference in average marks of the two groups of students who took the examination. Assume that the population standard deviations of the two groups are not equal.

Solution:

$$n_1 = 75, n_2 = 50, \bar{x}_1 = 52, \bar{x}_2 = 75, S_1^2 = 16, S_2^2 = 64, \delta = 0.96$$

$$\bar{x}_2 - \bar{x}_1 = 75 - 52 = 23$$

$$\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} = \sqrt{\frac{16}{75} + \frac{64}{50}} = 1.22$$

$$p(0 \leq Z \leq Z_c) = 0.48, \quad Z_c = 1.75$$

Therefore, the 96% confidence interval for $\mu_1 - \mu_2$ is

$$23 - 1.75 \times 1.22 < \mu_1 - \mu_2 < 23 + 1.75 \times 1.22$$

$$21.87 < \mu_1 - \mu_2 < 26.14$$

Exercise:

The following data obtained in an examination by sample of students from two classes:

Class 1	84	82	83	78	79
Class 2	75	76	77	80	76

Construct a 95% confidence interval for $\mu_1 - \mu_2$ where μ_2 , μ_1 denotes the mean marks of all the students in class 1 and class 2 respectively.

Assume that:

i. $\sigma^2_1 \neq \sigma^2_2$;

ii. $\sigma^2_1 = \sigma^2_2$.

12.4.3 Confidence Interval for the Population Proportion

In order to construct a $100\delta\%$ for the population proportion P , a random sample of size n is drawn from the population. The sample proportion, p , is computed.

Case 1:

For large sample size, $n > 30$, is assumed to have a normal distribution with mean μ and standard deviation σ_p , so that the precision is computed as follows:

$$precision = Z_c \quad \text{Where:}$$

$$\sigma_p = \sqrt{\frac{pq}{n}}, n > 30$$

$$\sigma_{\bar{x}} = \sqrt{\frac{pq}{n} \left(\frac{N-n}{N-1} \right)}, N \leq 30$$

For infinite population and finite population of size N respectively. The value of Z_c is obtained from the standard normal table as, therefore, the $100\delta\%$ confidence interval for mean is

$$P - Z_c \sigma_p < \mu < \bar{x} + Z_c \sigma_p$$

Case 2:

For a small sample of size $n < 30$, \bar{x} is assumed to have a t-distribution with $(n-1)$ degrees of freedom. The $100\delta\%$ confidence interval for μ is given by

$$\bar{x} - t_c \sigma_p < \mu < \bar{x} + t_c \sigma_p$$

Where the value of t_c is obtained from the t-table with $(n-1)$ degrees of freedom

For example:

If 45 out of 100 students drawn at random from the department of Economics are female, what is the estimate of the proportion of all the female students in the department with 99% confidence?

Solution:

$$n = 100, p = 0.45, q = 1 - 0.45 = 0.55, \delta = 99\% = 0.99$$

$$\sigma_p = \sqrt{\frac{pq}{n}} = \sqrt{\frac{0.45 \times 0.55}{100}} = 0.049$$

$$p(0 \leq Z < Z_c) = \frac{\delta}{2} = 0.495, Z_c = 2.58$$

Therefore, the 99% confidence interval for p is

$$0.32 < p < 0.58$$

12.4.4 Confidence interval for difference of two Populations' Proportion

Let $x_{11}, x_{12}, \dots, x_{1n}$ be a RS (n) from $N(p_1, \sigma_1^2)$ and Let $x_{21}, x_{22}, \dots, x_{2n}$ be a RS (n) from $N(p_2, \sigma_2^2)$.

In order to construct a $100\delta\%$ confidence interval for the difference of two populations' means

(p_1, p_2) random samples of sizes (n_1, n_2) are drawn from the two populations respectively. The sample means, (p_1, p_2) and the sample standard deviations, $(\sqrt{p_1 q_1}, \sqrt{p_2 q_2})$ are computed.

Case 1:

For large sample sizes, $n_1, n_2 > 30$, $p_1 - p_2$ assumed to have a normal distribution with mean $P_1 - P_2$ and standard deviation so that the precision is computed as: $precision = Z_c \sigma_{p_1 - p_2}$

Where

$$\sigma_{p_1 - p_2} = \sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}}$$

The $100\delta\%$ confidence interval for $\mu_1 - \mu_2$ is therefore given by

$$(p_1 - p_2) - Z_c \sigma_{p_1 - p_2} < P_1 - P_2 < (p_1 - p_2) + Z_c \sigma_{p_1 - p_2}$$

Case 2:

If the population standard deviations are assumed to be unequal and unknown or

$$\sigma_{p_1 - p_2} = S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$S_p^2 = \frac{(n_1 - 1)p_1 q_1 + (n_2 - 1)p_2 q_2}{n_1 + n_2 - 2}$$

is the pooled sample variance

In a small sample case, the $100\delta\%$ confidence interval for $\mu_1 - \mu_2$ is given by

$$(p_1 - p_2) - t_c \sigma_{p_1 - p_2} < P_1 - P_2 < (p_1 - p_2) + t_c \sigma_{p_1 - p_2}$$

When the population variances are assumed equal and unknown, the value of t_c is obtained from the t-table with $n_1 + n_2 - 2$ degrees of freedom.

For example:

A random sample of 120 students drawn from all students in Economics department contains 50 female students and 100 students drawn from all students in Sociology department contains 45 female students. Find a 90% confidence interval for the true difference in the proportion of the female students.

Solution:

$$n_1 = 120, p_1 = \frac{50}{120} = 0.42, q_1 = 1 - 0.42 = 0.58$$

$$n_2 = 100, p_2 = \frac{45}{100} = 0.45, q_2 = 1 - 0.45 = 0.55, \delta = 90\% = 0.90$$

$$\sigma_{p_1-p_2} = \sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}} = \sqrt{\frac{0.42 \times 0.58}{120} + \frac{0.45 \times 0.55}{100}} = 0.069$$

$$p(0 \leq Z < Z_c) = \frac{\delta}{2} = 0.450, Z_c = 1.64$$

Therefore, the 90% confidence interval for p is

$$-0.08 < p_1 - p_2 < 0.14$$

MODULE THIRTEEN

13.0

STATISTICS IN RESEARCH: THE CONCEPT OF HYPOTHESIS TESTING AND ERROR

When studying an observable phenomenon, we often have some prior hypothesis (a statement about a population characteristic or value) either from theory, previous studying or feeling. For example, a factory has been depositing mercuric waste into a river near a resident. It is feared that the waste may have increased the mercury content in the river beyond toxic level (say 1.0ppm) for human consumption. Indeed, hypothesis testing is another aspect of inferential statistics different from estimation.

13.1 Technique of Hypothesis Formulation

Statistical hypotheses are used to validate an experimental hypothesis. To understand what this means, assume that you do an experiment to test whether “nitrogen promotes plant growth.” This is an experimental hypothesis because it tells you something about the biology of plant growth. To test this hypothesis, you grow ten bean plants with added nitrogen and ten bean plants without added nitrogen. If the means of these two samples are 13.2 centimetres and 11.9 centimetres, respectively. Does this result indicate that there is a difference between the two populations and that nitrogen might promote plant growth? Or is the difference in the two means merely due to chance? A statistical test is required to discriminate between these possibilities.

Statistical tests evaluate statistical hypotheses. The statistical null hypothesis (symbolized by H_0 and pronounced H-naught) is a statement that you want to test. In this case, if you grow ten plants with nitrogen and ten without nitrogen, the null hypothesis is that there is no difference in the mean heights of the two groups and any observed difference between the two groups would have occurred purely by chance. The alternative hypothesis to H_0 is symbolized by H_1 and usually simply states that there is a difference between the populations. After the preceding experiment is completed and the data are described and summarized, a test of a hypothesis need to be carried out.

Definitions:

Hypothesis: A statistical hypothesis is an assumption or statement which may or may not be true, concerning one or more populations.

Null hypothesis: This is a statement that the population parameter equal to a specific value. It is usually the form of what is expected or no effect. E.g. $H_0: \mu = 1.0$ (mercury level).

Alternative Hypothesis: This is the hypothesis that opposes the null hypothesis. That is, the hypothesis we are willing to accept if we reject the null hypothesis. From the example on mercury level, we expect that if there is any change, it will be in the form of an increase in the mercury content i.e. greater than 1.0. That is, we have an idea of the expected direction of change, if any. This is an example of one sided hypothesis.

If we have no idea of the direction of change, our alternative hypothesis would have been that the mercury content is different from 1.0.

$$H_1: \mu > 1 \text{ or } H_1 = \mu < 1 \text{ (one tailed test or one sided hypothesis)}$$

$$H_1: \mu \neq 1 \text{ (two tailed test or two sided hypothesis).}$$

13.2 Type I and Type II Error

The objective of a statistical test is to reject the test (Null) hypothesis (in favour of the alternative). However, a test will not always lead to the right decision though a good test should lead to correct decision most of the time. There are basically two types of error that we can make:

- i. **Type I Error:** Rejecting H_0 when it is true, i.e. wrong rejection of H_0 . It is denoted by α .
- ii. **Type II Error:** Accepting H_0 when it is false, i.e. wrong acceptance of H_0 . It is denoted by β .

We cannot completely avoid making these errors. We would however like the chance of correct decision to be as high as possible. Decreasing the chance of type I error however increases the chance of type II error. We can keep both relatively small by making the sample size large enough. The possible decisions are as summarised in table 13.0.

Table 13.0: Hypothetical Permutations

Sample		H_0 True	H_0 False
	Accept H_0	Correct Decision	Type II error (β)
	Reject H_0	Type I error (α)	Correct decision

9.2 Steps in Hypothesis Testing

The following are the steps to be followed in testing hypothesis:

Step 1: Set up a null hypothesis (H_0)

Step 2: Set up an alternative hypothesis (H_1)

Step 3: Choose an appropriate significant level (α) such as 5%, 1% etc

Step 4: Based on the null hypothesis, define the sampling distribution (test statistic) and the area that will lead to rejection of null hypothesis.

Step 5: Compute, from the sample observations, the observed value of the chosen statistic

Step 6: Compare the sample value of the chosen statistic with the tabulated value that defines the critical region. If the observed value of the statistic falls in the critical region we reject the null hypothesis. Otherwise we accept the null hypothesis.

Step 7: Take a decision based on the position of the sample result and make a conclusion.

13.4 Tests of Hypotheses Concerning Population Means

Here we consider the test for difference between an observed sample mean (\bar{x}) and a hypothesized population mean μ or for difference between two sample means derived from the sampling distribution of the mean.

Null hypothesis: $H_0: \mu = \mu_0$

Alternative hypothesis: $H_1: \mu \neq \mu_0$ (two tailed test) or $H_1: \mu < \mu_0$ and $H_1: \mu > \mu_0$ (One tailed).

Case 1:**Test for Mean with Population Variance Known and Large Sample Size**

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \sim N(\mu, \sigma^2)$$

To test the above hypothesis, we need to compute Z and choose α (*level of significance*). The alternative Hypothesis indicates whether we use a one tailed or a two tailed test. Rejection region depends on α .

For different value of α , the rejection region for Two-tailed test (when $H_1: \mu \neq \mu_0$) is given as

$$|z| > z_{\alpha/2}$$

One tailed test, the rejection region is $z > z_\alpha$ for $H_1: \mu > \mu_0$ and $z > z_\alpha$ for $H_1: \mu < \mu_0$

You are advised to verify the value with $z_\alpha = 0.05$ and 0.01 from normal table.

Example 1:

All cigarettes presently on the market have an average nicotine content of at least 1.6 mg per cigarette. To test this claim, a sample of 20 of the firm's cigarettes were analysed. If it is known that the standard deviation of a cigarette's nicotine content is 0.8 mg, what conclusions can be drawn, at the 5 percent level of significance, if the average nicotine content of the 20 cigarettes is 1.54? Use $\alpha = 0.05$.

$$H_0: \mu = 1.6 \text{ vs } H_1: \mu \geq 1.6$$

$$z = \frac{\bar{x}_1 - \mu}{s/\sqrt{n}} = \frac{1.54 - 1.6}{0.8/\sqrt{20}} = -0.335$$

$$|z| = 0.335$$

$$z_{0.025} = 1.96$$

Exercise:

The amount of insulin released from a breed of animal is expected to be normally distributed with mean 5 and standard deviation 1.6. 64 determinations were carried out using the same breed to determine the amount of insulin released. Test the hypothesis that the amount of insulin released by the animal is not more than 3.

Case 2:**Test for Mean When Population Variance is Unknown and small sample**

A more realistic situation is when the population variance is unknown. We need to estimate this variance from the sample. An unbiased estimate of the population variance is given by

$$s^2 = \sum \frac{(x - \bar{x})^2}{n}$$

The statistic

$$T = \frac{\bar{x} - \mu}{s/\sqrt{n}} \sim t_{n-1}$$

Follows the student's t-distribution with $n-1$ degrees of freedom. The critical values for different values of $n-1$ and α can be obtained from t-Table.

The rejection region for the two-tailed test is given by

$$|T| > t_{n-1, \alpha/2}$$

For one tailed tests,

$$|T| > t_{n-1, \alpha} \text{ for } H_1: \mu > \mu_0 \text{ and } |T| < t_{n-1, \alpha} \text{ for } H_1: \mu < \mu_0 \text{ and}$$

Example:

The number of contaminants in a bacterial vaccine preserved with phenol are observed. A sample of twenty bacterial vaccines in a different preservative gave the following contamination counts:

60	62	52	55	54	51	61	54	59	57
60	50	57	68	66	52	53	54	56	58

Assuming that the counts are normally distributed, has the preservative significantly reduced the contamination counts from 60? Use $\alpha = 0.05$.

$$\bar{x} = \frac{60 + 62 + \dots + 58}{20} = \frac{1139}{20} = 56.95$$

$$s^2 = \frac{(60 - 56.95)^2 + (62 - 56.95)^2 + \dots + (58 - 56.95)^2}{20} = 22.45$$

$$s = \sqrt{22.45} = 4.738$$

$$T = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{56.95 - 60}{4.738/\sqrt{20}} = -2.879$$

$$|T| = 2.789$$

From the table, $t_{19, 0.05} = 1.729$

Conclusion:

Since $|T| > t_{\alpha}$ we reject H_0 . We therefore conclude that the preservative has significantly reduced the number of counts using 5% level of significance.

Exercise:

The following data represent the lifetimes (in hours) of a sample of ten Micro-organism; 10, 12.5, 5, 7.6, 12, 8, 9.2, 13.3 11 and 6.3. Can we conclude that the average life span of the micro-organism is 10 hours?

Testing Difference between Two Means when the Population Variances are known

If samples of sizes of n_1 and n_2 are drawn from two independent populations whose variances are σ_1^2 and σ_2^2 known, we may want to test whether significant differences exist in the two population means, i.e. we want to test

$H_0: \mu_0 = \mu_1$ vs. $H_I: \mu > \mu_0$ and $H_I: \mu < \mu_0$.

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \sim N(0,1)$$

Example:

A researcher studying mouse behaviour in locating the food in a maze, 13 different mice was considered from two variety of mice. The average time (in seconds) it took the two variety of mice to locate food in the maze are 39 and 41 seconds with standard deviation of 1.2 and 1.6 respectively. Is there any significant difference in their time taken?

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{39 - 41}{\sqrt{\frac{1.2^2}{13} + \frac{1.6^2}{13}}} = -3.606$$

$$|z| = 3.606$$

From the table, $z_{0.025} = 1.96$

Conclusion:

Since $|z| > z_{\alpha/2}$ we reject H_0 . We therefore conclude that there is significant difference in their time taken using 5% level of significance.

Testing Difference between Two Means when the Variances are not known and sample size is small

Again, this is a more realistic situation than the case discussed earlier. When we have two independent samples. In this case,

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \sim t_{n_1+n_2-2}$$

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

The number of *Daphnia* eaten by Goldfish in 30 minutes in tanks with or without underwater plants are presented in the table 13.1:

Table 13.1: The number of *Daphnia* eaten by Goldfish in 30 minutes in tanks with or without underwater plants.

Tanks	Plant (Sample 1)	Plant (Sample 2)
1 and 2	13	14
3 and 4	9	12
5 and 6	10	15
7 and 8	10	14
9 and 10	7	17
11 and 12	5	10
13 and 14	10	15
15 and 16	14	15
17 and 18	9	18
19 and 20	9	14

$$\bar{x}_1 = 9.6, \bar{x}_2 = 14.4, s_1^2 = 6.71, s_2^2 = 5.16$$

To determine whether the difference between the two groups was significant, the biologists calculated a *t*-test statistic, as shown below:

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

$$s_p^2 = \frac{(9)6.71 + (9)5.16}{10 + 10 - 2} = 5.935$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} = \frac{9.6 - 14.4}{\sqrt{5.935 \left(\frac{1}{10} + \frac{1}{10} \right)}} = -4.41$$

$$|t| = 4.41$$

There are $(10 + 10 - 2) = 18$ degrees of freedom, so the critical value for $\alpha = 0.05$ is 2.10 from t-table. The calculated t-value of 4.41 is greater than 2.10, so the students can reject the null hypothesis that the differences in the numbers of *Daphnia* eaten in the presence or absence of underwater plants were accidental.

Exercise:

A Botanist wants to investigate the effect of moisture response on Chlorophyll contents of *Acacia nilotica Seedling*. The following data on Chlorophyll contents of the seedlings were obtained after watering the seedlings for ten days;

Watering once per day 74.37 60.49 71.95 74.37 54.47 53.73 54.92 54.47 60.23 41.87

Watering twice per day 58.62 62.68 69.22 58.62 70.67 54.64 67.59 50.67 70.56 76.34

Determine whether the Chlorophyll contents of *Acacia nilotica Seedling* has improved with increase in the watering regime.

13.5 Tests for Proportions

In certain situations particularly with count data we may be interested in proportions rather than means of populations. We have discussed the distribution of proportions in the first section. Here we shall discuss test hypothesis that the sample proportion could have come from a population with a given proportion and also compare two population proportions based on sample proportion from the two populations.

Test for One Population Proportion

We may wish to test the hypothesis that the population proportion p is a given value p_0 . i.e.

$$H_0: p = p_0; H_1: p \neq p_0; H_1: p < p_0 \text{ or } H_1: p > p_0$$

The estimate of the proportion (p) for the number of successes x from number of trial or sample size n is given as;

$$\hat{p} = \frac{x}{n}$$

We therefore use the statistic

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} \sim N(\mu, \sigma^2)$$

The critical region is: Reject H_0 if

$$|z| > z_{\alpha/2} \quad H_1: p_1 \neq p_2$$

Example:

In a hypothetical population of 100 rock pocket mice (*Chaetodipus intermedius*), 61 individuals have light, sandy-coloured fur and a *dd* genotype. Scientists assumed that this population is at equilibrium; they used the Hardy-Weinberg equations to find proportion p for this population and calculated the frequency of heterozygous genotypes. Is there significant evidence, at the 5 percent level, to conclude that 50% of the population have *dd* genotype?

Test for Difference between Two Population Proportions

Assume that a random sample of size n_1 is taken from population 1 and n_2 from population 2. Let the number of successes be x_1 and x_2 respectively. We may wish to test if the proportions of successes in the two populations are the same or not.

i.e. $H_0: p_1 = p_2$; $H_1: p_1 \neq p_2$ or $H_1: p_1 < p_2$ or $H_1: p_1 > p_2$

The estimate of the proportion (p) for the number of successes x_1 and x_2 from number of trial or sample size n is given as;

$$\widehat{p}_1 = \frac{x_1}{n_1}, \widehat{p}_2 = \frac{x_2}{n_2}$$

$$z = \frac{\widehat{p}_1 - \widehat{p}_2}{\sqrt{\widehat{p}(1 - \widehat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \sim N(\mu, \sigma^2)$$

$$\widehat{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

The critical region is: Reject H_0 if

$$|z| > z_{\alpha/2} \quad H_1: p_1 \neq p_2$$

Example:

Two types of drugs A and B were tested on rats to find which of them is more effective. 20 out of 50 responded positively when method A was used while 30 of the 60 responded positively to method B. Is there enough evidence to show that the 2 drugs are not equally effective? Use $\alpha = 0.05$.

Solution:

$$H_0: p_1 = p_2 \text{ vs. } H_1: p_1 \neq p_2$$

Correlation:

This is a degree of relationship between two or more variables. Many times the occurrence of an outcome depends upon or affects some other things. For example, the litres of fuel consumption of a car may affect the number of kilometres travelled by the car, blood pressure affects the age of persons, per capital income affects standard of living and so on. When it

has been established that one thing is affecting another, we say a functional relationship exists between them. Functional relationship can be shown on a graph sheet known as scatter diagram.

13.6 Types of Scatter diagram

When we established that one thing (price of garri say,) is affecting another (price of sugar say), we then say that a functional relationship exists between garri and sugar. Scatter diagram or scatter plot can be used to represent this kind of functional relationship between variables.

The following are functional relationships where scatter diagram can be applied;

1. Perfect positive correlation ($r = 1$)
2. Perfect negative correlation ($r = -1$)
3. Partially positive correlation ($0 < r < 1$)
4. Partially negative correlation ($-1 < r < 0$)
5. Zero correlation ($r = 0$)

13.6.1 Pearson Product Moment Correlation

This is given as follows:

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}}$$

Hypothesis about the Correlation

$H_0: \rho = 0$ vs. $H_1: \rho \neq 0$ etc.

$$t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} \sim t_{n-1}$$

Example:

A researcher wants to test association between two subjects taken by students. The following data were obtained by ten students in two subjects

English:	7	4	5	5	7	4	6	4	6	3
Mathematics:	8	5	5	6	7	4	7	5	6	4

Obtain the strength of the relationship between the performances of students in the two subject. Hence, test whether the correlation value is significant.

Solution:

$$N = 10, \sum x = 51, \sum y = 57, \sum xy = 306, \sum x^2 = 277, \sum y^2 = 341$$

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}} = \frac{10 \times 306 - 51 \times 57}{\sqrt{(10 \times 277 - 51^2)(10 \times 341 - 57^2)}} = 0.93$$

$$H_0: \rho = 0 \text{ vs. } H_1: \rho \neq 0 \text{ etc.}$$

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.93\sqrt{10-2}}{\sqrt{1-0.93^2}} = 7.156$$

$$t_{8,0.025} = 2.306$$

Since $|T| > t_{\alpha/2}$ we reject H_0 . We therefore conclude that the correlation is significant using 5% level of significance.

13.6.2 Regression

Regression is a measure of relationship between two or more variables, one being dependent variable or response and others are independent variables or predictors. The regression equation generally is given as follows:

$$y = \alpha + \beta x + e$$

Where

y is the dependent variable or response

x is the independent variable or predictor

α is a constant value

β is a coefficient of independent variable

e is the error term which is normally and identically distributed with mean 0 and variance σ^2 .

This type of model stated earlier is referred to as simple linear regression model. For the purpose of this course we shall restrict ourselves to the model of this form.

$$\hat{\alpha} = \frac{\sum y - \beta \sum x}{n}$$

$$\hat{\beta} = \frac{n \sum xy - \sum x \sum y}{(n \sum x^2 - (\sum x)^2)}$$

Example:

Eight undergraduate students were surveyed in a study involving time spent on WhatsApp and their grade point average (GPA). The results are shown in Table 13.2. x is the amount of time spent on the WhatsApp weekly and y is the GPA of the student.

Table 9.2: Students' Hours on WhatsApp vs. GPA

Hours (x)	GPA (y)
11	2.84
5	3.20
22	2.18
23	2.12
10	2.90
19	2.36
15	2.60

18

2.42

- Fit a straight line regression to the data and give the values of α and β
- What will be the GPA of a student who spend 40 hours on WhatsApp weekly?

Solution:

$$\sum x = 123, \sum x^2 = 2169; \sum y = 20.62, \sum xy = 300.36$$

$$\hat{\alpha} = \frac{\sum y - \beta \sum x}{n} = \frac{20.62 - [(-0.06) * 123]}{8} = 3.5$$

$$\hat{\beta} = \frac{n \sum xy - \sum x \sum y}{(n \sum x^2 - (\sum x)^2)} = \frac{(8 * 300.36) - (123 * 20.62)}{(8 * 2169) - (123)^2} = -0.06$$

From $y = \alpha + \beta x + e$

The model is therefore being given as:

$$\hat{y} = 3.5 - 0.06x$$

Note that the error term (e) has minimised to zero (0) when estimating the parameters (α and β) using the least square method of estimation.

13.7 Contingency Table Analysis (Test of Independence)

One interesting use of the **chi-square** distribution is to test the hypothesis that two criteria of classification, when applied to the same set of entities are independent. The classification according to two criteria of a set of entities can be represented by a table in which the r rows represent the levels of the criterion and the c columns represent the levels of the second criterion. This type of cross-classification is popularly known as a **Contingency Table** as shown in table 13.3.

Table 13.3: Description of a two-way ($r \times c$) Contingency Table

Factor A	Factor B					Total
	1	2	..	.	C	
1	n_{11}	n_{12}	..	.	n_{1c}	R_1
2	n_{21}	n_{22}	..	.	n_{2c}	R_2
.
.
.
R	n_{r1}	n_{r2}	R_r
Total	C_1	C_2	..	.	C_c	N

The expected frequencies under the null hypothesis of independence are obtained as:

$$E_{ij} = \frac{R_i C_j}{N}$$

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \sim \chi^2_{(r-1)(c-1)}$$

Example:

A research team studying the relationship between blood group and severity of certain condition in a population, collected data on 1500 subject as displayed in table 13.4.

Table 13.4: Cross-Classification of Blood Group by Severity of a Disease

Severity	Blood Group				Total
	A	B	AB	O	
Absent	543	211	90	476	1320
Mild	44	22	8	31	105
Severe	28	9	7	31	75
Total	615	242	105	538	1500

- H_0 : Severity of disease is independent of patients' blood group
- H_1 : Severity of disease is not independent of patients' blood group

Solution:

From the equation

$$E_{ij} = \frac{R_i C_j}{N}, i = 1, 2, \dots, 4; j = 1, 2, \dots, 3$$

$$E_{11} = \frac{1320 * 615}{1500} = 541.2; E_{21} = \frac{105 * 125}{1500} = 5.12$$

The calculated expected frequencies to the corresponding observed frequencies are put in parenthesis in table 13.5.

Table 13.5: Cross-Classification of Blood Group by Severity of a Disease

Severity	Blood Group				Total
	A	B	AB	O	
Absent	543(541.2)	476(473.44)	8(7.35)	9(12.1)	1320
Mild	211(212.96)	44(43.05)	31(37.66)	7(5.25)	105
Severe	90(92.4)	22(16.94)	28(30.75)	31(26.9)	75
Total	615	242	105	538	1500

$$\chi^2 = \frac{(543 - 541.2)^2}{541.2} + \dots + \frac{(31 - 26.9)^2}{26.9} = 5.12$$

Note that $r = 3$ and $c = 4$, therefore $DF = (r-1)*(c-1) = (3-1)*(4-1) = 6$

Since $\chi^2 < \chi^2_{10,0.05}$ we do not reject H_0 that the accidents in the firm are poison distributed with $\lambda = 4$.

$$\chi^2_{6,0.05} = 12.59$$

Since $\chi^2 < \chi^2_{6,0.05}$ we do not reject H_0 . we therefore conclude that the severity of disease is independent of patients' blood group.

Exercises:

- 55 mice were randomly subjected to two treatment groups. It is desired to test if treatment is independent of presence or absence of tumour among mice. The data are represented in the table 13.6. Analyse these data and draw appropriate conclusion.

Table 13.6: Treatment vs. Tumour in Mice

Treatment Group	Tumour		Total
	Present	Absent	
I	21	19	23
II	2	13	32
Total	40	15	55

- The data below are obtained from a survey to determine whether gender is related to HIV testing status in a College. An investigator concludes that gender is not related to HIV testing status. Would you agree with him? Refer to Table 13.7.

Table 13.7: Relationship between Gender and HIV Testing Status

Gender	HIV testing status	
	Yes	No
Female	9	52
Male	8	51
Total	17	103

MODULE FOURTEEN

14.0 STATISTICS IN RESEARCH: ANALYSIS OF VARIANCE

In the previous section we considered hypothesis about one or two populations, which can be handled by Z, T or χ^2 tests, in this module, we present a technique that can be used to test a hypothesis of more than two population means. This technique, which is rather general and can be used to make inferences about a multitude of parameters relating to population means, is known as the analysis of variance. When the mean of a random variable depends only on a single factor, it is said to constitute a one-way analysis of variance. When it depends on two factors it is a two way analysis of variance etc.

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MODULE FIFTEEN**15.0****STATISTICS IN RESEARCH: DATA ANALYSIS USING SPSS**

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