M1

INTRODUCTION TO INFORMATICS RESEARCH

Understanding the nature, scope, roles, and characteristics of research in Informatics

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OUTLINE

01

What Is Research?

Definition, purpose, and fundamental characteristics of research.

02

Nature of Informatics Research

Systematic, evidence-based, problem-driven, analytical, and reproducible inquiry.

03

Scope of Informatics Research

AI & Machine Learning, Data Science, Software Engineering, Cybersecurity, HCI, Information Systems, Networks, and related areas.

04

Research vs. Development vs. Implementation

Distinguishing research, solution development, and implementation of existing methods.

05

Roles and Contributions of Research

Knowledge creation, problem solving, innovation, technology advancement, and societal impact.

06

Characteristics of Good Informatics Research

Novelty, relevance, rigor, validity, reliability, reproducibility, and ethical responsibility.



01 What Is Research?

Definition, purpose, and fundamental characteristics of research

Definition

Research is a systematic and rigorous process of inquiry to generate new knowledge, solve problems, or validate existing knowledge through evidence and logical reasoning.

Purpose

Generate new knowledge
Discover new facts, concepts, or methods.

Solve problems
Provide evidence-based solutions to real-world issues.

Validate existing knowledge
Test, verify, or refine previous findings.

Advance understanding
Contribute to scientific, technological, and societal development.

Fundamental Characteristics

Systematic
Follows a structured and organized process.

Evidence-Based
Relies on empirical data and credible evidence.

Objective
Based on logical reasoning, minimizing bias.

Analytical
Uses critical and analytical thinking.

Replicable
Can be repeated and verified by others.

Contributive
Generates new knowledge or improves existing understanding.



01 What Is Research?

Definition of Research

Research is a systematic and rigorous process of inquiry to generate new knowledge, solve problems, or validate existing knowledge through evidence and logical reasoning.



01 What Is Research?

Purpose of Research

The purpose of research is to **generate new knowledge**, **solve problems**, or **validate existing knowledge** in order to advance understanding and create positive impact.

- Generate New Knowledge
- Solve Problems
- Validate Existing Knowledge
- Advance Understanding
- Create Positive Impact



01

What Is Research?

Fundamental Characteristics of Research

Good research follows clear principles.

Systematic

Follows a structured and organized process.

Evidence-Based

Relies on empirical data and credible evidence.

Objective

Based on logical reasoning, minimizing personal bias.

Analytical

Uses critical and analytical thinking to interpret information.

Replicable

Can be repeated and verified by other researchers.

Contributive

Generates new knowledge or improves existing understanding.



02

Nature of Informatics Research

Systematic, evidence-based, problem-driven, analytical, and reproducible inquiry

Systematic

Follows a structured and organized process, using established methods and clear steps.

Evidence-Based

Grounded in empirical data and credible evidence, not merely opinions or assumptions.

Problem-Driven

Motivated by real-world problems, aiming to provide meaningful solutions and generate new knowledge.

Analytical

Uses critical and analytical thinking to interpret data, identify patterns, and draw valid conclusions.

Reproducible

Transparent and well-documented, allowing results to be verified, replicated, and built upon by other researchers.



02 Nature of Informatics Research

Systematic

Informatics research is **systematic**, meaning it follows a structured and organized process to ensure that the research is logical, consistent, and reliable.

- Uses established research methods and clear steps.
- Proceeds in a logical and well-planned manner.
- Helps to minimize bias and increases the credibility of the results.

A Systematic Research Process

1. Plan
Define the problem and objectives.

2. Collect
Gather relevant and reliable data.

3. Analyze
Use appropriate methods and tools.

4. Conclude
Interpret results and draw valid conclusions.



02 Nature of Informatics Research

Evidence-based

Informatics research is **evidence-based**, meaning it relies on empirical data and credible evidence rather than personal opinions, assumptions, or unverified claims.

- Uses observable and measurable data.
- Applies rigorous methods for data collection and analysis.
- Draws conclusions based on valid and reliable evidence.

Empirical Data

Based on real-world data such as user behavior, system logs, surveys, or experiments.

Credible Sources

Uses trustworthy data and recognized methods for data collection and analysis.

Verifiable Results

Findings can be checked, replicated, and validated by other researchers.

Reduces Bias

Relies on evidence to minimize personal opinions, assumptions, and subjectivity.



02 Nature of Informatics Research
Problem-driven

Real problems
Inspire meaningful
research.

Problem-driven

Informatics research is **problem-driven**, meaning it is motivated by real-world problems and aims to provide practical, relevant, and impactful solutions through the development of new knowledge, methods, or systems.

From Real Problems to Real Impact

1. **Identify the Problem**
   Recognize real-world challenges in society, industry, or everyday life.
2. **Understand the Context**
   Analyze the problem, its causes, and the needs of stakeholders.
3. **Develop Solutions**
   Propose and design methods, models, or systems to address the problem.
4. **Generate Impact**
   Contribute to solving the problem and creating value for society through research outcomes.



02 Nature of Informatics Research
Analytical

Analyze
Understand
Create Solutions

Analytical

Informatics research is **analytical**, meaning it uses critical and logical thinking to examine data, identify patterns, interpret results, and draw valid conclusions.

- Breaks down complex problems into smaller parts.
- Uses logical reasoning and systematic analysis.
- Leads to evidence-based and well-founded conclusions.

Key Aspects of Analytical Research

Data Analysis
Examines and processes data to find meaningful patterns and insights.

Critical Thinking
Questions assumptions, evaluates evidence, and considers alternative explanations.

Logical Reasoning
Uses systematic and objective reasoning to build arguments and solutions.

Interpretation & Inference
Draws valid conclusions based on analyzed data and existing knowledge.



02

Nature of Informatics Research

Reproducible Inquiry

Same Methods
Same Results
Stronger Science

Reproducible Inquiry

Informatics research is **reproducible**, meaning the research process, data, and results can be independently verified, replicated, and built upon by other researchers.

- Provides transparent documentation of methods and data.
- Enables independent verification of results.
- Supports cumulative knowledge and continuous improvement.

Key Elements of Reproducible Research

Clear Documentation
Describes datasets, methods, parameters, and experimental settings in detail.

Accessible Data and Code
Shares data, source code, and tools when possible.

Repeatable Methodology
Uses well-defined and standardized procedures so others can replicate the study.

Verifiable Results
Allows independent validation and encourages further research and innovation.



03 Scope of Informatics Research

Key Areas and Related Fields

Diverse Areas
Shared Goals
Greater Impact

AI & Machine Learning

Develop intelligent systems that learn from data and make decisions.

Data Science

Extract knowledge and insights from data to support decision-making.

Software Engineering

Design, develop, and maintain reliable, scalable, and high-quality software systems.

Cybersecurity

Protect systems, data, and users from threats and ensure trust, privacy, and safety.

Human-Computer Interaction (HCI)

Study and design interactions between humans and technology to improve user experience and accessibility.

Information Systems

Develop and manage systems that collect, process, store, and deliver information for organizations and society.

Networks

Design and analyze communication systems and network infrastructures to enable reliable and efficient data exchange.

Related Areas

Including computer vision, natural language processing, robotics, cloud computing, bioinformatics, ubiquitous computing, and other emerging fields.



03 Scope of Informatics Research
AI & Machine Learning

Smarter Algorithms Brighter Futures

AI & Machine Learning

Focuses on developing intelligent systems that can learn from data, reason, and make decisions to solve real-world problems.

- Builds models and algorithms that learn from data.
- Solves complex problems automatically.
- Enables intelligent applications to improve life and society.

Research Topics

Machine Learning
Developing algorithms for prediction, classification, and decision-making.

Deep Learning
Using neural networks for complex data such as images, text, and speech.

Computer Vision
Enabling machines to understand and interpret visual information.

Natural Language Processing (NLP)
Helping machines understand and generate human language.

Data-Driven Intelligence
Extracting knowledge and insights from large and complex datasets.

Real-World Applications
Applying AI/ML in healthcare, education, finance, industry, smart systems, and beyond.



03 Scope of Informatics Research
Data Science

Data Science

Focuses on extracting knowledge and insights from data using statistical methods, machine learning, and data analysis to support decision-making.

- Transforms raw data into meaningful insights.
- Combines statistics, computation, and domain knowledge.
- Supports data-driven decision-making for real-world problems.

Key Research Areas in Data Science

Data Mining
Discovering useful patterns and knowledge from large datasets.

Predictive Analytics
Building models to predict future events and trends from data.

Big Data Analytics
Processing and analyzing large, complex, and diverse data at scale.

Data Visualization
Presenting data and insights in an understandable and interactive way.



03 Scope of Informatics Research

Software Engineering

Build Better Software for a Better Tomorrow

Software Engineering

Focuses on the systematic design, development, maintenance, and evolution of reliable, scalable, and high-quality software systems to solve real-world problems.

- Applies engineering principles to software development.
- Ensures software is reliable, maintainable, and scalable.
- Supports innovation through systematic and collaborative development processes.

Key Research Areas in Software Engineering

Software Design and Architecture

Designing modular, flexible, and scalable software systems.

Software Development Methods

Improving development processes, methodologies, and tools (e.g., Agile, DevOps).

Software Quality and Testing

Ensuring reliability, security, and performance through verification and validation.

Software Maintenance and Evolution

Managing and improving existing software systems over time.

Software Engineering for Emerging Domains

Developing software solutions for AI, IoT, mobile systems, and other new technologies.

Human and Social Aspects

Studying collaboration, developer productivity, user needs, and the social impact of software.



03 Scope of Informatics Research
Cybersecurity

Secure
Systems
Safer Societies
Brighter Futures

Cybersecurity

Focuses on protecting computer systems, networks, data, and users from threats, attacks, and unauthorized access, ensuring confidentiality, integrity, and availability of information.

- Develops methods to detect, prevent, and respond to cyber threats.
- Enhances the security and resilience of digital systems.
- Supports a safer and more trustworthy digital world.

Key Research Areas in Cybersecurity

Network Security
Protecting networks and communication systems from attacks and unauthorized access.

Data Security
Safeguarding data through encryption, access control, and privacy-preserving techniques.

Threat Detection and Incident Response
Detecting, analyzing, and responding to cyber threats and security incidents.

Identity and Access Management
Ensuring the right users have the right access to the right resources.

Secure Systems and Software
Designing and developing secure architectures, protocols, and software systems.

Privacy and Trust
Protecting user privacy and building trust in digital technologies and services.



03 Scope of Informatics Research

Human-Computer Interaction (HCI)

People
Technology
Better Experiences
Brighter Lives

Human-Computer Interaction (HCI)

Focuses on the design, evaluation, and understanding of interactions between people and computers to create useful, usable, and meaningful technology for real-world use.

- Studies user needs, behaviors, and experiences.
- Designs interactive systems that are user-centered and accessible.
- Improves the way people and technology work together.

Key Research Areas in HCI

User-Centered Design

Designing systems that meet user needs, abilities, and contexts.

Usability and User Experience (UX)

Evaluating and improving the effectiveness, efficiency, and satisfaction of systems.

Accessibility and Inclusion

Creating technology that can be used by diverse people, including those with disabilities.

Human Behavior and Interaction

Understanding how people perceive, learn, communicate, and interact with technology.

Interaction Technologies

Exploring new interfaces such as touch, voice, gesture, AR/VR, and multimodal interaction.

Societal Impact

Examining the impact of technology on individuals, organizations, and society.



03

Scope of Informatics Research
Information Systems

Information Systems Connect People Data and Opportunities

Information Systems

Focuses on the design, development, implementation, and management of information systems to support organizational processes, decision-making, and value creation.

- Studies how information supports people, processes, and organizations.
- Designs and evaluates information systems and digital business solutions.
- Contributes to more efficient, effective, and data-driven organizations and societies.

Key Research Areas in Information Systems

Business Information Systems
Developing systems to support business processes, management, and strategic decision-making.

Data Management and Analytics
Managing organizational data and leveraging analytics for insights and value creation.

Enterprise Systems
Designing, implementing, and studying systems such as ERP, CRM, and supply chain management.

Information Systems and Society
Examining the impact of information systems on individuals, organizations, and society.

IT Governance and Security
Ensuring responsible, secure, and ethical use of information systems in organizations.

Digital Innovation and Transformation
Exploring how emerging technologies enable digital business models and create new opportunities.



03 Scope of Informatics Research
Networks

Networks

Focuses on the design, analysis, implementation, and management of communication networks to enable reliable, secure, and efficient exchange of data, information, and services.

- Studies how devices, systems, and people connect and communicate.
- Designs and evaluates network architectures and protocols.
- Supports the development of scalable, secure, and high-performance network infrastructures.

Key Research Areas in Networks

Network Architecture and Protocols

Designing and improving network architectures, protocols, and standards (e.g., TCP/IP, 5G, SDN).

Wireless and Mobile Networks

Enabling reliable and efficient communication in wireless, mobile, and IoT environments.

Network Security

Protecting networks from threats, attacks, and vulnerabilities, and ensuring secure communication.

Network Management and Monitoring

Managing, monitoring, and optimizing network performance and reliability.

Emerging Network Technologies

Exploring new paradigms such as IoT, edge computing, cloud networking, and software-defined networks (SDN).

Networks and Society

Studying the impact of network technologies on individuals, organizations, and society (e.g., digital divide, sustainability, smart cities).



03 Scope of Informatics Research
Related Areas

Interdisciplinary Ideas
Broader Impact
Better Solutions

Related Areas

Informatics research also intersects with many other disciplines, enabling broader perspectives, innovative solutions, and greater real-world impact.

- Integrates knowledge from multiple disciplines.
- Addresses complex, real-world problems.
- Creates opportunities for innovation and societal impact.

Examples of Related Areas

Computational Linguistics
Combining informatics with linguistics to enable natural language processing and language technologies.

Health Informatics
Applying informatics to healthcare, medical data, and biomedical research for better health outcomes.

Bioinformatics
Using computational methods to analyze biological data such as genomic and molecular information.

Computational Social Science
Analyzing social behavior, networks, and human interactions using computational methods.

Geoinformatics
Integrating informatics with spatial data and geographic information for environmental and urban applications.

Digital Humanities
Applying computational techniques to cultural, historical, and humanities research.



04 Research vs. Development vs. Implementation

Distinguishing research, solution development, and implementation of existing methods

Different Goals
Shared Impact
From Ideas
to Real-World Value

Research
Creating New Knowledge

Systematic and original investigation to discover new knowledge, methods, or understanding.

- Explores new problems or perspectives.
- Proposes new theories, models, or methods.
- Produces scholarly outputs (e.g., journal or conference publications).

Key Question:
What can be new or better understood?

Development
Creating Solutions

Design and building of new or improved systems, tools, or models based on research findings or practical needs.

- Transforms ideas into working solutions.
- Improves or adapts existing methods to specific needs.
- Produces prototypes, software, datasets, or technical frameworks.

Key Question:
How can we build a working solution?

Implementation
Applying Existing Methods

Use and integration of existing methods, tools, or technologies in real-world settings.

- Applies proven methods or technologies.
- Focuses on adployment, integration, and usage.
- Evaluates performance, efficiency, and real-world impact.

Key Question:
How can we effectively apply what already exists?



Different Roles, Complementary Impact
Research generates knowledge, development turns it into solutions, and implementation brings value to society.

From Knowledge to Real-World Impact

04 Research vs. Development vs. Implementation
Distinguishing Research

Explore
Understand
Create Knowledge

What is Research?

Research is a systematic and original investigation to discover new knowledge, methods, or understanding. It aims to answer questions, explore new problems, and generate evidence that contributes to the advancement of science and society.

> *"Research seeks to know and understand."*

Key Characteristics of Research

Originality
Seeks new knowledge or new perspectives.

Systematic Approach
Follows a structured and rigorous methodology.

Generates Scholarly Outputs
Produces theories, models, methods, or academic publications.

Addresses Open Questions
Explores problems that are not yet fully solved.

Examples of Research

AI Research
Developing new algorithms for more robust learning methods.

Health Informatics
Investigating novel methods for disease prediction using multi-modal data.

Social Computing
Understanding human behavior in online communities.

Data Science Research
Proposing new models for analyzing complex and high-dimensional data.



04 Research vs. Development vs. Implementation
Solution Development

From Research Ideas to Practical Solutions

What is Solution Development?

Solution development is the process of designing and building new or improved systems, tools, or models based on research findings or practical needs to solve real-world problems.

> *"Turns ideas and knowledge into working solutions that can be tested and used in real settings."*

Key Characteristics

Problem-Oriented
Focuses on solving specific problems or meeting user needs.

Design and Build
Creates new or improved systems, prototypes, or tools.

Uses Existing Knowledge
Builds on research results, theories, or existing methods.

Iterative Process
Involves design, development, testing, and refinement.

Evaluates Functionality
Assesses whether the solution works as intended and meets its objectives.

Examples of Solution Development

Software Development
Building a mobile app or web-based system to address a specific need.

Data Analytics Tool
Developing a tool for visualizing and analyzing data.

AI-based Application
Creating a prototype for a machine learning system.

Decision Support System
Designing a system to assist decision-making in organizations.

Educational Technology
Developing a digital platform to enhance learning experiences.



04 Research vs. Development vs. Implementation
Implementation of Existing Methods

Apply Proven Methods Create Real Value

What is Implementation?

Implementation is the process of using and integrating existing methods, tools, or technologies in real-world settings to solve practical problems and deliver value.

- Applies proven methods or technologies.
- Focuses on deployment and integration.
- Aims to achieve real-world benefits and impact.

Examples of Implementation

Deploying a Web Application Framework

Using an existing framework (e.g., Django, Laravel) to build and deploy a university information system.

Implementing a Machine Learning Model

Applying a pre-trained model (e.g., BERT, YOLO) to a specific dataset for a real-world application, such as document classification or object detection.

Integrating Existing Cloud Services

Using existing cloud platforms (e.g., AWS, Google Cloud) to deploy and manage an application or data pipeline.

Adopting Standard Security Tools

Implementing existing tools (e.g., firewalls, intrusion detection systems) to enhance the security of an organization's network.

Key Takeaway

Implementation brings proven knowledge and technologies into practice to solve real problems and create tangible impact.



05 Roles and Contributions of Research

Knowledge creation, problem solving, innovation, technology advancement, and societal impact

Research Today A Brighter Tomorrow

Why Research Matters?

Research plays a vital role in expanding knowledge, addressing real-world challenges, driving innovation, advancing technology, and creating positive impact for society.

> *"Research turns curiosity into solutions and ideas into a better future."*

01 Knowledge Creation

Generates new knowledge, theories, methods, and insights that expand our understanding of the world.

02 Problem Solving

Provides evidence-based solutions to real-world problems and addresses complex challenges in various domains.

03 Innovation

Inspires new ideas, products, services, and approaches that create value and meet evolving needs.

04 Technology Advancement

Drives the development and improvement of technologies that enhance efficiency, capability, and quality of life.

05 Societal Impact

Contributes to social, economic, environmental, and cultural well-being, leading to a more just, inclusive, and sustainable society.



05 Roles and Contributions of Research
Knowledge Creation

What is Knowledge Creation?

Knowledge creation is the process of generating new knowledge, theories, methods, models, or insights through systematic and original research.

> *"Research expands what we know and helps us see the world in new ways."*

Key Aspects of Knowledge Creation

New Theories
Developing theories to explain phenomena.

New Methods
Creating new research methods or approaches.

New Models
Proposing models to better understand or predict real-world problems.

New Insights
Revealing new perspectives and deeper understanding of existing knowledge.

Expanding Knowledge Frontiers
Filling knowledge gaps and opening new research directions.

Key Takeaway
Knowledge creation is the foundation of scientific and technological progress.



05 Roles and Contributions of Research Problem Solving

From Problems to Solutions Through Research

What is Problem Solving in Research?

Problem solving in research is the process of using systematic and rigorous methods to understand real-world problems and develop evidence-based solutions.

> *Research turns real-world challenges into practical solutions for a better future.*

How Research Contributes to Problem Solving

01 Identifies and Analyzes Problems

Helps to clearly understand the root causes, scope, and impact of complex problems through data and analysis.

02 Develops Evidence-Based Solutions

Generates and evaluates possible solutions using scientific methods and empirical evidence.

03 Tests and Validates Solutions

Examines the effectiveness, feasibility, and potential impact of proposed solutions through rigorous evaluation.

04 Addresses Real-World Challenges

Contributes to solving problems in various domains, such as health, education, environment, industry, and society.



Key Takeaway

Research provides structured and reliable ways to solve real-world problems and create meaningful impact.

05 Roles and Contributions of Research Innovation

What is Innovation in Research?

Innovation in research is the creation of new ideas, approaches, methods, products, or services that provide significant improvements and address real-world needs.

> *"Research drives innovation by turning knowledge into new possibilities for a better future."*

Forms of Innovation from Research

New Methods and Approaches
Developing novel algorithms, models, or techniques to solve problems more effectively.

New Products and Services
Creating new technologies, applications, or systems that meet emerging needs in society and industry.

Interdisciplinary Solutions
Combining knowledge from different fields to generate breakthrough innovations.

Continuous Improvement
Enhancing existing technologies, processes, or systems to achieve greater impact and value.

Key Takeaway
Research fuels innovation, leading to new solutions, opportunities, and a brighter future.



05 Roles and Contributions of Research Technology Advancement



What is Technology Advancement in Research?

Technology advancement in research refers to the improvement, development, or creation of new technologies driven by scientific investigation and innovative ideas.

> *"Research pushes the boundaries of what technology can do."*

How Research Drives Technology Advancement

New and Improved Technologies

Generates new technologies or enhances existing ones through systematic investigation and innovation.

Higher Performance and Efficiency

Develops better algorithms, materials, systems, and processes that are faster, smarter, and more efficient.

Enabling New Applications

Provides the technological foundation for new applications in various domains, such as healthcare, education, environment, industry, and daily life.

Driving Future Opportunities

Opens new possibilities for economic growth, industrial development, and solutions to global challenges.

Key Takeaway

Research advances technology, creating new opportunities and a better future for society.

05 Roles and Contributions of Research
Societal Impact

What is Societal Impact in Research?

Societal impact refers to the positive changes and benefits that research brings to individuals, communities, societies, and the environment.

> *"Research creates knowledge not only for publications, but for a better society."*

Examples of Societal Impact

01 Improving Quality of Life
Provides solutions to real-world problems, such as better healthcare, education, transportation, and public services.

02 Supporting Sustainability
Contributes to environmental protection, climate action, and sustainable development for future generations.

03 Driving Economic Growth
Creates new industries, jobs, and innovations that boost economic development and competitiveness.

04 Promoting Equity and Inclusion
Helps reduce social disparities and ensures that the benefits of technology and knowledge are accessible to all.

Key Takeaway
Research has the power to create a fairer, healthier, more prosperous, and more sustainable society.



06 Characteristics of Good Informatics Research

What Makes Informatics Research Good?

Good informatics research is more than just solving a technical problem. It should be original, relevant, methodologically sound, trustworthy, reproducible, and ethically responsible.

> *High-quality research generates trustworthy knowledge and creates lasting positive impact.*

Key Characteristics

01 Novelty
Brings new ideas, methods, or insights beyond existing work.

02 Relevance
Addresses important and current problems in informatics and society.

03 Rigor
Uses systematic, well-designed, and appropriate methods and analysis.

04 Validity
Produces accurate and credible results that truly reflect the research objectives.

05 Reliability
Yields consistent results under the same conditions and methods.

06 Reproducibility
Allows others to replicate the study and obtain similar results.

07 Ethical Responsibility
Respects ethical principles, protects privacy, and considers the broader impact on people and society.

Key Takeaway
Good informatics research is original, relevant, rigorous, valid, reliable, reproducible, and ethically responsible.



06 Characteristics of Good Informatics Research
Novelty

What is Novelty in Research?

Novelty means bringing new ideas, methods, or insights that go beyond existing work. It shows originality and contributes something new to the field of informatics.

> *"Good research does not just repeat what is known, but opens new possibilities."*

Examples of Novelty in Informatics Research

New Methods
Proposes a new algorithm, model, or technique to solve a problem more effectively.

New Applications
Applies existing methods in a new domain or real-world context.

New Insights
Provides a fresh perspective or deeper understanding of a known problem.

Improved Solutions
Offers a significant enhancement over previous approaches in terms of performance, efficiency, or usability.

Key Takeaway
Novelty is essential because it advances knowledge and drives innovation in informatics.



06 Characteristics of Good Informatics Research
Relevance



What is Relevance in Research?

Relevance means that the research addresses important, current, and real-world problems in informatics. It provides value to the field, responds to the needs of society, industry, or academia, and contributes to solving meaningful challenges.

> *"Good research is not only technically sound, but also relevant to the real world."*

Examples of Relevance in Informatics Research

Addressing Real-World Problems

Focuses on issues such as data privacy, cybersecurity, health informatics, smart cities, or education technology.

Meeting Societal Needs

Develops solutions that improve people's lives and support sustainable development.

Aligning with Current Trends

Tackles emerging topics such as artificial intelligence, big data, human–computer interaction, or the Internet of Things (IoT).

Contributing to the Field

Fills gaps in existing research and provides insights that are useful for both academic and practical applications.

Key Takeaway

Relevance ensures that research makes a meaningful contribution to people, society, and the advancement of informatics.

06 Characteristics of Good Informatics Research
Rigor

What is Rigor in Research?

Rigor means using systematic, well-designed, and appropriate methods to ensure the research process is thorough, logical, and scientifically sound.

> *Rigor builds trust in research and ensures that the results are credible and meaningful.*

Examples of Rigor in Informatics Research

Systematic Approach
Follows a clear and structured research process, from problem formulation to analysis and conclusion.

Appropriate Methods
Uses well-established and suitable methods, models, and evaluation metrics for the research questions.

Thorough Analysis
Conducts careful experimentation, statistical analysis, and validation to support the findings.

Critical Evaluation
Examines assumptions, limitations, and potential biases, and compares results with existing work.

Key Takeaway
Rigor ensures that informatics research is reliable, valid, and worthy of trust.



06 Characteristics of Good Informatics Research
Validity

What is Validity in Research?

Validity means that the research truly measures or investigates what it intends to measure, and that the results accurately reflect the real phenomena or concepts being studied.

> *"Valid research leads to correct conclusions and meaningful knowledge."*

Examples of Validity in Informatics Research

Construct Validity
Ensures that the research actually measures the intended concept (e.g., user satisfaction, system performance).

Internal Validity
Confirms that the observed results are caused by the factors being studied, not by other unintended factors.

External Validity
Indicates that the findings can be generalized to other contexts, datasets, or populations.

Statistical Validity
Uses appropriate statistical methods to ensure that the results are significant and not due to random chance.

Key Takeaway
Validity ensures that the research findings are accurate, credible, and truly reflect the reality being studied.



06 Characteristics of Good Informatics Research
Reliability

What is Reliability in Research?

Reliability means that the research produces consistent results when repeated under the same conditions, using the same methods, data, and analysis procedures.

> *"Reliable research builds confidence and allows others to trust and build upon the findings."*

Examples of Reliability in Informatics Research

Consistent Results
Produces similar results when the study is repeated with the same data and methods.

Clear Procedures
Uses well-documented and standardized methods so that others can reproduce the work.

Stable Data and Tools
Relies on reliable datasets, software, and experimental settings to minimize random variation or errors.

Reproducible Findings
Enables other researchers to obtain comparable results when following the same procedures.

Key Takeaway
Reliability ensures that informatics research is consistent, repeatable, and trustworthy.



06 Characteristics of Good Informatics Research Reproducibility

What is Reproducibility in Research?

Reproducibility means that other researchers can repeat the study using the same data, methods, and tools, and obtain similar results.

> *"Reproducible research strengthens credibility and accelerates progress in science."*

Examples of Reproducibility in Informatics Research

Open Data
Provides the dataset or a clear way to access the data used in the research.

Transparent Methods
Shares detailed information about algorithms, models, parameters, and experimental settings.

Open Source Code
Provides the source code or implementation details so others can run and verify the methods.

Replicable Results
Enables independent researchers to obtain similar results under the same conditions.

Key Takeaway
Reproducibility ensures that informatics research is trustworthy, verifiable, and useful for future work.



06 Characteristics of Good Informatics Research
Ethical Responsibility

What is Ethical Responsibility in Research?

Ethical responsibility means conducting research with integrity, respect, and concern for the potential impact on individuals, society, and the environment, while complying with ethical standards and regulations.

> *"Good research not only seeks knowledge, but also does good and avoids harm."*

Examples of Ethical Responsibility in Informatics Research

Respect for People
Protects the rights, privacy, and dignity of participants, including informed consent and responsible data handling.

Minimize Harm
Identifies and mitigates potential risks or negative impacts on individuals, society, or the environment.

Follow Regulations and Standards
Adheres to institutional guidelines, legal requirements, and professional codes of ethics.

Consider Societal and Environmental Impact
Ensures that the research outcomes contribute positively to society and do not harm the environment.

Key Takeaway
Ethical responsibility ensures that informatics research is trustworthy, fair, and beneficial for a better future.



TASK

1 BROWSE AND DOWNLOAD

Browse the **requirements** for the thesis proposal seminar and download the official thesis proposal **template**.



2 FIND REFERENCE JOURNALS

Search for and select a **main reference journal** that is relevant to your intended thesis topic.



3 DETERMINE YOUR THESIS TOPIC

Decide on your thesis title or topic based on the selected reference journal, with consideration and discussion with your prospective thesis **supervisor. in consultation with your prospective thesis supervisor.**

