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StandardGuide for Sensory Evaluation of Products by Children[1]

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1. Scope

1.1 This standard guide provides a framework for understanding the issues relating to conducting sensory and market research studies with children. It recommends and provides examples for developing ethical, safe, and valid testing methods. It focuses specifically on the concerns relevant to testing with children from birth through preadolescence. The guide assumes that teens older than 15 years of age are generally capable of performing sensory tests like adults, and therefore, all standard procedures used with adult subjects apply. The one exception, however, is legal consent where parental permission should be obtained for anyone under 18 years of age.

1.2 The guide will take into account the wide range of children's physical, emotional, and cognitive levels of development. It will prove useful for developing tasks that are understandable to children. It recommends alternative modes for children to communicate their opinions or perceptions back to the researcher, such as appropriate scales and measures.

1.3 The ethical standard presented in this document should be viewed as a minimum requirement for testing with minors. The safety and protection of children as respondents, as well as an attitude of respect for the value of their input should be of primary concern to the researcher.

1.4 The considerations raised in this document may also be useful when testing with the elderly or with adults who have developmental handicaps.

1.5 This document is not intended to be a complete description of reliable sensory testing techniques and methodologies. It focuses instead on special considerations for the specific application of sensory techniques when testing with children. It assumes knowledge of basic sensory and statistical analysis techniques.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E253 Terminology Relating to Sensory Evaluation of Materials and Products

E1958 Guide for Sensory Claim Substantiation

3. Summary of Guide—Specific Applications for Testing With Children

3.1 The primary use of children in sensory studies is to measure the acceptability of foods, beverages, pharmaceutical colors and flavors, and other products designed to be marketed to, consumed by, or used by children.

3.2 In this sense, they answer many of the same questions posed by effective sensory tests with adults. Children are used to measure overall acceptance, liking, or preference between samples. The resulting information can be used to aid in formulation changes or to choose between alternative products.

3.3 Sensory testing with children can also be used to identify unique characteristics or functions of products, such as the effectiveness of childproof safety caps. Other applications include advertising research or identification of unfilled needs or wants as part of the product development process (see Guide E1958).

3.4 Finally, some organizations are using children for basic research into the effectiveness of different scaling methods or sensory testing methodologies with children of varying ages.

4. Significance and Use

4.1 It is necessary and useful to test with children because they represent the real end-users for many products. Some products are developed specifically for children, and some are dual-purpose products that are intended for adults and children. Examples include: baby foods, diapers, ready-to-eat cereal,

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

juices, food or lunch kits, candy, toys, vitamins and other pharmaceuticals, music and videos, interactive learning tools, and packaging.

4.2 Children have influence over their parents' purchase decisions. They also have more money than in the past, and are responsible for more of their own purchase decisions at an earlier age. As a result, many manufacturers advertise specifically to children.

4.3 Creating a product for children requires input from children because their wants and needs differ from those of adults. For example, they may differ from adults in preferences or sensory acuity, or both, for sweetness, saltiness, carbonation, and texture. It is impossible to predict the nature of these differences without actual input from the intended target audience, and for that reason, testing with children continues to grow in the consumer product industry.

5. Test Methods

5.1 *Skill Development and Appropriate Testing:*

5.1.1 Testing with children requires special consideration of their language development, motor skills, and social and psychological development. Every child is unique, and there is great variation within and across age groups. In developing appropriate test methodologies for children, it is more important to consider individual skill development than chronological age. Table 1 provides a general guideline for expectations of skill level and appropriate evaluation techniques for each age group. For each age group, there is corresponding text discussing special testing considerations.

5.1.2 The researcher should keep in mind that there are many children in each age grouping who will fall below or above these skill levels. It is the responsibility of the researcher to verify the ability of the children to complete the task as planned, or to modify it as required to meet the needs of the children selected for testing. For example, while some second grade children may be able to read and understand test instructions, others will need assistance with that task.

5.2 *Infants (Birth to 18 months) and Toddlers (18 months to 3 years):*

5.2.1 *Recommended Evaluation Techniques and Types of Information:*

5.2.1.1 Information may be gathered from behavioral observations, diaries, or records from an adult experimenter who may be a trained evaluator, or the child's primary caregiver. It is the adult who interprets infant or toddler responses. With toddlers, some verbal responses may also be obtained. When the primary caregiver is involved, having an unbiased observer watch the interaction between the child and adult is beneficial. Video taping the test allows greater flexibility and opportunity for additional review.

5.2.1.2 Information may include observations recorded before, during, or after product use in either a clinical environment or more natural usage situation (such as the home or a group child care environment). Behavioral observations may include hand and eye movement, facial expressions, time spent playing, amount and time of consumption, or interaction with the product. Diaries or records can be used to track intake or consumption, frequency and duration of use, length of attention span, or the condition of the product before, during and after use. In addition, an adult can fill out a simple questionnaire with facial scales as a way to mimic the child's response and aid in interpretation.

5.2.2 *Cautions:*

5.2.2.1 Due to the limited language, attention span, and motor skills, the length of the testing session and number of products evaluated must be limited. Input from the primary caregiver as to the amount and length of exposure is critical. Consideration may be given to exposing the caregiver to the products prior to the test as a way to screen and eliminate a large number of samples. This technique also allows the caregiver to increase their comfort level about exposing their child to the product.

5.2.2.2 Caution should be used when the caregiver is asked to make a subjective judgement for the young child. Primary caregivers, especially parents, may respond from personal preferences, interpreting for the child their own personal opinion. At other times, primary caregivers or parents may unknowingly establish a pattern of responses that they believe would present their child in a positive manner to the evaluator. An option to reduce potential biases includes providing an environment that fosters honest responses (for example, fielding through a third party agency or non-company identified facility, indicating the importance of the data, or how the data will be used, or both). Another option is to have the parent feed the child first, record the child's response and then the parent may be instructed to taste and record their own response.

5.2.2.3 Whether the observer is the primary caregiver, an experimenter or trained evaluator, adult interpretation of observational responses are subjective and may be affected by factors unrelated to the product in question. For example, physical discomfort on the part of the child, such as tiredness or illness, may result in behaviors such as refusing to eat or pushing products away with hands. An unbiased observer or videotaping the session, or both, in conjunction with parental input can aid in cases where interpretation of a response is unclear. Multiple exposures and repeated evaluations may also be helpful.

5.3 *Pre-School (Age 3 to 5 years old):*

5.3.1 *Recommended Evaluation Techniques and Types of Information:*

5.3.1.1 Behavioral observations and the diaries used with infants and toddlers are also appropriate with children 3 to 5 years old. In addition, preschool children can begin using verbal skills to communicate their responses about the products. One-on-one interviews in the presence of a primary caregiver, paired comparisons, or limited use of sorting and matching techniques using pictures are appropriate.

5.3.1.2 Keeping in mind individual differences, many children in this age group can perform simple tasks that provide quantitative results. Suggested quantitative methods for preschool children include using facial scales to measure liking, paired preference, and preference ranking techniques.

5.3.2 *Cautions:*

5.3.2.1 Children 3 to 5 years old exhibit a wide range of developmental skills. This age group has relatively limited fine

TABLE 1 Summary of Skills and Behaviors of Children and Teens

Skill/Behavior	Infant Birth to 18 months	Toddler 18 months to 3 years	Pre-School 3 to 5 years	Beginning Readers 5 to 8 years	Pre-Teen 8 to 12 years	Teenage 12 to 15 years
Language—Verbal, Reading/ Written Language, Vocabulary	Pre-Verbal. Rely on facial expressions. Cannot read. Cannot write. Use sounds, very few words.	Beginning to vocalize, adult interpretation still required. Cannot read. Cannot write. Early word usage developing.	Early language development. Can observe facial expressions, respond to questions and pictures. Generally reading and writing skills are not present.	Moderately developed verbal and vocabulary skills; cognitive skills increase. Early reading and writing skills vary greatly at this age. Adult assistance is advised.	Increasingly verbal—self-expression improves. Reading and written language skills increase rapidly and are sufficient for most self-administered tasks at the upper limits of this age group.	Generally strong language and vocabulary skills. Reading and written language skills continue to increase. Adult level in most respects.
Attention Span	Gaged by eye contact and bodily movement. Bright colors, sound, and movements capture attention.	Gaged by eye contact or involvement with task, bodily movement. Bright colors, sound, and movements capture attention.	Limited, but increasing. Bright colors, movement are effective.	Limited by understanding of task and interest level, challenge. Limit tasks to < 15 min.	Attention span is increasing, but holding interest is critical and sometimes difficult. Taking tests is a familiar activity.	Similar to adults, involvement and interest subject to peer pressure.
Reasoning	Limited to pain and pleasure.	Limited, but concept of "no" becoming a factor. Definite preferences begin to emerge.	Limited, but beginning to be able to verbalize what is liked and what is not.	Developing with increased learning, cause/effect concepts.	Full ability for understanding and reasoning, capable of decision making.	Reasoning skills are fully developed and similar to adults.
Decision Making	Do not make complex decisions.	Do not make complex decisions, but "yes"/"no" can be decisive. Ability to choose begins.	Limited, but concepts of what is liked and what is not strengthen. Able to choose one thing over another.	Ability to decide is increasing, but influence of adult approval is evident.	Capable of complex decisions, peer influences a factor.	Fully capable of adult decision processes, subject to peer influences.
Understanding Scales	Do not understand scales.	Do not understand scales.	Understanding of simple scales beginning, sorting or identification tasks more effective.	Scale understanding increasing, simple is best, use easy vocabulary.	Capable of understanding scaling concepts with adequate instruction.	Similar to adults.
Motor Skills	Possess some gross motor skills, no fine motor skills	Rapid gains in gross motor skills, fine motor skills still limited.	Development of gross and fine motor skills increasing.	Gross motor skills developed, fine skills becoming more refined.	Hand to eye and other fine motor skills developed.	Similar to adults.
Recommended Evaluation Techniques	Behavioral Observations Diaries Consumption or duration measurements		Previous, plus: Paired Comparison Sorting and Matching Limited Preference Ranking One-on-one interviews	Previous, plus: Simple attribute ratings Liking scales—pictorial or simple word scales. Group discussions Concept testing	Previous, plus more abstract reasoning tasks. Hedonic scales. Simple attribute scaling and ratings.	Capable of all adult evaluation techniques.
Adult Involvement	Primary Caregiver Trained Observer Experimenter			Experimenter or Interviewer. Generally able to handle self-administered tasks.		Adult participation not required, unless appropriate to evaluation technique.

motor skills, attention span, verbal and cognitive skills. These characteristics, combined with possible emotional dependence, require that testing protocols be kept simple and non-threatening.

5.3.2.2 Careful consideration must be given to testing location. Suggested options include testing in central location, educational, play or social settings. Familiar settings such as preschools, churches, synagogues, or home settings may be ideal. Both controlled and relaxed environments offer advantages and disadvantages that the researcher must consider. Generally, a relaxed atmosphere encourages more typical behavior when testing products with young children than a clinical setting, although a controlled setting may sometimes be necessary for test specific reasons.

5.3.2.3 Some children in this age group are uncomfortable with unfamiliar adults. A suggestion to ease their apprehension may be to include a warm-up period to introduce the child to the researcher and task in the presence of their parents.

5.4 *Beginning Readers (Approximately 5 to 8 years old):*

5.4.1 *Recommended Evaluation Techniques and Types of Information:*

5.4.1.1 Children in this age group should be capable of completing any tasks that are used for testing with younger children. This age group usually has moderately developed verbal skills, an expanding vocabulary, increased cognitive abilities, and increased fine motor skills. Scale understanding is increasing, but limited word scales, facial scales, and paired preference are appropriate.

5.4.1.2 Although the early readers' ability to make decisions are increasing, choices should be limited and testing tasks should be simplistic. Appropriate techniques include using one-on-one interviews, short affective tests, or brief group discussions to accommodate the limited attention spans inherent to this age group.

5.4.1.3 Some children in this group are better able to convey more details about their likes and dislikes, preference ratings, product liking, and acceptance decisions than their younger counterparts, but not all have that capability. At this stage, since everything they do is so dependent on skill level, very simple tasks yield the best opportunities for success. Additional life experience and exposure to product advertising can lead to a better understanding of impressions about products and the development of more personal preferences. Children in this age group can certainly identify what they like, but not necessarily why they like it. Many do not understand the difference between sweet and sour, thick and thin, etc. Some children in this group, however, are able to understand and use just-about-right (JAR) scales, but only with very simple vocabulary.

5.4.2 *Cautions:*

5.4.2.1 Scale understanding and use is still limited for this group. Facial scales or one-on-one interviews are likely to be more effective than word-only scales that may not be completely understood. Simple, basic vocabulary is key. At best, children in this group can indicate if they like "how something looks," but not if they like its "appearance." They can indicate if they like the "taste" of a product, but not its "flavor." They can respond to "how it feels in your mouth," but not to "texture." Simple vocabulary is necessary. Adult intervention may be required for clarification of test instructions or assistance with reading tasks, but the researcher must be aware of potential parental influence or a desire on the part of the child to please the adult interviewer.

5.4.2.2 At this age, most children can participate in short interviews without the presence of their parents. For some children, emotional maturity and shyness may interfere with their ability to adequately complete the task and may result in a complete lack of response. The researcher is faced with a decision on how to handle children who have difficulties, and must determine whether or not their data should be eliminated, or if the child should be replaced through additional recruiting.

5.4.2.3 As mentioned with the previous age groups, simplicity is key. The researcher who keeps the task simple and gives clear, concise verbal directions will improve the likelihood of a successful test.

5.5 *Pre-Teen (8 to 12 years old):*

5.5.1 *Recommended Evaluation Techniques and Types of Information:*

5.5.1.1 Children in this age group should be capable of completing any tasks that are used for testing with younger children. Many children in this age group are also able to complete more challenging tasks and understand increasingly complex wording, which allows for greater flexibility in questionnaire design. Self-administered tests are usually appropriate for this age group. However, diversity in skill level can be especially pronounced in this age category. The researcher must continuously be aware of differences in skill levels, and be prepared for some children in this group to overlap with the early reader skill level. Sometimes, even basic reading skills are not fully developed until 11 to 12 years of age, and therefore, some children may require adult assistance in order to read the questionnaire or to complete self-administered questionnaires.

5.5.1.2 Quantitative techniques that are effective for this group are paired comparison or paired preference choices, ranking tasks, basic attribute and JAR scales (for example, sweet), and hedonic scaling (facial expressions may be more suitable than word anchors for the younger portion of the age group) (see Terminology E253 for definitions of terms). One-on-one interviews are still appropriate for this age group. At this age, children can be expected to participate in short interviews without the presence of their parents. Responses to open-ended questions may be quite limited, and some younger children in this group may have difficulty with answering any open-ended questions, except in an interview format.

5.5.1.3 Qualitative techniques such as focus group discussions are useful with this age group to address qualitative objectives, including concept testing. Depending on the testing situation, consider testing older children in this age group separately by gender.

5.5.1.4 In general, this age group is increasingly able to handle abstract ideas and complex decisions. Children in this age group have definitive ideas about their likes and dislikes, which may be quite different from adults. As verbal skills increase, they can provide increasingly informative descriptions about their impressions of products.

5.5.2 *Cautions:*

5.5.2.1 At this stage in development, interactions between boys and girls have increasing potential to interfere with concentration and attention to the task at hand. To aid in obtaining clearly individual responses and to avoid the bias that comes with peer interaction, it may be necessary to separate children who are friends. This usually applies when testing in a group setting such as school or camp. This is similar to the concerns previously expressed regarding parent-child interactions, or problems encountered when testing with adults who are acquainted. The desire and pressure to agree with one's peer group can be a powerful influence that may bias sensory test results, and good sensory practice dictates that the sensory professional anticipate potential sources of bias and protect against them as much as possible in structuring the test.

5.6 *Teen (12 to 15 years):*

5.6.1 *Recommended Evaluation Techniques:*

5.6.1.1 Teens are capable of completing all types of tests described for preteens. In addition, they are able to complete more complex questionnaires requiring multiple decisions. Their abilities are similar to those of adults, and they are able to participate in discrimination testing if they are trained to perform the task.

5.6.1.2 Evaluators between 12 and 15 years of age are increasingly verbal and can provide detailed descriptions of their likes and dislikes of products, as well as the reasons for those attitudes. JAR scales should pose no difficulty as long as the attributes in question are understood. Teens are able to use attribute scales and provide intensity ratings for product attributes.

5.6.2 *Cautions*—Consider the cautions described in 5.5.2.1. Again, it is important to emphasize that during group discussions, the researcher should consider separating males and females in order to limit distractions. Peer influence is important to teens and should be considered to assure unbiased responses.

6. Procedures—Test Design and Protocol

6.1 *Test Types:*

6.1.1 The standard formats used when testing with adults are also used with children, for example, home use, or central location tests, with modifications for the special circumstances that arise with children as subjects. Pretesting is recommended to determine the appropriate ratio of adults or administrators to children necessary for effective execution of the test. In addition, pretesting is necessary to determine the appropriateness of the questionnaire and the test method being used.

6.1.2 Computers are used effectively with children, depending on their experience and exposure. When using computers, the basics regarding skill-appropriate questionnaire design should be applied, using pictures and scales appropriate to children. When conducting tests outside the home, facilities should be structured to be user-friendly and safe for children.

6.2 *Criteria for Using Children as Subjects—Recruitment and Screeners:*

6.2.1 Children can be recruited from a wide variety of sources, with advantages and disadvantages to each (see case studies for examples of various recruitment scenarios). Over-recruiting is helpful with children as well as adults. Additionally, the behavior of the potential participants may be observed in the waiting room to eliminate those who may be too shy, nonverbal, or disruptive.

6.2.2 The number of children for the study will vary based on the objective, the test design, and the scope of information desired, in the same way as testing with adults. When testing with children, recruiting a somewhat larger assessor base is recommended because of the potential for unusable data, or dismissal of children prior to the study due to variation in children's ability to respond because of basic skill level.

6.2.3 Schools are a common source of children for testing, especially if participation is used as a learning experience. Often, private schools are more flexible than public school districts in allowing testing during the school day. Whenever possible, it is recommended that children from more than one school be recruited. This will help the researcher avoid potential biases due to homogeneity of children in terms of ethnic origin, religion, parent's social background, etc. Testing in schools is appropriate for all types of products used by children for early research since screening is limited in school settings.

6.2.4 Standard techniques such as shopping mall recruiting or newspaper advertising are also used.

6.2.5 Regardless of the source of recruiting, screening is necessary to obtain the proper sample of children to meet the test objective. Screeners should be administered first to the primary caregiver, and then to the child participating, depending on their age. While skill level is an important factor in all aspects of sensory testing with children, skill level is not the most important factor during screening. The test design can be adapted to be appropriate for the ability of your desired target audience. Current usage of the product within the category is often a criterion for selection of participants, as well as the age and gender of the audience for whom the product is intended. In the case of new products, a willingness to try the product or an interest in the concept may be the most appropriate criterion.

6.2.6 When determining secondary screening qualifications, developmental factors such as articulation and comprehension must be considered. With young children, visual response techniques are sometimes employed for screening. Verbal screening is suggested for children up to age 7 or 8, because it has been observed that younger children may have difficulty completing a written questionnaire without assistance. The researcher may find it necessary to recruit a category user group as an initial step, and follow up with additional screening to accommodate those children who have not yet developed the skill set necessary to complete the task required.

6.2.7 Consideration of allergies is especially important with children, making informed parental consent a necessity for participation. In most cases, it is prudent to eliminate children that have any allergies to food, skin or fragrance ingredients. However there may be cases where a child with an allergy may be important to the product being tested. An example is a soy butter that is used as a substitute for peanut butter, where children with peanut allergies are recruited so they can react to this new product. In this case, a list of ingredients contained in the test products is essential for informed parental consent. It

may be necessary to note that products are manufactured in a facility that also processes nuts. For pharmaceutical testing, it is important that the children are not currently taking medication. Consult your legal professional for additional guidance and risk assessment regarding allergens in children.

6.2.8 Creating a safe testing environment must be a primary consideration, even if it requires planning for physical limitations at a given developmental stage, such as testing very sticky or chewy products with young children that may have loose teeth, or for teens with braces. Please consult your legal department and refer to Section 8, Legal and Safety Issues, for additional screening considerations.

6.3 *Number of Subjects*—In a Central Location Test, when the number of children required is large, testing with smaller subgroups can make the task easier to manage. The number of administrators present should be proportional to the complexity of the task and taking into consideration the age of children in the study.

6.4 *Description of the Task:*

6.4.1 Children have been used in sensory tests concerning taste, visual appeal, or texture of food, for personal care products and toys, or pharmaceutical products. Visual tests of a product's eye appeal are also effective with children. Visual tests are often used with packaging, advertising issues, or with items such as toys. Home-use tests or one-on-one studies are useful for testing non food items such as disposable diapers. In-home testing may also be appropriate when the child is intended to be involved with the actual use of the product over time, such as making their own peanut butter and jelly sandwiches, or using ready-to-eat cereals on multiple occasions.

6.4.2 Depending on their skill level, children are capable of performing a variety of tasks. They can tell the researcher if a product is liked or disliked, and in some cases to what degree it is liked or disliked. They can rank products in order of their preference, and some are capable of answering simple and well-defined attribute questions. Use of a trained interviewer is essential with young children, and with older children, a trained interviewer allows a means of assessing how well the child understands the questions being asked. In a self-administered test, the child should be able to comprehend the questions being asked. Certain inherent biases exist when products are tested at home. Therefore, care should be exercised when determining the appropriateness for home-use tests that can be influenced by parents.

6.5 *Time to Complete Task:*

6.5.1 The key to successful testing with children is to keep the task short and to the point and to do the same with the length of the test session. Expectations should be set at the onset of the study. The time required for task completion is largely dependent on the test design, objective, and execution plan. Taste tests should be kept short due to fatigue, but other tasks can be longer if evaluative tools are entertaining. It is essential to have the task completed before the child loses interest, and attention wanders. If there are breaks between samples, provide activity books with word games for children to help occupy their time.

6.6 *Questionnaires:*

6.6.1 Depending on the age and developmental level of the children being tested, hedonic scales, intensity scales and just about right scales have been used successfully. The nine point children's language hedonic scale (super good—super bad) may be used with ages 8 to 12, as can the traditional 9-point hedonic scale, provided all the children can read and, more importantly, can understand the meaning of words. Prior to testing, an appropriate orientation is important to ensure that children have an understanding of the scale and the rating task. Facial scales, which use cartoon-like faces to express like and dislike and were developed for those with limited reading or comprehension skills, or both, have not been shown to provide advantages over verbal scales when used in consumer research. On the contrary, facial scales introduce their own complications. For example, children may respond by selecting a "happy" face because they like that face rather than because it represents their opinion about the product they are evaluating. For children, the cognitive task of matching an emotion expressed by a face to their reaction to a product may require more abstract thinking than a response on a verbal scale. Another potential distraction for children is that the faces may not reflect the child's racial or ethnic identity and that the meaning of facial expressions is far from universal across cultures. For these reasons, face scales are not recommended until more positive evidence is available that supports their use.

6.6.1.1 For children ages 3 to 5, choice questions are best. To obtain liking, you can first ask the child if they feel the product is good or bad. Depending on their response, they are then asked if the sample is "really good" (really bad) or "just a little good" (just a little bad). If in the first choice the child is not able to specify good or bad, their response is coded as neither, and the subsequent questions are not asked.

6.6.1.2 *Use of Intensity and JAR Scales*—Children ages 8 and higher are capable of using intensity scales. Since children in consumer studies often receive only a brief orientation to their rating task, it is important that the attribute whose intensity they are scaling be easy to understand; such comprehension, if in doubt, should be verified by pre-testing the questionnaire. Children can easily perform ratings of appearance, including size or visual amount. Other attributes, such as sweetness or hardness (of food products), are also easy for children to understand. In the case of more complex flavor or texture characteristics, the assumption that children understand the meaning of the attribute is likely not warranted.

6.6.1.3 Just-about-right scales used with children usually take the form of a three-point scale (not enough, just right, too much). JAR scales can give meaningful results with children, although as in the case of intensity scales, careful consideration must be given to the choice of attribute. Appearance attributes, basic tastes such as sweetness or sourness, and simple food texture attributes may be appropriate for this age.

6.6.2 Table 2 and Fig. 1 give examples of scales. Scale terminology needs to be validated for appropriateness to the children being tested. The questionnaire should be pretested to be sure the questions are understandable, the instructions can be followed, and the tasks can be completed independently. Pretesting also gives a sense of the average length of time