

The Utility of Single Subject Design Research

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ABSTRACT

Single subject design (SSD) research is a quantitative approach used to investigate basic and applied research questions. It has been used for decades to examine issues of social importance such as those related to general and special education strategies, therapeutic approaches in mental health, community health practices, safety, and business practices, to name a few. The purpose of this paper is to introduce the reader to the structure and function of SSD research, concepts of internal and external validity related to this methodology, and data analytic tactics used to evaluate SSD research. Additionally, several designs are described along with examples from the applied literature to illustrate the approach.

KEYWORDS

Single Case Research Design, Single Subject Design Research, Social Importance, Within Subjects Research Design

INTRODUCTION

Single subject design (SSD) research is a quantitative method of scientific inquiry (Baer, Wolf, & Risley, 1968; Horner et al., 2005; Horner, Swaminathan, Sugai, & Smolkowski, 2012; Richards, Taylor, & Ramasamy, 2014). It has been used for decades by researchers conducting basic and applied research. The approach is particularly useful for exploring questions and issues of social significance (Baer et al., 1968; Cooper, Heron, & Heward, 2007). For instance, researchers have used this methodology to develop and refine educational practices for children, therapeutic interventions for individuals in need, employee training practices for adult learners, and to increase productivity in business and industry. The purpose of this paper is to introduce the structure and logic of SSD, the strengths and weaknesses of the methodology, a sample of research designs that illustrate the system, and data analysis tactics.

A Note on Terminology

In SSD research, the independent variable (IV) is usually an intervention or treatment while the dependent variable (DV) is an observable and measureable behavior (Cooper et al., 2007). The term

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SSD is synonymous with single case research design and within subjects research design. Throughout this paper, I will use the term SSD, as it is an accurate description of this research method without the notion of it being a qualitative case study. Nevertheless, the term, SSD, is a bit of a misnomer. It leads one to believe that the participant pool consists of one person. Although there are variants of the methodology that permits researchers to include one participant, most of the time three to five individuals are included as participants with some researchers including more individuals (Cooper et al., 2007; Horner et al., 2005). Technically, the term SSD refers to each individual in an experiment serving as both a control and experimental participant. That is, participants in SSD research studies experience each condition of the study, including the control (or baseline) condition and the experimental condition (Cooper et al., 2007). Hence, the individual is the emphasis of most SSD research studies, and SSD experiments usually include multiple, albeit few, participants (Gast & Ledford, 2014; Horner et al., 2005).

Advantages of SSD

Focusing on the individual is considered to be among the greatest qualities of SSD research. The raw data of individual performance is typically presented in a graphical format and descriptive statistics of individual performance are reported. This allows others to examine all the data on an individual participant's performance and to judge the merits of the effects of an IV on a DV (Gast & Ledford, 2014). Consequently, SSD researchers, and consumers of that research, can determine the responders and non-responders to an intervention or treatment (Horner et al., 2005). In contrast, researchers using group designs amalgamate the individual's data into the group and determine differences between groups via descriptive and inferential statistics (Cooper et al., 2007). Indeed, most participants in a group-designed study with a normal distribution will perform at or near the measure of central tendency. However, there will be those that perform below or above that average, and that information is deemed critical by SSD researchers when examining the effects of a study (Cooper et al., 2007; Gast & Ledford, 2014; Horner et al., 2005). Questions such as what are the participant, task, and setting variables become important factors when analyzing research data to describe the features of responders and non-responders, which can assist in guiding practice (Horner et al., 2005). Moreover, there are other advantages of SSD research including its utility in settings where there are a limited number of available participants, its efficacy among heterogeneous populations, its effectiveness for testing interventions aimed at changing performance, its usefulness for examining interventions in applied settings, and its cost effectiveness (Horner et al., 2005).

Internal Validity and the Functional Relation

The aim of researchers using SSD methods is to determine if a functional relation (i.e., cause and effect relation) exists between an IV and a DV, and there are several research designs from which to choose depending on the research question(s) and parameters of the variables under investigation. As an introduction, these include designs to determine a functional relation based on presenting and/or removing an IV(s); introducing the IV in a step-wise method across participants, DVs, or settings; and alternating multiple IVs for comparative purposes (Horner et al., 2005). (Note that specific designs along with examples from the literature will be detailed in the following section of this article). Each design is established to permit the researcher to systematically introduce and/or withdraw the IV in such a way as to predict, verify, and replicate changes in the pattern of the participants' performance of the DV. Simultaneously, the experimenter seeks to control all possible confounding variables (e.g., history, attrition, multiple treatment interference, maturation, treatment drift, reliability of measurement; Cooper et al., 2007; Gast, 2014a; Richards et al., 2014). Cooper

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