Use of Single Subject Designs to Evaluate Educational Outcomes for Students with Autism

Jon S. Bailey, PhD, BCBA-D
Florida State University
Use of Single Subject Designs to Evaluate Educational Outcomes for Students with Autism

This is a rather narrow title since students with autism also have \textit{behavioral} outcome goals
And, it is also narrow in that you can’t really have “outcomes” without understanding the processes that make the outcomes happen
So, our new title is...
Use of Single Subject Designs to Evaluate Educational and Behavioral Processes and Outcomes, for Students with Autism
Assumptions:

Students have a right to effective treatments.
Assumptions:

We will use data for decision making about treatments that are being proposed or are in effect.
Assumptions:

Repeated Measures of Behavior are **ESSENTIAL**

not **optional**

![Graph showing repeated measures over time]

Time
Assumptions:

We will graph the behavioral data
Assumptions:

We will visually analyze the data to determine if a treatment or intervention was effective.
We start with the logic of it all.

Which has to do with prediction.
We start with Baseline Logic

Baseline vs. No Intervention

Repeated Measures

This is a good, stable baseline with an easy prediction.
This an unstable baseline with no prediction.
This is an uptrending, baseline with a fairly easy prediction.
If you want to…

*Evaluate Educational and Behavioral, Processes and Outcomes for anyone*

You will need to start by looking closely at the Baseline data and determine the direction of the desired effect of treatment or intervention.
What do you think of this Baseline?

Clearly not enough data to make a prediction.
How about two data points?

Uptrend?

Still not enough data to make a prediction
How about two data points?

Still not enough data to make a prediction
How about two data points?

And remember if you can’t make a prediction you can’t evaluate a treatment.

Still not enough data to make a prediction.
Some people will try to get you to look at the *mean* not the trend.

This is clearly misleading. Don’t be misled.

“Wow, look at the huge effect I got with my treatment.”
PURPOSE:
To demonstrate:
a) A cause-effect relationship between treatment and behavior change (i.e. “Proof”), and

b) Help the consumer determine if the size of effect is *clinically significant*.

\[ SS = \frac{(X - \bar{X})^2}{n} = \sum X^2 - \frac{\sum X}{n} \]
Single-Subject

Basic Research Designs

1. Reversal Design
2. Multiple Baseline Design
3. Multielement Design
1. Reversal design

This is a good, stable baseline with an easy prediction.
1. Reversal design

Here’s a Treatment with an immediate effect.
The 2nd Baseline replicates the first which it must do.
1. Reversal design

The 2nd Treatment Replicates the 1st application

This replicates the cause-effect

This shows cause-effect
1. Reversal design

We can also see the size-of-effect.
1. Reversal design

- Shows cause effect
  The $T_x$ produced this effect.

- Shows size of effect

This is a powerful design when the data are stable and the $T_x$ shows a strong effect.
It is amazing that you can use single subject designs like this for INDIVIDUAL students... to find out if a treatment works and if it is worthwhile.
1. Reversal design

*The main problem with the reversal is just that, you are reversing a behavior that may not work that way. There is also an ethical question. These are known as “limiting conditions”
Effects of Role-Play on Social Behaviors of High Functioning Autism Adolescents

Described as “Multiple-Baseline”

No actual Baseline
Baseline2 does not replicate Baseline1
There is no “Proof” this treatment works
“Excuse me, what other designs do you have that don’t have these limiting conditions?”
This is a “2-leg” Multiple Baseline, proof is shown by replication of results.
The $T_x$ is replicated and you can see the size of effect.
2. Multiple Baseline design

- **Shows cause-effect**
  
  The $T_x$ *produced* this effect.

- **Shows size of effect**

  This is a strong design when the data are stable and the $T_x$ shows an immediate effect.
It is still amazing that you can use single subject designs like this for INDIVIDUAL students... to find out if a treatment works and if the effect is worthwhile.
“What are the limiting conditions of multiple baselines?”
I was afraid someone would ask that.
“What are the limiting conditions of multiple baselines?”

The treatment effect may generalize from one baseline to another.

Outside variables may produce strange effects.

But, it is an *ethical* design.
The most responses occur when attention is given, the next most when tangibles are available, very few responses occur when requests are made or when the student is alone.
3. Multielement design

- Used to show relative controlling variables
- Many comparisons simultaneously

This is used primarily to find effective reinforcers and then paired with a multiple baseline or reversal design for proof of effect.
“What are the limiting conditions of multielement design?”
“What are the limiting conditions of multielement designs?”

The effects may trend up or down over time.

There may be interactions among the treatments.

But you can find out a lot of information quickly.
Effects of Role-Play on Social Behaviors of High Functioning Autism Adolescents

Described as “Multiple-Baseline”

What did the authors say?

Our results show that adolescents with HFA improved their verbal and nonverbal behavior as a result of a role-play intervention.

Real Multiple-Baseline

Remember This Example?

Not Really

Nonverbal behavior as a result of a role-play intervention.
The Effectiveness of the Snug Vest on Stereotypic Behaviors in Children Diagnosed With an Autism Spectrum Disorder
Effectiveness of the Snug Vest on Stereotypic Behaviors in Children with ASD

What did the authors say?

The results of the study show that the Snug Vest failed to reduce any participants stereotypy. Absolutely

In three out of three cases the vest increased stereotypy.
Figure 1. Levels of perseverative and nonperseverative speech during the attention and ignore conditions of the functional analysis.
2. Multiple Baseline Design

Figure 2. Percentage of compliance for baseline, intervention, and follow-up conditions for Dan in the hospital unit and classroom settings.
2. Multiple Baseline Design

Figure 1. The responses per minute of tics across each target tic for Lance.
3. Multielement Design

Ritualistic Toy Arranging

Figure 1. Rate of problem behavior and blocked attempts to arrange during test and control conditions of the blocking assessment (top) and percentage of session duration of toy arrangement (bottom).
3. Reversal/Multiple Baseline Design

Assessment of Problem Behavior Evoked by Disruption of Ritualistic Toy Arrangements in a Child with Autism

Figure 2. Rate of problem behavior and appropriate communication during baseline and treatment conditions across contexts during the treatment evaluation. FCT = functional communication training.
Assessment of Problem Behavior Evoked by Disruption of Ritualistic Toy Arrangements in a Child with Autism

What two research designs were used?

Figure 2. Rate of problem behavior and appropriate communication during baseline and treatment conditions across contexts during the treatment evaluation. FCT = functional communication training.
3. Multielement Design

Environmental Enrichment and Response Cost: Immediate and Subsequent Effects on Stereotypy

- Environmental Enrichment
- <Removal of Preferred Item>
- <Removal of Preferred Item>
- <Removal of Preferred Item>
- Note Uptrend in the Data
FIG. 16.3. Frequency of inappropriate sitting behavior (falling out of chair). During the intervention phase, sensory integration therapy (broken line) prior to the daily session was alternated with a differential reinforcement of low rate (DRL) program (solid line) during the session. In the follow-up condition, only the DRL program was in effect.
Figure 2. Treatment analysis data. The top panel shows the percentage of speech that was perseverative. The bottom panel shows the percentage of speech that was on topic. Asterisks denote sessions conducted by Derek’s mother (Sessions 45 to 56), novel therapists (Sessions 63 to 69), and brother (Sessions 71 to 73).
So, what have we learned?
It is possible to evaluate a wide variety of interventions with individual children.

These evaluations are made possible by single-subject designs adapted to each child, their distinctive behaviors and any type of treatment.

We can test the effects of a treatment and look at the size of effect.

There are limiting conditions for each type of single-subject design.
Unfortunately there are many treatments though widely accepted simply do not work

If you are an educated consumer you can separate the wheat from the chaff

QUESTION EVERYTHING
If you are an educated consumer you can separate the wheat from the chaff
Thank You for Inviting Me to Penn State

It is an Honor and a Privilege

Jon S. Bailey, PhD, BCBA-D
Florida State University