Lab Report

Types of Experimental Errors

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Using This Checklist

Use this checklist as a preliminary guideline when thinking about and analyzing potential errors in your experiment. The list is a guide but is not comprehensive, so make sure that you check with your instructor about the different types of errors to pay attention to in your lab.

Keep in mind that, as a student, your goal is not so much to explain why you got the errors you did (most of the time, your errors will be a result of your inexperience as a researcher). Rather, your goal is to show your instructor that you understand the lab's concepts well enough that you can identify what factors could cause errors in your lab. Feel free to note particular blunders or mistakes that you made, but spend more time analyzing errors that aren't simply your mistakes but that clearly relate to methodology, instrumentation, or the environment.

In science, errors are often categorized as **systematic**, **random**, or **blunders**.

Types of Experimental Errors

Systematic Errors

Systematic errors have an identifiable cause, produce results that are consistently too high or low and in theory, can be eliminated.

There are four kinds of systematic errors:

Instrumental

When an instrument itself is flawed and provides inaccurate readings.

Example

A thermometer that registered 102 (instead of 100) in boiling water bring results that were too high.

Observational

When the observer incorrectly reads a measurement.

Example

A researcher may be, standing at an angle (rather than straight on) when reading the weight on a scale. As a result, he consistently reads the scale in a way that reflects that angle.

Environmental

When problems in the lab's surroundings lead to inaccurate results.

Example

An experiment involving organic material may be affected if changes in humidity in the lab are not controlled.

Theoretical

When experimental procedures, a model system or equations for instance, create inaccurate results.

Example

In an experiment testing gravity's effect on acceleration, the effect of air friction, which slightly affects the acceleration rate, may not be included in the calculation.

Random Errors

Random errors:

- are caused by unknown or unpredictable changes in the environment
- lead to random fluctuations in measurement (about one-half of the measurements will be too high and one-half too low)
- do not always have sources that are identifiable
- can often be quantified by statistical analysis

There are two major types of random error:

Observational

When the judgment of an observer leads to random (rather than consistent) inaccuracies.

Example

When a researcher reading the weight on a scale records measurement to the smallest division. Random error suggests that, over time, the researcher's judgment is inconsistent. The individual will record some measurements that are too low and some that are too high.

Environmental

When there are unpredictable changes in environmental conditions, such as temperature, mechanical vibrations, etc.

Example

A piece of electrical equipment may have unpredictable noise that affects the results.

Types of Experimental Errors

Blunders

In science, a blunder is an outright mistake. An individual might record a wrong number, or add a digit when reading a scale, for instance. Although the types of mistakes are similar to systematic and random errors, blunders can be identified because the mistakes are usually not consistent. They also are usually not frequent enough to be random errors. Blunders should stick out as one-time mistakes by you, the researcher, and so cannot be analyzed in the way that other scientific errors can. However, if you think your blunder had a significant impact on the experiment, it is worth mentioning in your report.

A Blunder

Example

When transferring a scale to a centrifuge, an individual dropped some of the solid on the floor.