Scientific Method Checklist

Hypothesis: Every scientific theory starts as a hypothesis. A hypothesis is an idea that hasn't been proven yet.

Empirical evidence: Information acquired by observation or experimentation.

Design Process: Before any pieces of empirical data are collected, scientists carefully design their research methods to ensure the accuracy, quality and integrity of the data.

Qualitative research: Often used in the social sciences, examines the reasons behind human behavior. It involves data that can be found using the human senses. This type of research is often done in the beginning of an experiment.

Quantitative research: Involves methods that are used to collect numerical data and analyze it using statistical methods. This type of research is often used at the end of an experiment to refine and test the previous research.

Bias: The objective of science is that all empirical data that has been gathered through observation, experience and experimentation is without bias.

Steps:

1. Make an observation or observations.
2. Ask questions about the observations and gather information.
3. Form a hypothesis — a tentative description of what’s been observed, and make predictions based on that hypothesis.
4. Test the hypothesis and predictions in an experiment that can be reproduced.
5. Analyze the data and draw conclusions; accept or reject the hypothesis or modify the hypothesis if necessary.
6. Reproduce the experiment until there are no discrepancies between observations and theory. “Replication of methods and results is my favorite step in the scientific method," "The reproducibility of published experiments is the foundation of science. No reproducibility – no science."

Key Underpinnings:

* The hypothesis must be testable and falsifiable, according to North Carolina State University. Falsifiable means that there must be a possible negative answer to the hypothesis.
* Research must involve deductive reasoning and inductive reasoning. Deductive reasoning is the process of using true premises to reach a logical true conclusion while inductive reasoning takes the opposite approach.
* An experiment should include a dependent variable (which does not change) and an independent variable (which does change).
* An experiment should include an experimental group and a control group. The control group is what the experimental group is compared against.