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발달장애아동의 언어 및 운동발달에 관한 K-DST의 타당성

Validation of K-DST About Motor and Language Development in Children With Developmental Disabilities

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Purpose: The purpose of this study was to determine the validation of K-DST about motor and language development in children with developmental disability to screen them at an early stage in South Korea. **Methods:** 58 children with developmental disabilities in the study were collected to determine the aim of this study. K-DST was used as a measurement instrument to verify the validity of developmental screening test for children with developmental disabilities. Cronbach's Alpha and Confirmatory Factor Analysis were used to identify validity and reliability of K-DST in children with developmental disabilities. **Results:** The reliability of K-DST in children with developmental disabilities by developmental areas (e.g., gross motor, fine motor, language development) was 0.96-0.98, indicating a significantly high level of reliability. The results of confirmatory factor analysis had higher multicollinearity than .40, which means that they had positive loading of each question in each variable. In addition, there was a significant relationship between gross motor and fine motor development of children with developmental disabilities even though there were no significant relationships between others (e.g., gross motor and language, fine motor and language). In the model fit, the AGFI factor showed a positive model fit, but other factors did not have. **Conclusions:** Gross motor, fine motor, and language had positive loading of questions in each variable. There was a significant relationship between gross motor and fine motor development of children with developmental disabilities. But there was not a positive model fit in developmental screening test. In follow-up studies it is necessary to verify the validity by using the all the factors of the K-DST.

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목적: 본 연구의 목적은 발달장애아동의 운동 및 언어 발달에 대한 K-DST의 타당성을 확인하여 조기 선별 검사의 타당성을 살펴보기 위함이다. **방법:** 본 연구의 목적을 살펴보기 위해 발달장애아동 58명을 대상으로 자료를 수집하였다. 발달장애아동의 발달선별검사의 타당성을 검증하기 위한 측정도구로 K-DST를 사용하였다. 발달장애아동의 K-DST의 타당성과 신뢰성을 살펴보기 위해 Cronbach 's Alpha와 확인적 요인분석을 실시하였다. **결과:** 발달장애아동의 K-DST의 발달영역(예 : 대근육운동, 소근육운동, 언어발달)에 대한 신뢰도는 0.96-0.98로 상당히 높은 수준의 신뢰도를 나타내었다. 확인 요인 분석 결과는 .40보다 높은 다중 공선성을 보였으며, 이는 해당 변수의 질문문항이 양의 부하가 있음을 의미한다. 또한 발달장애아동의 대근육운동과 소근육운동 사이에는 상관관계가 있는 것으로 나타났다. 대근육운동과 언어발달, 소근육운동과 언어발달 간에는 상관이 없었다. 모형 적합에서 AGFI 계수는 양의 모형적합을 나타내었지만 다른 요인은 그렇지 않았다. **결론:** 대근운동발달, 소근운동발달, 그리고 언어발달과 관련된 각 문항들은 적절하였다. 그리고 발달장애아동의 대근육운동과 소근육운동 발달 사이에는 상관관계가 있는 것으로 나타났다. 본 연구에서는 K-DST검사의 전 영역에 대한 타당성을 알아본 것이 아니기 때문에 발달장애아동의 선별검사로 사용하기에는 제한점이 있다. 향후 연구에서는 K-DST의 모든 영역을 이용하여 타당성을 검증할 필요가 있다.

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Ⅰ. Introduction

Developmental disability, according to the Korea National Institute of Special Education (2009), is a disorder whose development is likely to significantly deviate from the average and sustain and there are severe and chronic disorders in both physical and mental areas. However, the term of developmental disability was not included in Welfare of Disabled Persons Act and Special Education Improvement Act in South Korea. Although the term development disorder does not yet have a harmonized view, it is widely used in areas, such as special education, adapted physical activity, medicine, and psychology (Yoon, 2004). Furthermore, this disability includes intellectual disability, autism, and cerebral palsy, which have similar educational needs, and is characterized by delays in cognitive development (Park, 2002).

The number of individuals with developmental disabilities continues to increase in South Korea. The number of individuals with developmental disabilities has increased 1.5 times, from 73,456 in 2005 to 137,399 in 2015. The portion of developmental disability in the disability population has increased from 7.7% in 2005 to 8.5% in 2015 (Ministry of Health and Welfare, 2016). This is because the number of individuals with developmental disabilities diagnosed with intellectual disability, autism, and cerebral palsy is increasing as social awareness of developmental disabilities has increased and medical technology has developed. For instance, cases that used to be dismissed as idiots or underperforming children are currently diagnosed with autism.

Developmental disability can be defined as inability to develop physically and mentally due to genetics, birth damage, or other causes (Mizzi & Charles, 2006). It occurs from birth to adulthood, and most occur throughout life. Most persons with developmental disabilities are diagnosed before entering elementary school. In particular, it is significant to be diagnosed early on with developmental disability. Many children with developmental disabilities show delays in development due to disability and may exhibit a different development process from children without disabilities. Problems with the development of childhood can negatively affect the overall development of childhood and present problems in the future development process. As a result, early detection of a developmental disability can provide children with a developmental disability with early intervention, which can improve development of children and have positive effects on treatment.

According to the Pierce et al. (2019), the best time to diagnose developmental disability is 14-16 months old to give effective treatment. However, the time of diagnosis of developmental disability is average after 3 years old in South Korea. In addition, many children with developmental disability were not diagnosed before entering into elementary school in South Korea (the Korea National Institute of Special Education, 2009). The reason why developmental disability were not diagnosed early is that there is still a lack of various systems and developmental tests to detect a developmental disability earlier. In the United States, a variety of systems for early diagnosis of developmental disability was created, and various developmental tests for infants and toddlers were developed. To solve these problems, the Korea Ministry of Health and Welfare (2016) began to use Korean Developmental Screening Test for infants and children (K-DST) in 2014.

K-DST analyzed the differences in the development speed of children according to their respective monthly age (a total of 20 sections) from 4 months to 71 months, and was divided into six development areas in the areas of gross motor, fine motor, recognition, language, sociality, and self-help. This test is recommended for infants and children who have been judged to “recommendation for deep evaluation.” K-DST, which was created only for primary screening, conducted only an analysis of classifying a disability, and did not examine the validity of a developmental screening test for children with developmental disability, which is not enough for early screening of children with developmental disabilities. In addition, there is not a research to determine the validity of a developmental screening test in children with developmental disability in South Korea. There was only one research to determine validity of the K-DST for very low birth weight infants (Kim et al., 2019). Therefore, the purpose of this study was to determine the validity of developmental screening test in children with developmental disability in order to screen children with developmental disabilities at an early stage in South Korea. Especially, this study was to validate a developmental screening test about gross and fine motor and language development for children with developmental disabilities because many children with developmental disabilities have low ability in these areas (e.g., gross and fine motor and language development).

Ⅱ. Method

1. Participants

The purpose of this study was to determine the validity

of a developmental screening test in motor and language development in over 60 months children with developmental disabilities in South Korea.

Table 1. Demographic characteristics of participants

Characteristics	Classification	Number of participants	Percentage
Gender	Male	38	65.6%
	Female	20	34.5%
Type of disability	Intellectual disability	18	31.0%
	Autism	15	26.0%
	Cerebral palsy	25	43.0%
Respondent	Mother	56	96.6%
	Father	2	3.4%

Total 62 children with developmental disabilities were recruited to identify the purpose of the study. On the other hand, 4 participants were removed because of incorrect replies such as no reply in a request on the given test questions. Finally, there were 58 children with developmental disabilities in the study. Table 1 presents the demographic characteristics (e.g., sex, type of disability, respondent) of participants in the study.

2. Procedure

The data collection period was about three months from May 2019 to July 2019. K-DST was conducted for children with developmental disabilities in A, B, and C areas in South Korea to achieve the purpose of this study. This test was conducted by parents or guardians who were aware of children with developmental disabilities due to participants' age or cognitive difficulties to take the K-DST test. The purpose of the study and test methods were explained in detail to parents or guardians of children with developmental disabilities before taking the K-DST. Further, this test was conducted only on those who agreed.

3. Instrument

K-DST was used as a measurement instrument to verify the validity of a developmental screening test for children with developmental disabilities. This test reflected developments at each month. The areas of gross motor, fine motor, and language development were only studied in this study, excluding cognitive and sociality development because they were conducted to identify a development process for children with developmental disabilities by many researchers, which was that many researchers conducted cognitive and sociality development of school age children (Kim, 2016; Kim & Kil; 2009; Park, 2002; Yoon, 2004). In addition, this test showed appropriate validity (RMSEA: 0.052-0.097) and reliability (Cronbach's Alpha: above 0.7, test-retest: 0.77-0.88). In this study, gross motor, fine motor, and language development variables were used to identify the validity of developmental screening test for over 60 months children with developmental disabilities because cognitive and social development of children with developmental disabilities was conducted in a variety of researches and many children with developmental disabilities have low skills in motor and language development. Therefore, 7 questions in gross motor, 11 questions in fine motor, and 10 questions in language were used to determine the validity of test in this study.

4. Data analysis

The frequency analysis was conducted to determine the demographic characteristics of children with developmental disabilities (e.g., sex, type of disability, respondent). Furthermore, Cronbach's Alpha and Confirmatory Factor Analysis (CFA) were used to identify the validity and reliability of K-DST in children with developmental disabilities using IBM SPSS 21.0 and AMOS 19.0 program.

Ⅲ. Results

1. Reliability analysis

Based on the data collected, the reliability of K-DST in children with developmental disabilities by developmental areas (e.g., gross motor, fine motor, language development) was calculated from Cronbach's Alpha, and the results were given in Table 2. This test consisted of a number of questions for each developmental area. The reliability of this test is an indicator of how consistently the concept of composition of the questions for each development area was measured. The value of 0.7 or higher can be interpreted as a significant confidence between the questions. The analysis of the collected data showed that the internal correspondence between development areas of children with developmental disabilities was 0.96-0.98, indicating a significantly high level of reliability.

Table 2. Results of reliability analysis

Period	*Cronbach's Alpha*		
	Gross motor	Fine motor	Language
Over 60 months	.96	.96	.98

2. Validity analysis

Confirmatory factor analysis was used to determine each question loading in each variable and relationships between variables (e.g., gross motor, fine motor, language development). Based on the results, all questions in each variable had higher multicollinearity than .40, which means that they had positive loading of each question in each variable.

In addition, there was a significant relationship between gross motor and fine motor development of children with developmental disabilities even though there were no significant relationships between others (e.g., gross motor and language, fine motor and language). In the model fit, the Adjusted Goodness of Fit Index (AGFI) factor showed a positive model fit, but other factors (e.g., Goodness of Fit Index; GFI, Root Mean Square Residual; RMR) did not have. Table 3 presented these outcomes.

Table 3. Results of validity analysis

Over 60 months					
Gross motor	Factor load	Fine motor	Factor load	Language	Factor load
G49	.90	F44	.87	L43	.90
G50	.81	F45	.77	L44	.46
G51	.95	F46	.82	L45	.98
G52	.81	F47	.92	L46	.90
G53	.69	F48	.82	L47	.98
G54	.76	F49	.81	L48	.75
G55	.89	F50	.89	L49	.62
-	-	F51	.86	L50	.78
-	-	F52	.89	L51	.88
-	-	F53	.86	L52	.44
-	-	F54	.43	-	-
Correlation coefficient					
Gross Motor-Fine Motor	.01***	Gross Motor-Language	.37	Fine Motor-Language	.61
GFI[a)]	.43	AGFI[b)]	1.00	RMR[c)]	.11

[a]GFI(Goodness of Fit Index), [b]AGFI(the Adjusted Goodness of Fit Index) [c]RMR(Root Mean Square Residual)
*** $p<.01$

Ⅳ. Discussion and Conclusions

The aim of this study was to identify the validity of a developmental screening test about motor and language development in children with developmental disabilities to screen children with developmental disabilities at an early stage in South Korea. Based on the results of the study, there were three outcomes.

First, all questions in each factor (gross motor, fine motor, language) had positive loading of each question in each variable. K-DST was developed to determine whether infants and toddlers have a normal developmental stage and there were 3,674 participants to develop this test. Although this test did not collect only participants who have disabilities to develop it, there were participants who have disabilities. Hence, this test has a positive validity of questions in each factor for children with developmental disabilities.

Second, gross motor and fine motor development of children with developmental disabilities had a significant relationship even though there were no significant relationships between others (e.g., gross motor and language, fine motor and language). Motor skills of children develop rapidly in infant and toddler period, and they develop overall as age increases (Kim, 2016). Gross motor refers to large muscle movements, as large muscle movements when running or walking (Kim, 2015). Fine motor can be defined as small muscle movements. For example, you can do things like dialing with your fingers when you make a call (Kim & Kil, 2009). A researcher stated gross motor develops faster than fine motor, and gross motor helps fine motor development (Park, 2005). As a result, the gross motor and fine motor development are closely related, and they help each other in development. However, there were not significant relationships between gross motor and language and fine motor and language. There is not an accurate answer why there were not significant relationships, but we can infer the answer about that. Many children with developmental disabilities have difficulties in language development (Ayres, 1979). In addition, a disability of children with developmental disabilities may become entrenched and motor development may not affect the development of language. Thus, motor development of children with developmental disabilities may not help to develop language due to these reasons.

Third, this test did not show a positive model fit because K-DST has six developmental stages (gross motor-fine motor-recognition-language-sociality- self-help). It was developed by using these six stages. However, this study used only three factors (e.g., gross motor, fine motor, language). Other factors were not included in this study. According to the Kim et al. (2019), it used all factors to validity the K-DST for very low birth weight infants. This study assessed this developmental tool compared to these factors with another developmental tool (e.g., the Bayley Scales of Infant Development-II). As a result, it could obtain a positive study result. Consequently, there was a limit to validate this developmental screening test about motor and language development for children

with developmental disabilities in South Korea.

In conclusion, the aim of this study was to determine the validation of developmental screening test about motor and language development in children with developmental disability to screen them at an early stage in South Korea. Based on the results, there were three conclusions. First, all questions in each factor (gross motor, fine motor, language) had positive loading of questions in each variable. Second, there was a significant relationship between gross motor and fine motor development of children with developmental disabilities. Third, there was not a positive model fit in a developmental screening test.

Furthermore, there were three suggestions. First, there were few data to validate developmental screening test in children with developmental disabilities. More participants are needed in the future study to determine the validity of this test in children with developmental disabilities. Second, this study used only three factors, such as gross motor, fine motor, and language development of children with developmental disabilities. On the other hand, K-DST has six factors including recognition, sociality, and self-help. In the future study, it is necessary to use all the factors of this test to validate. Third, this study examined children with developmental disabilities. Developmental disability has three types of disability such as intellectual disability, autism, and cerebral palsy. Thus, it is necessary to analyze the differences in the types of disability in the future study.

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