

# PHILOSOPHY OF SCIENCE & NURSING

## Introduction

### ► **Philosophy of Science and Nursing**

Welcome to the Philosophy of Science and Nursing Tutorial. The purpose of this tutorial is to provide you with the knowledge and skills to become critical users of scientific knowledge within advanced practice roles. Specifically, to locate credible sources of knowledge, critique and synthesize information, and apply new knowledge for evidence-based practice. Add on audio component to direct them to use the “introduction and “explore paradigms” The most respected source of knowledge for evidence-based practice is scientific knowledge. Evidenced-based practice is based on systematically reviewing literature to locate the best evidence from research studies. Other literature is included, but research findings are the core of evidence-based practice.

► **The body of knowledge that makes up the nursing discipline includes knowledge from several branches of philosophy:** logic, esthetics, ethics, and science. Within the discipline of philosophy, there have been three major views or paradigms of science: rationalism, empiricism and constructivism. The earliest view of science, rationalism, held that human reason was superior to observation. The second view, empiricism, held that truth is known through systematic observation that is value-free and independent of the researcher, focuses on the parts to know the whole, and requires objectivity. Early nursing theorists and researchers were most influenced by this view. In the 1950s, empiricism came under criticism for being defective due to its artificiality. Critics argued that conclusions drawn applied to some ideal world rather than actual reality. This criticism has evolved into what is known as post-positivism, which will be defined further later on. Empiricism remains a legitimate approach for sciences such as mathematics, astronomy, physics, chemistry, biology, human physiology, medicine, and nursing.

► **The criticism also led to the development of a new paradigm that could address human and social science.** It is referred to by a number of names (naturalism, constructivism, historicism, and phenomenology). For purposes of clarity in this tutorial, constructivism will be utilized to refer to this paradigm. For medicine, the empiricist paradigm guides scientific knowledge. For nursing, due to the holistic view of human beings, where human beings are more than the sum of their parts, knowledge comes from both paradigms: empiricism and constructivism. Throughout the rest of this tutorial, we will delve deeper into the paradigms of empiricism and constructivism. Both empiricism and constructivism are guided by a set of underlying assumptions. Review the table below which lists each set of assumptions. For now, note how each assumption is in direct contradiction with its counterpart for the two paradigms. Later in the tutorial, these assumptions will be defined further when focusing on each paradigm individually.

## Explore Paradigms

**Constructivism**

**Empiricism**

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## Constructivism

**Constructivism holds assumptions that individuals seek understanding of the world in which they live and work.** Most individuals will acquire subjective meanings for their experiences, which develop meanings directed towards objects or things. These individuals take the world in which they live and work and develop subjective meanings about their experiences (Creswell, 2009). Reality is not fixed, it exists within a framework and many interpretations can be determined (Polit & Tatano, 2012).

**Humans engage with their world, and, based on historical and social perspectives, will try to make sense of it.** The world in which they are born into has meaning that is given to them by their culture. Researchers will assess the process of interaction between individuals. They will study the manner in which people live and work to have a better understanding of their historical and cultural background. Researchers will gather their information through visiting these participants to better understand the context or setting that the individual experiences. The process of this qualitative research is largely inductive with the researcher producing meaning from the collection of data from the field. (Creswell, 2009).

## Empiricism

**Empiricism views the world as orderly. Any change that occurs is due to an antecedent cause or causes.** The world exists separate from observation. It is simply there. The world is not a creation of the human mind. In the empiricist view, phenomena do not occur by chance, but have identifiable causes.

**Present day empiricists agree that total objectivity is not possible.** However, the methods used to study reality are as controlled as possible to ensure that reality is not influenced by either the researcher or conditions outside the research. The evidence is framed within probability of occurrence rather than absolute certainty. This form of empiricism forms a basis for research in nursing.

## Constructivism Assumptions

### **There are multiple truths**

There are multiple truths which are dependent on each human being's perception. Truth is known through direct contact with the participants and their perception. Truth is what every human being perceives according to his or her own life.

### **Truth is affected by context and history**

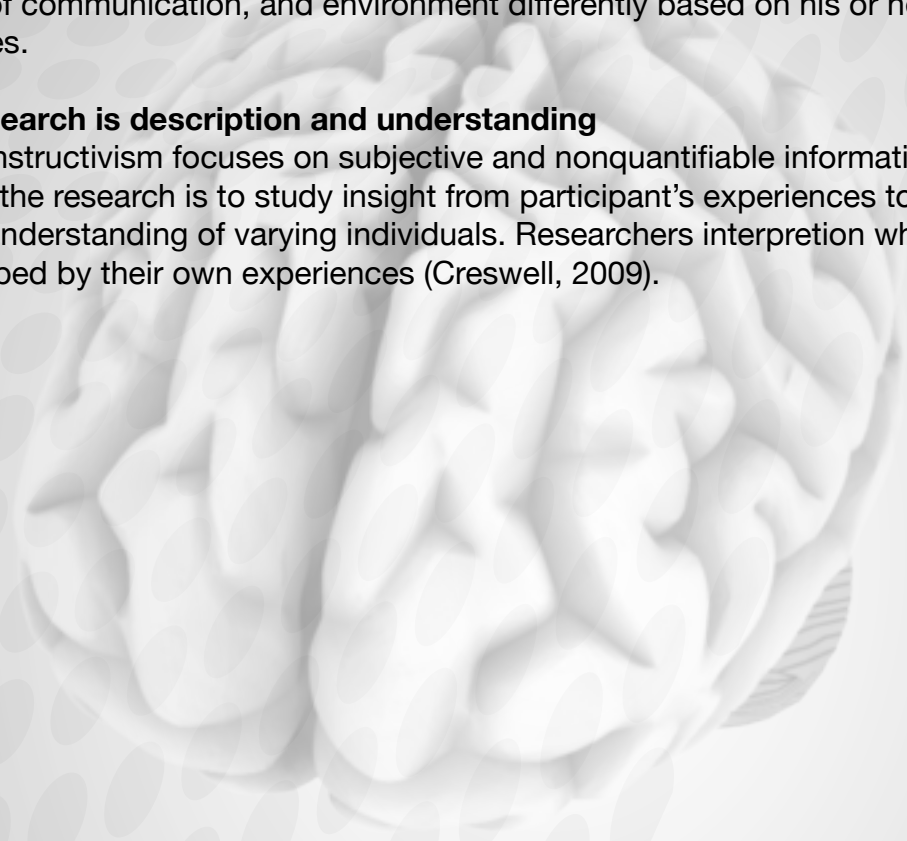
Truth exists within every human being who has been impacted through historical, cultural and personal experiences. Every person has a different perspective on life according to how he or she was raised, time and place in which he or she was raised, and the beliefs that were part of that time and place. This reality is studied through direct contact with individuals or observation.

### **Truth is subjective**

Truth is subjective and based on an individual's own reality of the world. As human beings engage with the world they are interpreting, meaning of their reality is being constructed (Creswell, 2009). Every human being is going to interpret a situation, problem, type of communication, and environment differently based on his or her own experiences.

### **Purpose of research is description and understanding**

Research in constructivism focuses on subjective and nonquantifiable information. The premise of the research is to study insight from participant's experiences to seek in-depth understanding of varying individuals. Researchers interpretation what they find is shaped by their own experiences (Creswell, 2009).



## Constructivism Assumptions

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### **Inductive logic is the primary process**

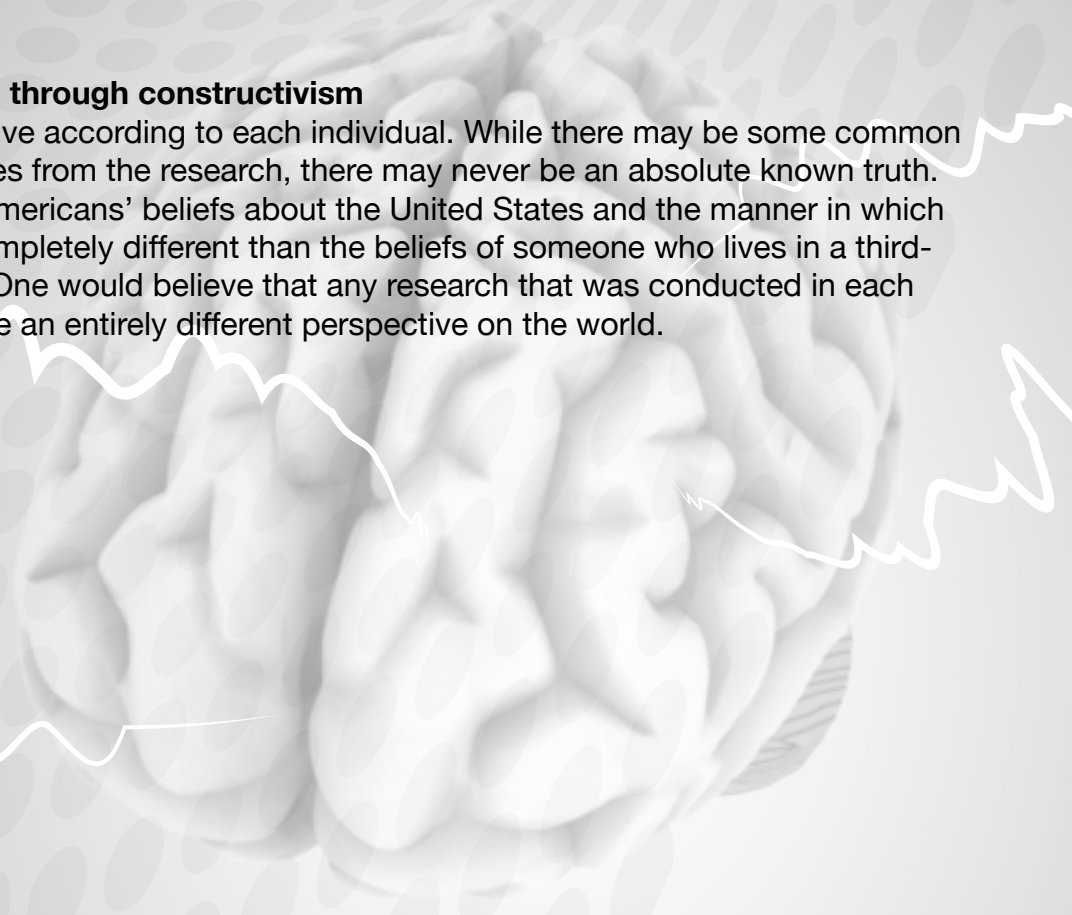
Inductive reasoning is done in stages: observation, analysis, inferences, and confirmation. This is the process that constructivist researchers utilize during their studies (Creswell, 2009). They observe the participants, analyze the information obtained, make generalizations about the information, and continue to test the information through further observations.

### **Truth is known through trends and patterns**

Researchers will continue to take the information from varying individuals and construct a pattern or trend through their interpretation of the data. They seek to understand the participants through visiting their reality and gathering information personally. Truth is subjective to each individual’s perspective on the world, which is why the research is an ongoing process in order to be able to establish a trend or pattern.

### **Truth is known through constructivism**

Truth is subjective according to each individual. While there may be some common beliefs or themes from the research, there may never be an absolute known truth. For example, Americans’ beliefs about the United States and the manner in which they live are completely different than the beliefs of someone who lives in a third-world country. One would believe that any research that was conducted in each area would have an entirely different perspective on the world.



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## Empiricism

## Assumptions

### **There is only one truth.**

Truth exists about reality and is not dependent on observation or awareness by human beings. Truth exists outside the human mind. This reality can be observed, studied, and known. For example, though there were no instruments to study the human cell in the 1700s, the human cell existed.

### **Truth is separate from context and history.**

Truth can be known only by removing all other influences beyond that which is being studied. The focus is on identifying causes of phenomena. This is best done by experiments which result in verification of theory. Interpretation is not needed because the results of the experiment can only be attributed to one cause.

### **Truth is objective,**

not subjective. For example, a photograph of a tree would be, in most instances, a more accurate reflection of the truth than a painting of a tree. When seeking the truth, researchers must use objectivity in order to prevent contamination of the phenomenon itself. Methods to know the truth must be objective, neutral, orderly, disciplined, and controlled. The ultimate example would be mixing two chemicals in a sterile vial under controlled circumstances.

### **Purpose of research is prediction and control.**

Though some purposes of research in empiricism include description and explanation, the ultimate purpose is to predict and control phenomena. If a certain medication is administered, the results must be predictable so the outcomes can be expected. There may be a range of outcomes, but the range is known. If there is no objective truth, there can be no prediction of outcomes.

### **Deductive logic is the primary process.**

This assumption originated from beliefs about rationality. The source of ideas is the rational mind. Through the mind, ideas form about the nature of reality and causes and effects. Formal theories are developed from ideas with propositions and well-defined concepts. Hypotheses are generated from these theories and tested in experiments.

### **Truth is known through validation and replication.**

Hypotheses deduced from theories are tested in the real world through experimentation. Due to the difficulty of achieving total control, validation of hypotheses is achieved through replication of findings from multiple studies. If studies conducted by different researchers using different populations produce consistent results, the findings are considered valid. Valid evidence is required for evidence-based practice.

### **Truth is known through reductionism.**

Truth can best be known by reducing a phenomenon to its simplest components. For example, studying a cell is preferable to studying the entire organ. Eventually, human testing is necessary to obtain truth; however, what is examined is the relationship between only one independent and one dependent variable. Though more than two variables may be included in experiments, the ultimate goal is to reduce the number of variables needed to predict and control a phenomenon.

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## Constructivism Research Methods

**Qualitative research** The purpose of nursing research is to provide answers for questions and solutions for problems that are associated with nursing practice and issues within the profession. The research method utilized within the constructivism paradigm is a qualitative methodology. Qualitative methods take the form of such narrative materials as interviews, field notes of participant observers, or diaries kept by study participants. In qualitative research, data collection and data analysis can occur at the same time, rather than after the data is collected. The search in this type of research is to assess for common themes and concepts from the beginning of the data collection.

During the 1990s and into the 21st century, the number and types of approaches in qualitative research have become more clearly visible. Quantitative researchers will usually begin with a broad topic area that is poorly understood and about which there is little known. Qualitative researchers have a flexible approach that makes it impossible to define the flow of activities precisely because the flow varies from one study to another. Most researchers, when conducting qualitative studies, do not know exactly ahead of time how the study will proceed. There are numerous methods of conducting qualitative studies, which will be discussed below.

**Phenomenological research** is a strategy of examination in which the researcher identifies the fundamental nature of human experiences about a phenomenon as expressed by the participant. This process involves studying a small amount of individuals through extensive and lengthy engagement to acquire patterns and relationships that have meaning (Creswell, 2009). This type of research is focused on what life experiences are about for individuals and what they mean. An example of a phenomenological study is a researcher conducting in-depth interviews with first-time fathers who had been deployed to combat regions when the birth occurred.

**Grounded theory research** assesses social settings and seeks to describe and understand the psychological processes that transpire. The discovery of the core variable is a major component of the grounded theory, as is it central in explaining what is going on in the social scene (Polit & Beck, 2012). For example, a study was conducted to examine a health care team process by identifying nurse-team communication practices that were seen by team members to improve patient care.

**Ethnography research** is a method of investigation in which the researcher studies an intact cultural group. The assessment takes place in a natural setting for the culture and over a prolonged period of time. The data collection is primarily through observation of and interviewing the participants (Creswell, 2009). This type of research usually entails the researcher to engage in extensive fieldwork, which most often will involve participating in the life of the culture being studied. For example, a study was conducted to investigate activity and active play with rural preschool children.

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**Historical research** focuses on a systematic collection of data evaluation relating to past occurrences (Polit & Beck, 2012). This type of research can be conducted in many different methods from chart reviews, to interviews about past experiences within a specific topic. Researchers will develop a method of study once they have determined what aspect about the human experiences is of greatest interest to them.

**Feminist research** focuses on gender domination and discrimination within male-controlled societies. Feminist researchers seek to understand how gender and gendered social order has shaped women's lives and their consciousness. There are three broad models that have been identified: a) feminist empiricism, which seek to describe more truthful pictures of the social realities of women's lives; b) feminist standpoint research, which holds that research should be based on the lived everyday sociopolitical experiences of women, and that women's views are particular and privileged; c) feminist postmodernism, which stresses that there is no particular "truth" about women's lives and sees the world as endless stories, narratives, and texts. For example, a study was conducted that assessed women's experiences of living with a mental illness and the interpersonal and organizational challenges they encountered as women interfacing with a health care system.

**Critical social theory** uses societal awareness to reveal social discriminations that keep individuals from reaching their full capability. The concept of the theory is that the evolution of a just society can be stimulated without the distortion of power imbalances within social exchanges and that truth is socially determined. For example, a study was conducted in magnet and nonmagnet hospital noting the relationship between nurse manager leadership characteristics and how this impacts the nurse autonomy. The results noted that the relationship contributes to magnet status.

**Critical ethnography** assesses varying cultures and their value-laden agendas by addressing the historical, social, political and economic dimensions of their world. The focus is to raise the awareness and assist emancipatory goals in the hope of being able to effect social change. One of the assumptions of critical ethnography is that the power of relationships mediates actions and thoughts. For example, a study was conducted that focused on the communication, silence, and power in the operating room between physicians and nurses. Three things were noted: absence of communication, no response to questions, and they spoke quietly.

### **Relationship Between Theory and Research** (Or Alternative written Conclusion)

Theory is a systematic, abstract explanation of some characteristic of reality which connects concepts together into a logical system. Theories play a role in both quantitative and qualitative research. Research is a process that validates and improves current knowledge, which then can generate new knowledge (McEwen & Willis, 2011). Research can validate and modify theory. Researchers will explore a significant problem, utilize a theory to formulate a set of generalizations within the variables, and, when empirically tested, the results of the research can be used to verify, modify, disprove, or support the theoretical intention.

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## Empiricism

## Research Methods

### **Overview:**

The purpose of nursing research is to provide answers for questions and solutions for problems relevant to nursing practice and professional issues. The research methods used within the empiricism paradigm are quantitative methods. Quantitative methods refer to systematic and orderly approaches that utilize statistics to present data and test relationships between the variables of interest in order to establish causality so that there can be prediction and control.

### **Quantitative designs**

are divided into two major classifications: experimental and nonexperimental. Experimental designs all have one thing in common: The researcher has control over the intervention under study. This is also called manipulation of the independent or causal variable. Nonexperimental designs are used to describe the occurrence of variables (for example, incidence and prevalence of diseases) and explore relationships between variables (for example, a contrast of the incidence and prevalence of disease according to race).



### **Quantitative Designs:**

Experimental designs are further separated into true experiments and quasi-experiments; true experiments are also called randomized clinical trials (RCTs) or randomized controlled experiments. Nonexperimental designs take many forms and are the most frequently seen designs in nursing research journals.

### **True Experiments (Randomized Clinical Trials)**

The “gold” standard for a quantitative design is the randomized controlled trial. This is the gold standard because it is the only design that allows for all three criteria required for causality to be met: time order, empirical relationship, and elimination of alternative explanations for the relationship observed.

### **The Experimental Design:**

The simplest form of this design is to select a sample and randomly assign the subjects to two groups: one group participates in the experimental intervention and the other group does not participate. The experimental intervention is the independent variable. For this example, the independent variable is a video on lateral violence.

The dependent variable is knowledge about the severity of consequences of lateral violence for the individuals involved, patients, and the health care institution. Prior to the intervention, both groups are measured on their knowledge regarding the consequences of lateral violence. After the intervention, both groups’ knowledge is again measured. By measuring knowledge both prior and after the intervention, time order is established: the cause occurred prior to the effect.

### **The Results:**

A test of significance (in this case a t-test would be appropriate) is used to analyze the data. If the difference in knowledge is found to be statistically significant, the hypothesis can be accepted (nurses who watch a video on the consequences of lateral violence will have increased knowledge as compared to nurses who do not watch the video).

By having randomized the subjects into groups, this results in two groups who are equivalent for important variables that might otherwise explain the change, such as age, education, gender, years of experience, and practice specialty.

The control group experienced the influences of time passing, historical events, and individual maturation similarly to the experimental group so these factors cannot be considered the explanation of the change observed.

### **Randomization:**

Though there are many types of this design, they all have in common the use of randomization to groups and an intervention under the control of the researcher. Randomization is what distinguishes true experiments from quasi-experiments.

### **Other True Experiment Types**

There are numerous types of designs that fall under true experiments, such as the Multiple Intervention, Factorial, and Crossover designs. They vary in the number of independent and dependent variables being tested and the timing of interventions. These are explained in the textbook for this course.

### **Quasi-Experiments**

Quasi-experiments include manipulation of the intervention by the researcher and a comparison that could take the form of pre- and post-measurements or a comparison to a similar group. The differentiating factor is that no randomization occurred. Time order can be established but there is no control or limited control for alternative explanations due to the lack of a control group.

### **Commonalities**

This design is used when randomization is not possible, not practical, or not ethical. There are also numerous types of this design. What they all have in common is no randomization, an intervention under the control of the researcher, and statistical analysis of the data to demonstrate if the relationship observed occurred by chance or not. There are various types of these designs described in the textbook with accompanying strengths and limitations, such as the Time Series design.

### **Nonexperimental Methods**

Nonexperimental methods refer to all other quantitative methods that do not include an intervention under the control of the researcher. These methods can study single variables, two variables, or many variables.

### **Advantages**

One advantage of these methods is that a great deal of data can be collected and relationships can be explored. For example, a survey of registered nurses in the United States on knowledge and attitudes towards evidence-based practice could be conducted. Usually, demographic information is obtained to see if that information is related to knowledge and attitude (in this example). Using statistics, many relationships can be explored. For example, the effect of age, education, and years of experience could be analyzed to explore their relationship to attitudes towards evidence-based practice.

### **Design Types**

Natural experiments fall under the category of Nonexperimental Methods. These are situations where the effectiveness and safety of existing interventions are compared by collecting data that is considered to result from the intervention. Prevalence and incidence studies would be other examples of nonexperimental designs. The text describes several types of nonexperimental designs most commonly used in nursing, which includes Descriptive and Cause-Probing/Correlational designs.

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