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Multilevel linear modelling of the response-contingent learning of young children with significant developmental delays

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ABSTRACT

Aim: The purpose of the study was to isolate the sources of variations in the rates of response-contingent learning among young children with multiple disabilities and significant developmental delays randomly assigned to contrasting types of early childhood intervention.
Method: Multilevel, hierarchical linear growth curve modelling was used to analyze four different measures of child response-contingent learning where repeated child learning measures were nested within individual children (Level-1), children were nested within practitioners (Level-2), and practitioners were nested within the contrasting types of intervention (Level-3).
Results: Findings showed that sources of variations in rates of child response-contingent learning were associated almost entirely with type of intervention after the variance associated with differences in practitioners nested within groups were accounted for. Rates of child learning were greater among children whose existing behaviour were used as the building blocks for promoting child competence (asset-based practices) compared to children for whom the focus of intervention was promoting child acquisition of missing skills (needs-based practices).
Implications: The methods of analysis illustrate a practical approach to clustered data analysis and the presentation of results in ways that highlight sources of variations in the rates of response-contingent learning among young children with multiple developmental disabilities and significant developmental delays.

What this paper adds

The practical, nontechnical description of the multilevel, hierarchical linear modelling of the response-contingent learning of young children with significant developmental delays makes the results accessible to a broad audience of developmental disabilities researchers and practitioners. The results illustrate how sources of variation in the rates of children's response-contingent learning could be attributed primarily to type of child learning (intervention) opportunities and how differences in practitioners could be ruled-out as a factor related to rates of child learning. Intervention practices that used existing child behaviour as the building blocks for response-contingent learning proved more effective than intervention practices that focused on facilitating child acquisition of missing skills.

1. Introduction

Multilevel modelling of nested (clustered) data poses many challenges to researchers in developmental disabilities and special

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education where the focus of investigation is the learning or development of individuals with low incidence conditions (Rumrill, Cook, & Wiley, 2011; Ward, Miller, & Lamar, 2013). This is especially the case in studies of infants, toddlers, and preschoolers with multiple disabilities and significant developmental delays where the prevalence of these conditions is often less than 1% or 2% of the general population (e.g., Blackburn, Spencer, & Read, 2010; Parsons & Platt, 2013). This would be expected to result in studies with small sample sizes which could make clustered analysis potentially problematic (Blackford, 2007; Maas & Hox, 2005).

This paper includes a description of the multilevel, clustered analyses of the effects of contrasting types of intervention on the rates of response-contingent learning of young children with varied types of disabilities and significant developmental delays. Response-contingent learning refers to child use of an operant behaviour to produce or elicit environmental consequences (Tarabulsy, Tessier, & Kappas, 1996; Williams, 2001). Infants without disabilities or delays typically demonstrate the use of these types of behaviour as young as 2 months of age (e.g., Dunst, Raab, Trivette, Parkey et al., 2007; Hulsebus, 1973; Lipsitt, 1971; Rovee-Collier & Gekoski, 1979) whereas young children with disabilities and significant developmental delays often show a latency to learn these types of behaviour (Hutto, 2007).

The contrasting types of intervention differed only in terms of how child behaviour were identified and used to produce environmental consequences where the same types of contingency games (Dunst et al., 2010) and routines (Ware, 2016) were used to promote child learning. One approach involved reinforcement of behaviour in a child's repertoire but not used to produce an environmental consequence (e.g., Lancioni, Singh, O'Reilly, Oliva, & Groeneweg, 2005) and the other approach involved reinforcement of missing or emerging skills that resulted in an environmental consequence (see e.g., New & Cochran, 2007). The two approaches to early childhood intervention were described by Eloff and Ebersöhn (2001) as asset-based and needs-based practices respectively. Asset-based practices use existing child behaviour as the building blocks for child learning, whereas needs-based practices focus on facilitating child acquisition of missing skills. Asset-based practices are part of a family of positive approaches to strengthening individual functioning (Buntinx, 2013; Granlund, Wilder, & Almqvist, 2013) whereas needs-based intervention practices are part of a family of deficit approaches to intervention emphasizing amelioration of behaviour deficiencies (Ludlow, 1987).

The effects of the interventions on each child's contingency learning were evaluated on multiple occasions over an 8-week period of time where linear growth curve changes in child response-contingent learning were the dependent measures (Tate, 2004). Each type of intervention was implemented by the children's carers together with different early childhood intervention practitioners. The repeated measures of child response-contingent learning were nested within children, children were nested within practitioners implementing either intervention approach, and practitioners were nested within type of intervention. Fig. 1 shows the research design for the study. The main focus of analysis was the differential effects of the contrasting approaches to child response-contingent intervention (asset-based practices vs. needs-based practices) implemented by different practitioners (P) with different children (C) over the course of the eight weeks of intervention (t).

The analyses described in this paper compared the effects of the two types of interventions on child rates of learning controlling for the variances associated with the different practitioners nested within intervention group. We also examined the extent to which the sizes of effects for the interventions were similar to or different from data analyses not taking into consideration differences associated with practitioners (Raab, Dunst, & Hamby, 2016, 2017). The secondary focus of analysis was whether or not there were between practitioner differences in rates of child learning for practitioners facilitating carers' use of either the asset-based or needs-based intervention practices.

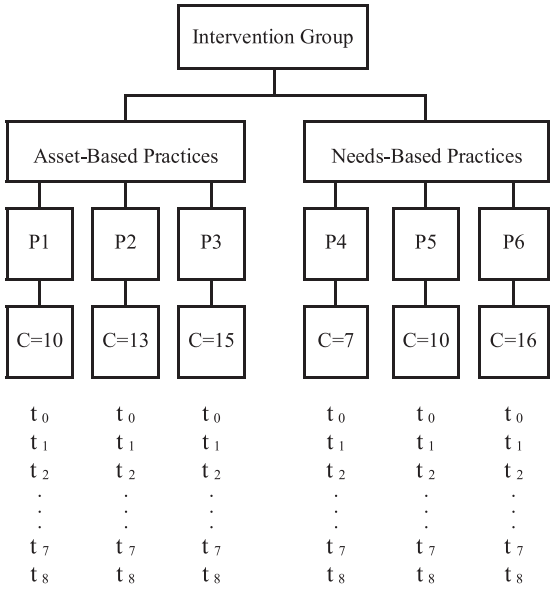

Fig. 1. Nested research design for evaluating the effects of the two contrasting types of intervention on child response-contingent learning. (NOTE. P = Early child intervention practitioner, C = Child study participants, and t = Repeated measurement occasions.).