

Scales of Measurement: Nominal, Ordinal, Interval & Ratio

Instructor: Natalie Boyd. Natalie is a teacher and holds an MA in English Education and is in progress on her PhD in psychology. Source: Study.com

When doing research, variables are described on four major scales. In this lesson, we'll look at the major scales of measurement, including nominal, ordinal, interval, and ratio scales.

Variables

Imagine that you are a psychologist, and you want to do a study to see whether eating breakfast will help kids focus. You think that the students who eat a healthy breakfast will do best on a math quiz, students who eat an unhealthy breakfast will perform in the middle and students who do not eat anything for breakfast will do the worst on a math quiz.

So, how do you do your study? Where do you even begin?

In research, one of the first things that you have to do is identify your **variables**, or factors that can change. For example, whether a person eats breakfast or not is a variable - it varies from person to person and perhaps from day to day. A person can eat a healthy breakfast, eat an unhealthy breakfast or not eat breakfast at all. If eating breakfast did not vary, every single person would eat the exact same thing for breakfast every single morning.

Likewise, performance on a math test is a variable because it varies from person to person. Susie might do great on a math quiz, while Jonas fails it. Or Susie might do well today but not as well tomorrow. Whatever the reason, scores on a math quiz change, and therefore, they are variables.

So we know that our variables are eating breakfast and math performance. But how do we measure them? There are four major scales (or types) of measurement of variables: nominal, ordinal, interval and ratio. The scale of measurement depends on the variable itself. Let's look closer at each of the four scales and what types of variables fall into each category.

Nominal

You might have noticed a difference in our two variables. While scores on a math test are reported as numbers, eating breakfast isn't numeric. A person eats a healthy breakfast, an unhealthy breakfast or no breakfast at all. These are not numbers but categories.

A **nominal scale** of measurement deals with variables that are non-numeric or where the numbers have no value. In other words, we can put them in any order and it wouldn't matter. Think about the numbers on the jerseys of football players. Is the player wearing number 1 a better player than the player wearing number 82? Maybe, but that doesn't have anything to do with the numbers they wear.

Jersey numbers have no value as far as telling us anything about the ability of the players; it's just a way to identify them. Other examples of variables measured on a nominal scale include gender, race and the number on pool balls.

Sometimes for statistical analysis, a researcher will give non-numeric variables numeric values. For example, we might say that students who eat a healthy breakfast are -1, the students who eat an unhealthy breakfast are 0 and the students who do not eat breakfast are +1. These numbers are just a way to mark who is in which group but don't really have value.

Ordinal

Let's say that, instead of looking at grades on a specific math quiz, we want to look at the letter grades overall for the course for each student. So Susie has an A, and Jonas has a D, and there are other students with Bs and Cs and Fs. In this case, the letters are not completely meaningless. Unlike football player jerseys, for example, we know that Susie is doing better than Jonas. But how much better?

An **ordinal scale** of measurement looks at variables where the order matters but the differences do not matter. When you think of 'ordinal,' think of the word 'order.' In the case of letter grades, we don't really know how much better an A is than a D. We know that A is better than B, which is better than C, and so on. But is A four times better than D? Is it two times better? In this case, the order is important but not the differences.

Have you ever filled out one of those customer service surveys that companies send out? They might ask a question like 'How was your experience today?' and ask you to rate it on a scale of 1-10. Those, too, are ordinal. Other examples of variables measured on an ordinal scale include difficulty (hard, medium, easy) and the order of finishing a race (first place, second place, and so on).

Interval

Okay, but what if we want to measure something where the differences between the numbers do matter? For example, what if we decide that the temperature of a person's breakfast matters? We believe that the kid who eats the hottest breakfast will do best on the math test, and the kid who eats the coldest breakfast will do the worst.

When the order and differences between the levels of a variable matter, but they are not in a ratio, it is measured on an **interval scale**. Intervals are the distance between two things, so you can remember this because we are looking at the distance between levels of a variable. Temperature is a good example of a variable measured on an interval scale. If one kid eats a breakfast that is 100° and another eats one that is 50°, the difference between those two breakfasts is 50°. That tells us something about how far apart they are. Likewise, if it was 70° last month and it is 35° today, we know how many degrees warmer it is. But note that we wouldn't say, 'It's half as warm today as it was last month.' That doesn't make sense! That is why, while the differences are meaningful, the ratios are not.

Ratio

But what if the ratios are meaningful as well as the differences? Let's go back to our original idea. We want to look at the nominal variable of eating breakfast, and we also

want to look at the scores of the students on a math quiz. If Susie gets a 90 on the test and Jonas gets a 45, we know that Susie did twice as well as Jonas. The scores, which are percentages, are **ratios**. That is, the numbers tell us how much of one thing we have in comparison to another thing.

Variables measured on a **ratio scale** are numbers where the order, differences and ratios are all meaningful. Think about it like this: if you can say, 'That's twice as much' about one number in relation to another one, then it can be measured on a ratio scale. Things like number of minutes in a commute, weight or height are all ratios. Susie can spend twice as long commuting, be half the weight or twice the height of Jonas.

Lesson Summary

In psychological measurement and research design, there are four major scales of measurement used to talk about variables. A **nominal scale** includes variables where the order of the units does not matter. **Ordinal scales** consist of variables where the order matters, but the difference between the units does not matter.

An **interval scale** looks at variables where both the order and difference is meaningful, but the ratio of the units is not meaningful. Finally, a **ratio scale** is made up of variables where the order, difference and ratio all matter.