Original Article

Adaptation of Subtests of Kaufman Assessment Battery for Children, Second Edition for Gujarati Pre-school Children

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ABSTRACT

Context: Cognition testing is frequently used in children to assess their intelligence for various needs. Abundant tests to assess cognition are available in the western world. The paucity of such tests for use in Gujarati population necessitates their adaptation for Gujarati culture. **Aims:** To adapt three subtests (Number Recall, Word Order, and Triangles) of Kaufman Assessment Battery for Children, Second Edition for Gujarati-speaking preschool age children using priori (judgemental) procedures of test adaptation process. **Settings and Design:** This was a prospective study of test adaptation process carried out in three kindergarten schools of Gujarat. **Subjects and Methods:** Three subtests were translated and adapted into Gujarati. A pilot study evaluating the applicability and appropriateness of the adapted version of the three tests was done, and the results of these raw scores were compared with English tests' scores. Of 68 children (age 3–6 years) who completed the pilot study, 15 boys and 15 girls 4–6 years of age were randomly selected to perform English tests for agreement between English and the adapted versions. **Statistical Analysis Used:** Agreement between the adapted and English versions of the tests was measured. **Results:** During adaptation, modifications were required only in the items of the Word order subtest. All children were able to understand and perform the test. Triangles did not require adaptation or modifications in test items. The agreement between raw scores of the two versions was good for both "Number Recall" (mean difference = 0.8, 95% confidence limits: -2.6, 4.1) and "Word Order" (mean difference = 0.6, 95% confidence limits: -3.2, 4.4). **Conclusion:** Adaptation of three subtests of KABC-II using *a priori*, that is, judgemental, procedure was suitable for Gujarati-speaking preschool children.

Key words: *Cognition, culture, intelligence, language*

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INTRODUCTION

Psychologists and researchers depend on psychometric tests and questionnaires to assess cognitive function in adults and children. Galton was one of the first persons to develop a scientific and theoretical interest in intelligence.[1] Binet and Simon developed a battery of tests for higher mental processes, which showed good validity in predicting academic performance.[2]

Administration of a comprehensive intelligence battery provides a valid and reliable assessment. A variety of such batteries are currently available. These batteries have excellent psychometric properties and provide updated norms against which a specific child's performance can be evaluated. Most importantly, these batteries provide profiles of functioning across different subtests, including verbal, perceptual, spatial, mathematical knowledge and reasoning, working memory, and processing speed.[2] Among all these tests, Kaufman Assessment Battery for Children, Second Edition (KABC-II) helped expand the field of intelligence testing over traditional tests.[3]

The language used for these tests is English, and these tests are developed in affluent Western countries. Because of cultural and linguistic differences, original cognitive tests may not apply to people familiar with different language and/or with different cultural backgrounds.[4]

Individual cognitive abilities depend not only on genes but also on environmental influences which modulate the regulatory processes of genes.[5] Despite these reasons, these tests are extensively used in developing countries without adapting them to the local culture.[6] Because of cross-culture differences, these tests may be inappropriate for Indian population. Research in neuropsychological assessment has increased in Asia, suggesting the increasing need of cognition testing in this population.[7] To make them adequate to test in a different culture, they may not only need translation to local language but also need to be adapted.[4] This should be further supported by pretesting and cognitive interviews on the population to be tested.[8]

This study was done to adapt three subtests (verbal and non-verbal) of KABC-II for Gujarati-speaking preschool age children in India by *a priori* (judgmental/qualitative) procedure. The objective of this study was to systematically translate and adapt Word Order, Number Recall, and Triangles subtests of KABC-II for Gujarati-speaking preschool children.

SUBJECTS AND METHODS

Study site

This study was carried out in three kindergarten (KG) schools of Gujarat. Children in these schools belong to lower middle to middle-class family. Children in these schools are taught play activities and Gujarati and English alphabets, numbers, and poems; they are provided with lunch. The study was approved by Institutional Human Research Ethics Committee. Study-related processes were conducted after the school principals' approval and informed consent of the parents or legally acceptable representative.

Study population

Children in these schools were from the urban, peri-urban, and rural areas. Most of the children belonged to joint families and were Hindu or Muslim by religion. Gujarati is their mother tongue, and they can understand basic instructions appropriate for their age in English.

Study procedure

Step 1

Approval from Pearson Clinical and Talent Assessment, Pearson India Education Services Private Limited was taken for translation and adaptation of three subtests of KABC-II for use in Gujarati population.

Step 2

Preparation of the study material in Gujarati: As KABC-II is originally in English, three subtests (Number Recall, Word Order, and Triangles) were translated into Gujarati by certified translators fluent in English and Gujarati.

These translations of the three KABC-II subtests were checked by five parents of children between 3 and 6 years of age, two teachers of KG schools, and two psychologists having PhD, to confirm familiarity of test items and instructions for 3–6 years old children and whether the test items of Number Recall and Word Order, post-translation, were still mono or bisyllabic.

As to the best judgment of these people, "No changes" were required to test instructions and test items of translated (Gujarati) version of both Number Recall and Triangles. "No changes" were suggested to the "instructions" of translated (Gujarati) version of Word Order subtests. "Changes" to two test items of Word Order were suggested, that is, "cat" was suggested to be replaced by "fan" and "heart" was suggested to be replaced by "rickshaw." These changes were proposed to ensure "familiarity" of the test items for Gujarati-speaking children between ages 3 and 6 years, to ascertain that the test items post-translation were

either "monosyllabic" or "bisyllabic," taking care that their black and white images are easily understood and do not match with those of other objects. The translated versions of Number recall, Triangles, and translated and adapted version of Word Order were referred to as "Adapted Version 1."

Step 3

A Pilot study evaluating "Adapted Version 1" of Number Recall, Triangles, and Word Order:

Inclusion criteria: For the pilot study, boys or girls age 3–6 years were eligible, and for evaluation of Adaptation Version 1 (i.e., step 4), boys and girls within the age group of 4–6 years were eligible. Participants had to be bilingual, that is, should understand Gujarati and English words and should be in good general health, with the absence of any condition that could impact the individual's ability to understand and follow study procedures and requirements. Participants with body mass index (BMI) for age and sex between $<+1$ standard deviation (SD) and >-2SD as per World Health Organization Anthro software were eligible to participate in the study.

Exclusion criteria

- Children in Care (CiC): Children who had been placed under the control or protection of an agency, organization, institution, or entity by the courts, the government, or a government body acting in accordance with powers conferred on them by law or regulation were excluded. CiC did not include a child who was adopted or had an appointed legal guardian
- A child receiving, in the past 30 days, any drug that is likely to impact cognitive function
- Sibling of a child already enrolled in the study
- A child belonging to the study personnel or members of their immediate family.

Convenience sampling was used to recruit the participants. Demographics-related information, such as the participant's date of birth, gender, and his or her parents' education, was recorded on Case Report Forms. Medical history was recorded and physical examination was conducted by a medically qualified designee. The administration of the tests was done in a quiet room at school and/or at home, with minimum distraction. After rapport was established, Adapted Version 1 of all the three subtests was administered to children by trained psychologists.

The test administration was done in a non-standard way, without strictly following the test administration guidelines, to evaluate the appropriateness of the test materials and test procedure of Adapted Version 1 of all the three subtests. The primary focus was on identifying the process behind a child's response by observation and enquiry than on a child's response to the test items. The time to complete the test item of Triangles was noted. The results of these tests were recorded on individual subtests scoring sheets.

A supervising child psychologist observed these test administrations. Both the supervisor and the test examiner qualitatively evaluated the child's ability to work with the test materials and the response format. Supervisor also assessed the skills of the test examiners (i.e., Is the examiner able to understand the testing procedure adequately? Is she/he able to administer the subtests? Is she/he clear in providing instructions? Is she/he able to build rapport with the child? Is she/he able to manage the child, e.g., crying?).

On the day of cognitive assessments, children were required to have had breakfast, to avoid the effect of hunger on cognitive assessment scores. A pilot study evaluating "Adapted Version 1" of Number Recall, Triangles, and Word Order did not suggest any modifications, and therefore Adapted Version 1 of Number Recall, Triangles, and Word Order were considered final.

Scoring was done on the score sheets of Number Recall, Word Order, and Triangles, and by adding the scores to each response, raw scores were derived for each test. Data from individual scoring sheets were entered in Excel 2010. The range of raw scores for Number Recall, Word Order, and Triangles was 0–22, 0–31, and 0–29, respectively.

Step 4

Evaluation of Adapted Version 1: From children who participated in the pilot study, 15 boys and 15 girls within the age group of 4–6 years were selected randomly by WINPEPI software. These 30 children were administered original English version of Number Recall and Word Order of KABC-II after a gap of 1 month post the pilot study to minimize learning effects. English was used to name test items, and Gujarati was used for giving test instructions. The similarity between raw scores attained by each child on Number Recall and Word Order when given in English and Gujarati was derived using Bland–Altman plot. Triangle test was not evaluated as its items are "non-verbal."

RESULTS

From 84 children screened, 5 were excluded as their age was not between 3 and 6 years and 4 were excluded because of BMI. From the remaining 75 children, 3

were absent during the study conduct, and 4 were not willing to take part in study-related activities. A total of 68 children were eligible and completed the pilot study.

Most of the parents of the study participants had received education up to high school or above [i.e., all the fathers and 65 (95.6%) of 68 mothers]. All the 68 children were able to understand the instructions of Adapted Version 1 of all the three subtests. Test items were also familiar to the children.

The agreement between the raw scores of the two versions by Bland–Altman method was good for both "Number Recall" (mean difference = 0.8, 95% confidence limits: −2.6, 4.1) and "Word Order" (mean difference = 0.6, 95% confidence limits: −3.2, 4.4) [Figures 1 and 2].

DISCUSSION

KABC-II is an individually administered measure of cognitive abilities and processing for children between 3 and 18 years of age. It measures short-term memory, visual processing, long-term storage and retrieval, fluid reasoning, and crystallized abilities. It measures these abilities with low score differences between different ethnic and cultural groups. The dual theoretical basis of KABC-II [the Cattell–Horn–Carroll (CHC) model of broad and narrow abilities and Luria's neuropsychological theory of processing] allows psychologists to evaluate children for whom English is a second language.[9]

Sources of bias are plenty during cross-cultural assessment. To avoid misleading results during the process of cross-cultural assessment, construct bias, method bias, and item bias need to be addressed.[10] To reduce the effect of construct bias among the variety of the subtests available in KABC-II (total 18), we selected only three subtests which depend on sequential processing, short-term memory, visual processing, and spatial relations. To reduce the effect of method bias, we selected narrow age range (3–6 years) of the bilingual (Gujarati and English) participants, three schools with similar teaching methodologies, and test administrators with equal expertise. (Psychologists were extensively trained in test administration at a single institution). We did a local survey using judgemental method from psychologists, parents, and teachers of KG to the translated version of the three subtests to find out whether the translated instructions and items would be understood by children of 3–6 years and whether it is culturally appropriate. Back-translation to English was also done to validate translation. Pilot testing in a non-standard way was done to get insight into the administration process and face validation.

However, this study does not validate the adaptation process; the items of the subtest have the same meaning across the culture, and thus it avoids construct inequivalence. This ensures that the process used in the study is cross-culturally equivalent, making cross-cultural assessments more valid.[11]

Number Recall subtest measures sequential processing as per Luria model and short-term memory as per CHC model. In this test, a child repeats a series of numbers in the same sequence as the examiner, with series ranging in length from two to nine numbers; the numbers are single digits, except "10" which is used instead of "7" to ensure that all the numbers are one syllable. The literal Gujarati translation of the digits occurs as: "one" as "ek"; "two" as "be"; "three" as "tran"; "four" as "char"; "five" as "pach"; "six" as "chh"; "eight" as " ath"; "nine" as "nav"; "ten" as "das." According to Baddeley's phonological loop model, the number of items that can

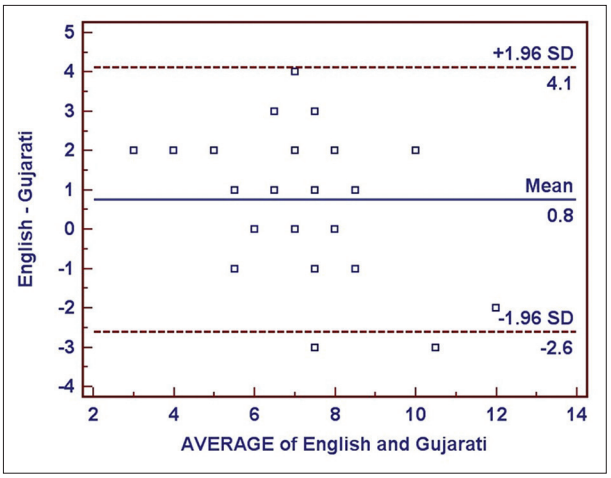

Figure 1: Agreement between raw scores of Number Recall subtest of KABC-II

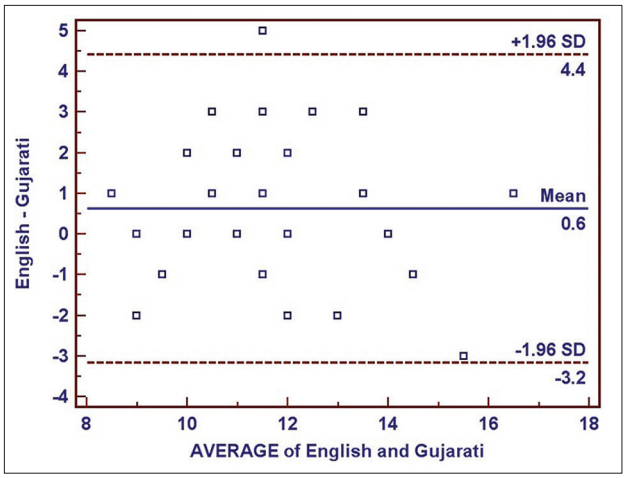

Figure 2: Agreement between raw scores of Word Order subtest of KABC-II

be stored in memory varies with their phonological length such as the number of syllables.[12,13] The shorter the items, the more items can be recalled. It follows from the model that Number Recall is more sensitive to differences in memory capacity when shorter digits are used and that it is important to maintain a constant phonological digit length.[4] All the test items of number recall when translated into Gujarati were one syllable and thus no changes to the "test items" were required. During the pilot testing of this test, children were familiar with test items and were able to understand the instructions comfortably.

Word Order subtest like Number Recall measures sequential processing as per Luria model and short-term memory as per CHC model. In this test, the examiner says the name of common objects, and then the child touches a series of silhouettes of these common objects in the same order as the examiner said their names. More difficult items include an interference task (colour naming) between the stimulus and response. Gujarati translation of objects used in Word Order subtest are "star" as "taro"; "cup" as "kap"; "key" as "chavi"; "bird" as "paxi"; "house" as "ghar"; "heart" as "raday"; "cat" as "biladi"; "ball" as "bol", "hand" as "hath"; "tree" as "zad", "shoe" as "but" and "moon" as "chando." In this test, objects with one syllable name were chosen to control to some extent the linguistic properties of each stimulus. Gujarati translation of star, key, bird, heart, and moon are two syllables, and for cat, it is three syllables. Very few one-syllable words in Gujarati are known to children. Hence, the change was not done to most of the objects. However, since the picture of the heart used in the object card is less familiar and its Gujarati translation seemed to be less commonly understood by children of age 3–6 years, it was replaced with "rickshaw." The Gujarati translation of "rickshaw" is "rixa," which is of two syllables. The Gujarati translation of "cat" is of three syllables, so it was replaced with "fan"; the Gujarati translation of it is "pankho" which is of two syllables. Thus, test items of Word Order subtest required adaptation to make it culturally suitable. During pilot testing of this test, children were able to understand test instructions and were familiar with test items.

Triangles subtest measures simultaneous processing as per Luria model and visual processing and spatial relations as per CHC model. In this test, a child assembles a different set of colorful plastic shapes to match a model constructed by the examiner. In later part of the test, the child assembles several identical foam triangles (blue on one side and yellow on the other) to match a picture of an abstract design. Since this test is "non-verbal" and the activity measures spatial relations based on the arrangement of the objects, no modifications were required to the "test items." Only instructions of the "Triangles subtest" were translated to Gujarati. During pilot testing of this test, children were able to understand test instructions and were able to perform the tasks of the test items.

This study used judgmental, *a priori* procedures of test adaption, which was also used when KABC-II battery was adapted for Kannada-speaking children. This approach combines two aspects: (1) translation and (2) piloting to modify test instructions and/or test items. Similar to the study by Malda *et al*., cultural and linguistic differences between the original (American context) and the adapted (Indian) context were seen.[4] The results showed agreement between raw scores on original English and Adapted Gujarati Version 1 of Number Recall and Word Order. Thus, judgmental, priori procedures of test adaption may be useful in case of cross-cultural adaptations.

As culture and intelligence are inextricably interlinked, the same instruments may not always be appropriate for use across cultures and may require some modifications. As a result, one can translate a particular test of intelligence, but it may not guarantee that it is appropriate for use in another culture.[14] The results of this study also highlight the fact that awareness of sociocultural aspects and inputs from various informants such as parents, teachers, and psychologists are important in the process of adaptation. Children's understanding of different test concepts, the way they describe them, and how much they relate to test items play a significant role in the adaptation process. It is more important to know how much a child or target population is familiar and understands the test, that is, instructions and test items. This study showed that test adaptation might be needed to incorporate sociocultural factors and collaborate information from multiple informants like parents, teachers, and experts in various fields (psychology, culture, and local language). This goes well with the existing view that intelligence cannot be fully or even meaningfully understood outside its cultural context, and multicultural collaboration in instrument development constitutes a powerful tool to detect and prevent cross-cultural misunderstandings that undermine validity in cross-cultural ability testing. The analysis of culture-specific meanings, culture-specific ways of knowing, and culture-specific modes of communication enhances the validity of cross-cultural ability testing.[14]

CONCLUSION

Adapted Version 1 (using *a priori*, i.e., judgemental procedure) of Number Recall, Triangle, and Word Order subtests of KABC-II was suitable for Gujarati-speaking preschool (3–6 years) children.

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Conflicts of interest

There are no conflicts of interest.

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