International Journal of Early Years Education
Vol. 12, No. 2, June 2004

Carfax Publishing
Taylor & Francis Group

Utilizing parental observations and computer technology in developing a child-screening instrument in Singapore

Celina Kwan[1*] & Sang Seok Nam[2]
[1]*University of Alaska Anchorage, USA;* [2]*Albany State University, USA*

It is widely known that parent–teacher partnerships are vital to children's progress in their development and learning in schools. These partnerships involve parent–teacher conferences, parents helping in the classroom, teachers making home visits and parent education seminars. However, partnerships rarely extend to having parents involved in the assessment process of their children in a significant way. In Singapore, opportunities for parents to be involved in the assessment process exist but only when invited by a professional, and this is only to a limited extent. Routinely, when professionals assess a child, parents are asked for their observations of their progress at home. However, such information gathered from parents is informal, unorganized and used on a supplementary basis. Hence, it was the purpose of this research project to develop a child-screening instrument that utilized observations of Singaporean parents in an organized fashion by the help of computer technology. With this, it is hoped that the involvement in the assessment process will educate and empower parents to make decisions and play a more active role in the identification of their children's learning needs.

This paper reports the use of parents' observations of their children across five developmental domains in the device of a computer-based child-screening questionnaire in Singapore. The Developmental Screening Questionnaire (DSQ) is developed as an initial screening tool to detect potentially at-risk children within the age range of one to six years. This paper also describes the validity and utility of the instrument, making use of computer technology in the test administration process.

Introduction

Parental involvement in the assessment process

For many years, professionals have determined the eligibility and goals of education for children with disabilities based only on their own assessment results (Garshelis & McConnell, 1993). Although the appraisal of a child's developmental competency is an important component in the assessment procedure, perceptions of parents regarding their child's developmental status and needs have not assumed equal

*Corresponding author: School of Education, University of Alaska Anchorage, 3211 Providence Drive, Anchorage, AK 99508, USA. Email: ckwan@uaa.alaska.edu

ISSN 0966-9760 (print)/ISSN 1469-8463 (online)/04/020117-13

DOI: 10.1080/0966976042000225516

weight in the decision-making process (Kochanek, 1993). In most cases, parents have been excluded from assessment because of the belief that assessments must be administered in a standard fashion and that this can be done only by a person with requisite training. Even when assessment tools are based on naturalistic observations rather than on standard testing, parental involvement has been limited because of the belief that observational skills are learned only with extensive training (Sheenhan, 1988).

Since parents have a rich history of observations and experiences with their children, information obtained from parents can represent a highly reliable source of input that contributes unique information to the screening process (Henderson & Meisels, 1994). However, more extensive utilization of parental information in assessment of young children has generally been overlooked.

Parents can bring unique contributions to the assessment procedure, especially in describing how the child functions within the family context. Parents' observations also serve an educational purpose because they learn to identify age-appropriate behaviors (Byrne *et al.*, 1986). It has been reported that when parents have a more accurate picture of their child's development, the child's developmental progress is better (Hunt & Paraskevopolous, 1980).

In the USA, the Individuals with Disabilities Education Act, a major federal law for the education of children with disabilities, mandates that a child-find system needs to be set up in each state to locate preschool-aged children at risk and make referrals to the local education agency. The role of the local education agency is, then, to assess the type and extent of a child's perceived delays. This means that the child-find system has to screen the entire population of preschool-aged children while the local education agency deals with referral cases only. It seems reasonable, then, to utilize parental observations in the initial screening process to fulfill the law's intention.

Parent and professional congruence in screening

A number of investigations have examined congruence between parental assessments of their child with professional assessment. Some researchers used parent-completed questionnaires and reported substantial accuracy of parental assessment of their infants' developmental status (Frankenburg *et al.*, 1976; Knobloch *et al.*, 1979). Statistically significant correlations have also been found between parental reports on questionnaires and professionally administered standardized assessments (Stancin *et al.*, 1984; Kenny *et al.*, 1987; Saylor *et al.*, 1991).

Bricker and Squires (1989a, b) developed a series of monitoring questionnaires and asked parents to report on all domains of their child's behavior. They found a substantial agreement between parents' and professionals' reports. The agreement between classifications of infants judged by the standardized tests and the questionnaires was high, ranging from 86% to 91%. Cools (1982) used a parent-completed questionnaire as a pre-screening tool. He investigated whether and to what extent it might be possible to use a short, parent-completed questionnaire to identify those children who demonstrate no developmental problems. The questionnaire was

found to be a useful instrument for increasing efficiency of the process of early detection of developmental problems. The parents were found to give accurate answers to the questions and proved to be good assessors of their child's developmental level with the aid of a questionnaire (Cools, 1982).

Research, however, has suggested that parents' estimates tended to be somewhat higher than those derived from professionals (Gradel *et al.*, 1981; Hagekull *et al.*, 1984; Sexton *et al.*, 1984, 1990; Stancin *et al.*, 1984). For example, Sexton *et al.* (1990) compared maternal judgments about the developmental status of their children enrolled in early intervention programs with developmental testing data obtained for 53 children. The results indicated that although maternal and professional estimates were highly correlated, mothers provided overestimates of development relative to actual performance. The greatest parent–teacher disagreement was in the area of speech and language (Sexton *et al.*, 1990). In another study, parents' estimates of their children's development were about 3.6 months higher than professionals' estimates (Hagekull *et al.*, 1984). Sheehan (1988) reviewed 24 empirical studies of parental and professional agreement in early childhood assessment and found that in 18 of them mothers rated their children's developmental status significantly higher than did professionals.

Beckman (1984) pointed out that parents were often asked to make judgments concerning their children's developmental status with different assessment tools from professionals. Beckman designed a study to determine whether maternal assessments of their young children with handicaps would be consistent with those of professionals if mothers and professionals used similar assessment techniques. When parents were given the same instruments with which to evaluate their child, they obtained very similar results to those of the professionals.

Sexton *et al.* (1990) suggested that close parent–professional collaboration is important in both the design of specific intervention programs and the ongoing assessment of child and family outcomes. Parents' and professionals' observations on a child's capabilities together contribute more information than is available from either one alone (Diamond, 1993). Child developmental data across contexts and from multiple sources will give a clearer direction for the family-centered intervention service.

Parental judgment of child development

Hunt and Paraskevopolous (1980) found significant positive relations between the accuracy of maternal prediction and the child's overall developmental performance. The study pointed to the importance of the match between a mother's developmental expectations and her child's actual developmental level. For example, mothers who have accurate knowledge of their child's developmental level are more likely to provide developmentally appropriate learning experiences for their children. Significant positive correlation has also been reported between parental predictions and the performance of infants with developmental handicaps (Donnelly *et al.*, 1984; Stancin *et al.*, 1984).

Parental perceptions of a child's development may influence child outcomes and parent–child interactions. If parents become familiar with early development with a screening tool, this may help them to establish appropriate expectations. These expectations might enable them to create an optimally challenging environment in which their children can acquire proper behaviors.

Screening errors

The assumption underlying developmental assessment is that with early identification of developmental delay or deficit, appropriate stimulation or intervention may be initiated that might reduce the impact of later problems (Byrne *et al.*, 1986). In assessment procedures, screening is the process of identifying those children in need of further in-depth assessment. Screening does not specify the nature of the problem; however, it does inform us of the suspected presence of developmental problems. Additional assessment is then required to confirm the presence of a developmental delay or handicapping condition (Widerstrom *et al.*, 1991). In that way, the professional may make recommendations and suggest referrals for additional assessment, service, or assistance.

Two potential errors can occur during screening. First, the screening procedures may indicate that a child has delay when in fact s/he does not. As a result, the child may be referred for assessment unnecessarily. Second, the screening procedures may indicate that a child does not have developmental delay or disability when s/he actually does. Ideally, the primary screening would neither identify a normal child as at risk nor fail to identify a child who has a disability. The enactment of the law in the USA will certainly increase the number of children who go through the screening process and it will also result in a number of children being falsely identified.

An alternative screening tool

In order to predict the child's future development adequately, effective screening should include data from parents' knowledge of their children. It is important to find a way in which parents can easily and dependably assess their children. A special issue of *Exceptional Children* reported efforts to improve the quality of assessment in the context of advances in technology (*Exceptional Children*, 61(2), 1994). That issue reflected current interests of computer-based assessment in special education. Several advantages can be assumed when using computer technology in the assessment. It can (a) reduce total assessment administration time; (b) give immediate results to users; and (c) reduce recoding and computing errors, hence increasing scoring reliability and reducing the cost of the assessment.

Development of the Developmental Screening Questionnaire

Purpose

The Developmental Screening Questionnaire (DSQ) is devised for use by parents as an initial screening tool to detect potentially at-risk children within the age range of

one to six years. The DSQ utilizes computer technology to assist parents to conduct the screening questionnaire reliably and to inform them of their child's developmental status immediately. It is hoped that this process will enable parents to know when to seek further assessment of their child if at-risk development is initially screened by the DSQ. The instrument also provides parents with information on local resources and general advice for child development.

Norm sampling

The norm sample for the item validation was taken in Singapore. Singapore is a city-state on an island located between Malaysia and Indonesia in Southeast Asia. Singapore consists of main three ethnic groups: Chinese (77%), Malay (14%), and Indian (8%). A quota sampling method by ethnicity and age of child was adopted to obtain an adequate sampling distributed across different age levels of children and three ethnic groups. The ethnic quota of the sample was consistent with the ethnic composition of the 2000 national census (Leow, 2001).

About 20 research assistants were recruited and trained to help parents to complete the demographic survey and questionnaire on paper. Parents were given explanations about the purpose of the survey and informed that their participation was voluntary. Only parents who were over 18 years of age and could read questions in English were invited to complete the survey. Research assistants contacted parents in homes, childcare centers, kindergartens, medical centers in communities, and community centers.

The sampling quota was monitored during the process of collecting responses. This meant that if a cell of quota was filled, then responses that arrived later were not included in the sample. Initially 788 parents with 6- to 78-month-old children completed and handed in their responses. Cases that overfilled quotas and those with incomplete answers ($n = 239$), children with some disability ($n = 6$) and non-parent responses ($n = 37$) were excluded from the data analyses. The final sample for the data analyses consisted of 506 parents—376 mothers (74.3%) and 130 fathers (25.7%). Table 1 presents the characteristics of the sample by the child's age and sex. Figure 1 shows child characteristics by ethnic group, relationship, education level, and family income.

The DSQ was normed on a reasonably representative sample in terms of parents' educational and income level. It is noted that 54% parents of the sample had the least formal education, i.e. O level or less. Since the validation of the DSQ was based on responses from three ethnic groups, that is Chinese, Malay, Indian, it is inappropriate for parents from other ethnic groups (such as Eurasian) to use this screening questionnaire.

Item generation

The DSQ consists of items describing developmental milestones of children in five areas: cognitive, personal–social, speech–language, fine-motor, and gross-motor

Table 1. Norm sample by child's age and sex ($N = 506$)

Age in months	Male	Female	Total
6–8	18	16	34
9–10	16	16	32
11–12	18	8	26
13–14	8	12	20
15–16	10	20	30
17–18	14	13	27
19–20	5	9	14
21–22	5	5	10
23–24	8	8	16
25–27	12	11	23
28–30	12	6	18
31–33	16	14	30
34–36	11	18	29
37–39	12	10	22
40–42	8	8	16
43–45	7	7	14
46–48	5	8	13
49–54	15	17	32
55–60	14	14	28
61–66	15	13	28
67–72	16	13	29
73–78	10	5	15
Total	255	251	506

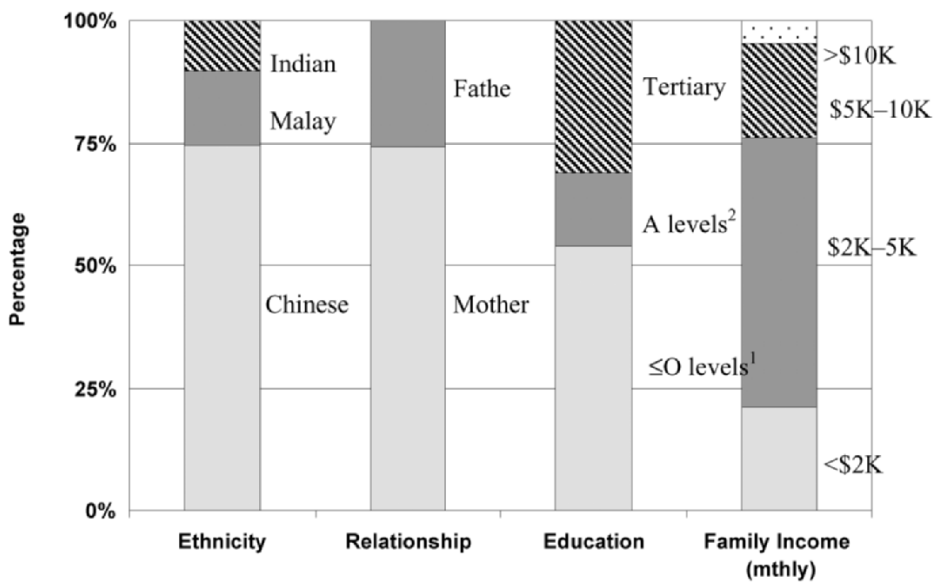

Figure 1. Demographic information of parents

Notes

1. National exam taken at end of secondary school (age 16).
2. National exam taken at end of junior college (age 18).

Table 2. Definitions of developmental areas

Development area	Definition
Cognitive development	Concerned with pre-academic skills such as sorting, counting, remembering things, and planning what to do in the future. This also includes the ability to integrate newly learned information with previously learned knowledge and skills, solve problems, and generate novel ideas
Personal and social development	Concerned with skills that lead to independence and self-regulation. Personal skills such as eating, dressing, maintaining personal hygiene, and other skills necessary to take care of personal needs. Social skills such as the ability to get along with others, making friends, sharing toys, taking turns, and cooperating with others. It is also important for a child to have the ability to express his/her emotions and feelings
Language and speech development	This area includes a child's ability to use non-verbal gestures or actions, and the acquisition of spoken language, for example sound, words, phrases, and sentences. Ability to use written, spoken and manual symbols to exchange information about needs, feelings, knowledge, and desires
Fine-motor development	Concerned with small-muscle control such as writing, tying, eye–hand coordination, grasping, and manipulation of small objects
Gross-motor development	Concerned with large-muscle movements such as walking, running, head balance, sitting, and standing

development. With reference to Table 2, each developmental area is defined to facilitate the generation of items. Items were generated from a review of child development literature, particularly studies of milestone development (e.g. Bayley, 1993). From the survey of child development literature, a pool of 310 statements describing young children's developmental milestones was generated. The only criterion used in the generation of items was that parents or primary care givers could recognize them easily from their daily interactions with children. These 310 statements were changed into a question format so that parents could answer whether their child could perform the tasks described.

Finalizing items

Analysis of variance (ANOVA) was conducted for each item and no significant differences between group variables such as gender, ethnicity, and education level of parents were found. The following criteria were then used to confirm the final 178 items of the DSQ:

1. Items that did not have a significant difference (at the .01 level) between groups by sex, ethnic group, and education level of parents.
2. Items that had enough age-discriminating power; that is, items that had an increasing number of positive responses from parents at as much as 75% and maintained thereafter.
3. Selection of items, sometimes overriding decisions made previously (criterion 1) to secure a minimum number of items (a range of 1–3 items) at any age range.

Age value of items

The age value of an item refers to the age at which the developmental milestone first appears in a large enough proportion of children to be considered reasonably characteristic of that age. In this study, the age value of an item was defined as the age at which at least 75% of parents who participated in the age validation answered that their child could perform the milestone task at that age. Here, 'at least 75%' indicates a range of 75–100% answers of sampled parents.

The DSQ consists of 178 items describing milestone development of children aged between six months and six years. The pace of child development varies at different age levels. This means that children accomplish many distinctive milestones rapidly in their first 24 months then the changes become slower. As a result it was necessary to estimate the pace—how fast children accomplish developmental milestones—at different age levels. Based on the review of developmental milestone studies, it was determined that three levels exist between 6 and 78 months of age in which each level has a different interval of months as follows:

- two-month intervals from 6 to 24 months;
- three-month intervals from 25 to 48 months;
- six-month intervals from 49 to 78 months.

The data analysis was performed on this interval system to determine the developmental age value of items. Accordingly, the age value of an item is not a single point in time but an age range. In the process, data were split by the age-range variable first, then they were analyzed with descriptive statistics to locate the age range at which 75% of parents surveyed answered 'yes, my child can perform this task'. As shown in Table 3a, for item 2-18, at the age of 31–33 months only 73.3% of parents responded 'yes'. However, Table 3b shows that at the age of 34–36 months the required percentage, 79.3% of parents, confirmed that their child was able to do the task. Hence the item was placed in this age range. This analysis was performed for each of the potential 310 items in the selection process (see criterion 2 of the finalizing of the items).

Table 3a. Item 2-18. Want to answer telephone calls (only picks up and speaks few words)? Age range = 31–33 months

	Frequency	Percent
Yes	22	73.3
No	8	26.7
Total	30	100.0

Table 3b. Item 2-18. Want to answer telephone calls (only picks up and speaks few words)? Age range = 34–36 months

	Frequency	Percent
Yes	23	79.3
No	6	20.7
Total	29	100.0

Estimated developmental age

The DSQ assesses five areas of child development and estimates a developmental age in each area. The developmental age in each area is determined by the age value of the last item with 'yes'. The last item with 'yes' in each area comes between a basal and a ceiling set by a user's responses.

A basal is the establishment point of items while a ceiling is the termination point of items in each area of the questionnaire. A basal must be established for a user to move to reach a ceiling. Passing the first two items with 'yes' can set a basal. A ceiling can be set by passing three consecutive items with 'no'.

The DSQ has been designed for users to answer as few questions as possible instead of reading the entire questionnaire. This has been accomplished by two programming mechanisms. The programming first takes a child's age and determines a starting item of the questionnaire in which five areas of development categorize items. So the user can start with an item that is less challenging but not too easy for the child's age. The programming then constantly adjusts the difficulty level of items according to users' responses and automatically skips those questions far below or beyond their child's ability.

Results report of the DSQ

The results report is presented to users upon their completion of the DSQ. It includes three types of information: (1) growth profile, (2) developmental status, and (3) advice.

The growth profile graphically presents a child's development in five areas. It contains five bars representing five developmental areas of the DSQ and each bar

shows a child's developmental age in the area. The developmental age indicates a child's current competency level in an area. For instance, if a child has a developmental age of 12–15 months in the language area, this means that the child's language competency is comparable to children in that age range.

The results report also informs users of their child's developmental status—normal or potentially at risk. The normal or potentially at-risk status is determined by a 30% delay cutoff. The cutoff is set in relation to a child's age. The formula used to set the cutoff is {child's age – (child's age × 0.3)}. The 30% delay cutoff is equivalent to –2 standard deviations (SD). If any of the five development areas fall below the cutoff, the child's development is referred to as potentially at risk.

The results report then provides parents with advice to help them enhance their children's development and learning and find relevant referral resources. The advice is prepared according to the following four scenarios determined by the individual child's chronological age and developmental status:

Scenario 1:

Potentially at-risk development; toddlers (12–24 months)

Scenario 2:

Potentially at-risk development; preschoolers (25–66 months)

Scenario 3:

Normal development; toddlers (12–24 months)

Scenario 4:

Normal development; preschoolers (25–66 months).

Initial validity study

Validity refers to the extent to which a test performs the function for which it was intended. The validity of a new test can be verified by examining the extent to which it agrees with an established criterion test. An initial validity test was conducted using the Denver Developmental Screening Test (DDST), Singapore (Ministry of Health, Singapore, 1991; Lim, 1996) as a criterion test to validate the function of the DSQ. The DDST, Singapore was designed for use in clinical settings by professionals and paraprofessionals who have training on the test (Frankenburg *et al.*, 1990).

Participants and procedure

For this study, 90 children aged one to six years were sampled randomly from homes, childcare centers and kindergartens in Singapore and their parents were contacted for consent. Seventy-two parents (80%) agreed to participate in the study. They completed the DSQ and their children were tested on the DDST. The parents were informed that their children's and their participation in the study was voluntary and that the information provided in the assessment would be confidential and would be used for research purpose only.

A doctoral student in psychology who had relevant training in testing young children conducted the DDST. The standardized procedures described in the training manual (Frankenburg *et al.*, 1990) were followed in the administration and scoring of the test. Parents completed the DSQ running on a laptop computer with the help of a research assistant. The research assistant was trained to ensure proper functioning and operation of the computer when the parents completed the DSQ.

Results

The validity of the DSQ was examined by comparing the classification of the sampled children by the DSQ and the DDST. The DSQ identifies each child's developmental status as 'normal' or 'at risk'. The DDST also has a similar classification system where every child is identified as 'normal' or 'suspect'. Any one of four outcomes is possible: (1) both tests classify a child as normal; (2) both tests classify a child as at risk (or suspect); (3) the DSQ classifies a child as normal but the DDST as suspect; or (4) the DSQ classifies a child as at risk and the DDST as normal. As a result, the DSQ identified 72 children as normal but none as at risk. Meanwhile, the DDST identified 70 children as normal and 2 children as suspect.

The specificity and sensitivity were sought to determine the extent of agreement in the classification between the two tests. The specificity of a testing instrument is the percentage of children without problems correctly identified. Seventy of the children who were classified as normal by the DDST were correctly identified as normal by the DSQ. Therefore, the specificity of the DSQ was 97% ($70/72 \times 100$). The sensitivity of a testing instrument is the percentage of at-risk children correctly identified according to a criterion test. Neither of the two children identified as suspect by the DDST was identified correctly by the DSQ. However, it should be noted that two children are not sufficient for any significant data interpretation.

Conclusion

The classification of children's development as normal by the DSQ agreed highly with the criterion test (DDST). Glascoe and Byrne (1993) suggested a specificity of at least 90% and a sensitivity of at least 80% for a valid screening instrument. Thus the specificity of the DSQ (97%) was found to be adequate. However, the sensitivity of the DSQ could not be validated with the current data. With the outcome of two children, it is difficult to conclude that the DSQ had a low sensitivity.

A further study is necessary to test the sensitivity of the DSQ with a targeted sampling including children who are already in early intervention centers. In this way, the classification of at-risk development between the DSQ and a criterion test can be compared on a sufficient number of children.

The sensitivity of the DSQ can be enhanced by lowering the current cutoff point if the sensitivity of the DSQ proves to be low. The classification for at-risk status usually requires that a child exhibits a 20–30% delay in functioning when compared to his or her peers (Eisert *et al.*, 1980; Bayley, 1993). The DSQ presently adopts a 30% delay cutoff which is equivalent to –2 SD. A further study will determine the extent to which the cutoff should be adjusted.

Research findings have indicated the importance and effectiveness of family–teacher partnerships in children's progress in school (Sheldon & Epstein, 2002). Such partnerships include parent–teacher conferences, parent involvement in the activities of the classroom; home visits by the teacher and parent education. Partnerships can be extended to having parents involved in the assessment process of their children. Computer technology can be integrated in the assessment of the child and this makes it more accessible to parents. The technology also makes the test administration (i.e. recording responses, computing scores, and providing feedback) more reliable. In Singapore, parents are involved in the assessment process only to a limited extent. It is hoped that this research and further investigations will begin to educate and empower parents with skills to play a more active role in the identification of children needing early intervention services.

References

Bayley, N. (1993) *Bayley scales of infant development* (2nd edn) (San Antonio, TX, Harcourt Brace, Psychological Corporation).

Beckman, P. J. (1984) Perceptions of young children with handicaps: a comparison of mothers and program staff, *Mental Retardation*, 22(4), 176–181.

Bricker, D. & Squires, J. (1989a) Low cost system using parents to monitor the development of at-risk infants, *Journal of Early Intervention*, 13(1), 50–60.

Bricker, D. & Squires, J. (1989b) The effectiveness of parental screening of at-risk infants: the infant monitoring questionnaires, *Topics in Early Childhood Special Education*, 9(3), 67–85.

Byrne, J. M., Backman, J. E. & Smith, I. M. (1986) Developmental assessment: the clinical use and validity of parental report, *Journal of Pediatric Psychology*, 11(4), 549–559.

Cools, A. T. M. (1982) Early detection of developmental problems by questionnaire, interview, and observation, in: N. J. Anastasiow, W. K. Frankenburg & A. W. Fandal (Eds) *Identifying the developmentally delayed child* (Baltimore, MD, University Park Press), 111–120.

Diamond, K. E. (1993) The role of parents' observations and concerns in screening for developmental delays in young children, *Topics in Early Childhood Special Education*, 13(1), 68–81.

Donnelly, B., Doherty, J., Sheehan, R. & Whittemore, C. (1984) A comparison of maternal, paternal and diagnostic evaluations of typical and atypical infants, paper presented at the *Council for Exceptional Children* conference, Washington DC, April.

Eisert, D. C., Spector, S., Shankaran, S., Faigenbaum, D. & Szego, E. (1980) Mothers' reports of their low birth weight infants' subsequent development on the Minnesota Child Development Inventory, *Journal of Pediatric Psychology*, 5(4), 353–364.

Frankenburg, W. K., Dodds, J., Archer, P., Bresnick, B., Maschka, P., Edelman, N. & Shapiro, H. (1990) *Denver—II* (Denver, CO, Denver Developmental Materials).

Frankenburg, W. K., Van Doorninck, W. J., Liddell, T. N. & Dick, N. P. (1976) The Denver prescreening developmental questionnaire (PDQ), *Pediatrics*, 57, 744–753.

Garshelis, J. A. & McConnell, S. R. (1993) Comparison of family needs assessed by mothers, individual professionals, and interdisciplinary teams, *Journal of Early Intervention*, 17(1), 36–49.

Glascoe, F. P. & Byrne, K. (1993) The accuracy of three developmental screening tests, *Journal of Early Intervention*, 17(4), 368–379.

Gradel, K., Thompson, M. S. & Sheehan, R. (1981) Parental and professional agreement in early childhood assessment, *Topics in Early Childhood Special Education*, 1(2), 31–39.

Hagekull, B., Bohlin, G. & Lindhagen, K. (1984) Validity of parental reports, *Infant Behavior and Development*, 7, 77–92.

Henderson, L. W. & Meisels, S. J. (1994) Parental involvement in the developmental screening of their young children: a multiple-source perspective, *Journal of Early Intervention*, 18(2), 141–154.

Hunt, J. V. & Paraskevopolous, J. (1980) Children's psychological development as a function of the inaccuracy of their mother's knowledge of their abilities, *Journal of Genetic Psychology*, 136, 285–298.

Kenny, T. J., Hebel, J. R., Seston, M. J. & Fox, N. L. (1987) Developmental screening using parent report, *Developmental and Behavioral Pediatrics*, 8(1), 8–11.

Knobloch, H., Stevens, F., Malone, A., Ellison, P. & Risemberg, H. (1979) The validity of parental reporting of infant development, *Pediatrics*, 63(6), 872–878.

Kochanek, T. T. (1993) Enhancing screening procedures for infants and toddlers: the application of knowledge to public policy and program initiatives, in: D. M. Bryant & M. A. Graham (Eds) *Implementing early intervention: from research to effective practice* (New York, Guilford Press), 46–66.

Leow B. G. (2001) *Census of population 2000: demographic characteristics* (Singapore, Department of Statistics).

Lim, H. C., Ho, L. Y., Goh, L. H., Ling, S. L., Heng, R. & Po, G. L. (1996) The field testing of the Denver Developmental Screening Test, Singapore: a Singapore version of the Denver II Developmental Screening Test, *Annals of the Academy of Medicine Singapore*, 25, 200–209.

Ministry of Health, Singapore (1991) *Denver Developmental Screening Test Singapore. DDST, Singapore Test Manual* (Singapore, Material and Child Health Service, Ministry of Health).

Saylor, C., Foster, K. & Huntington, L. (1991) Predictive and concurrent validity of two measures of development with premature infants, paper presented at the international *Early Childhood Conference on Children with Special Needs*, St. Louis, MO, November.

Sexton, D., Hall, J. & Thomas, P. J. (1984) Multisource assessment of young handicapped children: a comparison, *Exceptional Children*, 50(6), 556–558.

Sexton, D., Thompson, B., Perez, J. & Rheams, T. (1990) Maternal versus professional estimates of developmental status for young children with handicaps: an ecological approach, *Topics in Early Childhood Special Education*, 10(3), 80–95.

Sheenhan, R. (1988) Involvement of parents in early childhood assessment, in: T. Wachs & R. Sheehan (Eds) *Assessment of young developmentally disabled children* (New York, Plenum), 75–90.

Sheldon, S. B. & Epstein, J. L. (2002) Improving student behavior and school discipline with family and community involvement, *Education and Urban Society*, 35(1), 4–26.

Stancin, T., Reuter, J., Dunn, V. & Bickett, L. (1984) Validity of caregiver information on the developmental status of severely brain-damaged young children, *American Journal of Mental Deficiency*, 88(4), 388–395.

Widerstrom, A. H., Mowder, B. A. & Sandall, S. R. (1991) *At-risk and handicapped newborns and infants: development, assessment, and intervention* (Englewood Cliffs, NJ, Prentice Hall).