

Single case design



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Introduction

Single case design (SCD) is also called intrasubject-replication design, single case research, time series methodology, N= 1 research and so on. (Hilliard, 1993) This is an experimental method utilized in one analytical unit, and only one or few subjects will be observed, in other words, SCD strongly focuses on intra-participant variability. Kazdin (1982) had asserted that SCD is an essential methodological tool to examine a myriad of research questions with individual.

In 1960, Sidman explained the intrasubject-replication design as a method consists of different experimental conditions. In these conditions, a given variable will be repeated to observe. The performance of the same subject will be compared before, during and after the intervention, and evaluate the effect of a given variable. As a consequence, observing the performance of different phases in the experimental process of SCD is essential. In addition, SCD has already been applied in education, psychiatry, behavior medical science, social work, rehabilitation, counseling and other disciplines. (Barlow and Hersen, 1984) It seems obviously that SCD plays a pivotal role in experiments and widely be utilized in different perspectives.

In the beginning of this essay, the history and difference between SCD and group study will be discussed and compared. Secondly, the basic requirement and three experiment designs of SCD will be described in detail. Finally, this essay will discuss the advantage and the disadvantage of SCD.

History of single case research

The first step to learn SCD is to understand how it develops. In 1984, Barlow et al stated that the development of single case study began in the 1830s, with Johannes Muller and Claude Bernard, but the significant landmark was made by Paul Broca (1861) who observed and dissected the patient's brain, and found the Broca's area. Thirty years later, Fechner (1860) utilized repeat measurements of different conditions in an individual subject to determine the sensory threshold. Furthermore, the father of modern psychology, Wundt (1832-1920), believed that the best way to understand sensation and perception is studying one or a few subjects. Almost at the same age, a famous physiologist, Pavlov (1849-1936), also focused mainly on one or few subjects in his experiments. In addition, studying individual cases strongly assisted psychoanalyst Freud (1856-1939) to interpret personality. (Barlow & Hersen, 1984)

With the progress of those times, the direction of single case study became more scientific. Ebbinghaus (1850-1909) who worked on memory, Stratton (1897) who researched perception (1897) and Cannon & Washburn (1912) who studied intestines and stomach used themselves as a subject to proceed the experiments. Moreover, Watson (1922) used a single subject, little Albert, to create a famous condition experiment. The vital role of single case research could be enhanced by the father of behaviorism, Skinner (1966), who stated that he would rather use 1000 hours to study a mouse than use one hour to study 1000 mice or spent 10 hours to study 100 mice. (Kazdin, 1982)

Therefore, studying one subject carefully might acquire more information than a researcher can imagine. Studying history of single case research not

only explains how this design helps scientists accomplish their research but encourages us to understand how to apply the design into different fields to obtain the knowledge we want to know.

Introduction of group studies

Since so many psychologists used single case study, why did group studies become dominant? The reason is because of the gradual progress of statistics. Robinson et al (1979) found the direction of journal publications began to transfer from small sample studies with no statistics being applied to large sample studies utilizing statistical skills in 1930s. Besides, group studies emphasizes on inter-participant variability, the average and standard deviation. Therefore, multiple participants will be observed, the data from Group studies can be applied to the population and individual difference variance between subjects can be found, but the variability of the individual will be hidden by average which should be care. In picture 1, both designs will be compared.

General principles of single case design

Kazdin (1982) described three critical requirements in SCD. First of all, continuously assessing the subject in the process of experiment is essential. In SCD, the subject will be observed in different times or places during the whole experimental process, especially when the intervention was implemented. The most vital thing observer has to do is to examine the stability of performance in each phrase of SCD. If performance is not stable, it would be difficult to predict the tendency of future and confirm the reason of change in the future. Besides, continuous observing the subject will offer a powerful comparison between the different phrases.

Secondly, acquiring the baseline data hoists the accuracy of explaining performance change. Baseline data not only describes the performance before the special intervention is implemented but also predicts future performance. The data can be utilized to evaluate if the intervention was effective or not. If the performance from a baseline differs from the intervention phase, it might increase confidence to declare that the intervention leads to the change of performance.

Last but not the least, the performance and data of the baseline should be stable. The best data is no trend or slope exhibited by the baseline data. When the direction of tendency tends to what a researcher desires to change, showing a trend may not cause any problem. But the effect of intervention will always be examined clearly by the absence of trend. On the other hand, the conclusion about the effect of intervention will be interrupted by excessive changes in the data of baseline. It would be more difficult to distinguish if the data is really affected by the intervention or only a drastically variation tendency in the small part of the baseline. Therefore, acquiring the stable rates of performance is momentous for experimenter to explain the effect of intervention. (Kazdin, 1982)

There are three examples of SCD, those are ABAB design, Multiple Baseline design and Changing Criteria design which will be discussed clearly below.

ABAB design

ABAB design contains a string of procedures is the most fundamental experimental design in SCD. This design is also called an equivalent time-samples design by Campell and Stanley (1966). The procedures of ABAB

design consist of two conditions, one is baseline condition (phase A) in which subjects will be observed when there is no intervention to be implemented, and another is intervention condition (phase B) in which intervention will be implemented. Both phases will be altered repeatedly to complete the order of the four phases in ABAB design. The purpose of the order is to compare the performance in different phases and examine if the intervention will bring the effect or not. Figure1-1 shows a hypothetical picture for ABAB design

Each phrase of ABAB design contains its significant and unique purpose for experimental design. The initial A phase starts with baseline observation which describes the existing level of performance and predicts the performance in the future without implementing interventions. The intervention B phase could observe if the performance will be influenced by the intervention, and examine the effect of intervention. Actually, the different tendency in the intervention B phase already can be used to demonstrate the effect of intervention, but ABAB design tends to hoist the confirmation of the intervention's effect. (Kazdin, 1982)The second A phase has the same function as the initial A phase, but it can examine the degree of similarity with the initial A phase. The final phase is to test whether performance will show similar tendency with the intervention B phase, and to emphasize the result of intervention.

Illustration of ABAB design

This is an example of ABAB design (Figure 1-2) which was conducted by Reep & Deitz (1974) The design is to reduce the self-injurious and aggressive behaviors of a 12 years old male who was diagnosed as retarded and

belligerent. In the baseline phase, the aggressive behavior will be recorded and each aggressive behavior will cause the subject to be restrained for 30 seconds. In the intervention phase, the rule is the same but the subject can earn some desserts when he did not show any aggressive behaviors. We can observe the effect of intervention through figure 1-2.

Multiple Baseline design

Baseline and intervention phases maintain the same function in this design; however, different experimental design can create more copious research methods. Multiple baseline design is also called within-subject multiple baseline design. In multiple baseline design, intervention is introduced to different baselines at different time points for the same target behaviors but for different subjects or different behaviors in one subject or a group of persons. For example, if we want to know whether an intervention could affect the inattention behavior in the class, we could divide the inattention behavior into three dimensions, such as talking, sleeping and eating in the class. Each dimension has its own baseline time; accordingly, the intervention will be implemented at different times. Figure 2-1 shows a hypothetical picture for multiple baseline design.

If the performance changes with the implement of intervention all the time, the effect can contribute to the intervention. Moreover, it no needs to return the behavior back to the baseline phase in multiple baseline design. This is a design which can be utilized in some experiments with no need to withdrawn for practical limitation and ethical consideration. (Kazdin, 1982)

Illustration of multiple baseline design

This multiple baseline design was conducted by Bornstein et al (1977). The goal of this study is to train the social skills for unassertive children. The subject is an 8 year old female who was passive and oversensitive to criticism. Multiple baseline design focuses on the requests, loudness of speech, eye contact, and overall assertiveness. The intervention can be clearly seen in different time, and behavior will vary with it.

Changing Criteria design

This is a design in which the criteria of intervention will be gradually elevated to observe whether the performance of the subject vary with different criteria. Changing criteria design begins with a baseline phase, but the intervention phase will be divided into a series of sub phases which have different standards of criteria. The latter criteria will be hoisted to more stringent when the performance stabilizes and consistently meet the former criteria. Figure 3-1 shows a hypothetical picture for changing criteria design.

By the special way of change criteria design, the effect of intervention was proved by improving the performance over time to meet the criterion, that is to say, performance would be expected to follow the swifts of criteria. On the other hand, using bidirectional change could offer more powerful evidence; the reason is that the design of criteria can change not only to be more and more strict but also looser. If the intervention is responsible for change, the performance must change with the criteria rather than follow in the same direction, and the ambiguity about the effect of intervention will be reduced. (Kazdin, 1982)

Illustration

The study of behavioral treatment of caffeinism was conducted by Foxx and Rubinoff (1979). The subject was a female school teacher. At first, the treatment (intervention) phase of this design was divided into four phases, and the subject had to give \$20 to researcher before the experiment started. If they did not exceed the criterion level of a sub phase (solid line), they can take \$.50 back and receive a \$1 bonus and remain the qualification to take \$10 at the end. In figure 3-2, the behavior of the subject varied with the intervention will be showed.

Conclusion

SCD has highly flexible which can provide detailed observation about behavior changes of an individual. Although SCD needs more expensive to fund, lacks of the support of statistics and the design may be oversimplified, but it still offers a good opportunity to study the area of interest, good external validity and internal validity. Also the result of SCD is easier to predict and be explained. Besides, when subject will show the progress of behavior, for example, epilepsy reduction or reducing behavior harmful, it is unethical to withdraw the treatment.

SCD is utilized in many research areas, especially in clinical practice. Thomas R. K (1992) asserted that single case research can provide a unique opportunity for clinical workers to subsume the study research within the clinical practice. Furthermore, SCD which focuses on clinical significance rather than statistical significance concerns whether a patient's life was influenced by the intervention or not. In my opinion, SCD is an experiment which highly focuses on the requirement of patient.

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