Quality Indicators of Rigor in Quantitative Methods

Dr. Jackie Goodway
The Ohio State University
Essential & Desirable Indicators of Research

- Determine quality research by identifying essential & desirable indicators.
  - Gersten, Fuchs, Compton, Coyne, Greenwood, & Innocenti, 2005

- An assessment device designed to determine if an article is scientifically rigorous
  - Study Design & Implementation Assessment Device (DIAD, Valentine & Cooper, 2003)
Research Questions

- **Purpose statement** is clear and precise outlining the intent of the study and constructs being studied.

- **Research Questions** are precisely stated including variables and outcomes and participants
  - Directional – specify the perceived outcome of the study
  - Non-direction – suggest a relationship but don’t specify a direction
Methods

✓ Context
✓ Participants
  ✓ Ethics
✓ Design
✓ Dependent variable
✓ Instrumentation

✓ Independent variable (Intervention)
✓ Procedures
✓ Data Analysis
Context

- Detailed description of where the study took place. Help the reader understand the nature of the environment.
  - Country, geographic region, urban, suburban, rural
  - Location – e.g. school, childcare, youth sport team
  - Other relevant information such as socio-cultural factors e.g. socio-economic status, religion
Context: Large Urban Midwestern City in USA

- 99% single parent families
- Low income & disadvantaged community
  - Mean combined family income $16,000
  - 99% free & reduced lunch
- High rates of crime
- 1 park - unsafe with gangs and drug deals in the park, lots of broken glass
- All rental accommodation, with no gardens
- Sidewalks have glass & debris
- No recreation facilities within 3 miles
Methods

Participants

- Detailed description of participants (age, gender, ethnicity, income level, sports experience, home environment etc)
- Link participant characteristics to literature definitions & prove participants meet them.
- Description of characteristics relevant to intervention
- Description of teachers who teach intervention

Sampling

- Appropriate procedures to ensure participants are comparable across conditions:
  - Random assignment
  - Random assignment of group to condition
  - Matched pairs
  - Purposeful sampling
- Appropriate procedures to ensure interveners are comparable across conditions.
Ethics with Participants

- Informed consent
  - Adults can consent – over 18 years

- Parental permission
  - Parents must consent to a child’s participation

- Child Assent
  - Child agrees to participate in study

- Support letter from site
  - Must get approval from the site you are working in

- Review of the study procedures by faculty on an Ethics Board
  - You cannot start a study until you have an approved protocol

- Cannot change your methods without approval

- USA - Must keep all consent documents for 5 years
Design of the Study

- Specify the design of the study
  - Descriptive
  - Correlational designs
  - Quasi-experimental designs – condition is not randomly assigned
  - Experimental designs – e.g. randomized controlled trial, group randomized design

Dependent Variables (DV)

- Operationalize (define) what you mean by your DVs. E.g. “Motor Competence” is a child’s ability to demonstrate fundamental motor skills with critical elements of form.
Dependent Variables (DV)

- DV was operationalized clearly e.g. “motor competence”
- Explain how the instrument selected actually measures the DV in the study (consider all options of instruments)
- Description of instrument
  - Internal consistency (Cronbach’s alpha)
  - Range of scores
  - Reliability & Validity

- Multiple measures of the DV if possible
- Training of testers
- Inter-observer agreement (IOA)
  - Inter – between
  - Intra – within
  - Blind coders to condition
- Multiple time frames of testing pretest-posttest
  - Add a retention test
**Test of Gross Motor Development 2**

**Locomotor Subscale**
- 6 skills: Run, Gallop, Hop, Leap, Jump, Slide
- Raw score - 0-48 points
- Standard score based on age
- Percentile rank for age & gender

**Object Control Subscale**
- 6 skills: Throw, Bounce, Strike, Catch, Kick, Roll
- Raw score 0-48 points
- Standard score & percentile rank based on age & gender

- **Gross Motor Quotient** (overall motor skills)
- All skills videotaped & coded from videotape
- Coders trained prior to coding & blind to group
- **Inter-rater reliability** - reliability between 2 independent raters
- **Intra-rater reliability** – reliability across time

Ulrich, 2000
Independent Variable Intervention

- Theoretical origins of intervention
- How *theory* drives decisions in designing intervention
- Detailed description of intervention - replication
  - Content
  - DOSE - amount
  - Teacher language, behaviour
  - Student behaviour
  - Attendance/attrition rates
- Describe how child moves through an intervention session
- **Intervention fidelity** – did the intervention get implemented as intended
  - Document fidelity
- Detailed description of comparison conditions
Study Procedures

- Outline the procedures of the study in detail for replication
- In complex studies it is helpful to break the study into phases:
  - Phase 1 – Teacher Training on intervention
  - Phase 2 – Pretest >>> Intervention>>Posttest
  - Phase 3 – Retention test
- Have someone who knows nothing about your study read the procedures and see if they can explain your study to you
Data Analysis & Results

- Data analysis ties to research questions in sequential order
- Explains sample size and statistical power at the appropriate unit of analysis (individual, class)
- Unit of analysis may change with RQ
- Underlying assumptions for statistical tests documented e.g. normally distributed

- Account for variability in data via sampling or design
- In intervention research include effect sizes
- Don’t duplicate data e.g. data in table & figure & text
- Results presented in sequential order tied to RQs
RIGOR, ALIGNMENT

Detail necessary for replication