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21. Describe the most appropriate uses of single subject research in special education.

When is single subject research more appropriate than group-experimental research?

Special education is dedicated to working with the individualized needs of students. Single subject design is very appropriate for research in special education because it is a way to gain insight on the behavior of individuals as Horner et al. (2005) point out on pages 165 and 166, "Single-subject research has proven particularly relevant for defining educational practices at the level of the individual learner." Some of the specific situations that would indicate a need for single subject design were listed by Scruggs, Mastropieri, and Reagan (2006) from the work of Horner et al. (2005). The list of particularly appropriate investigations for single subject design included dangerous, destructive, or self injurious behavior of low incidence disabilities, treatments that are individually applied, and the testing of conceptual theory.

Group experimental research assumes that the groups are representative of a normal population normally distributed, rather, and even this may not be necessary. Because special-education, by its very nature, is representative of the extreme ends of the normal population, other research designs, that have more flexibility, such as single subject research and qualitative research may often be more appropriate. Another benefit from using single subject research is that students in special-education often do not react as predicted. The design in single subject research can be adjusted to fit both the "responders" and "nonresponders" (Horner et al., 2005, p. 173 & Scruggs et al., 2006). Although the planned procedure may not work, an adaptation based on data collected can

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provide new information on what may influence a change in behavior. This happened to one of the participants in the research by Hine and Wolery (2006). If they had been constrained by group experimental research, they would not have been able to adjust the material for Kaci when it was thought that satiation of the materials had resulted in a decreased response.

2 2. How is reliability established in single subject research?

Because single subject research is involved with very small numbers of participants, reliability is often a question. Cresswell **Cresswell** (2005) explains threats to internal validity as being unable to infer the cause and effect of the treatment due to the participants' experiences or flawed procedures. Horner et al. (2005) mentions **mention** that threats to internal validity can be addressed through "within- and between-subjects comparisons" (p. 166). The control is determined to be the comparison of the participant's behavior in all of the stages, before, during, and after the treatment. Hine and Wolery (2006), conducted in intervention with two students and Hughes, C., Ruhl, K., Schumaker, J., & Deshler, D. (2002) **don't use initials here** had nine student participants. In the first study, multiple measures of individual student behavior were compared to each of the participant's previous behavior before the intervention had begun, during treatment, and during the second treatment. Then the behaviors of two participants were compared. In the second study the nine students were put into small groups of three with a multiple baseline design. The progress of each group was compared to, both itself and to the other two groups after intervention.

2 3. Describe the problem of external validity and how this can be addressed in single subject research.

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External validity as Cresswell (2005) writes about is the ability to generalize from one research study to other settings. This can be problematic for single subject research. To address this concern, researchers must be diligent in their operationalized definitions of participants, context, influential factors, settings, materials, methods, and procedures (Horner et al., 2005). Only with a number of systematic replications with similar findings can enhance the confidence in the external validity. Attrition can be a threat to both internal and external validity, therefore all participants who were included in the baseline and treatment must be included in the study (Horner et al.).

2 4. What problems are associated with visual inspection of data, and how can these problems be addressed in single subject research?

Visual inspection, one of the usual methods of interpreting the results of a single subject design, (Scruggs et al., 2006), entails actually looking at graphs which depict the measurement data throughout all conditions of the study. Sometimes a graphic representation can be easy to interpret if there is a definite jump **step change** in levels from baseline to treatment, and baseline to treatment in an ABAB design, or at the specific point of introduction of treatment for each participant or group of participants in a multiple baseline design. Horner et al. (2005) discusses the importance of interpreting "...the level, trend, and variability of performance occurring during baseline and intervention conditions" (p. 171). The level of each condition would be its mean performance, the trend refers to noticing "... the rate of increase or decrease of the best-fit straight line for the dependent variable within a condition (i.e., slope)." The variability is measured for each phase indicates the fluctuation of performance during that phase. The person inspecting the visual data must notice how quickly the data changes after the

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introduction or the withdrawal of a treatment, the proportion of data overlap of phases that are adjacent to each other, to change magnitude of the dependent variable, and the pattern consistency.

Some concerns about visual inspection raised by Scruggs et al. (2006) was the lack of specific criteria for making decisions. To what degree is a level, slope, or variability change important? What number of data points constitutes clear interpretation? Also there is a large rate of discrepancy between those persons doing the visual inspection.

2 5. Discuss issues in uses of statistical tests on single-subject data, including randomization tests.

Some researchers, Scruggs et al. (2006) point out, disagree with the use of statistics on single subject research data because those who use single subject research especially if they are in the Special Education field, are working for changes in behavior that are socially acceptable rather than clinically or experimentally significant. Any change in behavior that improves an aspect of everyday life for a student and or those around him/her, is significant with or with out statistical numbers. Because single subject research by definition involves small numbers of participants, and the frequent small numbers of data points, as well as the point that the data measures are not independent, violate some of the important statistical assumptions.

How then can we find more systematic ways of analyzing data from single subject research? One possibility is to find the Percent of Non-overlapping Data points (PND) in the baseline versus the treatment phase. Although that can help establish a level change, it does not take into account the magnitude of that change and may not recognize a

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continuation of a data point trend. Another possible statistical procedure is the autoregressive, integrated moving average (ARIMA) model which can address some statistical issues such as serial dependency, the number of data points in baseline and intervention required would not be practical **given you have 20+ (or even 50) data point per phase**. A third possibility is the randomization tests which gives a statistical measure. These tests involve randomly choosing data points, after reserving **e.g.**, five or more data points in the baseline, and five or more data points at the end of the treatment, to determine if any other point, beside the intervention point, has a greater change.

2 6. List research questions appropriate to single subject research in special education, and justify why they would be particularly relevant to single subject research.

Horner et al. (2005) listed types of research questions to be used with single subject research. The single subject research designs are particularly suited when one is seeking small changes over a period of time after independent variables have been systematically introduced or if one is seeking to understand how a certain individual will behave/perform under specific conditions. Because single subject design is experimental, it attempts to identify causal or functional relationships of a change in the dependent variable that occur after an independent variable has been manipulated or introduced. Single subject design can also focus on a set of independent variables that can affect the targeted dependent variables. A third focus could be the identification of the relative effects on the dependent variables when two or more interventions are introduced. The following questions are appropriate for single subject research because they address the academic deficits of students with special needs. There are relatively few numbers of students in most classrooms who need this kind of software to be able to produce making

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single subject research advantageous. The interventions for each individual student may need adjustments for a maximum effect. The focus of these questions is the effect of using software on the dependent variables of writing productivity and accuracy. Sample questions would be:

- ❑ Does the use of picture to text software increased written productivity of young students who struggle with writing?
- ❑ Does the use of picture to text software help cognitively delayed high school students respond more accurately to questions posed after academic instruction that has been delivered using the same software?
- ❑ Does the use of text-to-speech software with auditory dictionary and word prediction features increase the number of words generated, the quality of sentences, and the percentage of accurately used and spelled words, if used in conjunction with a writing strategy? This question includes finding the effect of two or more interventions for dependent variables.

2 7. Describe the most appropriate uses of qualitative research in special education. When is qualitative research more appropriate than group-experimental or single subject research?

Husserl advocates the importance of reflecting systematically on experience from the viewpoint of the person doing the study which is one of the benefits of qualitative research. In Brantlinger, Jimenez, Klingner, Pugach, and Richardson (2005), the authors presented a definition that emphasized that qualitative research is most appropriate when "... understanding qualities, or the essential nature, of a phenomenon within a particular context..." is desired. The particular context we are investigating is that the area of

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special education and the phenomenon can be varied. Brantlinger et al. also mentioned that qualitative research includes the systematic production of knowledge using particular tools and skills, to produce scientific evidence about an area of interest within a particular context such as special education, through careful observation and analysis of information gathered. The result should have useful implications for the field.

Whereas group experimental design helps researchers understand effects of interventions, situations, or strategies on groups of participants by comparing the results of a similar group without the intervention, and single subject research investigates how an individual reacts to intervention comparing behavior during phases of research without the intervention to behavior during phases with intervention or by comparing baselines of 2 or more individuals before and after an intervention is applied, qualitative research is particularly helpful when seeking to define a phenomenon or find out why things happen or how they occur in the manner observed. "... Qualitative studies explore attitudes, opinions, and beliefs of a number of parties involved in special education as well as the general public, and examine personal reactions to special education and teaching strategies" (Brantlinger et al., 2005).

2 8. Describe reversal (ABAB) and multiple baseline designs; and reasons for selecting each design when planning single subject research.

An example of ABAB design is found in DePrey and Sugai (2002). It shows that a baseline was established with the six data points that were fairly stable. And then the intervention of Planned Responding was started and the data points were collected using Planned Responding. The intervention was briefly stopped and data points were taken to

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show that the baseline behavior resumed while the intervention was not in place. Once Planned Responding started again the data points dropped showing the correlation between the intervention and resulting behavior. This design is appropriate when the intervention can be taken away after a period of implementation. For instance if participants were given a tool to use, such as a word processor, it could be withdrawn after the first intervention stage to establish a second baseline, then it could be given back to the participants for the final intervention stage. The intervention stages are then compared with the baseline stages to determine if there is a correlation between the tool and a change in behavior. The ABAB design would not be appropriate when the intervention is a skill learned by a participant. When a participant learns a skill, "behavioral trapping" occurs and the skill cannot be "unlearned" for the second baseline. When "behavioral trapping" is an issue, the multiple baseline single subject design is a more appropriate choice.

In the multiple baseline single subject design, two or more participants or groups of participants would be included. After the baseline is established for all participants, one participant or group of participants begins with the intervention. Once those data points stabilize the next participant or participant group would begin and continue until those data points stabilize. If a third participant or participant group are included in the study the procedure would continue until all participants and/or groups had started the intervention and data points were stabilize. The point of initiation of the intervention for each participant and/or group would be compared on a visual graph to determine what effect, if any the intervention had on the behavior of the participants. The studies by Regan, Mastropieri, and Scruggs, (2005) and Hughes, Ruhl, Schumaker, and Deshler,

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(2002) used a multiple baseline single subject design because once the students started using the strategies there was no way to go back to the baseline.

2 9. Describe the problem of external validity and how this can be addressed in qualitative research.

Although generalization is not the aim of qualitative research, the evidence produced can be very enlightening and provide valuable insight into situational context surrounding a phenomenon. External validity is concerned with the replicability and generalizability of research. Qualitative researchers may address external validity through particular attention to careful selection of participants and sites as well as thorough or thick description of the participants, the situation, the environment and the interaction of all components. With extremely accurate description a reader can determine if the findings could be relevant to his/her own situation. Having large enough samples of participants is also important to be able to ensure representativeness of a particular population. Another way to enhance external validity of qualitative research is have a design that includes more than one site.

10. List research questions appropriate for qualitative research in special education, and justify why they would be particularly relevant to qualitative research.

Some research questions that would fit the qualitative research design would be:

- How is the use of assistive technology implemented in a classroom with students with special needs?
- What are the perceptions of peers/ students/ parents/ teachers/ administrators about the use of assistive technology for writing?

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- What types of strategies can facilitate/inhibit the introduction to students with writing deficits and use of assistive technology by those students?
- What problems emerge when using assistive technology with students with special needs?
- What problems emerge when using assistive technology with students with special needs in a co-taught setting?
- What are the perceived benefits of allowing students access to assistive technology for writing tasks?
- Overall, “How” is better than “What” for qualitative

These questions focus on learning more about how the use of assistive technology can be implemented, what happens when assistive technology is introduced and used by students with special needs, and the perceptions, attitudes, beliefs, and opinions of the students using the assistive technology and those around them. They attempt to discover what factors in the situations can contribute to the success or failure of using assistive technology by students with special needs.

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