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A New Inventory for Assessing *Affordances in the Home Environment for Motor Development (AHEMD-SR)*

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Abstract A contemporary view of motor development considers environmental influences as critical factors in optimal growth and behavior, with the home being the primary agent. The intent of this communication is to introduce the *Affordances in the Home Environment for Motor Development Self-Report (AHEMD-SR)* to early childhood practitioners. The *AHEMD-SR* is a reliable and valid parental self-report assessment instrument that addresses the quality and quantity of factors (affordances and events) in the home that are conducive to enhancing motor development in children ages 18–42 months. The instrument could provide useful information in a wide variety of settings, including applications to intervention and remediation.

Keywords Early childhood · Motor skills · Motor assessment · Home environment

The purpose of this communication is to introduce the *Affordances in the Home Environment for Motor Development Self-Report (AHEMD-SR)* to early childhood practitioners, teachers, childcare providers, and teacher educators. The *AHEMD-SR* is a reliable and valid parental self-report assessment instrument that addresses the quality and quantity of factors (affordances and events) in the home that are conducive to enhancing motor development in children ages 18–42 months (Rodrigues et al. 2005).

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Background and Significance

Contemporary research in child development suggests quite convincingly that an optimal level of development occurs with a stimulating environment and strong contextual support (Bronfenbrenner 2000; Diamond 2000). Furthermore, these factors may have even more impact during the first years of life. Of the various factors comprising the environment, few would disagree that the *home* is a primary agent for learning and development. For the past half century, considerable effort has been devoted to mapping the relations between the home environment and selected aspects of the child's development. Perhaps the most notable attempt in this area—the *Home Observation for Measurement of the Environment* (HOME) inventory by Caldwell and Bradley (1984)—has been used in numerous studies to examine environmental effects on cognitive and social development. Interestingly, although the HOME inventory was not designed to specifically examine the relationship to child motor development, one of the most striking and consistent findings has been *"availability of stimulating play materials"* as a predictor of future mental behavior (Abbott and Bartlett 1999; Mundfrom et al. 1993).

Although specific home environment and motor development characteristics have been examined; for example, availability of toys and the child's level of fine- and gross-motor development (Abbott and Bartlett 2000; Adolph and Avolio 2000; Bartlett and Fanning 2003), the fact remains that minimal information is available in relation to the multidimensional effects of the home,

especially on motor development. The following examples illustrate the promise of this line of inquiry—Goyen and Lui (2002) examined motor development at 18-, 36-, and 60-months in a group of 58 "apparently normal" high-risk infants. Their intent was to determine the relation of motor behavior to the quality of the home environment as measured by the HOME inventory. They concluded that the home environment differently influenced the development of gross and fine motor skills. Infants with a lower HOME score consistently scored poorer on Peabody motor scores, however, the difference was only significant for the gross motor skills. Abbott et al. (2000) used the HOME inventory and the Alberta Infant Motor Scale (AIMS) to assess 43 homes and the children's motor development. Although there was lack of statistical support for the hypothesized relation between home environment and motor development, related evidence suggested that a more supportive home environment was associated with higher infant motor development. According to Abbott and colleagues, lack of sensitivity in the HOME inventory (ceiling effect), questionable validity of the HOME inventory to support infant motor development, homogeneity of family aspects (median and high SES) and significantly high motor scores with the AIMS, could have combined to reflect the results. The researchers concluded that although the home environment is surely within the host of subsystems that contribute to infant motor development, little research exists examining this relationship. Furthermore, they strongly emphasized that, "a valid measure reflecting aspects of the home environment that support infant motor development needs to be created" (Abbott et al. 2000, p. 66). Arguably, such an instrument could have potential for enhancing our understanding of the role of the home on early childhood motor development. In addition, such an instrument could provide useful information in a wide variety of settings, including schools and educational research, with applications to intervention and remediation.

Theoretical Basis and Development

The starting premise, founded in selected propositions of ecological theory (Gibson 1979, 2002) underscores the notion that the home provides *affordances* that can be conducive to stimulating motor development. Although the term affordance has been interpreted in several ways, ours is one of a more general nature. Affordances are opportunities that offer the individual potential for action, and consequently to learn and develop a skill or a part of the biological system (Heft 1997). In addition to the more obvious set of affordances such as toys, materials, apparatus, and availability of space, stimulation and nurturing by parents (and others) provide the additional component of *events*. This view agrees with Stoffregen (2000) and Hirose (2002) in that events can be affordances—events offer the child opportunities for action. Hirose stated, "Affordances are opportunities for action that objects, events, or places in the environment provide for the animal," (p. 104).

Steps in the development of the *AHEMD-SR* included initial face validity determination, expert opinion feedback and selective pilot-testing. Construct validity and reliability was examined using Portuguese and US families. We hypothesized that affordances are organized according to a common structure that can be represented by a number of specific stable dimensions of the home environment. Of the five plausible models tested by a confirmatory factor analysis (used to assess construct validity; Joreskog et al. 1999) the 5-factor solution provided the best fit to the data: *Outside Space* (OS), *Inside Space* (IS), *Variety of Stimulation* (VS), *Fine Motor Toys* (FMT), and *Gross Motor Toys* (GMT). All fit indexes were over .90, the root mean square error of approximation was smaller than 0.5, and all factors were well defined by single path loadings. The standardized factor loadings varied in a range from .33 to .85, but revealed in every case a statistically significant *t*-ratio ($p < .001$) (Rodrigues et al. 2005, p. 145). Reliability was established through the *scale reliability coefficient* with a value of .85 with a SE of 0.028, and a 95% CI ranging from .80 to .91, which indicated a high consistency of the instrument for measuring the construct of interest.

The *AHEMD-SR* consists of the five factors (subscales) described earlier plus a section on *Child and Family Characteristics.* Three types of questions are used: simple dichotomic choice, 4-point Likert-type scale, and description-based queries; representing 20 variables and 67 items. Table 1 provides examples of the first two types of questions. In addition, pictorial examples with the description-based queries are provided to help the user identify available categories and specific items (see Fig. 1). Readability was established at an approximate fourth grade reading level. Although the *AHEMD-SR* is reliable as a self-report by parents/caregivers, in some cases, direct administration by an examiner (in the home) is appropriate.

Potential Use in Education and Intervention

Although the *AHEMD-SR* was initially developed as a research instrument to enhance our basic understanding of the potential of the home environment in optimizing motor development of the child, its use in clinical and educational settings has equally significant potential. For example:

Table 1 Examples of simple dichotomic and Likert scale questions

Simple dichotomic	YES	NO
Outside your house (but associated with it) is there ample space for your child to play or move around freely (backyard, front yard, garden, etc)?	☐	☐
4-point Likert-type scale		
On a typical day, how would you describe the amount of awake time your child spends in a seating device (high chair, stroller, car seat, sofa, etc)?		
No time ☐ *Very little time* ☐ *Sometime* ☐ *A long time* ☐		

Fig. 1 Examples of pictorial illustrations to aid identification

Puzzles (2-3 pieces) and Shape Sorters (fine-motor)

Examples are:

How many of these toys do you have in your house?

None ☐ One ☐ Two ☐ Three ☐ Four ☐ Five ☐ More than 5 ☐

Play materials used for gross movement exploration (sliding, creeping, climbing, rolling, etc). Examples are slides, stairs, tunnels, climbing apparatus, exercise mattresses, parachutes.

Examples are:

How many of these toys do you have in your house?

None ☐ One ☐ Two ☐ Three ☐ Four ☐ Five ☐ More than 5 ☐

- The *AHEMD-SR* can be used to improve the relationship between teacher and parent and therefore increase the level of child readiness for learning.
- This instrument can be used as a tool for early intervention. That is, assessment of the home (by parent, professional, or future teacher) followed up with recommendations for home modification and parental education by the early childhood professional. As noted earlier, developmentally appropriate plays materials and parental stimulation can be strong influences in child development. This observation may be especially relevant to children at risk.
- For teachers educators, the *AHEMD-SR* is a viable tool for providing interaction between future teachers and parents in the home setting. Future educators can experience cultural and economic diversity, as well as

gain insight to the diverse educational characteristics (toys, play equipment, stimulation) associated with the home.

Potential Use in Research

One of the most logical next steps in the progress of the *AHEMD-SR* is to examine the relationship between specific aspects of the home (inventory) and the child's level of motor development. That is, via comparing the instrument's components (total score, subscale and items) with an appropriate motor assessment tool. For example, comparing *AHEMD-SR* scores to: *Peabody Developmental Motor Scales*, *Bayley Scales of Infant Development (Bayley-III)*, *Test of Gross Motor Development-2*, and the *Movement Assessment Battery for Children*. One of the key hypotheses would be that a low *AHEMD-SR* score would complement the likelihood of a low motor development profile. And, following this reasoning, a high (inventory) subscale score would complement a higher level of motor development for the related area of behavior; for example, Gross Motor Toys (GMT) and gross motor development. Other areas for potential research are:

- Comparing *AHEMD* scores with later academic performance. This could be a major complement to the findings of the HOME Inventory mentioned earlier. Possible avenues of inquiry could include a study of the relationship between early experience with specific toys and play materials and (for example) handwriting ability and cognitive development in preschool and primary grades.
- Observing the longitudinal characteristics of the instrument. For example, tracking *AHEMD-SR* scores and behavior (motor and mental) over time.
- Testing the instrument's clinical significance for early intervention. For example, as a follow-up to assessing the home, the environment could be modified to include developmentally appropriate fine-motor materials—then, over time, examine the effects on behavior. This may be especially interesting with high-risk populations such as infants born with low-birth weight, or from low-income homes.
- Given that level of stimulation is a potentially significant factor, future research should consider a more in-depth analysis of this component. Currently, the questions related to level of stimulation are somewhat broad; these could be expanded and modified for greater detail depending on the specific research questions addressed.
- Examining cross-cultural characteristics; comparing home environments from different cultures.
- Exploring the instrument's application in daycare and early childhood centers.

Since the published report of findings (Rodrigues et al. 2005), the *AHEMD-SR* has been introduced in six countries as a research instrument and translated from English to Portuguese, Spanish, Chinese, and most recently to Italian. The *AHEMD-SR* is free and available for download via this website: http://www.ese.ipvc.pt/~dmh/AHEMD/ahemd.htm. There is also an on-line version that includes a calculator (Microsoft Excel required) with an instant results section indicating a score ranging from 0–4 (very low to high) for five categories (Inside Space, Outside Space, Variety of Stimulation, Fine Motor Toys and Gross Motor Toys).

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