Case 1

Ihnwhi studied the effect of statistics education settings for high school students in the United States. He recruited 300 students in total. Next, 100 students were randomly assigned to either an offline small-size classroom, an offline large-size classroom, or an online platform. Students in each condition subsequently took an exam of 20 questions. The average score was 15.7 for the offline small-size classroom, 8.1 for the offline large-size classroom, and 9.4 for the online platform.

- **What is the research design? Why do you think so?**
  Experimental design. There is a manipulation of variables in the sense that Ihnwhi varies the level of statistics education settings into three conditions (note that the independent variable is statistics education setting). There is also a random assignment.
- **Are there any observable entities or latent constructs?**
  The effect of statistics education is a latent construct. The average scores of an exam are observable entities.
- **What are the population and the sample? Can you guess what would be the parameter and the statistic?**
  The population is all the high school students in the United States. The sample is the 300 students recruited. The average scores from the sample (15.7 for the offline small-size classroom, 8.1 for the offline large-size classroom, and 9.4 for the online platform) are statistics. Using these statistics, if we infer the average scores of the population in each condition, it would be the parameters.
- **Are there any variables? What is the type?**
  The statistics education setting is a variable, which is polytomous (either an offline small-size classroom, an offline large-size classroom, or an online platform). The score of exams is variable, which is continuous (the scores take decimal points).

Case 2

Matthew is interested in investigating the relationship between life satisfaction and academic achievement for UC Merced students. He plans to recruit 150 students from all the departments. Then, he will administer two questions to measure life satisfaction. One asks how often students join extracurricular activities a week (on a 10-point scale from 1 through 10). Another questionnaire asks how much students receive financial support from the university this semester (in $). For academic achievement, he will collect the GPA (A~F) of students. He expects that the higher the measures of life satisfaction are, the higher the measure academic achievement is.

- **What is the research design? Why do you think so?**
  Correlational method. There is no manipulation of variables. Matthew does not vary the level of any variables. Rather, he collects responses from students to observe whether there is any relationship between life satisfaction and academic achievement.
- **Are there any observable entities or latent constructs?**
  There are two latent constructs (life satisfaction and academic achievement). There are three observable entities (how often students join extracurricular activities a week, how much students receive financial support from the university this semester, the GPA of students).
- **What are the population and the sample? Can you guess what would be the parameter and the statistic?**
  The population is all the UC Merced students. The sample is 150 students recruited. The measure of the relationship between life satisfaction and academic achievement (that is, the measure of the correlation between life satisfaction and academic achievement) from the sample is the statistic (you will learn that such a measure of the correlation is called correlation coefficient later). Using that measure of correlation from the sample, if we infer the measure of the correlation between life satisfaction and academic achievement in the population, that would be the parameter.
- **Are there any variables? What is the type?**
  How often students join extracurricular activities a week is a numerical variable (if the scale is only recorded on an integer level, it is discrete; if the scale is recorded not only on an integer level but also on a decimal level, it is continuous). How much did students receive financial support from the university this semester is a numerical variable, which is continuous. The GPA (A~F) is a categorical variable, which is polytomous.

Case 3

Alejandra has been working on a cross-cultural research project about differences in the level of empathy. A sample consists of 2000 participants with different ethnographic backgrounds (Americans, Africans, Asians, and Europeans). Participants are asked to respond to several empathy items to measure their empathy level. The empathy level is categorized as the lowest level, lower level, neutral level, higher level, and the highest level. She expects that there are no differences in the level of empathy between different ethnographic backgrounds, both in the sample and the population.

- **What is the research design? Why do you think so?**
  Quasi-experimental design. There is a manipulation of a variable in the sense that Alejandra varied the conditions of the independent variable (which is ethnographic background) into four levels (Americans, Africans, Asians, and Europeans). There is no random assignment. We can not randomly assign people to different ethnic backgrounds.
- **Are there any observable entities or latent constructs?**
  Empathy is a latent construct.
- **What are the population and the sample? Can you guess what would be the parameter and the statistic?**
  All the Americans, Africans, Asians, and Europeans on earth are population. 2000 participants are a sample. The difference in the level of empathy between different ethnographic backgrounds in the sample is the statistic. Using that statistic, we are interested in the difference in the level of empathy between different ethnographic background in the population, which would be the parameter.
- **Are there any variables? What is the type?**
  The level of empathy is a categorical variable, which is polytomous (there are five categories/labels). Ethnographic background is a categorical variable, which is polytomous (there are four categories/labels).