

Sensitivity and Specificity of the Thai Version of the Functional Emotional Developmental Questionnaire (FEDQ) for Childhood

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ABSTRACT

Objective: This study aimed to examine the sensitivity and specificity of the Thai version of the Functional Emotional Developmental Questionnaire (FEDQ) as a screening tool for children with delayed development.

Methods: The FEDQ was translated with standard method. The final version of the FEDQ was administered by caregivers of the children. The experts' opinions of the children's development were used as the gold standard. All of the children who were categorized as "Functional Delay" and fifty-five children categorized as "Functional Normal" were randomly selected and sent to the assessor to perform Denver II Development Screening test (DDST).

Results: Ninety respondents (86%) of 113 respondents were mothers. The mean age of the children was 22.7 months (range 4-42). The Thai version of the FEDQ had a satisfactory internal consistency (Cronbach's alpha = 0.83) Test-retest reliability was acceptable with the intra-class correlation coefficient of 0.89 (95% CI 0.82 to 0.93). When the cut point of 0.5 level less than age-appropriated functional developmental was used, the Thai version of the FEDQ had a sensitivity of 0.82, a specificity of 0.54, positive predictive value (PPV) of 0.32, negative predictive value (NPV) of 0.92, and an accuracy of 0.80. The diagnostic agreement of the Thai version of the FEDQ and Denver II Development Screening Test (DDST) was fair (Kappa = 0.31).

Conclusion: The Thai version of the FEDQ was found to be a reliable and valid caregiver-assessment to screen for children with delayed development at a cut-off point of 0.5 level less than age-appropriated functional developmental level. More studies with a larger sample size with the parent of the children less than 12 months of age should be performed.

Keywords: The Functional Emotional Developmental Questionnaire, screening test, child development

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INTRODUCTION

Access to high quality early childhood services is fundamental to the long-term success of the children and their families.¹ The recent model focused increased attention on

early identification, prevention, and intervention services, including attention to the emotional and social development of infants and young children.²⁻³ Social-emotional screening with infant and young children should include skills such as pro-social behavior, self-regulation, self-concept, and self-efficacy because researches have demonstrated that these skills are strongly related to school readiness and future school success.³⁻⁵

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In Thailand, the most widely used screening instruments are the Denver Developmental Screening Test[®] (DDST)⁶ and the short or modified versions of the DDST.⁷⁻⁹ They focus primarily on motor skills, cognitive abilities and language attainment without sufficient measures emphasizing emotional and social well-being or non-verbal problem abilities. In addition, they generally do not measure in-depth aspects of emotional functioning and also do not systematically assess the vital-building aspects of emotional functional interactions, such as ability to relate to others, symbolize wishes and affects, and test reality.

The Functional Emotional Assessment Scale (FEAS),¹⁰⁻¹¹ the Functional Emotional Developmental Questionnaire (FEDQ)¹² and the Greenspan Social-Emotional Growth Chart¹³ are three measurement instruments which compile the results and validation from several years of research.^{10,12-17} The scales describe the critical emotional capacities that characterize functioning and problem solving capabilities. They also serve as an organizing construct for the other aspects of development, including motor, sensory, language, and cognitive functioning.

The Functional Emotional Developmental Questionnaire (FEDQ) which was loosely derived from the Functional Emotional Assessment Scale (FEAS) is a screening questionnaire for parents which starts with infants, but can also be used for adolescents. The FEDQ is based on the premise that failure to master critical functional development capacities is associated with increased likelihood of developmental disorders. To the best of the authors' knowledge, there is no single published screening tool for functional emotional development model in Thai language. A cross-cultural adaptation of the instrument must be performed before it can be accepted for clinical use. The main objective of this study was to compare the results of the Thai version of the FEDQ questionnaire completed by the children's primary caregivers to the results of direct observation of participating children by experienced child

development specialists in order to find out the sensitivity, specificity, positive predictive value and negative predictive value of the FEDQ. The secondary objectives were to test for its reliability, validity and to compare its results with those of the Denver II Development Screening Test (DDST).

MATERIALS AND METHODS

Questionnaire

The FEDQs are 10 parent-reported questions that span the age range of 3 months to 42 months and could be completed in a few minutes. The scale evaluates six stages of social and emotional growth of children from birth to 42 months of age.

Stage 1, 0-3 months: growth in self-regulation and interest in the world,

Stage 2, 4-5 months: engagement in relationship,

Stage 3, 6-9 months: use of emotions in an interactive purposeful manner,

Stage 4, 15-18 months: use of interactive emotional signals or gestures to solve problems,

Stage 5, 19-24 months: use of symbols or ideas to convey intentions or feelings

Stage 6, 31-42 months: creation of logical bridges between emotions and ideas.

All of the items are scored on a 7-point scale depending on the quality and frequency of the responses. The scale is designed for use with parents and primary caregivers in a check list format. The scale does not require the use of an interview.

With the permission from the Questionnaire owner and the Institutional Review Board, a bilingual person translated the Functional Emotional Developmental Questionnaire (FEDQ) into Thai and then a second, independent, bilingual person translated the document back into English. After that the cultural and linguistic issues were discussed between the authors and the translators. The approved document was used as a preliminary Thai version.

Testing of the pre-final Thai version of the Functional Emotional Developmental Questionnaire (FEDQ)

The linguistic validation of the pre-final Thai version of FEDQ was performed on 24 parents from different social classes and with various levels of education. The questionnaire was revised according to the consensus of the investigators and the translators to come up with the final version.

Part I Validity and reliability testing

Before the main study, the psychometric testing of the Thai version of FEDQ was carried out. The testing involved the assessment of internal consistency and test-retest reliability in addition to face, content and concurrent validity. The Thai version of FEDQ was evaluated by three developmental pediatricians for its relevance to the specific age and validity across culture. Each item was graded as three levels: 0=no relevance, 0.5=moderate relevance and 1=very relevance. After evaluation, the total content validity was calculated. A mean score greater than 0.5 was considered as an acceptable content validity.

Regarding criterion validity, it was shown that the original version of the FEDQ (Bayley-III Social-Emotional Scale) had relationships with the standard measures: the Bayley's Scale of Infant Development, Fourth edition, the Wechsler Preschool and Primary Scale of Intelligence, third edition, the Preschool been proved Language Scale, Fourth edition, the Peabody Developmental Motor Scale, second edition, and the Adaptive Behavior Assessment System, second edition.¹⁸ Criterion validity of the Thai version was not tested.

To assess the concurrent validity of the Thai version of the FEDQ (Baley-III Social-Emotional Scale), clinical data was obtained whether the children had problems of autistic spectrum disorder (ASD), Downs syndrome, cerebral palsy, and global delayed development.

Test-retest reliability with 24 families representing 20 % of the sample was carried

out. The two consecutive tests were done one week apart in order to lessen the effects from their memory. The samples were selected by the team's and sample's convenience. A Cronbach's alpha coefficient of greater than 0.70 and no significant difference in initial and follow-up raw total score were considered as good reliability.

Part II Psychometric property testing

The main testing involved finding the sensitivity, specificity, positive predictive value and negative predictive value of the scale. It was tested by using direct observation of the experienced developmental pediatricians as a gold standard. The direct observation of the developmental pediatrician experts and the questionnaire completion of the caregivers were carried out in the same day. The experts were blinded from the result of the screening instrument.

In order to find out the correlation between the result of the FEDQ and DDST, we assumed that at least the correlation has moderate effect size ($r=0.3$) whereas the null hypothesis was no correlation ($r=0.0$) (α equaled to 0.05 and power of study equaled to 80 %), so we had to have the sample size at least 85 cases.

If we assumed that the FEDQ had sensitivity and specificity at least equal to 80% and an acceptable error equaled 8% and the power of study was 95%, we had to have a number of cases (delayed development) and non-cases (normal development) of 97 subjects/ group. If we prepared another 20% for incomplete data, the sample size should be 120.

A study was carried out on an opportunity sample selected from well-baby clinic, out-patient clinics and routine home visits in Bangkok and the northeast part of the country where the authors were working. Inclusion criteria were the literate 18 year old or more primary caregivers who took care of the children (3-42 months of age) at least 2 days a week for two weeks and willing to participate in this study who were invited to participate this study.

After obtaining informed consent, the

participants were asked to complete the questionnaires; consisting of a simple demographic semi-structured questionnaire requesting information on basic background of the families and the final Thai version of the Functional Emotional Developmental Questionnaire (FEDQ). The direct observation of the developmental pediatrician experts classified each child to Normal Development (ND) or Delayed Development (DD) including the specific classification of the apparent delay, and the arrangement for the intervention. The ND group included only children who were judged as having age-appropriate development and no clinical concern was expressed by the examiner.

After clinical judgment of each child was obtained, the FEDQ was scored by a research assistant based on a predetermined sub-scale scoring system (Table 1). Functional delay was defined when the children whose score on the FEDQ was less than 1 level of age-appropriated functional developmental level.

Question 1 A and 1B were used for the children aged 0-2 months, Question 1A-2B for 2-6 months, Question 1A-3 for 7-11 months, Question 1A-4B for 12-23 months, Question 1A-5B for 24-35 months, and Question 1A-6 for 36-42 months (**Appendix**). The cut points for each level have been shown in Table 1.

All of the children who were categorized as “Functional Delay, FD” and fifty-five children who passed the parent-completed FEDQ

and who were categorized as “Functional Normal, FN” were randomly selected and sent to the assessor to perform Denver II Development Screening test (DDST). The assessors for the DDST were the experienced health care providers who had finished the DDST training course. The Denver II screening test was used to assess personal-social, fine motor, adaptive, language and gross-motor domains. In each domain, a child was suspected if he or she had 2-or-more “caution” or any “delayed” items. These two groups were defined as not able to pass the level where 75% and 90% of normal children of the same age could pass, respectively.

RESULTS

During a 1-year period, caregivers of a sample of 120 children were recruited to the study. Four caregivers skipped some pages and 3 caregivers skipped some items of the questionnaire. Out of the 113 children whose caregivers completed the questionnaire, 90 (86%) were their mothers. The mean age of the children was 22.7 months (range 4-42). The demographic of the study population have been shown in Table 2.

Internal consistency

To ensure the reliability of the Thai version of the FEDQ, the internal consistency was calculated from the questionnaire of 24 families and the result was satisfactory and the

TABLE 1. Assignment of scales Scores based on sub-scale FEDQ Scores*.

Functional emotional level	FEDQ possible score by 1 level	EEDQ score to obtain 0.5 level	EEDQ score to obtain 1 level
1 (Q1A, Q1B)	14	5-10	11-14
2 (Q2A, Q2B)	14	5-10	11-14
3 (Q3)	7	3-4	5-7
4 (Q4A, Q4B)	14	5-10	11-14
5 (Q5A, Q5B)	14	5-10	11-14
6 (Q6A, Q6B)	14	5-10	11-14

* Example Child FEDQ 1 = 12 Clinical Functional Emotional Level = 1
 Child FEDQ 2 = 8 Clinical Functional Emotional Level = 0.5
 Child FEDQ 2 = 3 Clinical Functional Emotional Level = 0.5
 Total score assigned = 2

TABLE 2. Demographic data of the study population.

Variable	Number (%)
N = 113	
Children	
Gender (Female)	56 (50%)
Clinical diagnosis	
Autistic spectrum disorder	11 (10 %)
Global delayed development	7 (6%)
Cerebral palsy	4 (3%)
Down syndrome	1 (1 %)
Family	
Participants (primary caregivers)	
Gender (Female)	106 (93%)
Mother/ father, grandmother or others	90 (80%), 23 (20%)
Education	
Elementary school	18 (16%)
Middle school	18 (16%)
High school	41 (36%)
Bachelor degree or higher	36 (32%)
Family structure	
Two parent/ Mother and other adult	105 (93%), 8 (7%)
Income (Bath/ month)	
Less than 10,000	38 (34%)
10,000 – 20,000	43 (38%)
More than 20,000	32 (28%)
Having siblings	34 (30%)
Attending school or nursery	27 (23%)

Cronbach’s alpha coefficient of the total score was 0.83. Test-retest reliability was acceptable with the intra-class correlation coefficient of 0.89 (95% CI 0.82 to 0.93).

Validity analysis

The Index of Conjugate (IOC) was utilized to assess the content validity of the Thai version of the FEDQ. The IOC among three reviewers was between 0.5-1.0. It meant that the content validity was acceptable.

For concurrent validity, clinical data was obtained. According to the expert opinion, 23 children were categorized delayed development (DD). The diagnosis comprised of 11 autism, 7 global delayed development, 4 cerebral palsy and 1 Down’s syndrome. The performance of the caregiver completed FEQD against

the diagnosis of “Delayed development” by the expert’s judgment as a gold standard was examined. According to FEDQ, 36 children were categorized as “Functional delay” when their functional development were 1 level less than the age-appropriated functional developmental level. The validity of the Thai version of the FEDQ as a screening tool has a sensitivity of 0.70, a specificity of 0.78, positive predictive value (PPV) of 0.44, negative predictive value (NPV) of 0.91, and an accuracy of 0.76. If the cut point was changed to 0.5 level less than age-appropriated functional developmental level, the sensitivity of this test was increased to 0.82 and NPV was increased to 0.92, but the specificity was decreased to 0.54 and the positive predictive value was decreased to 0.32. (Table 3)

TABLE 3. Validity of the Thai-version of the FEDQ.

	Cut by 1 level delay	Cut by 0.5 level delay
Sensitivity	0.70	0.82
Specificity	0.78	0.54
Positive predictive value	0.44	0.32
Negative predictive value	0.91	0.92
Accuracy	0.76	0.60

In order to study the Thai version of the FEDQ as a screening tool, the analysis was based on the cut point of 0.5 level delay by age band and the details of false positive and false negative cases. Table 4 shows that there was no true positive in the children age 2-6 and 7-11 months, so the sensitivity of the test for these age groups cannot be calculated. The age bands from 12 months to 42 months showed that the sensitivity of the test was increasing and the specificity was decreasing in the older age group.

The analysis of each item of the questionnaire revealed that the item which contributed the most to the number of false positive was the item 2a. “When your child is upset, overwhelmed, or in any type of discomfort does he or she...and the choice vary from 1 “Withdraw or discriminately seek comfort with whoever is closest” to 7 “Look to you always to comfort”. If the result of this item was not considered (yielding the score 7 from all of the cases), the number of false positive decreased from 41 to 29 and the specificity increased from 0.54 to 0.68. The second most item which contributed to the large number of false positive

was the item 2b. “When you typically interact with your child, is he or she....” of which the choice vary from 1 “Disengage and cold” to 7 “Mostly or always warm and caring”.

In 4 false negative cases, 1 was a child with autistic spectrum disorder (n=11) and 3 children were cerebral palsy (n=4). There was no false negative from the caregivers of the children with global delayed development (n=8) and Down’s syndrome (n=1).

The diagnostic agreement of the Thai version of the FEDQ and DDST for delayed development was compared from the data of 91 cases. It was found that the level of agreement for the sample was fair (Kappa = 0.31). If the item 2a was not used for judgment (score = 7 for all of the cases), the level of agreement was moderate (Kappa = 0.60).¹⁹

DISCUSSION

The results of this study showed that the Thai version of the FEDQ achieved acceptable levels of reliability and validity. The internal consistency of the Thai version of the FEDQ (Cronbach’s alpha coefficient = 0.89) was within the acceptable range.²⁰ It was also indicated that the Thai version of the FEDQ had sufficient discriminatory validity as a screening tool for detecting the children with delayed development. At a cut point of 0.5 level less than age-appropriated functional developmental level, the Thai version of the FEDQ had acceptable sensitivity (0.82) but the specificity was not high (0.54).

From the study of the Bayley-III Social-Emotional Scale which based on the same con-

TABLE 4. Analysis of the validity by age segment (0.5 level delay cut point).

Age band (months)	True positive	True negative	False positive	False negative	Sensitivity	Specificity
2-6		7	2			
7-11		21	11			0.47
12-23	5	24	10	1	0.90	0.58
24-35	6	28	12	3	0.50	0.57
36-42	12	10	6	0	1.00	0.40
Total	23	90	41	4	0.82	0.54

ceptual framework with FEDQ, the sensitivity of the Bayley-III Social-Emotional Scale (0.86) was similar to the result from this study, but their specificity was higher (0.90)¹⁷ The reason might be due to the difference of the study population. Breinbauer and Casenhiser reported the results of Bayley-III Social-Emotional Scale for screening the children diagnosed with autistic spectrum disorders while our study used the Thai version of FEDQ for screening the children diagnosed with all developmental disabilities. The high percentage of false negatives from caregivers of the children diagnosed with cerebral palsy (3 in 4 cases) emphasizes further study in this population. When the analysis was focused on the children diagnosed with autistic spectrum disorders, the specificity and sensitivity was increased to 0.98 and 0.56 accordingly.

The PPV was 0.32. Thus, one of every three referrals will render a diagnosis. While this may seem troublingly inaccurate, the costs of over-referral are substantially less than the cost of delayed treatment.²¹⁻²² The test's negative predictive value is 0.92 meaning that at the chosen cut point score, there would be 92% chance of no developmental problems.

However, item nonresponse should be minimized by embedding a clear instruction phase in the questionnaire. Item modification should be carried out to increase specificity of the test especially the clarification about the perception of engagement (item 2a, 2b) among Thai caregivers.

In addition, more studies with a larger sample size with a variety of children age bands and clinical diagnosis should be warranted, especially for the children less than 12 months of age.

CONCLUSION

The results of the present study showed that the Thai version of the FEDQ is a valid and useful instrument in screening for children with delayed development. It has satisfactory inter-rater reliability and sensitivity with the cut

point of 0.5 functional level delay from age-appropriated functional developmental level. However its specificity should be improved by carefully modification of some of the items.

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The Functional Emotional Developmental Questionnaire for Childhood

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The following questions about emotional and intellectual development are evaluated on a seven-point scale. The numbers with no answer next to them indicate choices that fall in between the adjacent answers. Please complete the questions with current information about your child. Please circle the number that most closely applies to your child under each question. Please note that there is an accompanying motor and sensory processing questionnaire that should also be filled out.

1a. Can your child be calm, focus, and perform routine tasks at home or at school in an age-appropriate manner when doing something he wants to do (e.g., a baby focusing on Mom's moving face; a school-aged child focusing on playing a game of checkers with you)?

- 1 — None of the time
- 2
- 3 — Rarely
- 4
- 5 — Some of the time
- 6
- 7 — Most of the time

1b. Can your child be calm and focused and perform routine tasks at home or at school in an age-appropriate manner when doing something someone else wants him to do?

- 1 – None of the time
- 2
- 3 – Rarely
- 4
- 5 – Some of the time
- 6
- 7 – Most of the time

2a. When your child is upset, overwhelmed, or in any type of discomfort does he or she...

- 1 — Withdraw or indiscriminately seek comfort with whoever is closest.
- 2
- 3 — Look to you for comfort, but is superficial and need oriented.
- 4
- 5 — Look to you, but if very overwhelmed sometimes shuts down and withdraws.
- 6
- 7 — Look to you always for comfort.

2b. When typically interacting with your child, is he or she...

- 1 – Disengaged and cold.
- 2
- 3 — Only warm to you when they want something in return.
- 4
- 5 – Sometimes warm and caring, but are easily distracted from the interacting.
- 6
- 7 – Mostly or always warm and caring.

3. When you are closely interacting and playing with your child and you make an emotional gesture, i.e. smile or funny face, does he or she...

- 1 – Look disinterested and unresponsive.
- 2 – Only interact if you really push and repeatedly try for a response.
- 3
- 4 – Smile back or respond, but sometimes seem confused and do nothing.
- 5 – Smile back and clearly understand your expressions, but with only a limited number of emotional gestures.
- 6
- 7 – Smile back and clearly understand your expressions with a wide range of emotional gestures.

4a. When you and your child are interacting or playing, your child...

- 1 — Can not sustain a back and forth interaction.
- 2
- 3 — Can only briefly sustain a back and forth interaction, i.e. 20-30 seconds.
- 4
- 5 — Sometimes can sustain a long back and forth interaction, i.e. 5-10 minutes of either gesturing, playing, or talking with you.
- 6
- 7 — Most of the time can sustain a long back and forth interaction.

4b. In a situation where your child needs you to do something for him or her, can use words, gestures, or a combination of the two...

- 1 — Only very rarely or not at all and, therefore, is not able to let you know what he or she wants.
- 2
- 3 — Only sometimes to let you know what he or she wants, but often gets frustrated and give up.
- 4
- 5 — And is persistent in letting you know what he or she wants with the same or very similar gestures or verbal directions.
- 6
- 7 — And is persistent with letting you know what he or she wants, but can modify and change the directions until you understand. (i.e. can keep showing you in different ways what is wanted)

5a. When your child is frustrated or experiencing some emotion and you ask how he or she feels, the child...

1 — Does not respond and may get confused.

2

3 — Is unable to use words to tell you and instead acts it out by hitting, clinging, or getting excited.

4

5 — Explains how she or he feels for a few feelings (e.g., happy or mad), but can't describe other feelings or use words when emotions are intense.

6

7 — Clearly tells you that he or she is happy, mad, sad, etc., most of the time, even if the feelings are intense.

5b. When playing with or without toys your child is

1 — Unable to develop even basic pretend play with concrete actions (e.g., moving the truck to the house).

2

3 — Able to develop a few elements of a story, but without elaboration, motivations, or feelings (e.g., man put on truck).

4

5 — Create a pretend story with motives and emotions some of the time.

6

7 — Create a story line with motives and emotions most of the time.

6. When your child is feeling certain emotions toward you, he or she is...

1 — Unable to tell you why they feel how they do.

2

3 — Can partially tell you how they feel, but thinks that it is the end of the world.

4 — Can tell you how they feel partially, but the explanation wanders and is hard to understand - you can get the gist of their explanation.

5 — Can give you a clear reason for some feelings like happiness, but not others like anger or frustration.

6 — Can give you a clear reason for why they feel a certain way

7 — Can give you a clear reason for why they feel a certain way, even under extreme emotions.