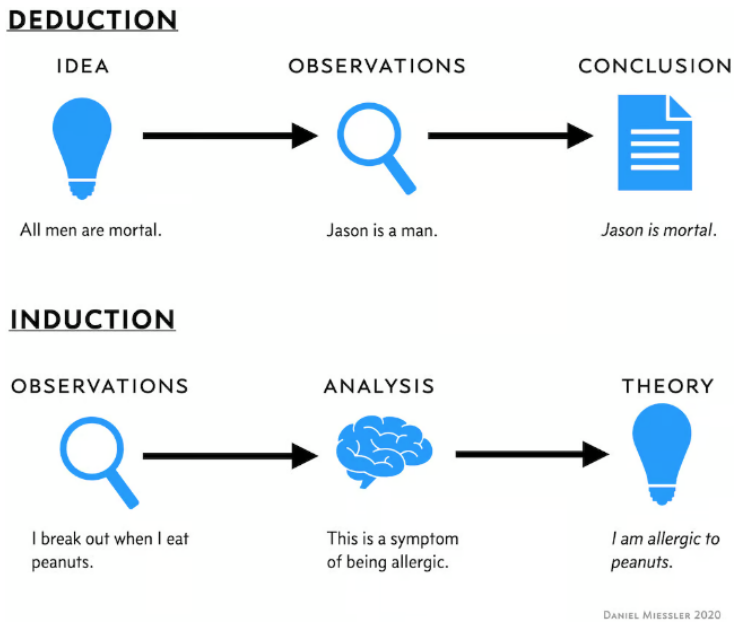
Unit 1: Introduction to Research Methods. The Scientific Investigation and Ethics in Computing

1. **Differentiate between inductive and deductive reasoning.**

Woiceshyn & Daellenbach (2018) make a compelling case for the power of inductive research. They argue that while deductive methods may dominate due to their structured nature, inductive research has the potential to lead to groundbreaking discoveries. This method, they suggest, requires extensive empirical observation, but the rewards can be immense.



According to Miessler (2020), deductive and inductive reasoning are practical tools for solving real-world problems. However, they approach problem-solving differently. Deduction starts with an idea, observations, and a conclusion. On the other hand, induction involves beginning with observations, followed by an idea that could explain what's been seen. Deduction's conclusions are bulletproof, assuming no mistakes, while induction's quality depends on the quality of the observations and analysis. Deduction is more precise and quantitative, while induction is more general and

qualitative. Deduction is more complicated to use outside lab settings due to the lack of fully agreed-upon facts. Induction is used constantly in everyday problems dealing with partial information and usable conclusions. Both types of reasoning can be used together cyclically, but avoiding arguing with the force of deduction while using induction is essential.

Deductive arguments are based on premises that necessarily lead to their conclusion. In logic, the validity of an argument is determined by three criteria: the premises must guarantee the conclusion, the premises must be true, and it must be impossible for the premises and conclusion to be false (Knachel, 2017). The validity of an argument depends on its form and can have propositions with varying truth values. Validity judgments cannot be revised even when new information changes the argument's form.

Knachel (2017) highlights a key strength of inductive arguments-their flexibility. Unlike deductive arguments, which are based on premises that necessarily lead to their conclusion, inductive arguments are not guaranteed and are based on the likelihood of their findings. This allows for revision based on new evidence, making inductive logic a powerful tool for adapting to new information.

2. **Understand why ethics are important and how they may relate to your area of research and your professional practice.**

Research is a highly systematic inquiry using inductive and deductive methods to describe, explain, predict, and control observed phenomena. The main goal of research is to identify potential customers, understand existing ones, set goals, develop strategies, address challenges, and identify new opportunities. Qualitative methods collect data through conversational means, while quantitative methods deal

with numbers. For accurate research, valid, reliable, timely, and complete data must be absolute (Fleetwood, 2018).

Dittrich et al. (2013) point out that ethics are crucial for ethical research, but they fall short when providing practical guidance for information and communication technology research (ICTR). Our comprehension of harm in physical interactions with human subjects is still in infancy. By comparing physical and virtual environments, we can assess the magnitude of harm and the factors leading to harm. In computer security research, harm to humans and damage to systems and data are both foreseeable and unpredictable.

Stahl et al. (2016) state that ethics is paramount in computing research and practice for countless reasons. It protects participants, ensures data security and privacy, reduces algorithmic bias, and promotes fairness in algorithm design, development, and deployment (Singhal et al. 2024). Ethical considerations also guarantee responsible innovation that benefits society and minimises potential adverse impacts, as Sutcliffe (N.D.) emphasises.

Whittlestone et al. (2017) conducted a comprehensive study on the ethical and societal implications of algorithms, data, and AI, considering both their positive and negative impacts on society. AI is a highly contentious term and has the potential to optimise processes and operate autonomously, creating complex behaviours beyond what is explicitly programmed. Ethical guidelines and regulatory oversight are critical to ensuring equitable access to AI technologies and bridging the digital divide. We can harness AI's transformative potential while upholding ethical principles by fostering interdisciplinary dialogue, promoting transparency, and prioritising inclusivity.

The BCS Code of Conduct is not just a set of ethical standards but a crucial one that IT professionals must abide by to ensure responsibility and integrity in the computing field. These standards consist of four fundamental and non-negotiable principles. Firstly, it makes IT accessible, respects public health, privacy, security, and the environment, and promotes equal access to IT benefits. Lastly, professional competence, integrity, and respect for the organisation or individual should be maintained, conflicts of interest resolved, and ethical standards upheld (BCS, 2020).

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