Chapter 4
Peabody Developmental Motor Scales - Second Edition (PDMS-2)
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4.1 FOUNDATIONS OF PDMS-2

The original PDMS was published in 1983 by Folio and Fewell for various purposes (i.e. to determine developmental skill level of a child, to identify skills that were not developed or not in the child’s repertoire, and to plan an instructional program to develop that skill). Its motor skills repertoire and comprehensive age ranges were broader than that of BSID-I & BSID-II (as these do not provide separate assessments for gross & fine motor functions). These properties helped PDMS to be considered as well-credentialed test to assess motor development for early intervention.

But when PDMS was developed, test developers (Folio and Fewell) did not adhere to any specific theoretical perspective as its conceptual foundation. Folio (1975), DuBose and Folio (1977), Harris (1981), Jenkins, Fewell and Harris (1983), Campbell and Stwart (1986), Boucher and Doescher (1992), and Block and Davis (1996) have shown that children receiving targeted motor intervention program (which promotes identified sequential skills) make significant gains in motor development. Wickstrom (1983), Robertson and Halverson (1984), Halverson and Williams (1985), Ulrich (1985), Eichstaedt and Kalakian (1993), Payne and Issacs (1995), Gallahue & Ozmun (1995) and Block (1995) advocated to use qualitative and quantitative approaches for the evaluation of motor skills. The findings of these studies and practical experiences of PDMS urged test developers to revise PDMS. Thus, the Peabody Developmental Motor Scale -Second Edition (PDMS-2) was published in the year 2000.

General developmental framework has been adopted in PDMS-2 and it contains both qualitative (refers to how well child performs the skill) and quantitative (refers to how many skills child is able to perform) approach to assessment.
4.2 GENERAL OVERVIEW OF PDMS-2

PDMS-2 is a norm referenced scale containing 249 items. It is composed of six subtests that measure interrelated motor abilities that develop early in life. Normative sample of PDMS-2 involves cross-sectional sample of 2,003 subjects (includes 10% children with special needs) living in United States of America and Canada. It can assess motor skills in children from birth through 6 years of age (0-71 months). PDMS-2 scale is adapted in countries like; USA, Canada, Australia, Netherlands, Taiwan and India for research works.

I. SUBTESTS DESCRIPTION

Following are the components and subcomponents of the PDMS-2 scale:

A. Gross Motor Scale:

a) Reflex: 8- Items Reflex subtest, measures aspects of a child’s ability to automatically react to environmental events. Since reflexes typically get integrated at 12 months of child’s age, so this subtest is given only to children from birth through 11 months of age.

b) Stationary: 30- Items Stationary subtest, measures a child’s ability to sustain control of his/her body within its centre of gravity and retain equilibrium.

c) Locomotion: 89- Items Locomotion subtest, measures a child’s ability to move from one place to another. The activities analyzed are crawling, walking, running, hopping, and jumping.

d) Object Manipulation: 24- Items Object Manipulation subtest, measures a child’s ability to manipulate balls. The activities analysed are throwing, kicking, and catching a ball. This subtest is given only to children ages 12 months and older.
B. Fine Motor Scale:

a) Grasping: 26- Items Grasping subtest, measures a child’s ability to use his/her hands. It begins with ability to hold an object with one hand and progress to actions involving both hands.

b) Visual-Motor Integration: 72- Items Visual-Motor Integration subtest, measures a child’s ability to use his/her visual perceptual skills to perform complex eye-hand coordination tasks (i.e. reaching, grasping for objects, building with blocks and copying design etc.)

II. COMPOSITE DESCRIPTION

Subtests results are used to generate three global indexes of motor performance called composites.

(a) Gross Motor Quotient: The Gross Motor Quotient (GMQ) is a composite of subtests results that measure the use of large muscle systems. Three of the four subtests form this composite score: Reflexes (Birth to 11 Months only); Stationary (all ages); Locomotion (all ages); Object Manipulation (12 Months and Older). High scores on GMQ are attained by children with well developed gross motor abilities having above average movement and balance skills. Such children will have good agility and coordination with graceful movement. Low scores on GMQ are obtained by children with weak movement and balance skills and these children will have difficulty in learning to crawl, walk and run.

(b) Fine Motor Quotient: The Fine Motor Quotient (FMQ) is a composite of two subtests results that measures the use of small muscle systems. This composite score is formed by 2-subtests: Grasping (all ages); Visual-Motor Integration (all ages). High scores on FMQ are acquired by children with well developed fine motor abilities. Such children would have above average skills in picking up small objects, drawing figures and stringing beads. They will be described as good with hands. Low scores on FMQ
are obtained by children with weak grasp and visual-motor integration skills. They have difficulty in learning to pick up objects, drawing designs and using hand-held tools.  

(c) Total Motor Quotient: The Total Motor Quotient (TMQ) is formed by combination of the results of gross and fine motor subtests. This is the best estimate of overall motor abilities.

III. SCORING CRITERIA

Each PDMS-2 item employs three-point rating scale with specific scoring criteria. The general criteria for scoring items are following:

2  The child performs the items according to the criteria specified for mastery.

1  The child’s performance shows a clear resemblance to the items mastery criteria, but does not fully meet the criteria.

0  The child cannot and will not attempt the item, or the attempt does not show that the skill is emerging.

IV. TEST ADMINISTRATION

For easy administration of PDMS-2 test, entry/start point, basal level and ceiling level are used for all the subtests:

a. Entry/Start Point: The Entry/Start Points are marked on each subtest in Examiner Record Booklet. It is determined empirically to allow the examiner to begin testing on an item that 75% of children in the normative sample at that age have passed.

b. Basal Level: The basal level is established when child receives a score of 2 on three successive items in a row. The last three 2s before the 1 or 0 becomes the basal level. The tester begins testing the child with an entry point item. If child does not score 2 on each of the first three items administered (i.e. if child scores 0 or 1 on any of the first three items
administered starting from the entry point), then tester should test backward until child scores 2 on three items in a row. This will be the Basal Level. All items below the basal are scored 2.

c. Ceiling Level: Once the basal level is determined, tester administers progressively more difficult items until a ceiling is achieved. The ceiling is established when child scores 0 on each of the three items in a row. Once ceiling level is established, testing is discontinued.

V. TEST SCORE AND THEIR INTERPRETATION

PDMS-2 gives 5 types of scores: raw scores, standard scores, age equivalents, percentiles, and composite quotients. These scores provide most important information regarding infants/children’s motor performance. Information about each of the above mentioned scores are discussed below:

a) Raw Scores: Raw scores are total points accumulated by a child on a subtest. Because level of difficulty for items on different subtest varies, so raw scores are of little clinical value but is important for research purposes i.e. to make group comparisons or to compute coefficients.

b) Standard Scores: Standard scores provide clearest indication of a child’s subtest performance. It allows examiner to make comparisons across subtests. Subtest standard scores are converted from raw scores based on the distribution with a mean of 10 and a standard deviation of 3. Standard Scores for PDMS-2 subtests are generated through manual’s reference Table A.1- A.37 or via PDMS-2 software scoring and report systems.

c) Age Equivalents: Developmental ages are often used to convey information to parents of young children. Age equivalents for PDMS-2 are called ‘motor ages’ which convey to parents that their child is passing on items that child of a certain chronological age typically pass. Age Equivalents for PDMS-2 subtests are generated through manual’s
d) Percentiles: Percentiles (Percentile Rank) represent a value that indicates percentage of the distribution which is equal to or below a particular score. Since this interpretation is easy to understand, so it is a popular score for practitioners, while sharing test results with others. It is important to note that distance between the two percentile ranks becomes much greater, as those ranks are more distant from the mean or average (i.e. 50th Percentile). Percentiles for PDMS-2 subtests are generated by manual’s reference tables A.1-A.37 or via PDMS-2 software scoring and report systems.

e) Composite Quotients: Quotients are most reliable scores for PDMS-2 scale. It reflects examinee’s ability relative to the basic constructs built in to the test. It comprises many representative subtests instead of only one, thus quotients tend to be highly reliable. GMQ, FMQ and TMQ are derived by adding the subtest standard scores and converting the sum to a quotient (based on the distribution with a mean of 100 and a standard deviation of 15). Percentiles for PDMS-2 quotients are generated using manual’s reference tables table B.1 or via PDMS-2 software scoring and report systems.

VI. USES OF PDMS-2

According to Folio and Fewell, PDMS-2 can assist in early detection and in longitudinal monitoring of motor delays in the age range of birth to 71 months.

The PDMS-2 has 5 principal uses:

a) To estimate a child’s motor competence relative to his/her peers,

b) To compare gross and fine motor disparity using quotients scores,
c) To provide qualitative and quantitative aspects of individual skills and translate the identified skill deficits as individualized goals and objectives,

d) To evaluate a child’s progress during successive tests and make comparison across the administrations, and,

e) To provide as a research tool.

VII. PSYCHOMETRIC PROPERTIES OF PDMS-2

PDMS-2 is extremely valuable as research tool, because scores can be used to study the;

a) nature of motor development in various populations of children,

b) role of motor ability in academic success, and

c) effectiveness of various motor interventions.

Simple administration procedure and comprehensive test manual are important clinical merits, which provide technical and psychometric information for clinical use. Using conventional test theory, Folio and Fewell have found PDMS-2 to have satisfactory reliability \(^{26}\) (i.e., Internal consistency \[0.71 \leq \text{Cronbach’s alpha} \leq 0.98\], test-retest reliability \[0.73 \leq \text{Pearson r correlation coefficient} \leq 0.96\], and inter-rater reliability \[0.73 \leq r \leq 0.96\]) and acceptable validity (i.e., content validity, concurrent validity \[0.84 \leq r \leq 0.91\] by correlation with the original PDMS) and criterion validity \[0.55 \leq r \leq 0.86\], by correlation with the Mullen Scales of Early Learning: AGS edition). \(^{26}\)

Recently, high test-retest reliability \(0.84 \leq \text{Spearman p correlation coefficient} \leq 0.98\), high Interrater reliability \(0.94 \leq p \leq 0.99\), acceptable convergent validity \(p=0.69\) with the M-ABC (Movement Assessment Battery for Children test), and discriminant validity of the FM scale in PDMS-2 were re-confirmed in children with/without mild FM problems. \(^{56}\) The high test-retest reliability \(0.88 \leq \text{Intraclass correlation coefficient} \leq 1.0\) was found and its responsiveness (ability to detect changes) were confirmed in children with cerebral palsy. \(^{57}\) Modest relationships \(0.67 \leq r \leq 0.76\) and \(0.22 \leq r \leq 0.32\), respectively) between PDMS-2 and BSID-II were
found in children with developmental delays \textsuperscript{58} and typically developing infants. \textsuperscript{59}

Also construct validity (i.e., dimensional structures) of PDMS-2 has been supported by the confirmatory factor analysis. \textsuperscript{26} Item characteristics (e.g. Item difficulty and discrimination power) for each PDMS-2 item has been examined in the use of a two-parameter model in item response theory (IRT) \textsuperscript{26}, but details of IRT analysis was not reported \textsuperscript{10}.