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Research Process and Organizing Research Write-ups: The Key to Improve Your Research Skills and Publish High-Level Articles

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01

What is Research?

Research, Research Problem, Various Steps Involved in Research.

What is Research?

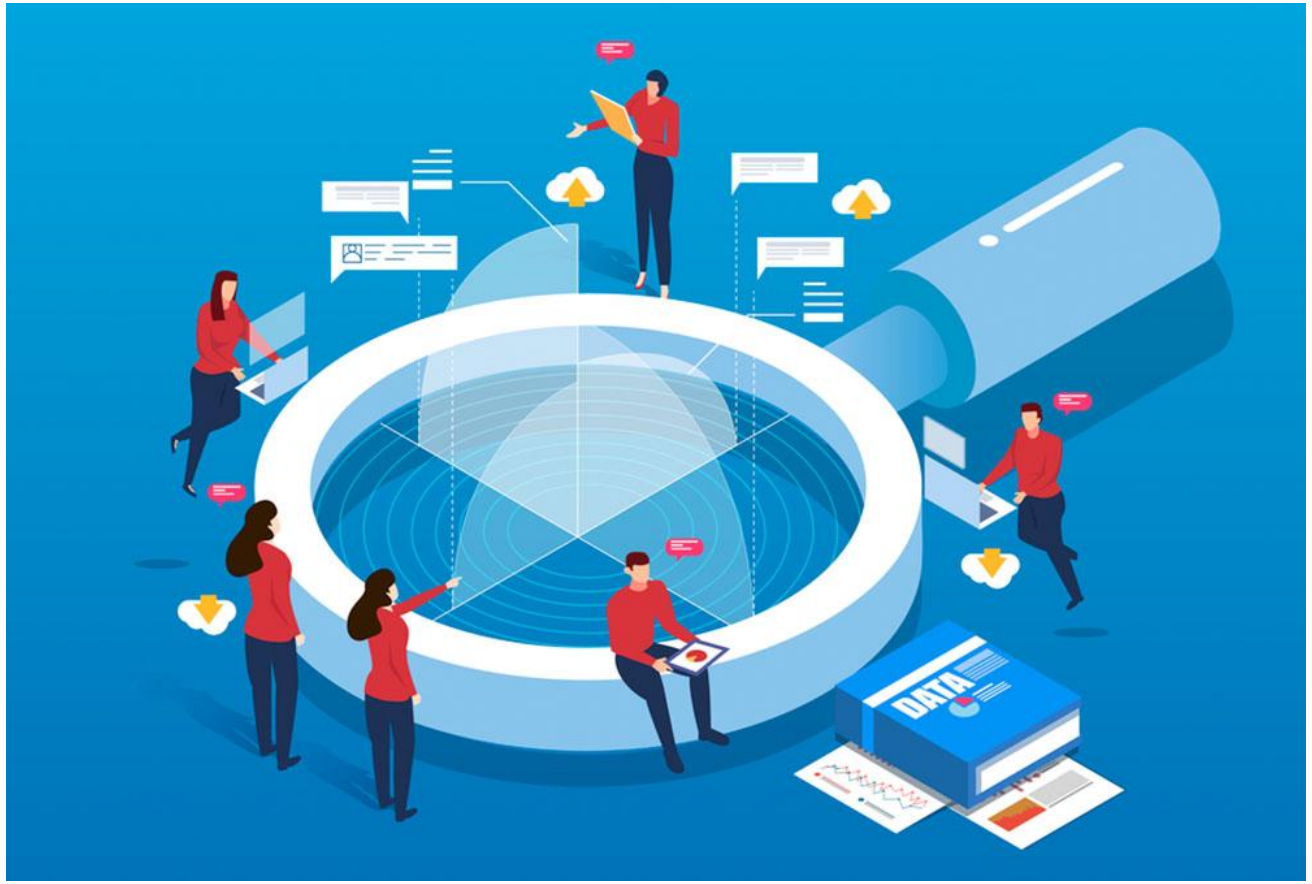
Research is "creative and systematic work undertaken to increase the stock of knowledge“.

It involves collecting, organizing and analyzing evidence to increase understanding of a topic, characterized by a particular attentiveness to controlling sources of bias and error.

Types of Research

The major types of research can be broadly categorized as follows:

1. **Quantitative Research**
2. **Qualitative Research**
3. **Mixed Methods Research**
4. **Applied Research**
5. **Basic Research (or Pure Research)**
6. **Exploratory Research**
7. **Experimental Research**
8. **Observational Research**
9. **Descriptive Research**
10. **Correlational Research**



Common Problem with Research

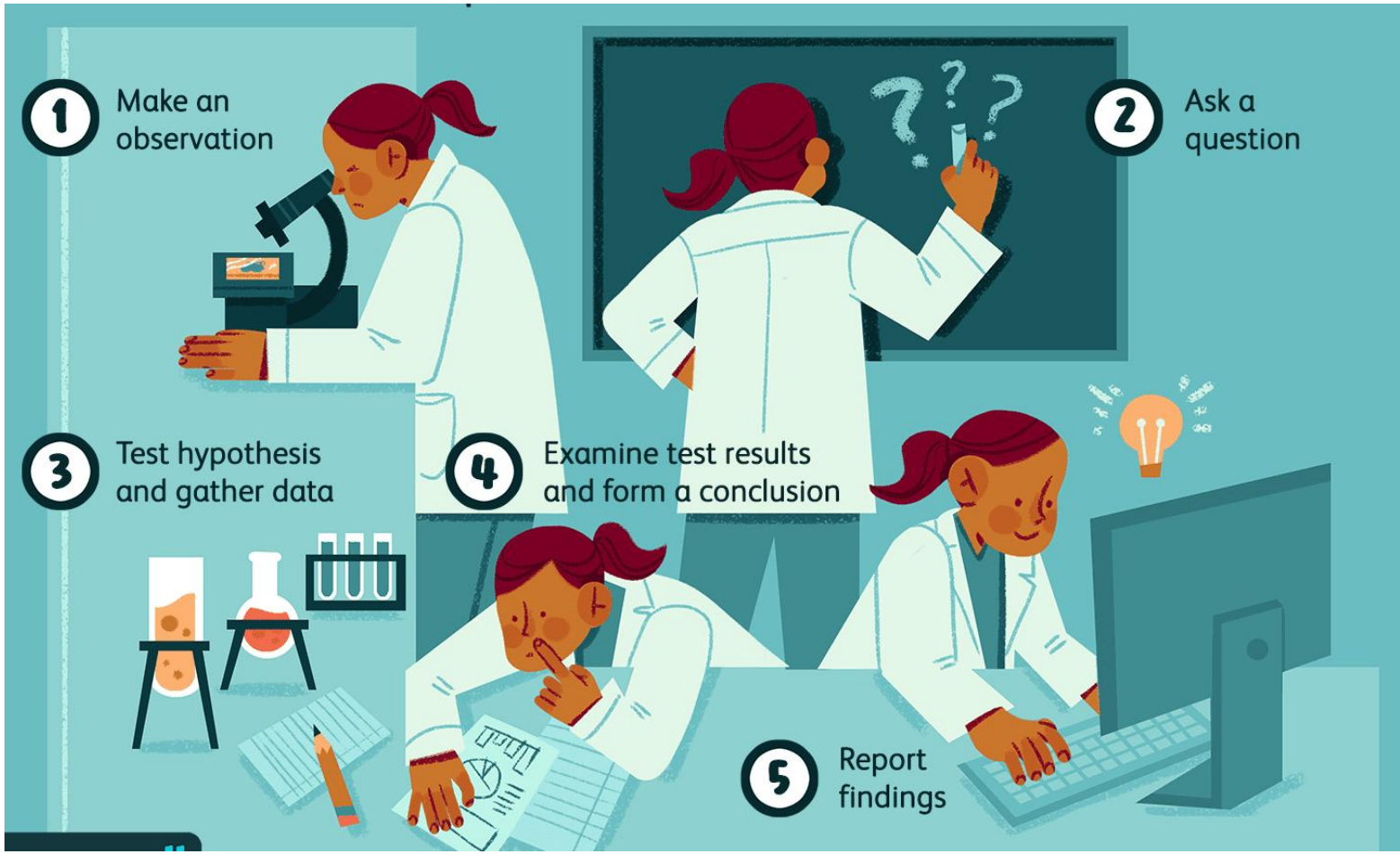
1. Limited or biased sample
2. Insufficient sample size
3. Measurement issues
4. Non-response bias
5. Researcher bias
6. Confounding variables
7. Ethical issues
8. Funding limitations
9. Time constraints
10. Publication bias

Research Process

- The research process is a systematic and organized approach follows by researchers to investigate a specific topic.
- It involves identifying the research question, reviewing relevant literature, designing the study, collecting and analyzing data, interpreting the results, and drawing conclusions.
- The process is repetitive, and researchers often refine their methods and hypotheses based on the findings.
- The ultimate goal is to generate new knowledge and contribute to the existing body of research in a particular field.

Steps Involve in Research

- Define the research problem
- Develop a research plan
- Collecting data
- Analysing research data
- Presenting the findings/writeup



Define the Research Problem

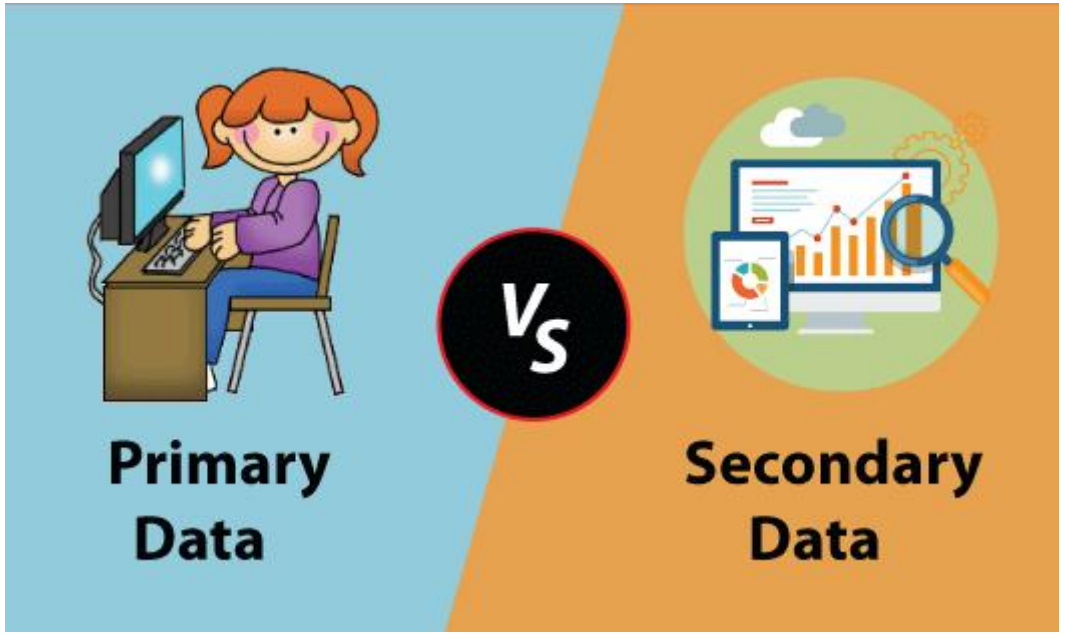
A research problem is a statement about an area of concern, a condition to be improved, a difficulty to be eliminated, or a troubling questions that exists in scholarly literature, in theory, or in practice that points to the need for meaningful understanding and deliberate investigation.

- Statement of the problem in general way
- Understanding the nature of the problem
- Review the available literature
- Developing ideas by discussion

Develop a Research Plan

- Define the project purpose.
- Identify individual objectives.
- Select a research method.
- Prepare a project summary.
- Create a realistic timeline
- Determine how to present your results.

Collecting Data



Primary Data

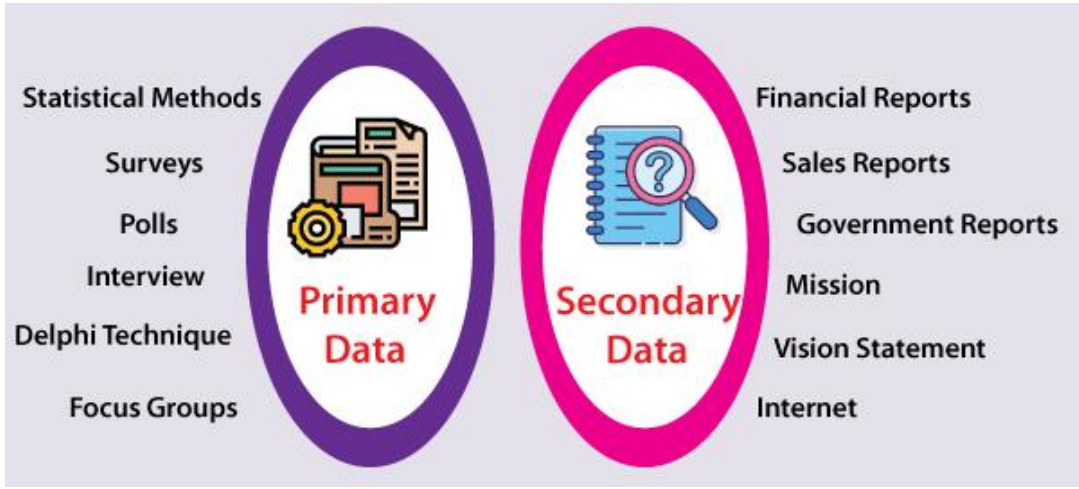
When data is not available and must be obtained through some form of data collection.

(Generated first-hand)

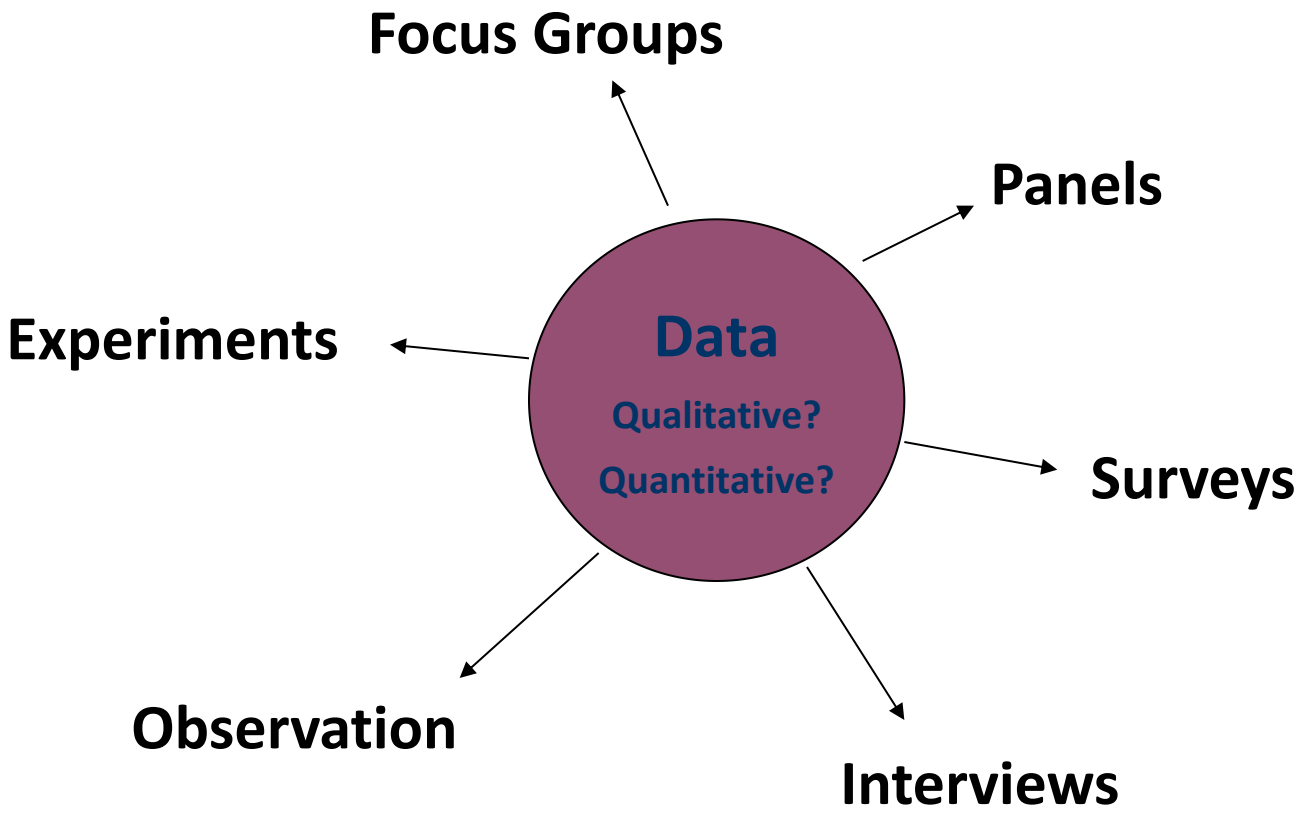
Secondary Data

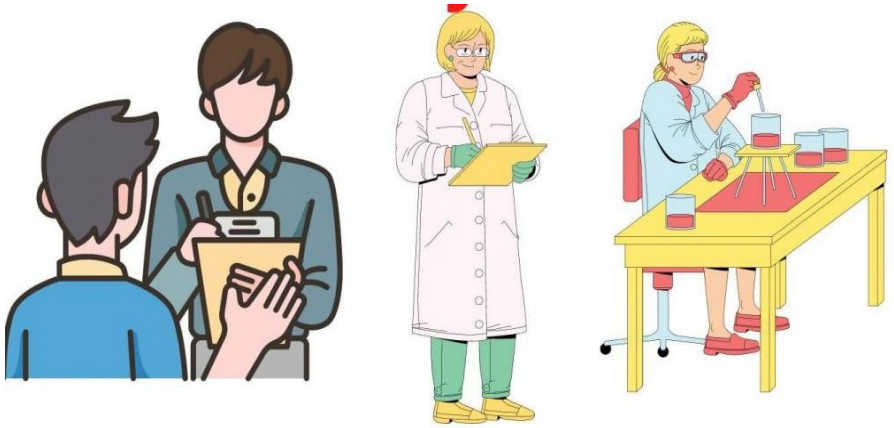
When data exists and is available through a variety of sources (i.e., internet, publications, government records, etc.).

(Readily available, used for other purposes)



Methods for Developing Primary Data





Problems of Gathering Primary Data

- **Inconsistent data collection standards.**
- **Context of data collection.**
- **Data collection is not core to business function.**
- **Complexity.**
- **Lack of training in data collection.**
- **Lack of quality assurance processes.**

Methods for Developing Secondary Data

- Data available on internet
- Government and non-government agencies
- Public libraries
- Educational institutes
- Commercial information sources

Problems with obtaining elevant data

Problems with obtaining relevant and accurate Secondary data are;

- **Availability of Data**
- **Reliability of Data**
- **Comparability of Data**
- **Validating Secondary Data**
- **Who collected the data ? Would there be any reason for purposely misrepresenting the facts ?**
- **For what purpose were the data collected ?**
- **How were the data collected ? (Methodology)**
- **Are the data internally consistent and logical?**

Analyzing Research Data

- Step 1: Write your hypotheses and plan your research design.
- Step 2: Collect data from a sample.
- Step 3: Summarize your data with descriptive statistics.
- Step 4: Test hypotheses or make estimates with inferential statistics.
- Step 5: Interpret your results.

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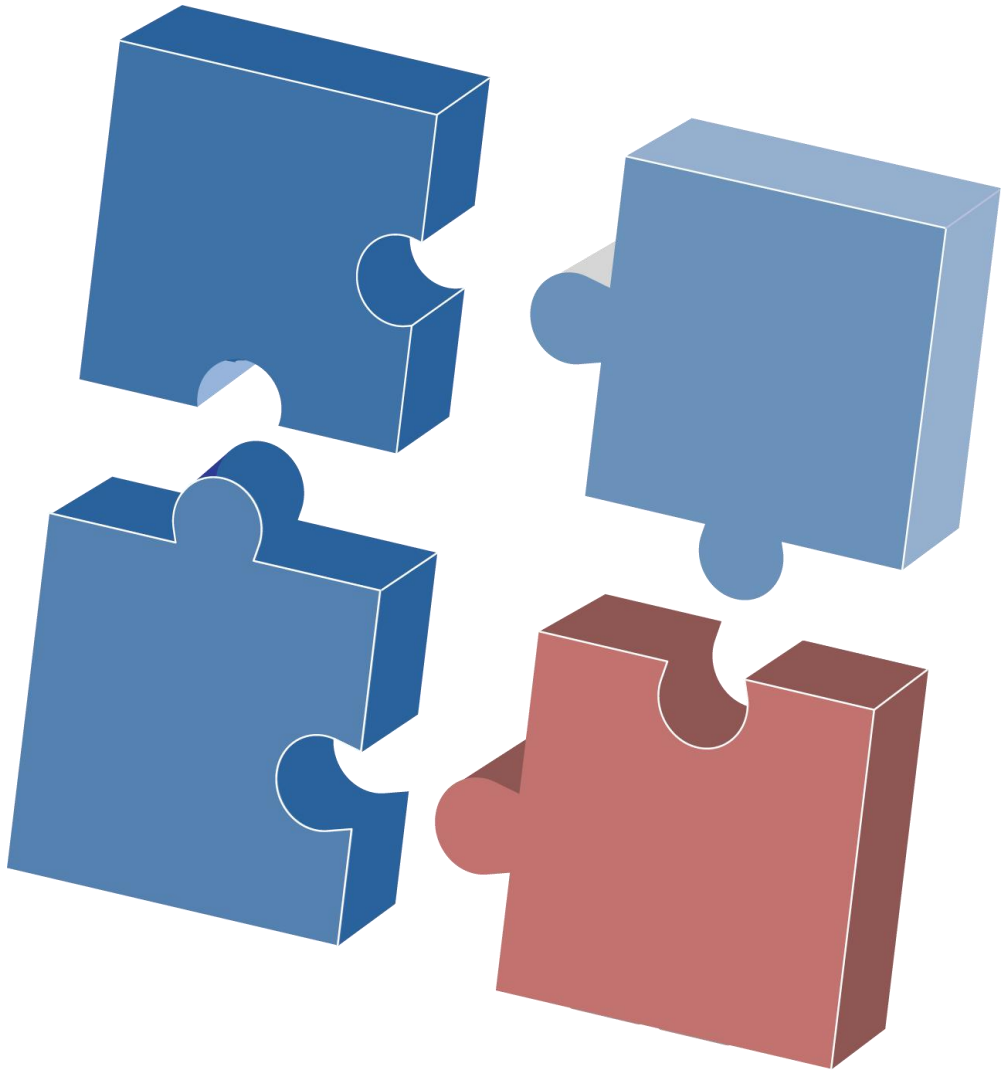
02

Research Write-ups

How to organize the various section of research article or thesis chapter.

Research Write-ups

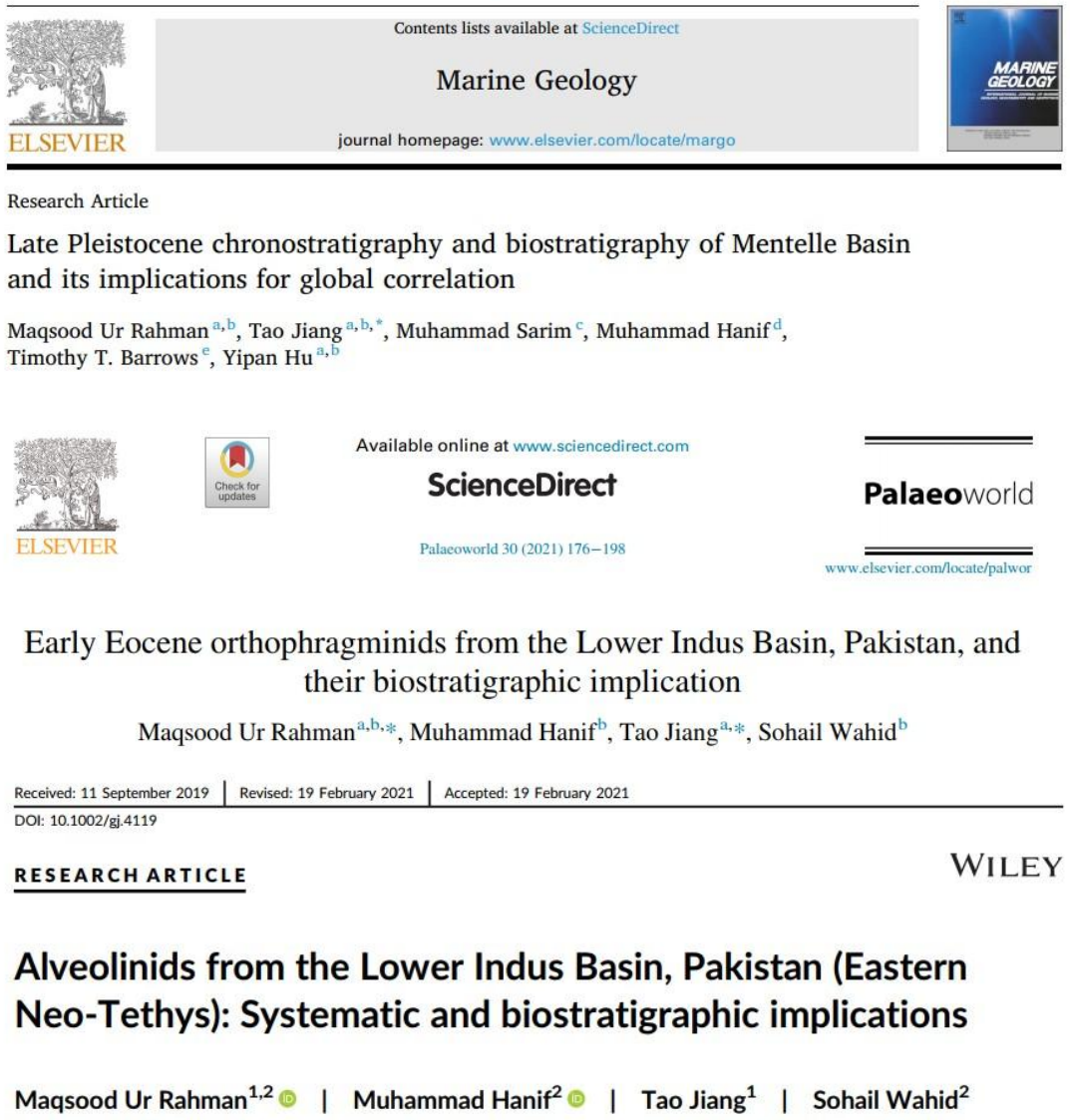
- Suitable Title
- Introduction
- Background (if applicable)
- Methodology
- Results
- Discussion
- Conclusions
- Abstract



Suitable Title

The “title” should be

- Descriptive
- Direct
- accurate
- Appropriate,
- Interesting
- Concise
- Precise
- Unique
- Should not be misleading.



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Research Article

Late Pleistocene chronostratigraphy and biostratigraphy of Mentelle Basin and its implications for global correlation

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Early Eocene orthophragminids from the Lower Indus Basin, Pakistan, and their biostratigraphic implication

Maqsood Ur Rahman[a,b,*], Muhammad Hanif[b], Tao Jiang[a,*], Sohail Wahid[b]

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RESEARCH ARTICLE

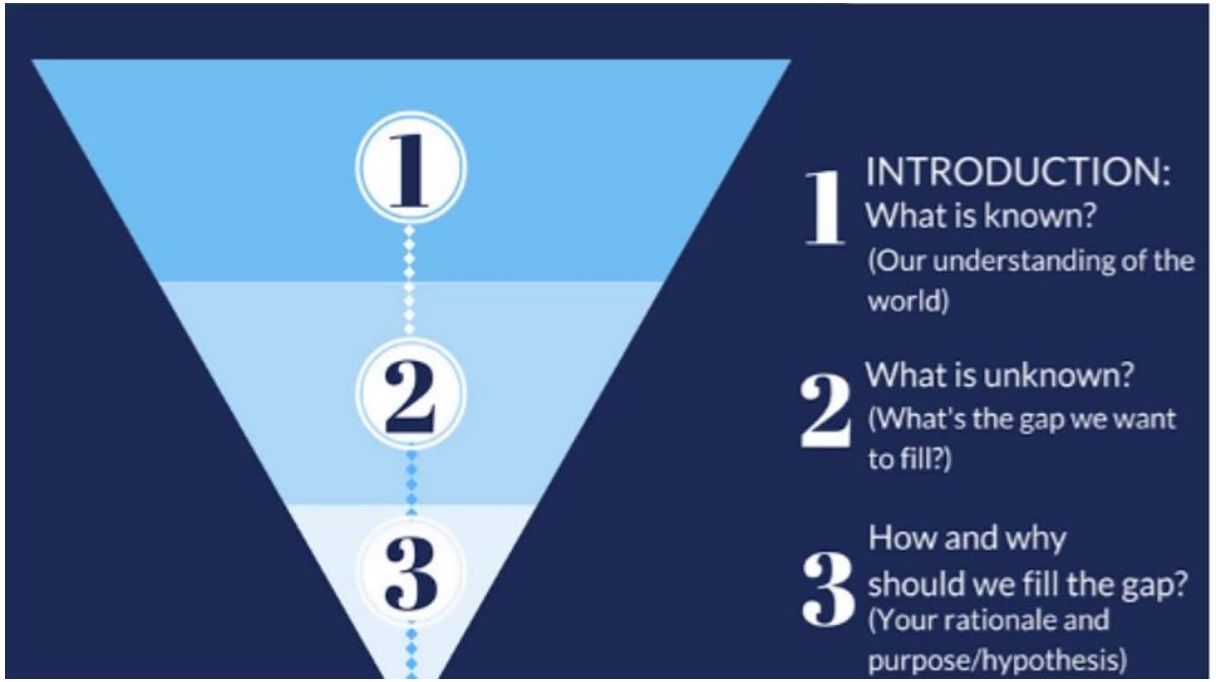
WILEY

Alveolinids from the Lower Indus Basin, Pakistan (Eastern Neo-Tethys): Systematic and biostratigraphic implications

Maqsood Ur Rahman[1,2] | Muhammad Hanif[2] | Tao Jiang[1] | Sohail Wahid[2]

Introduction

- Introductory Note
- In depth literature review (Existing work)
- Highlight existing problem (Research gap)
- Your objectives
- Method (In short if applicable)
- Significance
- Concluding remarks



Methodology

- The methodology section or methods section tells you how the a research.
- It should let you know a) what method they used to gather data etc.), why they chose this method, and what the limitations are t
- Should be clear and concise.
- Every methods should be discussed used in research.
- Appropriate references.
- If any modification made in methodology, it should be mentionec

3. Materials and methods

3.1. Core samples of IODP Hole U1516B

IODP Site U1516 was drilled during Expedition 369 in the Mentelle Basin (Fig. 1). Site U1516 comprises four holes (U1516A, B, C and D). Hole U1516A (34°20.9169′S, 112°47.9553′E) was drilled up to 223.6 m CSF-A and then the vessel was offset 20 m east to core Hole U1516B (34°20.9175′S, 112°47.9684′E). The Hole U1516B was drilled up to 16.2 m CSF-A with ~102% recovery (Huber et al., 2019a; Huber et al., 2019b). The cores were immediately sectioned into 30 cm whole rounds on the catwalk and sealed in light-proof bags with no further shipboard analysis. Since the cores from Hole U1516B are also cored and curated by IODP, the depth scheme of CSF-A can be used for this hole even though it was not included in the proceeding of IODP Expedition 369. The subsampling has been detected in the lab for biostratigraphic analysis, oxygen isotope analysis, and radiocarbon dating.

3.2. Oxygen isotope analysis

Oxygen isotope analysis was performed for Hole U1516B. The planktonic foraminiferal species *Globigerinoides* (*G*). *ruber* sensu stricto (s.s) (white) was selected for isotopic analysis from samples spaced about 10–13 cm apart while the initial few samples were taken at an interval of 4 cm. About 35–40 individuals of *G. ruber* s.s were picked from the >250 μm (250–355 μm) fraction. The tests of the foraminifera were carefully crushed into several fragments and were cleaned following the cleaning method of Barker et al. (2003). Stable oxygen isotope ratios of the planktonic foraminifera tests were measured on Thermo-Finnigan MAT-253 isotope ratio mass spectrometer with an on-line, automated carbonate preparation system (Kiel IV) at the State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Wuhan. The values are reported per mil (‰) relative to Vienna Pee Dee Belemnite (VPDB) standard, calibrated by using GBW 04416 and GBW 04417 standards, along with a laboratory internal standard ISTB-1 (Supplementary Table DS1). Standards were run after every 10 samples and the standard deviation was <0.045% for $\delta^{18}O$.

3.3. Radiocarbon dating

The chronology for core top 0.75 m samples of Hole U1516B is based on seven accelerator mass spectrometry (AMS) radiocarbon (^{14}C) dates (Table 1). Planktonic foraminifera species *Globigerina inflata* were analysed at Beta Analytic Test Laboratory, United States of America (USA). AMS ^{14}C dates were calibrated using the MARINE20 calibration curve in BetaCal4.2 (Heaton et al., 2020; Ramsey, 2009b). The age is reported as radiocarbon years before present (BP), "present" = 1950 CE and is rounded to the nearest 10 years.

Table 1
Radiocarbon (^{14}C) ages of Hole U1516B upper 0.75 m CSF-A interval. (CI – confidence interval).

Samples	Depth CSF-A (m)	Lab identifier	Age BP (ky)	Age cal BP (ky) (95% CI)	$\delta^{13}C$ ‰
1H-1-J1-F-1	0.06–0.10	Beta-582,633	8.9 ± 20	8.2–7.8	0.9‰
1H-1-J1-F-2	0.13–0.16	Beta-594,965	9.6 ± 60	9.1–8.5	0.6‰
1H-1-J1-F-3	0.26–0.30	Beta-582,634	13.4 ± 40	14.2–13.7	0.9‰
1H-1-J2-F-1	0.30–0.33	Beta-594,967	19.7 ± 60	21.4–20.8	0.7‰
1H-1-J2-F-2	0.42–0.46	Beta-594,964	27.5 ± 120	19.1–28.6	0.8‰
1H-1-J3-F-1	0.60–0.63	Beta-594,968	32.6 ± 120	35.0–34.1	0.9‰
1H-1-J3-F-2	0.73–0.76	Beta-594,966	34.7 ± 230	37.7–36.7	0.9‰

3.4. Age model

The age model for Hole U1516B is based on the ^{14}C and $\delta^{18}O$ records. The $\delta^{18}O$ record of Hole U1516B was visually tuned to the $\delta^{18}O$ record *G. ruber* s.s with the astronomically tuned global benthic foraminifera $\delta^{18}O$ stack LR04 (Lisiecki and Raymo, 2005) (Figs. 3D and 5), using QAnalySeries (Kotov and Paelike, 2018; Paillard et al., 1996). Tuning a planktonic $\delta^{18}O$ to the benthic stack is justified on the grounds that the SST component of the record is small and therefore there is a good correspondence of oxygen isotope events between the two records. This approach has been used successfully elsewhere (Barrows et al., 2007) and the associated errors are unlikely to be significant beyond the last glacial cycle (Supplementary Fig. S1). 32 $\delta^{18}O$ tie points and seven ^{14}C ages (top 76 cm) were used for the tuning (Supplementary Table S2).

3.5. Biostratigraphy

Calcareous nannofossils, planktonic foraminifera, radiolarians and diatoms were identified for biostratigraphy of Hole U1516B. The samples were split into required aliquots (i.e., 0.5 g for nannofossils, 1 g for radiolarians and diatoms and 5 g for planktonic foraminifera) for analysis on the same depth levels. The sample preparation procedures followed are briefly discussed below.

3.5.1. Planktonic foraminifera

The core samples were dried overnight at 40°C. 5 g of the dried samples were washed over a 74 μm sieve to obtain the planktonic foraminifera. The samples were then dried at room temperature. The fraction >150 μm was examined for diversity under a stereomicroscope. In each mixed sample, > 300 specimens were counted, excluding the broken and altered specimens (two rounds of analysis, overall >600 specimens). The entire samples were thoroughly examined above and below a biostratigraphic event/zone to ensure the presence or absence of species.

3.5.2. Calcareous nannofossils

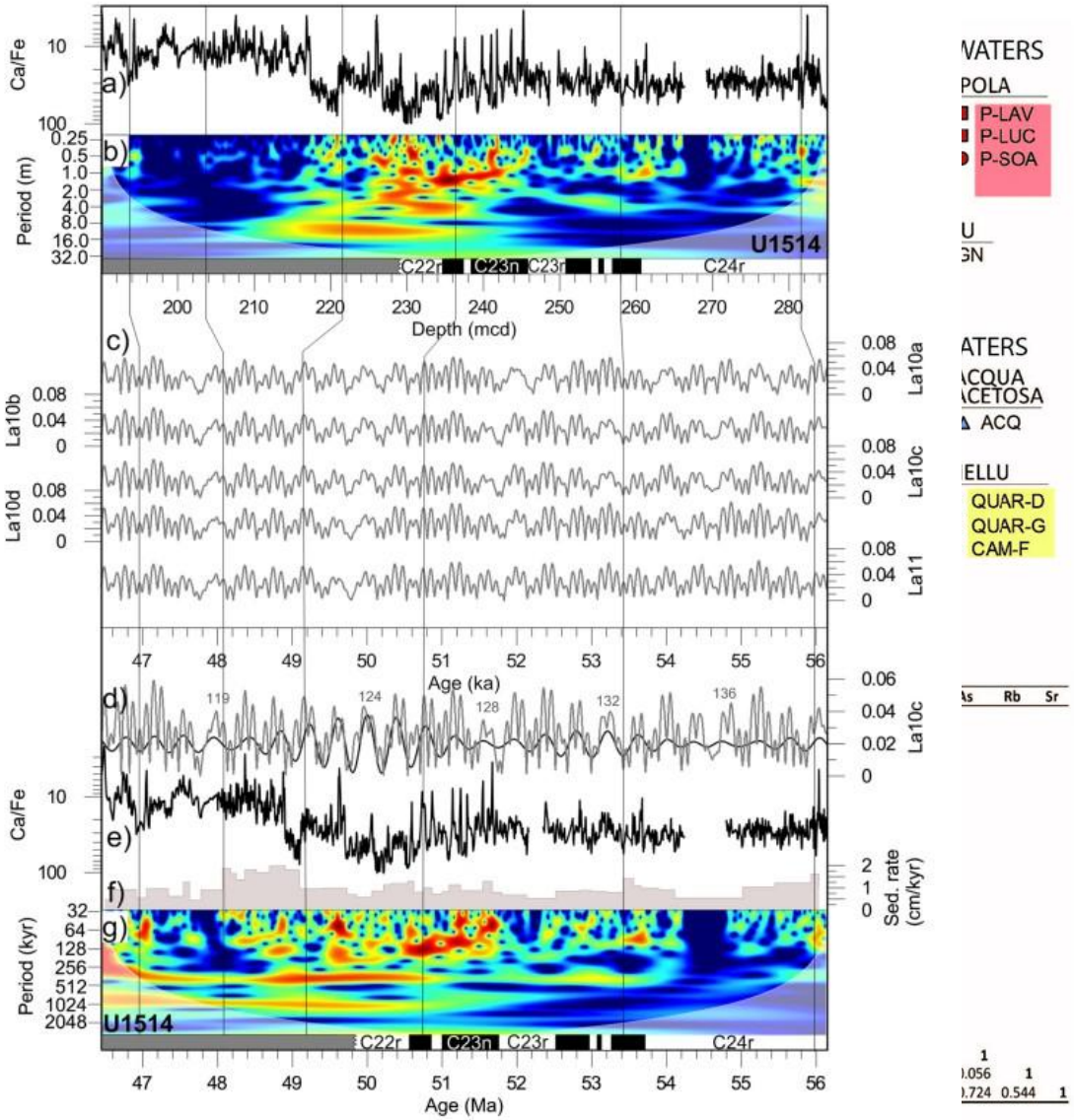
Samples were prepared for nannofossils according to the method of Ma et al. (2019). For each sample, 0.5 g of dried bulk sample was disintegrated in 250 ml ultra HQ distilled water. The solution was kept in an ultrasonic bath for a short time. The weight of sediment, the amount of ultra HQ water, and the time in the ultrasonic bath remained the same for all samples. Then 330 μl of the well-mixed suspension was added to a coverslip using an automatic precision pipette and dried on a hot plate at a low temperature of 30–35 °C. After drying, the coverslip was mounted on a glass slide with Canada balsam. The sections were described at the State Key Laboratory of Biological Sciences, CUG, Wuhan by polarizing microscope. The sections were examined at 630× and 1000× resolution and photomicrographs were taken of each slide. For taxonomic nomenclature, the nomenclature described in Nannotax 3 (Young et al., 2018) was used. The species are well preserved and visible under the microscope.

3.5.3. Radiolaria and diatoms

For the analysis of Radiolaria and diatoms, 1 g of dry sediment was used. To remove the organic matter, the sediments were treated with 36% hydrogen peroxide (H_2O_2). After removing the organic matter, carbonates were removed with 30% hydrochloric acid (HCl). After keeping the sediments in HCl overnight, the HCl were washed three times (centrifuge method) with distilled water and the clean siliceous materials were kept in a test tube. The clean siliceous material was diluted in 3 ml of distilled water. The silica mixture of 330 μl was added to the glass coverslip and kept overnight to dry. After drying overnight, the coverslips were mounted to the slide with Canada balsam. The

Results

- The Results (also sometimes called Findings) section what the researcher(s) found when they analyzed the
- Its primary purpose is to use the data collected to an introduction, even if the findings challenge the hypot
- The result should tell us about the problem not only
- Results should be clear stated and should accompani
- Avoid repetition



Discussion

- **In the discussion, you explore the meaning and relevance of you they fit with existing research and theory.**
- **No repetition of methodology and results without proper outco**
- **Every argument must have appropriate references.**
- **All the hypothesis, suggestions, indications must be based on th**
- **The limitation of the study/results/ methodology/ materials ma**

5. Discussion

5.1 Global Age framework of Planktonic foraminiferal

Taxonomy and biostratigraphy of planktonic foraminifera are the foundations for providing first-order relative age control in marine sediments, understanding open marine evolutionary dynamics, and reconstructing ocean-climate history (Kennett and Srinivasan, 1983; King et al., 2020; Norris, 2000; Vats et al., 2020; Wade et al., 2011; Wei and Kennett, 1986). Planktonic foraminifera are globally important for biostratigraphy and correlations due to their evolutionary history (Sabba et al., 2022). The evolutionary characteristics of planktonic foraminifera can be considered ideal for biostratigraphic index fossils such as diversity (Fischer and Arthur, 1977; Loeblich and Tappan, 1987; Tappan and Loeblich, 1973), morphology of lineage and species (Arnold et al., 1995; Cifelli, 1969; Malmgren and Kennett, 1981; Norris, 1996; Spencer-Cervato and Thierstein, 1997) and studying the dynamics of origins and extinctions of species (Thunell, 1981; Wei and Kennett, 1986) and biogeographic distribution through time (Parker et al., 1999). Therefore, they are widely utilized for biostratigraphy of Cretaceous and Cenozoic marine sediments and are a fundamental component of Cenozoic chronostratigraphy (Wade et al., 2011). The diachroneities in the planktonic foraminifera datums can be caused by various factors including the dispersal of species by ocean gyre (Darling et al., 2000), opening and closing of ocean gateways (Fenton, 2015; Haug and Tiedemann, 1998), ecology (Ding et al., 2006) and dissolution (Nguyen et al., 2009). In particular, the intensification of glacial-interglacial transitions during the Pleistocene strongly influenced the stratification of surface waters and the marine environment as a whole (e.g., Crundwell et al., 2008; De Boer et al., 2010; Lisiecki and Raymo, 2005) These substantial environmental changes caused regional endemicity (Tsandev et al., 2008) which probably contributed to age diachronicities of planktonic foraminifera biostratigraphic events.

A total of seven biostratigraphic events were identified in U1516B, five of which are global and two are regional in nature (Table 4). The first event is marked with the FAD of *Gr. hessi* at 750 ka (Fig. 7). In tropical-subtropical regions, this event is globally synchronous at ~ 750 ka (Chaproniere et al., 1994; Wade et al., 2011) (Table 4). However, the LAD of *Gr. hessi* is geographically diachronous and categorized as a local/regional event due to age diachrony e.g., 400 ka (Aze et al., 2011), 80 ka (Bolli and Suva (1973) and 243 ka in Hole U1516B. The LAD of *Gr. tosaensis* occurs at the base of PT1b (610 ka) (e.g., Berggren et al., 1995b, 1995a; Mix et al., 1995; Wade et al., 2011). The event is usually considered globally synchronous. However, the event is reported at 650 ka south of Australia (Li et al., 2003), as well as placed in the earlier zonation scheme of Berggren et al. (1995b, 1995a). The earlier extinction of *Gr. tosaensis* in

Conclusions

- **The conclusion is intended to help the reader un after they have finished reading the paper.**
- **A conclusion is not merely a summary of your p but a synthesis of key points.**
- **The conclusion tell us about the research proble statistical values.**
- **Conclusion should be clear, concise and direct.**

6. Conclusions

IODP Hole U1516B preserves an excellent record of biostratigraphy based on nannofossils and planktonic foraminifera whereas the radiolarian taxa and diatoms are poorly preserved. This biostratigraphy can be used for further correlation with the sediments of the Pacific and Atlantic oceans and the Mediterranean Sea. The conclusions drawn from the current study are as follows:

- Seven planktonic foraminifera biostratigraphic events are identified, including the demarcation of the PT1b boundary.
- The planktonic foraminifera datums marked in Hole U1516B are mostly synchronous with datums previously marked in the southern hemisphere whereas diachronous with the northern hemisphere.
- Nannofossils are well preserved and show good diversity. Eight biostratigraphic events are identified including the *H. inversa* zone which is the only complete zone of the Late Pleistocene.
- The nannofossil datums marked in Hole U1516B have a close affinity with those globally reported but have small inconsistencies probably due to strong ecological control and dissolution factor.
- The radiolarian taxa and diatom are poorly preserved. The diatoms are restricted to specific intervals in interglacials whereas the radiolarian taxa are relatively consistent but key marker species are absent are rarely occurred.

Abstract

- An abstract is a c
- The broad backg
- Research probler
- Research objecti
- Materials and M
- Key results
- Any limitation (M
- Significance of th
- Overall text body conditional).

ABSTRACT

An accurate and high-resolution age model in marine sediments is essential for reconstructing past oceanographic and climate changes. The southeastern Indian Ocean is an important component of oceanographic circulation and global climate. However, the integrated biostratigraphy for the Late Pleistocene interval is not well known in the region. To address this issue, we constructed a new chronology for International Ocean Discovery Program (IODP) Hole U1516B in the Mentelle Basin, offshore southwestern Australia. We employ planktonic foraminifera $\delta^{18}O$ to construct an astronomically tuned age model for Hole U1516B. Biostratigraphic analysis was performed for Hole U1516B using planktonic foraminifera, nannofossils, radiolarian taxa and diatoms. Seven planktonic foraminifera events are recorded, including the PT1a and PT1b boundaries. Eight nannofossil events were recorded including the boundaries between CN14a, CN14b and CN15. The planktonic foraminifera datums marked in Hole U1516B are mostly synchronous with datums reported in the southern hemisphere but are diachronous with datums in the northern hemisphere. The nannofossil datums marked in Hole U1516B have a close affinity with globally reported datums but small inconsistencies are probably due to strong ecological control. The diatom events are inconsistent and only recorded in short intervals during interglacials and several key radiolarians taxa are absent.

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03

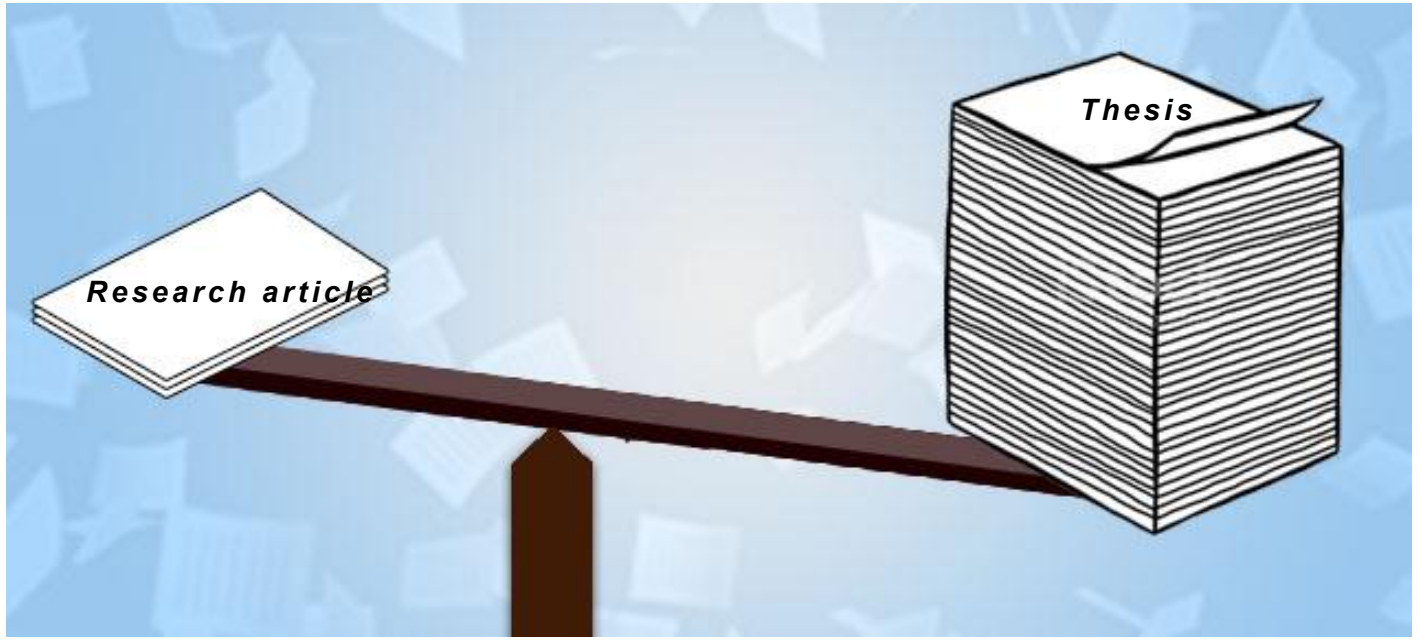
Difference between Article and Thesis

The basic difference between research article and research thesis.

Difference between research paper and thesis

- Research Paper and Thesis are both academic documents that involve research and scholarly writing, but they differ in their purpose, scope, and level of detail.
- Here are the key differences between a research paper and a thesis:

1. Purpose
2. Scope and Depth
3. Length
4. Structure
5. Audience



04

Research Ethics

During research which basic code and conducts of research ethics should be followed.

Research Ethics

- Research ethics refers to the set of principles, guidelines, and standards that govern ethical conduct in research involving human subjects or the use of data.
- It ensures that research is conducted with integrity, respect for participants' rights, and adherence to ethical principles.
- Strive for honesty in all scientific communications.
- Honestly report data, results, methods and procedures, and publication status.
- Do not fabricate, falsify, or misrepresent data.
- Do not deceive colleagues, research sponsors, or the public.

Research Ethics

- Data fabrication
- Plagiarism
- Data falsification
- Authorship issue
- Conflict of interest
- Non-disclosure of safety procedures
- Simultaneous submission
- No informed consent
- Duplicate submission
- Salami Slicing
- No permission for data
- Copy right
- Image manipulation

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THANKS