

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



روش تحقیق در فیزیک

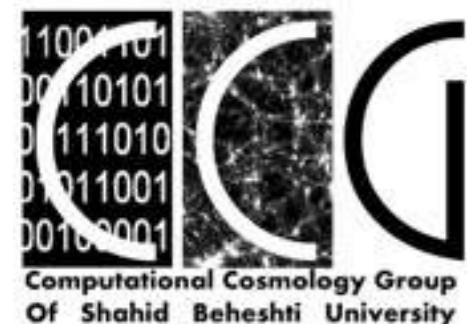
جلسه سوم (۱)

سید محمدصادق موحد

دانشکده فیزیک - دانشگاه شهید بهشتی

گروه کیهان شناسی محاسباتی و آزمایشگاه میان رشته ای ابن سینا

<http://faculties.sbu.ac.ir/~movahed>



فهرست مطالب

- (۱) پژوهش چیست؟
- (۲) اهمیت و اهداف پژوهش
- (۳) روش پژوهش و روش شناسی پژوهش



Rajasekar, S., Philominathan, P., and Chinnathambi, V., “Research Methodology”, *arXiv e-prints*, 2006. doi:10.48550/arXiv.physics/0601009.

What is a Research? (General view)

- It is an investigation of finding solutions to scientific and social problems through objective and systematic analysis
- Looking for answering “What”, “Why” and “How”
- Research is done with the help of study, experiment, observation, analysis, comparison and reasoning.

What is a Research?

(A quote)

As stated by Gerald Milburn Scientific research is
1) a chaotic business, stumbling along amidst red herrings, errors and truly, creative insights.

2) Great scientific breakthroughs are rarely the work of a single researchers plodding slowly by inexorably towards some final goal.

3) The crucial idea behind the breakthrough may surface a number of times, in different places, only to sink again beneath the babble of an endless scientific discourse

What are the Objectives of Research? (the prime ones)

- (1) To discover new facts
- (2) To verify and test important facts
- (3) To analyze an event or process or phenomenon to identify the cause-and-effect relationship
- (4) to develop new scientific tools, concepts and theories to solve and understand scientific problems
- (5) to find solutions to scientific problems
- (6) To overcome or solve the problems occurring in our every day life.

Motivations to do research

1) To get a research degree (Doctor of Philosophy (Ph.D.)) along with its benefits like better employment, promotion, increment in salary, etc.

Motivations to do research

- 1) To get a research degree (Doctor of Philosophy (Ph.D.)) along with its benefits like better employment, promotion, increment in salary, etc.
- 2) Curiosity to find out the unknown facts of an event and new things

Motivations to do research

- 1) To get a research degree (Doctor of Philosophy (Ph.D.)) along with its benefits like better employment, promotion, increment in salary, etc.
- 2) Curiosity to find out the unknown facts of an event and new things
- 3) To solve the unsolved and challenging problems

Motivations to do research

- 1) To get a research degree (Doctor of Philosophy (Ph.D.)) along with its benefits like better employment, promotion, increment in salary, etc.
- 2) Curiosity to find out the unknown facts of an event and new things
- 3) To solve the unsolved and challenging problems
- 4) To get joy of doing some creative work

Motivations to do research

- 1) To get a research degree (Doctor of Philosophy (Ph.D.)) along with its benefits like better employment, promotion, increment in salary, etc.
- 2) Curiosity to find out the unknown facts of an event and new things
- 3) To solve the unsolved and challenging problems
- 4) To get joy of doing some creative work
- 5) To serve the society by solving social problems.

Thesis Research

1) One reaches the frontier of knowledge and begins the lifelong task of learning how to do research.

Thesis Research

1) One reaches the frontier of knowledge and begins the lifelong task of learning how to do research.

2) During graduate course, particularly during Ph.D. course ideally, one learns:

- ❖ How to pick a research problem,
- ❖ How to carry out it,
- ❖ How to extract new information from the results
- ❖ How to publish the findings to the scientific community

Importance of Research

Research assists us to understand nature and natural phenomena

Importance of Research

Research assists us to understand nature and natural phenomena

- 1) Research on existing theories and concepts helps us to identify their range and applications of them.

Importance of Research

Research assists us to understand nature and natural phenomena

- 1) Research on existing theories and concepts helps us to identify their range and applications of them.
- 2) It is the source of knowledge and provides guidelines for solving problems.

Importance of Research

Research assists us to understand nature and natural phenomena

- 1) Research on existing theories and concepts helps us to identify their range and applications of them.
- 2) It is the source of knowledge and provides guidelines for solving problems.
- 3) It is important for Government to make policies, for Industries, for Business,

Importance of Research

Research assists us to understand nature and natural phenomena

- 1) Research on existing theories and concepts helps us to identify their range and applications of them.
- 2) It is the source of knowledge and provides guidelines for solving problems.
- 3) It is important for Government to make policies, for Industries, for Business,
- 4) It leads to the identification and characterization of new materials, new living things, etc.

Importance of Research

Research assists us to understand nature and natural phenomena

- 1) Research on existing theories and concepts helps us to identify their range and applications of them.
- 2) It is the source of knowledge and provides guidelines for solving problems.
- 3) It is important for Government to make policies, for Industries, for Business,
- 4) It leads to the identification and characterization of new materials, new living things, etc.
- 5) The inventions can be made only through research

Importance of Research

Research assists us to understand nature and natural phenomena

- 1) Research on existing theories and concepts helps us to identify their range and applications of them.
- 2) It is the source of knowledge and provides guidelines for solving problems.
- 3) It is important for Government to make policies, for Industries, for Business,
- 4) It leads to the identification and characterization of new materials, new living things, etc.
- 5) The inventions can be made only through research
- 6) Research leads to a new style of life and makes it delightful and glorious.

RESEARCH METHODS AND RESEARCH METHODOLOGY

Part I

Research methods are the various procedures, schemes and algorithms used in research.

While

Research methodology is a systematic way to solve a problem. !!!

- It is the science of studying how research is to be carried out.
- Its aim is to give the work plan of research.

For example, a researcher not only needs to know how to calculate mean, variance and distribution function for a set of data, but also need to know:

- 1) Which approach is a suitable method for the chosen problem? (Theoretical approach, Experimental approach, Simulations, ...)
- 2) What is the efficiency of the method?
- 3) What types of data should be collected?

RESEARCH METHODS AND RESEARCH METHODOLOGY

Part 2

The study of research methods gives training to apply them to a problem.

While

The study of research methodology provides us the necessary training in choosing methods, materials, scientific tools and training in techniques relevant for the problem chosen.

Example I

Subject: Investigation of electrical conductivity of a material

Methodology deals with:

- Doing experiment or simulation and why?
- In experiment, setting up the thermodynamics or electricity tools (Type of data should be collected)

While

Method deal with:

How to use an Amperemeter?

How to measure the electric current?

How to compute the Resistivity from collected data set?

Example 2

Subject: Recognizing the phases in matter

Methodology deals with:

- Simulation or experiments?
- Which type of Order parameter should be consider?
- Which type of data should be evaluated?

While

Method deal with:

How to analyze the corresponding data?

How can construct a pipeline (a sequence of different measures)

How can measure the selected order parameter

Example 3

Subject: Resolve the air Pollution

Methodology deals with:

- Engaging with life-style
- Engaging with car manufacturing (Exhaust mechanism, ...)
- Engaging with Public transportation
- Type of data

While

Method deal with:

How to analyze the corresponding data?

Which parts of selected approaches should be analyze? (Catalyst, ...)

خلاصه و جمع بندی

- (۱) پژوهش و مفهوم آن
- (۲) اهمیت و اهداف پژوهش

از توجه شما سپاسگزارم