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# Methodological standards in single-case experimental design: Raising the bar

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ABSTRACT

Single-case experimental designs (SCEDs), or small-n experimental research, are frequently implemented to assess approaches to improving outcomes for people with disabilities, particularly those with low-incidence disabilities, such as some developmental disabilities. SCED has become increasingly accepted as a research design. As this literature base is needed to determine what interventions are evidence-based practices, the acceptance of SCED has resulted in increased critiques with regard to methodological quality. Recent trends include recommendations from a number of expert scholars and institutions. The purpose of this article is to summarize the recent history of methodological quality considerations, synthesize the recommendations found in the SCED literature, and provide recommendations to researchers designing SCEDs with regard to essential and aspirational standards for methodological quality. Conclusions include imploring SCED to increase the quality of their experiments, with particular consideration regarding the applied nature of SCED research to be published in *Research in Developmental Disabilities* and beyond.

## What this paper adds

This paper provides guidance to single-case experimental researchers with regard to the quality of the experiments they design and report, based on the most current literature. We highlight the relationship between increasing standards for single-case experimental design and the impetus to identify evidence-based practices for the education of individuals with developmental disabilities. This paper may serve as a guide to researchers who wish to publish single-case experimental research in *RIDD*.

## 1. Introduction

Single-case experimental designs (SCEDs), or N-of-1 experiments, are prominent in the disability literature, particularly given research on low-incidence disabilities, such as severe intellectual and developmental disabilities (IDD; Tate, Perdices, McDonald, Togher, & Rosenkoetter, 2014). Although previously not held in high regard, within the recent past, such designs have become more widely accepted (Wilson, 2011). However, increased acceptance should come with increased scrutiny. Despite efforts of SCED experts to increase methodological standards over the past decades, we, as editor and associate editor of high-quality journals on autism spectrum and developmental disabilities, continue to see submissions to *Research in Developmental Disabilities* (*RIDD*) and SCEDs that are published with questionable methodological quality. Beyond journal submissions, our own work conducting single-case research,

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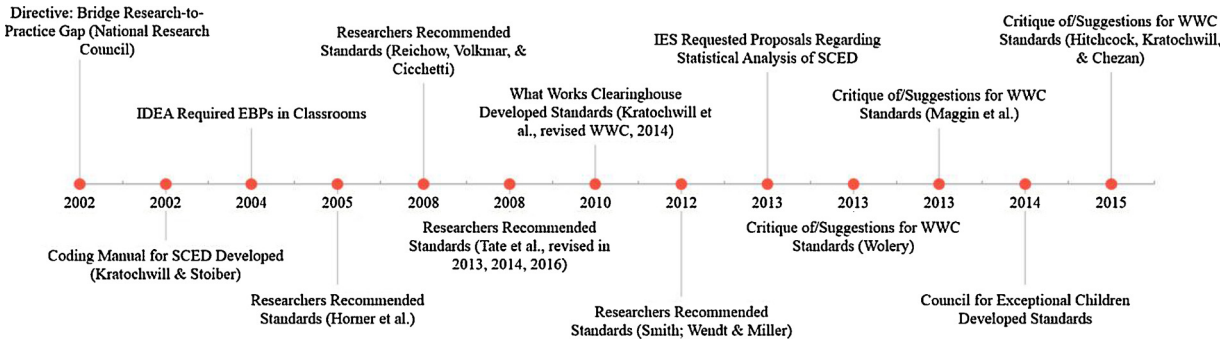


**Fig. 1.** Evolution of Standards Movement for SCED: Highlights (Institute of Education Sciences, 2013; National Research Council, 2002; Reichow, Volkmar, & Cicchetti, 2008; Hitchcock, Kratochwill, & Chezan, 2015; Kratochwill et al., revised WWC, 2014; Maggin et al.; Kratochwill & Stoiber, 2002; Tate et al., revised in 2013, 2014, 2016; Horner et al., 2005; Smith, 2012; Wendt & Miller, 2012; Council for Exceptional Children, 2014).

meta-analyses, and systematic reviews has led us to advocate for increased methodological rigor across the literature base, both for the sake of the reputation of SCED and for the purpose of allowing determination of evidence-based practices. That is, without strongly designed and relevant SCED research, researchers cannot possibly draw conclusions regarding whether or not interventions are evidence-based and for whom and under what conditions these interventions are most likely to be effective.

### *1.1. History of literature on methodological standards*

For approximately the last decade and a half, there has been an increasing focus on identifying evidence-based practices in special education, which necessitates evaluation of the methodological quality of SCED literature and status of the evidence of said literature (see Fig. 1. Evolution of Methodological Standards). Primary drivers of this movement have included legislation (No Child Left Behind in 2001; the Individuals with Disabilities Education Improvement Act in 2004), which required that educators consider and, whenever possible, apply scientifically-supported interventions for all students, including those with disabilities.

The process of developing and revising standards for SCED is iterative. That is, research and educational organizations have published recommended standards, which have been followed by critiques of these standards, which have been followed by further revision of standards. Key researchers and organizations are provided in Fig. 1. Highlights include initial pressure on educational institutions to implement research-supported educational interventions; this pressure was driven by legislation and statements from national institutes (Council for Exceptional Children, 2014; National Research Council, 2002; What Works Clearinghouse, 2014). Further, individuals and groups of researchers have participated in development of these standards or have published critiques and additional suggestions (Horner et al., 2005; Kratochwill & Stoiber, 2002; Reichow, Volkmar, & Cicchetti, 2008; Smith, 2012; Wendt & Miller, 2012), including developing research review protocols (Tate et al., 2008, 2014).

### *1.2. Highlights of recommended standards reported and evaluated in the literature*

The question of which criteria among those proposed are necessary and critical to developing and reporting a high-quality SCED is unanswered. Reviewing the literature exposes a range of priorities. This discrepancy across authors and evaluation tools is problematic (Maggin, Briesch, Chafouleas, Ferguson, & Clark, 2014). Primarily, use of different evaluation tools results in disagreement regarding the standing of literature base and, thus, the state of the evidence for intervention practices and for whom and under what conditions they may be considered to be most effective. Furthermore, as standards and expectations evolve over time, research considered rigorously designed a decade ago may no longer be viewed as adequate. Thus, we have reviewed the literature to produce a sampling of the standards to enable us to best propose best practices in SCED quality based on this literature and our own experience and expertise as experienced single-case researchers. This summary of previously recommended standards is provided in Table 1.

Although there appears to be some agreement across quality rubrics with regard to criteria that evaluate the ability of the design to document an experimental effects if it exists (e.g., number of data points per phase, systematic manipulation of the independent variable, collection of inter-rater reliability data); there is less agreement related to components related to generalizability of studies (e.g., description of participants, description of the procedures, collection of procedural integrity data) (Maggin et al., 2014; Moeller, Dattilo, & Rusch, 2015). Further, while some sources recommend the following requirements, most do not: stability or contra-theraputic trend of baseline data, detailed requirements regarding numbers of data points required per phase, inclusion of data measuring procedural integrity, description of recruitment procedures, blinding procedures, and supplementing of visual analysis with statistical analysis (CEC, 2014; Horner et al., 2005; Kratochwill et al., 2010; Logan, Hickman, Harris, & Heriza, 2008; Maggin et al., 2014; Reichow et al., 2008; Tate et al., 2014; Wolery, 2013). In fact, existing standards document have been criticized for ignoring elements of quality that allow for generalization of the results (Hitchcock, Kratochwill, & Chezan, 2015) or assurance of internal integrity (Wolery, 2013).

While systematic literature reviews and meta-analyses have increased the use of quality indicator analyses, there are still