LECTURE

12-03-2021

LECTURE

Hypothesis

Module 4.2.

12-03-2021

The Introduction: Key Terms

Key Research Definitions and Research Typology basics

RESEARCH

- Broadly defined, the purpose of research is to answer questions and acquire new knowledge.
- Research is the primary tool used in virtually all areas of science to expand the frontiers of knowledge.
- For example, research is used in such diverse scientific fields as psychology, biology, medicine, physics, and botany, to name just a few of the areas in which research makes valuable contributions to what we know and how we think about things.
- Among other things, by conducting research, researchers attempt to reduce the complexity of problems, discover the relationship between seemingly unrelated events, and ultimately improve the way we live.

RESEARCH

- In all types of science, research is frequently used for describing a thing or event, discovering the relationship between phenomena, entailing making predictions about future events.
- In short, research can be used for the purposes of description, explanation, and prediction, all of which make important and valuable contributions to the expansion of what we know and how we live our lives.
- In addition to sharing similar broad goals, scientific research in virtually all fields of study shares certain defining characteristics, including

(1) testing hypotheses, (2) careful observation and measurement,

(3) systematic evaluation of data, and (4) drawing valid conclusions.

SCIENTIFIC RESEARCH

- In simple terms, *science* can be defined as a methodological and systematic approach to the acquisition of new knowledge. This definition of science highlights some of the key differences between how scientists and nonscientists go about acquiring new knowledge. Specifically, rather than relying on mere casual observations and an informal approach to learn about the world, scientists attempt to gain new knowledge **by making careful observations and using systematic, controlled, and methodical approaches.** By doing so, scientists are able to draw valid and reliable conclusions about what they are studying.
- In addition, scientific knowledge is not based on the opinions, feelings, or intuition of the scientist. Instead, scientific knowledge is based on **objective data** that were **reliably obtained** in the context of a carefully designed research study. In short, scientific knowledge is based on the accumulation of empirical evidence.

SCIENTIFIC RESEARCH METHODOLOGY

- Research methodology simply refers to the practical “how” of any given piece of research. More specifically, it’s about how a researcher systematically designs a study to ensure valid and reliable results that address the research aims and objectives.
- For example, how did the researcher go about deciding:

❑ What data to collect (and what data to ignore)

❑ Who to collect it from (in research, this is called “sampling design”)

❑ How to collect it (this is called “data collection methods”)

❑ How to analyse it (this is called “data analysis methods”)

SCIENTIFIC RESEARCH METHODOLOGY

- Importantly, a good methodology chapter in a research paper or thesis explains not just **what** methodological choices were made, but also explains **why** they were made.
- In other words, the methodology chapter should **justify** the design choices, by showing that the chosen methods and techniques are the best fit for the research aims and objectives, and will provide valid and reliable results. A good research methodology provides scientifically sound findings, whereas a poor methodology doesn't.

SCIENTIFIC RESEARCH METHODS

- Qualitative, quantitative and mixed-methods are different types of methodologies, distinguished by whether they focus on words, numbers or both.
- **Qualitative research** refers to research which focuses on collecting and analysing words (written or spoken) and textual data, whereas quantitative research focuses on measurement and testing using numerical data.
- **Qualitative analysis** can also focus on other "softer" data points, such as body language or visual elements.

SCIENTIFIC RESEARCH METHODS

- Qualitative, quantitative and mixed-methods are different types of methodologies, distinguished by whether they focus on words, numbers or both.
- It's quite common for a **qualitative methodology** to be used when the research aims and objectives are **exploratory** in nature. For example, a qualitative methodology might be used to understand peoples' perceptions about an event that took place, or a candidate running for president.

SCIENTIFIC RESEARCH METHODS

- Qualitative, quantitative and mixed-methods are different types of methodologies, distinguished by whether they focus on words, numbers or both.
- **The mixed-method** methodology attempts to combine the best of both qualitative and quantitative methodologies **to integrate perspectives and create a rich picture**

SCIENTIFIC RESEARCH METHODS

- Qualitative, quantitative and mixed-methods are different types of methodologies, distinguished by whether they focus on words, numbers or both.
- Contrasted to this, **a quantitative methodol**ogy is typically used when the research aims and objectives are **confirmatory** in nature. For example, a quantitative methodology might be used to *measure the relationship between two variables* (e.g. personality type and likelihood to commit a crime) or *to test a set of hypotheses.*

SCIENTIFIC RESEARCH METHODS

Quantitative: distinct methods Inductive, apriori hypotheses, Positivism, Durkheim, functionalism, researcher separate from participants	Qualitative: fluid lines btw methods Deductive, no apriori hypotheses, Interpretivism, Weber, Symbolic Interactionism, researcher interacts with participants
Experiments: true, quasi quasi ['kweɪzaɪ], ['kwɑːzɪ]	Observation: participant, non-participant
Surveys: f-to-f, mail, phone	In-depth interviews: structured, unstructured
Cross-sectional vs. Longitudinal	Advanced Qualitative Methods
Longitudinal:	case study, extended case study
a. trend: follow 1 variable over time	Ethnography (critical observation of a culture)
b. cohort: follow a pop over time c. panel: follow same group over time	ethnomethodology: study small interactions (moments, situations), look for rules/methods of interaction
d. Time series	phenomenology: study experiences

	Qualitative Research	Quantitative Research
Purpose	Discover ideas/To gain a qualitative understanding of the underlying reasons and motivations	Test hypotheses or specific research questions/To quantify the data and generalize the results from the sample to the population of interest
Approach	Observe and interpret	Measure and test
Data Collection Methods	Unstructured; free- forms	Structured; response categories provided
Researcher Independence	Researcher is intimately involved; results are subjective	Researcher is uninvolved; results are objective
Sample	Small samples – often natural setting	Large samples to allow generalization
Most often used in:	Exploratory research designs	Descriptive and causal research designs
Outcome	Develop an initial understanding	Recommend a final course of action

Questions

Questions

After getting a research idea, perhaps from making observations of the world around us, the next step in the research process involves translating that research idea into an answerable question. The term “answerable” is particularly important in this respect, and it should not be overlooked.

It would obviously be a frustrating and ultimately unrewarding endeavor to attempt to answer an unanswerable research question through scientific investigation. An example of an unanswerable research question is the following: “Is there an exact replica of me in another universe?” Although this is certainly an intriguing question that would likely yield important information, the current state of science cannot provide an answer to that question. It is therefore important to formulate a research question that can be answered through available scientific methods and procedures.

Hypotheses

Hypotheses

Scientific research presupposes coming up with a hypothesis, which

is (put simply) an educated—and testable—guess about the answer to your research question.

A hypothesis is often described as an attempt by the researcher to explain the phenomenon of interest.

Hypotheses can take various forms, depending on the question being asked and the type of study being conducted.

Hypotheses

Hypotheses

Hypotheses attempt to explain, predict, and explore the phenomenon of interest. In many types of studies, this means that hypotheses attempt to explain, predict, and explore the relationship between two or more variables.

To this end, hypotheses can be thought of as the researcher's educated guess about how the study will turn out. As such, the hypotheses articulated in a particular study should logically stem from the research problem being investigated.

Hypotheses

Hypotheses

A key feature of all hypotheses is that each must make a *prediction.* Remember that hypotheses are the researcher's attempt to explain the phenomenon being studied, and that explanation should involve a prediction about the variables being studied.

These predictions are then tested by gathering and analyzing data, and the hypotheses can either be supported or refuted (falsified in terms of Karl Popper) on the basis of the data (analysis).

Hypotheses

Hypotheses

In their simplest forms, hypotheses are typically phrased as “if-then” statements. For example, a researcher may hypothesize that “*if* people exercise for 30 minutes per day at least three days per week, *then* their cholesterol levels will be reduced.”

This hypothesis makes a prediction about **the effects of exercising** on levels of cholesterol, and the prediction can be tested by gathering and analyzing data.

Hypotheses in quantitative research

Hypotheses in quantitative research

Hypotheses in quantitative research:

1) Conceptual hypotheses follow from research question:

ex. The more experiences a person has with taking the role of other, the less prejudice they are.

2) Operationalized hyps follow from conceptual ones after methods are selected:

Ex. Respondents who have higher scores on the role taking scale will have lower scores on the prejudice scale than respondents who have lower scores on the role taking scale.

3) Statistical hypotheses follow from operationalized hyps: mean group 1 < mean group 2.

Hypotheses in **qualitative research**:

Do not have hypotheses. You may have expectations.

Hypotheses

Hypotheses

- Two types of hypotheses with which one should be familiar are the null hypothesis and the alternate (or experimental) hypothesis.
- The *null hypothesis* always predicts that there will be no differences between the groups being studied.
- By contrast, the *alternate hypothesis* predicts that there will be a difference between the groups.

Hypotheses

Hypotheses

- In our example, the null hypothesis would predict that the exercise group and the no-exercise group will not differ significantly on levels of cholesterol.
- The alternate hypothesis would predict that the two groups will differ significantly on cholesterol levels.

Hypotheses

Hypotheses

Null Hypotheses and Alternate Hypotheses

The first category of research hypotheses includes the *null hypothesis* and the *alternate* (or *experimental*) *hypothesis.*

In research studies involving two groups of participants (e.g., experimental group vs. control group), the null hypothesis always predicts that there will be no differences between the groups being studied

If, however, a particular research study does not involve groups of study participants, but instead involves only an examination of selected variables, the null hypothesis predicts that there will be no relationship between the variables being studied.

By contrast, the alternate hypothesis always predicts that there will be a difference between the groups being studied (or a relationship between the variables being studied).

Hypotheses

Null Hypotheses and Alternate Hypotheses

Let’s look at an example to clarify the distinction between null hypotheses and alternate hypotheses. In a research study investigating the effects of a newly developed medication on blood pressure levels, the null hypothesis would predict that there will be no difference in terms of blood pressure levels between the group that receives the medication (i.e., the experimental group) and the group that does not receive the medication (i.e., the control group). By contrast, the alternate hypothesis would predict that there will be a difference between the two groups with respect to blood pressure levels. So, for example, the alternate hypothesis may predict that the group that receives the new medication will experience a greater reduction in blood pressure levels than the group that does not receive the new medication.

Hypotheses

Null Hypotheses and Alternate Hypotheses

It is not uncommon for research studies to include several null and alternate hypotheses. The number of null and alternate hypotheses included in a particular research study depends on the scope and complexity of the study and the specific questions being asked by the researcher. It is important to keep in mind that the number of hypotheses being tested has implications for the number of research participants that will be needed to conduct the study. This last point rests on rather complex statistical concepts that we will not discuss in this section. For our purposes, it is sufficient to remember that as the number of hypotheses increases, the number of required participants also typically increases.

Hypotheses

Null Hypotheses and Alternate Hypotheses

In scientific research, keep in mind that it is the null hypothesis that is tested, and then the null hypothesis is either confirmed or refuted (sometimes phrased as rejected or not rejected). Remember, if the null hypothesis is rejected (and that decision is based on the results of statistical analyses), the researcher can reasonably conclude that there is a difference between the groups being studied (or a relationship between the variables being studied).

Rejecting the null hypothesis allows a researcher to not reject the alternate hypothesis, and not rejecting a hypothesis is the most we can do in scientific research. To be clear, we can never accept a hypothesis; we can only fail to reject a hypothesis. Accordingly, researchers typically seek to reject the null hypothesis, which empirically demonstrates that the groups being studied differ on the variables being examined in the study.

This last point may seem counterintuitive, but it is an extremely important concept that you should keep in mind.

Nondirectional Hypotheses vs. Directional Hypotheses

Nondirectional Hypotheses vs. Directional Hypotheses

A reliable way to tell the difference between directional and nondirectional hypotheses is to look at the wording of the hypotheses.

If the hypothesis simply predicts that there will be a difference between the two groups, then it is a nondirectional hypothesis. It is nondirectional because it predicts that there will be a difference but does not specify how the groups will differ.

If, however, the hypothesis uses so-called comparison terms, such as "greater," "less," "better," or "worse," then it is a directional hypothesis.

It is directional because it predicts that there will be a difference between the two groups and it specifies how the two groups will differ.

Nondirectional Hypotheses vs. Directional Hypotheses

Nondirectional Hypotheses vs. Directional Hypotheses

A simple example should help clarify the important distinction between directional and nondirectional hypotheses. Let's say that a researcher is using a standard two-group design (i.e., one experimental group and one control group) to investigate the effects of a memory enhancement class on college students' memories.

Nondirectional Hypotheses vs. Directional Hypotheses

Nondirectional Hypotheses vs. Directional Hypotheses

At the beginning of the study, all of the study participants are randomly assigned to one of the two groups.

Subsequently, one group (i.e., the experimental group) will be exposed to the memory enhancement class and the other group (i.e., the control group) will not be exposed to the memory enhancement class. Afterward, all of the participants in both groups will be administered a memory test. Based on this research design, any observed differences between the two groups on the memory test can reasonably be attributed to the effects of the memory enhancement class.

Nondirectional Hypotheses vs. Directional Hypotheses

Nondirectional Hypotheses vs. Directional Hypotheses

In this example, the researcher has several options in terms of hypotheses. On the one hand, the researcher may simply hypothesize that there will be a difference between the two groups on the memory test. This would be an example of a nondirectional hypothesis, because the researcher is hypothesizing that the two groups will differ, but the researcher is not specifying how the two groups will differ.

Nondirectional Hypotheses vs. Directional Hypotheses

Nondirectional Hypotheses vs. Directional Hypotheses

Alternatively, the researcher could hypothesize that the participants who are exposed to the memory enhancement class will perform better on the memory test than the participants who are not exposed to the memory enhancement class.

This would be an example of a directional hypothesis, because the researcher is hypothesizing that the two groups will differ and specifying how the two groups will differ (i.e., one group will perform better than the other group on the memory test).

Research Methods and Research Design

Research Methods and Research Design

Data Collection + Data Analysis

= Research Methods and Research Design

Typical Sections of an English Research Manuscript

For manuscripts that describe empirical studies, the following sections are typically included:

1. Title
2. Abstract (brief summary of the study)
3. Introduction (rationale and objectives for the study; hypotheses)
4. Method (description of research design, study sample, and research procedures)
5. Results (presentation of data, statistical analyses, and tests of hypotheses)
6. Discussion (major findings, interpretations of data, conclusions, limitations of study, and areas for future research).

IMRAD Стандартная структура научной статьи / презентации по результатам КР	
Title (Название статьи)	Указывается тема исследования, автор, аффилиация. В студенческих сборниках также научный руководитель.
Annotation (Аннотация)	Конкретизирует содержание статьи и кратко отражает структуру IMRAD
Key Words (Ключевые слова)	Указываются ключевые термины и понятия исследования
Introduction **(Введение)**	Проблема, актуальность, новизна, объект и предмет; цели и задачи; Аналитический обзор литературы; ключевые понятия исследования.
Methods **(Методы)**	Методы, материал анализа, условия эксперимента, методики и средства проведения исследования
Results **(Результаты)**	Анализ, интерпретация и первичное обобщение полученных в результате исследования новых данных.
Discussion (Обсуждение)	Полученные ответы, их достоверность, значение,
Conclusion (Заключение)	Обобщение полученных результатов и выводов по ним; перспективы дальнейших исследований.
References (Литература)	Библиографические данные статей оформляются по требованиям издания (e.g. ГОСТ, APA etc.). Указываются все процитированные и проанализированные источники.

FIND MORE READING AT

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