Chapter 3 | Test Construction

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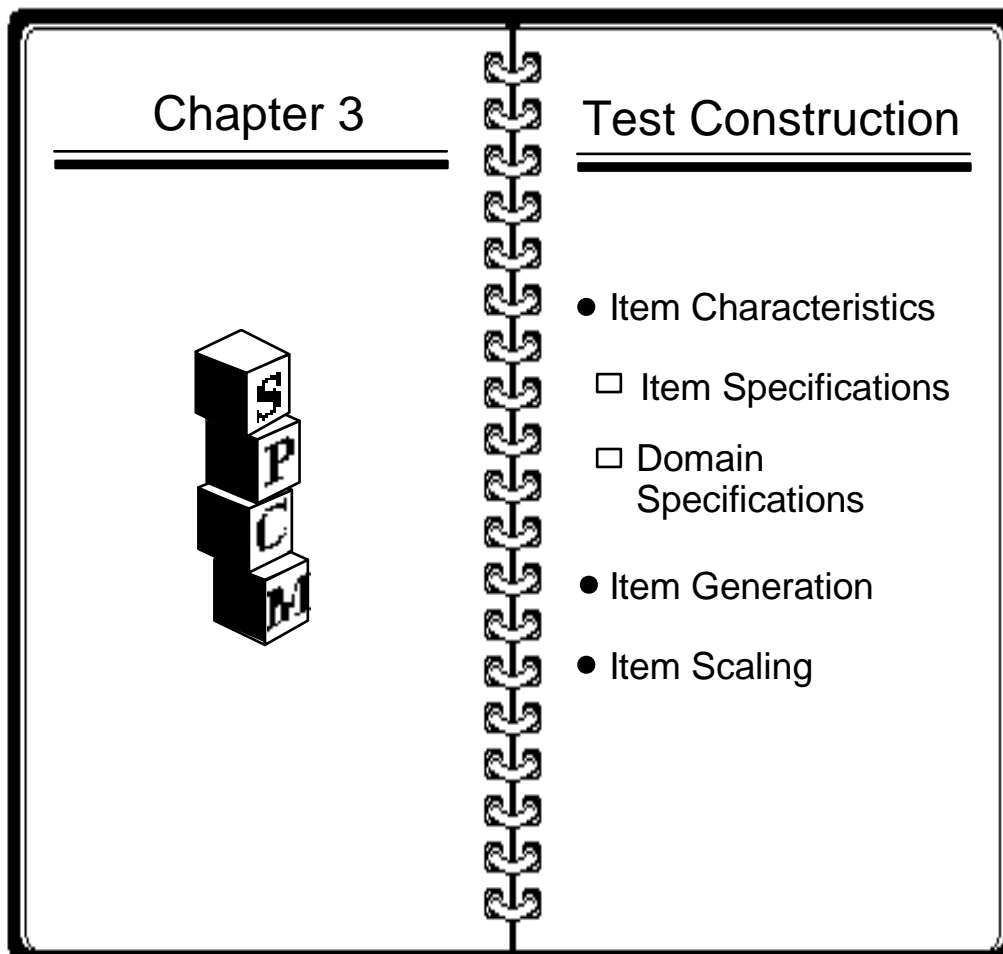- Item Scaling

Test construction initially involved establishing item specifications based on the postural control theory

and measurement frameworks discussed in the previous chapter. Items were then generated from the specifications and scaled for subsequent selection and reliability testing.

Item Characteristics

Test development commenced with a review of the literature describing postural control theories, measurement theory related to the development of evaluative measures, and characteristics of measures of motor function and postural control. Item specifications were developed to guide the generation and selection of items for the measure. A number of general specifications were identified which would apply to all items.

General Item Specifications

◆ Items must measure an aspect of postural control which is expected to change as a result of adaptive seating intervention. All aspects of postural control which have the potential to change should be included.

◆ Items must be feasible to administer in a clinical setting. The equipment required for administration must be readily available in a clinical setting and the time involved to administer the item must not be excessive.

◆ The response burden for the child must not be excessive particulary in terms of cognitive and language demands.

◆ The items must have the capacity for graded responses to allow scaling which will capture the degree of change in the aspect of postural control being assessed.

◆ Items must be capable of being administered while the child is seated in an adaptive seating system.

◆ Item responses should not require "hands on" assistance as the degree of assistance provided is difficult to standardize

◆ Items should have face validity, i.e., be engaging for the child if their active response is required and appear valid to the clinicians who will ultimately be using the test.   Items should also appear valid to the parents of the children being tested.

◆ Items must be safe to administer in a clinical setting

◆ Items must involve therapist ratings rather than child or parent interview ratings as the SPCM is being designed to measure behaviors that the child demonstrates during testing rather than behaviors which are reported.

◆ Items must not compromise the dignity of the child, e.g., items requiring clothing removal should be avoided

Domain Specifications

Two test domains were identified through a review of postural control theory and by grouping the lists of postural control seating goals generated by clinicians and those discussed in the seating literature. The test domains which seemed to emerge were subsequently labelled "alignment" and "functional movement". Additional item specifications were developed for items in each of these domains.

Alignment domain specifications required that the items assess an aspect of body segment alignment which was thought to change as a result of adaptive seating intervention and which could be scored using visual inspection and palpation only.

A function domain specification was that items had to involve a task goal and must be meaningful to the child. Functional movement items should not measure the movement strategy used by the child to perform a given task but rather the degree to which the movement goal (i.e., the task) is achieved.

Item Generation

Items fitting the specifications were generated through literature review, examination of existing measurement tools and discussions with clinicians working in the seating clinic at Sunny Hill Health Centre. The measurement tools which contributed to the generation of items were the Gross Motor Function Measure (Russell et al., 1990), the Assessment of Behavioral Components: Analysis of Severely Disordered Posture and Movement in Children with Cerebral Palsy (Hardy et al., 1988), the Peabody Developmental Motor Scales (Folio & Fewell, 1983), the Posture and Fine Motor Assessment of Infants (Case-Smith, 1988), and the Movement Assessment of Infants (Chandler, Andrews & Swanson, 1980). Although specific items were not adopted from these measures, they did provide valuable information on item format.

The initial item pool consisted of thirty-one items, twenty-two of which were alignment section items. Body segments for which items were generated in the alignment section included the pelvis, trunk, head, thighs, lower legs, and ankles. The three cardinal planes of movement

were considered in the development of items for the alignment section and items were thus generated for proximal body segment position in each of these planes. Items for knee and ankle positions were only generated for the sagittal plane due to the difficulty anticipated in detecting the small angular deviations of these joints in the other planes and the opinion of clinicians that these joint positions were not affected by adaptive seating interventions. Although some aspects of shoulder alignment were captured with trunk alignment items, no alignment items were generated for distal upper limb segments because seating goals typically do not include changes in static upper limb alignment.

Nine function items were generated within the initial item pool. These items assessed achievement of seated functions including head and trunk control, reach, grasp, release, bimanual manipulation, and wheelchair management.

Generated items were scaled and pilot tested in the clinic with children of varying ages and abilities to evaluate their clinical feasibility and to determine whether sufficient response options were present. Based on this experience, six additional items were generated for the function section to increase the range of functional movements tested. Drafts of the generated items were then mailed to seven external seating experts for their opinions on the face and content validity, comprehensiveness, clarity, and clinical feasibility of the items. Experts, selected from Canada and the United States, were either clinical coordinators of seating units, authors of adaptive seating books, or executive members of professional adaptive seating organizations (see Appendix #1). These external reviewers suggested several additional categories of seating components for the documentation of the child's currently used seating

system as well as the elimination of a number of function items which scored right and left upper limb movements separately. They felt that the child who had functional use of only one arm would repeatedly lose points on the items testing the more involved arm and thus the total change score would be significantly lowered. Reviewers also found some of the pictorial representations of the pelvis and hip items on the scoring sheet confusing.

Based on reviewer comments and insights gained from clinical trials, further seating component options were added to the cover sheet and many of the items were refined. Item refinements involved clarification of item descriptions and the addition of angle reference features to graphic depictions of alignment items.

Item Scaling

For the alignment items, graphic representations and written descriptions of postures are used to facilitate administration and scoring of the test items. A neutral position of each body segment in the sitting position is defined and increasing angular deviations from the neutral position represent mild, moderate and severe degrees of abnormal alignment. An ordinal scale of 1 to 4 is used to score each segmental posture. Scale increments were selected to be as sensitive as possible to detect changes in alignment yet also be able to be reliably scored. Alignment item scales were generated by operationalizing clinicians' definitions of their routinely used categories of normal alignment to severe alignment deviations for each body segment. The width of scale categories were thus unique to each item.

Each of the 12 items in the Function Section is scaled using four criterion-referenced levels, with higher grades representing better task achievement (from zero to completion). By giving credit for partial task achievement, this four-level function item scale is more sensitive to changes which may occur as a result of seating intervention than is a scale which only credits full task achievement.