

**MEASUREMENT INSTRUMENT DEVELOPMENT EARLY CHILDREN DEVELOPMENT :
LITERATURE REVIEW**



Sudiyati¹, Asri C Adisasmita², Hadi Pratomo³, Rini Sekartini⁴

¹Doctoral Student of Public Health at Faculty of Public Health, Universitas Indonesia, Jakarta, Indonesia

² Department of Epidemiology, Faculty of Public Health Universitas Indonesia

³ Department of Health Promotion, Faculty of Public Health Universitas Indonesia

⁴ Department of Medicine, Faculty of Medicine Universitas Indonesia

Abstract— Monitoring the development of early childhood (Early Child Development) is a very important thing that must be done in every country. To carry out such monitoring, an instrument that is easy, low-cost but valid and reliable is needed in assessing child development. Instrument development efforts have been carried out in various countries, both developing new instruments and adapting existing instruments. The purpose of this research is to identify steps in developing instruments for measuring child development in various countries that are easy to implement but valid and reliable. Literature review through the article search stage from data-based online, English-language articles published from 2010-2020, which contain research content on the development of child development measurement instruments. Of the 17 articles reviewed in developing instruments, 3 articles on creating new instruments, 10 adapting existing instruments, and 4 only testing and comparing with gold standard instruments. All articles go through the validity and reliability test phase. However, only 8 used other instruments as the gold standard.

Keywords: Development, instrument, development, early childhood.

1. Introduction

Development is the increase in the ability of the structure and function of the body to be more complex. Development involves the process of differentiation of cells, tissues, organs and organ systems that develop in such a way that each can fulfill its function.(1)(2). Early child development (ECD) includes physical, social, emotional, language and cognitive development. What happens at the beginning of the year is a critical period that will affect the development of the next period throughout life(3). Recommendations from the American Academic Pediatrics (AAP) are that each country is expected to screen and monitor child development regularly so that early intervention can be carried out if there is a suspicion of developmental disorders in children.(4). In carrying out child development monitoring activities, the aspects of development that are measured include aspects of psychology and behavior. Measurements are carried out by various methods using various screening tools or instruments(5). Instruments are tools used to produce objective conclusions(6). Questionnaires or tests are a set of goals that have been standardized either from the answers to individual questions that are concluded with numbers or scores. Item score is defined as a number that marks a question, task or behavior item (Dorans, 2018).

Instrument development is the activity of assembling or writing the underlying items in making questions as a tool aimed at the target population(7). The target population is a group of people or individuals whose measurements will be made from the developed instrument(8). Test development and standardization (normalization) were related processes when the development of the first instrument was carried out. During and after development, items are compiled and relevant indicators are made in selecting the measurement constructs contained and the final step is to determine specific standard (7). Effective scale construction has important implications in drawing research conclusions, the main influence is the quality and magnitude of

the effect obtained and has a statistically significant value (9) or in other words the value of sensitivity and specificity (10). The development of the test instrument consists of steps including reviewing literature, compiling items, measuring validity, conducting trials and analysis before being designated as the final version of the instrument (11). Several screening tools that have been used to measure child development worldwide include Bayley Scales of Infant Development II, Ages & Stages Questionnaires (ASQ), Parents' Evaluation of Developmental Status (PEDS), Denver-II Developmental Screening Test (DDST). Meanwhile in Indonesia, there are several instruments or tools used by health workers in monitoring developments, including DDST, KPSP, and the checklist for the development of the MCH Handbook, Primaku Application.

The purpose of this review is to identify steps in the development of instruments for measuring child development in various countries that are easy to implement but valid and reliable.

2. Method

This study uses the literature review method through the article search stage from online data-based, the authors collect a number of English-language articles published from 2010-2020, which contain research content on the development of child development monitoring instruments. The online data used are Proquest, JSTOR, Scencedirect, Pubmed and Googel Scholar. Search using keywords: instrument development, screening, validity, reliability and child development. The inclusion criteria for this article search were: English articles, research on the development of child development monitoring instruments. From this article, the author reviews the articles based on objectives, methods, samples, analysis and results.

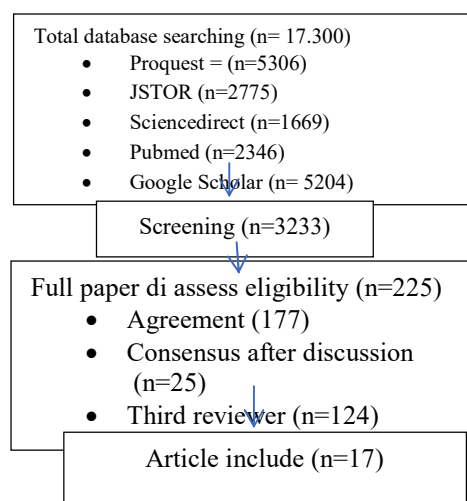


Figure 1 Literature Review Flow Chart

3. Result

Results: From 16 research articles on the development of child development instruments that were reviewed, the objectives were almost the same, namely developing, adapting, comparing and assessing the ease of the instrument in measuring and detecting developmental disorders in children which include cognitive, gross and fine motor, social emotional and behavioral domains. Instruments for measuring child development are made to detect delays or developmental disorders in children.

No.	Title	Aim	Instrument	Measure domain	Sample	Method	Analysis and result
1	A Cross Sectional Pilot Study of The Scottish Early Development Instrument : a tool for addressing inequality Lisa Marks Woolfson, et all BMC Public Health Year 2013	Undertake the development of an easy-to-use instrument to measure Early Child Development (ECD) in Scotland and carry out Validation with an instrument developed in Canada	1.Scottish Early Development Instrument s (SEDI) 2.Canadian Early Development Instrument (CEDI)	1. Physical and mental health 2. Social Skills 3. Emotional maturity 4. Language and cognitive development 5. Language 6. General knowledge	Sample : 1090 (524 female and 563 male) Child age: 4-6 years Place: Canada	Adaptation from Canadian EDI to Scottish EDI Stage 1 1. Implementation of Canadian EDI in Scottish schools with a small sample 2. Adapting Canadian EDI to a Scottish context Stage 2: 1. Converting CEDI to SEDI version 2. Implementing SEDI in a Scottish school with a large population 3. Conducting socialization about children's development 4. Perform analysis	• Scottish Early Development Instruments (SEDI)
2	Concurrent	Identify	1.Group	1. Cognitive	Sample of	1. Measuring	• Internal consistency

	<p>Validity and Feasibility of Short Tests Currently Used to Measure Early Childhood Development in Large Scale Study</p> <p>Marta Rubio-Codina, et al Population Health Metrics 2016</p>	<p>instruments that are easy to implement and use to measure child development</p>	<p>A: Ages Stage Questionnaire (ASQ) Denver II, Short-Forms (SFI and SFII)</p> <p>2. Group B : Bayley III (Gold standard)</p>	<p>e</p> <ol style="list-style-type: none"> 2. Expression language 3. Rough motoric 4. Fine motor 	<p>1,533 children aged 6-42 months</p> <p>Place: Bogota, Colombia</p>	<p>g children's development using multidimensional</p> <ol style="list-style-type: none"> 2. Re-measurement with gold standard (Bayley III) 3. Performing concurrent reliability and validity measurements of developmental screening instruments 	<p>and test-re test reliabilities after 6–19 days very good on Bayley-III (ICCs 0.9)</p> <ul style="list-style-type: none"> • Validity internal good, except ASQ 3 • Good concurrent validity • The need for predictive validity to select the instrument to be used in a large population
<p>3</p>	<p>Measuring Early Childhood Development at global Scale Evidence from the Caregiver – Reported Early Development Instrument</p> <p>Charles McCoy Fund, <i>Journal of Early Childhood Research Quarterly</i> 2018</p>	<p>Develop child development instruments for babysittersCaregiver Reported Early Development Instrument (CREDIT)</p>	<p>Caregiver Reported Early Development Instrument (CREDI)</p>	<ol style="list-style-type: none"> 1. Cognitive 2. Emotional social 3. Rough motoric 4. Fine motor 5. Mental health 	<p>Sample = 8022 children in 17 countries 0-36 months old</p> <p>Place: Ghana, Pakistan, Tanzania, India, Laos, Bangladesh, Brazil</p>	<p>Instrument development</p> <ol style="list-style-type: none"> 1. Creating a conceptual framework 2. Create question items, 3. do a test run, 4. Perform validation tests, <p>Perform analysis</p>	<p>Quantitative and qualitative include:</p> <ol style="list-style-type: none"> 1) Test re test reliability = kappa: 0.62 2) Item response theory 3) level invariance (bias) test 4) Percent Unsigned on the differential test function (% uTDF = 5%) 5) Internal Consistency (Cronbach alpha = 0.89) 6) Discriminant v

							<p>ality (multi level linear regression model)</p> <p>7) Criterion validity with standard correlation ($r=0.23$)</p> <p>8) CREDI instruments are valid, reliable and suitable for ages under 3 years.</p>
4	<p>Development and validation of an early childhood development scale for use in low-resourced settings</p> <p>Dana Charles McCoy et al</p> <p>Population Health Metrics 2017</p>	<p>Develop an early childhood development report instrument designed to be used by housewives</p>	<p>CREDIT Gold standard : Baley Score Development II</p>	<ol style="list-style-type: none"> 1. Cognitive 2. Emotional social 3. Rough motoric 4. Fine motor 5. Mental health 	<p>Sample : 284 children aged 18-36 months from urban and rural areas</p> <p>Place: Tanzania</p>	<p>Instrument development</p> <ul style="list-style-type: none"> - Validity test with test re-test reliability, internal consistency, and discriminant validity from the ECD test measurement - Qualitative studies 	<p>Analysis CFAConvergent validityDivergent validity Test re-test Alpha cronbach = 0.93 ICCS = 0.78 TAQ-C is clear, cheap, easy to implement, can be used individually and in groups, it can also be used for research,</p>
5	<p>Further Development and Validation of the Affordances in the Home Environment for Motor Development – Infant Scale (AHEMD-IS)</p> <p>Priscila M. Cac,ola, et al</p>	<p>Develop and validate the Affordances in the Home Environment for Motor Development –Infant Scale (AHEMDIS) instrument as a quality instrument with motor measurement capabilities</p>	<p>Affordances in the Home Environment for Motor Development–Infant Scale (AHEMDIS)</p>	<ol style="list-style-type: none"> 1. Physical 2. Fine motor 3. Rough motoric stimulation 	<p>Sample : 419 parents of children aged 3–11 months (n=252) and 12–18 months (n=167)</p> <p>Place: Brazil</p>	<p>Instrument development</p> <ol style="list-style-type: none"> 1. Panel of experts, Forum Group Discussion 2. Content validity 3. Instrument determination 4. Perform 	<p>–CREDI can describe the behavior and skills of 18-36 months of age well .</p> <p>–The strength of acceptability and internal consistency is adequate in new instruments in the motor, cognitive and socio-emotional realms.</p>

	Journal of Physical Therapy Year 2014	that can be performed at home				reliability test, internal consistency, and revise the questionnaire 5. Phase III: perform an internal consistency test from AHEM D-IS and interpret ability analysis of the revised questionnaire in phase II	– correlation of BSID III is high ($r > 0.50$) in motor, cognitive but low in social emotional ($r < 0.20$) –Test score re-test reliability is different between tests
6	Measuring early childhood development in multiple contexts: the internal factor structure and reliability of the early Human Capability Index in seven low and middle income countries	Exploration of psychometric measurement instruments using the Early Human Capability Index (eHCI), and see all components of the instrument	eHCI	1. Physical health 2. Communication 3. Knowledge 4. Social and emotional Numerical literacy	Sample of children aged 2-6 years from low-medium income countries Place: Brazil	Development steps: • Adaptation to local culture • Testing the Validity of the look and the validity of the content • Perform statistical analysis test	• The average value of agreement among experts is 95% covering all criteria. Cronbach alpha of 41 items between 0.639-0.824 with various dimensional divisions. With a total value of 0.824 (95% confidence interval [95% CI] 0.781, 0.862). • ICCs value is 0.990 for

	Alanna Sincovich et al BMC Pediatrics 2019						interrater reliability and 0.949 for intratester reliability. • Mereduksi items from 41 into 35 • • AHEMD shows a reliable and valid instrument used in the home environment to see the baby's motor development
7	The Early Development Instrument: An Examination of Convergent and Discriminant Validity Shelley Hymel Springer's Journal Year 2011	Seeing the validity of the EDI instrument by measuring the validity of the convergent and discriminant in kindergarten students of various cultures	1. Early Development Instrument (EDI) 2. Early Screening Instrument - Kindergarten— Revised (ESI-K)	1. Physical 2. Fine motor 3. Rough motoric stimulation	142 male = male, 125 female) 51/2 years old Place: Canada	1. Measuring children's development with EDI and conducting convergent validity tests and discriminant analysis Comparing measurements using ESI-K (test retest reliability test)	• Results of the CFA and internal consistency coefficient shows the adaptation of local translation, and implementation in the country is different, the instrument Echi can be used in countries with income low and moderate and measure and monitor the progress of children ages early
8	The Malawi Developmental Assessment Tool (MDAT): The Creation, Validation,	Developed a developmental measurement instrument that was close to cultures and	Malawi Developmental Assessment Tool (MDAT), Denver II	1. Cognitive 2. Emotional social 3. Rough motoric 4. Fine motor	Sample: 1513 children aged 0-6 years Africa place	Instrument development 1. Preliminary with a qualitative study, making	• Reliability (ESI K) (inter-rater reliability (.97-.99)) • • EDI has a high decimal value

	<p>and Reliability of a Tool to Assess Child Development in Rural African Settings</p> <p>Melissa Gladstone Journal of Plos Medicine</p> <p>The year 2010</p>	<p>adopted from the Malawi Developmental Assessment Tool (MDAT) instrument, for use in the outskirts of Africa</p>		<p>5. Mental health</p>		<p>110 MDAT items</p> <ol style="list-style-type: none"> 2. Adapt item development by translating language to Melawi 3. Draft 1 MDAT (161 items) 4. Conducting appearance and content validity tests through expert panels and peer reviews 5. Draft II to 166 items 6. Conducting instrument trials in the field 7. Doing FGD and adding items 8. Draft III 185 items and the validity of the appearan 	
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						<p>ce and content is carried out</p> <p>9. Tried again</p> <p>10. Final determination of the MDAT instrument</p> <p>11. Implementation of the use of MDAT in large populations</p>	
9	<p>Validation Study Of the Chinese Early Development Instrument (CEDI)</p> <p>Patrick Ip BMC Pediatrics Year 2013</p>	<p>To assess the internal consistency, concurrent validity, and test re-test reliability of the Chinese Early Development Instrument (CEDI). CEDI and analyze its relationship with socioeconomic variation</p>	<p>Chinese Early Development Instrument (CEDI) and Hong Kong Early Child Development Scale (HKECDS) Family Questioner</p>	<ol style="list-style-type: none"> 1. Cognitive 2. Emotional social 3. Rough motoric 4. Fine motor 	<p>A sample of 167 kindergarten children</p> <p>Place: Hong Kong</p>	<p>Instrument development through the stages:</p> <ol style="list-style-type: none"> 1. CEDI language translated from English to Chinese traditional language, 2. Translated and adapted as an instrument in Chinese culture. 3. Review and established at Offord Center for Child Studies (in 	<ul style="list-style-type: none"> • Reliability results 94 %– 100% Kappa item score 0.0.4 for immediate, delayed, and intra observer testing. • The results also showed a significant difference in all scores in children with neuro disability (35 Vs 99 (p<0.001) compared to normal children . • Having a sensitivity that is good compared with Denver II (97%) and sensitivity (82 %).

						<p>Hamilton, ON, Canada) The CEDI consists of 103 items and 5 domains.,</p> <p>4. Re-measurement with HKECDS</p> <p>5. Looking at the comparison of CEDI and HKEDI using the kappa . test</p> <p>6. To see the relationship between developmental disorders and socio-economic conditions (region, family income, mother's education) it was measured by a logistic regression ratio controlled by sex variable.</p>	
10	Validity and Reliability	Assessing the Chinese	Chinese (Traditional)	1. Cognitive	Community sample:	Research stages	<ul style="list-style-type: none"> • Results: The samples were

<p>Study of the Chinese (Traditional) Version of the Devereux Early Childhood Assessment for Toddlers (DECA-T)</p> <p>Sophie Hsin-Yi</p> <p>Neuropsychiatric Disease and Treatment Journal</p> <p>2019</p>	<p>version of the clinical measurement tool DECA-T (C-DECA-T) using IRT and response theory test As well as measuring sensitivity and specificity.</p>	<p>Version of the Devereux Early Childhood Assessment for Toddlers (C-DECA-T) Chinese Version of Child Behavior Checklist for Age 1.5–5, Parent Form (CBCL/1.5–5)</p>	<p>2. Emotional social</p> <p>3. Rough motoric</p> <p>4. Fine motor</p>	<p>81 (18-36 months) Clinical sample : 57 (18-36 months) Control group : healthy children.</p> <p>Place: China</p>	<p>1. Translet from English to Chinese and retranslet by a psychiatrist and approved by the publisher</p> <p>2. Taking measurements with C-DECA-T to measure social emotional</p> <p>3. Taking measurements with (CBCL/1.5–5 to measure behavior problems</p> <p>4. Classifying with PCA</p> <p>5. Perform TRI and IRT analysis using Mokken analysis</p> <p>6. Other analyzes: reliability tests ((test–retest reliability , internal consisten</p>	<p>analyzed 160 (aged 5.43 to 7.31 years)</p> <ul style="list-style-type: none"> • Cronbach alpha (internal consistency) 0.70-0.95 for 5 CEDI domains • Concurrent validity with a weak and significant correlation between 0.25-0.49 with a kappa of 0.89. • Reliability : Test-retest reliability on CEDI after 4 weeks with 30 participants , Kappa coefficient 0.89, • The CEDI instrument is valid and reliable measuring school readiness and identifying developmental disorders in the Chinese population
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						cy, & inter-rater reliability) and validity tests (concurrent, discriminative, & sensitivity/specificity)	
11	<p>A developmental screening tool for toddlers with multiple domains based on Rasch analysis</p> <p>Ai-Wen Hwang et al.</p> <p>Journal of the Formosan Medical Association 2015</p>	<p>To develop a multidimensional child development screening instrument (MuSIC) as a concise developmental screening instrument for young children with a valid construct</p>	<p>MuSIC</p> <p>a. Type II</p> <p>b. SiCDeST</p> <p>DICHIP</p>	<ol style="list-style-type: none"> 1. Cognitive 2. Emotional social 3. Language 4. Rough motoric fine motor 	<p>N= 632 children aged 3-35.5 months</p> <p>Place: Taiwan</p>	<p>Instrument development:</p> <ol style="list-style-type: none"> a. Phase I: adapting from 3 instruments and (211 items) b. Eliminate duplicate items to 176 items c. Stage 2 analyzes items using Unidimensional Rasch analysis, eliminating statistically inadequate items (1141 items) d. Perform multidimensional 	

						nsional analysis of Rasch again so that the item becomes 75	
13	A Pilot Comparing Two Developmental Screening Tools for Use With Homeless Children Sheauy Hue et al Journal of Pediatric Health Care The year 2010	To see a picture of the growth and development of homeless children, and to compare measurements made by parents and health workers using developmental screening instruments.	c.DDST and ASQ	1. Cognitive 2. Emotional social 3. Language 4. Rough motoric fine motor	• Mother sample = 20 Child = 21 ages 4-60 months Place: Florida	Stages: Mothers of toddlers take part in child examinations using two instruments DDST and ASQ. Results are analyzed and compared	Reliability 0.91-0.94 The limitation of the absence of a gold standard
14	Development of a new instrument for determining the level of chewing function in children S. Serel Arslan Journal of Oral Rehabilitation 2016	Develop an instrument scale for the classification of several disorders and measure their validity and reliability	1. Karaduman Chewing Performance Scale (KCPS). 2. BPFAS	1. mouth function 2. dysphagia 3. speech function eating disorder problem	SAMPLE: 144 children (Group I: 61 healthy children Group II: 83 children with cerebral palsy who have chewing disorders Place: Ankara Turkey	Developing instruments 1. Literature review, and interviews with experienced experts 2. Expert panel on content validity the Delphi way. 3. Analysis of validity content	The strongest agreement between the 2 DDST and ASQ screening tools was on gross motor skills and social personal domains (95%) but weak on language development (67%).

						<p>using Content validity index (CVI) minimum CVI 0.80</p> <p>4. Measuring interobserver reliability, intraobserver reliability, structural validity and criterion validity</p>	
15	<p>Cross-Cultural Validation of the Polish Version of the ADI-R, Including New Algorithms for Toddlers and Young Preschoolers</p> <p>Izabela Chojnicka</p> <p>Journal of Child Psychiatry & Human Development</p>	<p>Conduct validation tests on the Polish version of the Autism Diagnostic Interview-Revised (ADI-R-PL) measurement instrument, and the use of algorithms in childhood and preschool</p>	<p>ADI-R-PL ADOS-2 (gold standard)</p>	<p>1. Autism detection</p> <p>2. Communication skills, social IQ Measurement</p>	<p>Sample 125, 65 with Autism Spectrum Disorder (ASD) group and 60 control group</p> <p>Normalization of 178 children, 118 with ASD and 60 controls</p> <p>Age, 16 years old</p> <p>Place: Poland</p>	<p>Develop the instrument with the steps:</p> <ol style="list-style-type: none"> 1. ADI-R Adaptation, 2. Translate to Polish 3. Proofread by Polish linguists, corrected and revised. 4. Translate back 5. Determination of test items by publishers to be used as 	

	2019					<p>scientific research.</p> <p>6. Image layout design and format and instructions for use.</p> <p>7. Conduct convergent validity and reliability tests. (n=117)</p> <p>8. Diagnostic test: sensitivity and specificity and PPV value.</p> <p>9. Reliability: interrater reliability (Kappa and ICCs), test-retest reliability (ICCs), and internal consistency (Cronbach's alpha),</p> <p>10. CFA : likelihood</p> <p>11. Kappa test (ADI-R-</p>	
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						PL : ADOS-2, and SCQ)	
16	Development of a Simple 12-Item Theory-Based Instrument to Assess the Impact of Continuing Professional Development on Clinical Behavioral Intentions France Le gare Plos One Journal Year 2014	Developed an instrument based on model integration to assess the impact of instrument development by experts in behavioral clinics	Simple 12-Item Theory-Based Instrument to Assess the Impact of Continuing Professional Development on Clinical Behavioral Intentions	1. Behavior 2. Confidence 3. Habit 4. Moral Social influence	Place: Canada	Stages: 1. Systematic review, various instruments in English and French, and a review of the first item selection, by the researcher and the CPD (8) 2. E Delphi study (expert, linguist, CPD organizational activist, clinical practitioner, medical educator, and cognitive social expert) 3. Test reliability test retest. :Kappa test Exploratory factor	1. Analysis statistics : deskriptiv , assuming normal use test Shapiro Wilk, s test, the relationship between variable (Spearman correlation coefficient) 2. Chi square 3. Kappa test (interobserver and intra-observer 4. Consistency (KCPS and McNemar –Bowker test) Result: 1. CVR > 0, 622, and CVI 0, 885. 2. 100% sensitivity and specificity 3. criterion validity (r = 0, 444–0, 773, P < 0, 001) 4. interobserver reliability r = 0, 962, P < 0, 001; Group I: 5. r = 0, 799, P < 0, 001; Group II: r = 0, 969, P <0, 001). 6. Agreement (P> 0, 05) consistency is very baik , (P<0, 001, j: 0, 834).

						analysis (EFA)	
1	<p>A Cross Sectional Pilot Study of The Scottish Early Development Instrument : a tool for addressing inequality</p> <p>Lisa Marks Woolfson, et al</p> <p>BMC Public Health Year 2013</p>	<p>Undertake the development of an easy-to-use instrument to measure Early Child Development (ECD) in Scotland and carry out Validation with an instrument developed in Canada</p>	<p>3.Scottish Early Development Instrument s (SEDI)</p> <p>4.Canadian Early Development Instrument (CEDI)</p>	<p>7. Physical and mental health</p> <p>8. Social Skills</p> <p>9. Emotional maturity</p> <p>10. Language and cognitive development</p> <p>11. Language</p> <p>General knowledge</p>	<p>Sample : 1090 (524 female and 563 male)</p> <p>Child age: 4-6 years</p> <p>Place: Canada</p>	<p>Adaptation from Canadian EDI to Scottish Stage 1</p> <p>3. Implementation of Canadian EDI in Scottish schools with a small sample</p> <p>4. Adapting Canadian EDI to a Scottish context</p> <p>Stage 2:</p> <p>5. Converting CEDI to SEDI version</p> <p>6. Implementing SEDI in a Scottish school with a large population</p> <p>7. Conducting socialization about children's development</p> <p>8. Perform analysis</p>	<p>Result:</p> <p>1. Kappa test : 0.75 (very good)</p> <p>2. ICCS (0.88-0.91)</p> <p>3. Cronbach's alphas, (internal consistency coefficients) are high for all domains (0.85–0.95) except RPI (0.64) RRBs (0.63)</p> <p>ADI-R-PL 85% sensitivity, 93% w specificity compared to ASD</p>

Apart from these objectives, this review also looks at methods or development techniques concerning literature reviews, types of instruments, validation processes, trials on samples, methods and results of instrument item analysis. This literature review has accessed many library sources from various accredited journals. However, this literature review is limited to journals that can be accessed through on-line sites, and does not access other literature that is unclear in material or method. The results of the literature review of these 16 articles show the process of developing instruments for measuring child development, both developing new instruments or adapting existing instruments. In Indonesia research on instrument development, which compares measurement instruments with gold standards or instrument adaptations., Among other things, research on the application of mother cares (MOCA) to detect deviations in the development of the MoCA instrument compared to the Developmental Pre-Screening Questionnaire (KPSP) as the gold standard, the results obtained sensitivity of 83.33% and specificity of 97.92%, thus meeting the validity and reliability. as a measuring tool for toddler development. (Mother Cares (Moca) Application Diagnostic Test for Early Detection of Risk of Deviant Development Toddlers (12). In addition, research on the development of an assessment instrument for language development in Early Childhood Education (PAUD) children used by kindergarten teachers in Bandung obtained a trial which was analyzed by Confirmatory Factor Analysis, all items had good validity and reliability, as well as good model fit. (Development of Instruments for Measuring the Level of Attainment of Early Childhood Language development (13).

4. Discussion

The instrument development process consists of setting goals, looking for relevant theories, compiling instrument items, validating and revising, conducting trials and then conducting analysis (reliability) and finally assembling the instrument (12). Adaptation is one way of developing instruments, where researchers adapt from existing instruments in other regions or countries and try to use them according to the culture and culture of the local community, as was done in Scotland by adapting the Canadian Early Development Instrument (CEDI) for use in Scotland called SEDI with the initial step of piloting SEDI in schools in Scotland before the instrument was implemented in a large population (13). The steps of instrument adaptation are not much different from assembling a new instrument, but there are several stages in instrument development that are not passed. The adaptation process begins with taking existing instruments, conducting validity and testing and conducting item analysis of the instrument (14). But sometimes. If the instrument is taken from another country with a different language and culture, the adaptation of this instrument requires the stage of language transfer or translating the language from the area of origin of the instrument into a language and culture that is in accordance with the area to be used, in addition a review is needed to adjust to the culture of the country to be used. use. The adaptation process usually involves a translator or translator and is carried out more than once to produce an instrument that is understandable and in accordance with the local culture. The adaptation process is simpler than the process of making a new instrument.

In this review, several instruments have been made starting from the early stages, such as those carried out in several countries such as India, Pakistan, Bangladesh in 2018 where in developing an instrument for caregivers and parents called CREDI as a tool to measure early childhood development. Another instrument that was made new and passed through all stages, among others, in Turkey, S Serel (2016) the manufacture of an instrument to identify chewing disorders in children called the Chewing Performance Scale (KCPS), in Canada an instrument was developed to assess the behavior of children called the Chewing Performance Scale. Based Instrument to Assess the Impact of Continuing Professional Development (14)(15)(16). Meanwhile, from the results of the study, those who developed instruments for adaptation methods were,

among others, in Scotland (CEDI-SEDI), in Australia (PCCQ), in Brazil (AHEMDIS and eHCI), in Africa (MDAT and Denver), in Taiwan (MuSIC) and Canada (ADI-R-PL).

In the process of developing instruments, both new and adapted instruments, at the stage after the question items are formed, the next step is the analysis process consisting of internal consistency reliability, test retest reliability, and interrater reliability while for validity the most use discriminant validity and construct validity (17). An instrument is said to be valid if the instrument can accurately measure something to be measured, thus showing the legitimacy of the score from the measurement consisting of test items. It can be said that validity is related to the accuracy of a measuring instrument. With a valid instrument will produce valid data(12). (18) Validity consists of content validity including appearance and logical validity, construct validity, criterion validity and concurrent validity and prediction validity (11). An instrument is said to be reliable (trustworthy) if it gives steady results or steady (consistent) if it is tested many times. Steady or constant, the score does not always have to be the same, the score obtained can change but the order is in the same group (11).

An important process in instrument development is the pilot testing stage, namely mconduct experimental tests, with samples that represent the population where the test will be used so that later it will help researchers understand how and function the test. Questions and answers with respondents (adults) and data collectors after the experimental test can be additional information and procedure aspects of the test (19).

Of the 17 articles that did all validity tests, and the most used concurrent validity, divergent and convergent validity. Meanwhile, most of the reliability analysis used internal consistency, test retest and inter rater test. Concurrent validity is if The results are in accordance with the criteria which have parallels with the existing criteria. Existing criteria can be in the form of other instruments that measure the same thing and their validity has been recognized, for example in the form of standardized tests (18), while divergent validity is whether the test scores are related between one factor and another (19).

The most frequently used reliability analysis in this review is the internal consistency test used to measure whether a number of questions on the instrument measure the same thing. Internal consistency is measured using the Cronbach alpha coefficient which has a value between zero and one.(11). Reliability focuses on the consistency between individuals who measure or rate the same item or when one measures or evaluates several items (McKenzie). Determined by the similarity of results obtained by two or more observers when measuring the same subject. Inter rater reliability is assessed by the Kappa coefficient (K) which is considered good if the K value is close to 1 (≥ 0.60)(11), while the reliability test retest was carried out by measuring the same subject by the same person at two different times and producing the same results, the aim is to see the consistency of the tool in two measurements (11). From all the articles in the review, in general, they go through the stages of making new instruments or adapting instruments, and passing through phases that are in accordance with the concepts and theories of instrument development. The results of the articles in this review also mostly show that the instrument is valid and reliable to be used in accordance with the domain to be measured.

Another step that is often carried out in instrument development research is diagnostic testing. Diagnostic test isa way to determine whether a person has a disease or not. Diagnostic test research has several objectives, namely firstly to diagnose disease and exclude disease, secondly for screening purposes, to look for disease in asymptomatic subjects, so that further examination can be carried out so that an early diagnosis can be established. Diagnostic tests for screening must have a very high sensitivity value even though the specificity is slightly low (10). Diagnostic tests produce sensitivity and specificity. Sensitivity is the proportion of sick subjects with positive diagnostic test results (true positive) compared to all sick subjects or the ability of a test to state positive in sick people. High sensitivity can be used for screening a disease.(10) Specificity is the proportion of healthy subjects who give a negative diagnostic test result (true negative) compared to all subjects who are not sick (10).

From the literature review above that uses diagnostic tests in the articles Dana Charles (2018), Shelley (2011), Mellisa (2010), Patrick (2013), Shopie (2019) Hwang (2015), Arslan (2016) and Izabella (2019), all of these articles used good sensitivity and specificity tests, meaning that the newly developed instrument was sensitive and specific in detecting developments according to what domain was being measured compared to the gold standard instrument.

In Indonesia, there are several child development instruments, including the Developmental Pre-screening Questionnaire (KPSP), and the Denver Development Test (DDST) carried out by health workers, but there are other developmental instruments such as Baley III which is used by psychologists to measure child development. Meanwhile, for the general public, parents, cadres and PAUD teachers, a child development questionnaire is available in the Maternal and Child Health (KIA) book which has been published by the Ministry of Health since 2015. The questionnaire contains a list of questions to measure the development of children aged 0-72. month. In addition, the Indonesian Pediatrics Association (IDAI) issued an adaptation instrument from the KPSP in the form of an android application called PRIMAKU, which can be accessed by the general public via smartphones.

Monitoring the development of children is very important to detect as early as possible developmental disorders or delays. With early detection, it is hoped that interventions can be carried out so as to prevent adverse impacts in the future. The use of appropriate and easy instruments will increase the scope of child development monitoring services. The findings in this review are the process of developing instruments, both new and adapted, all pass through stages in accordance with the concept and theory of instrument development.

5. Conclusion

The steps in the process of developing a child development monitoring instrument are starting with a literature review in accordance with the objective indicators, creating question items, reviewing the expert panel, conducting content validity, conducting trials and analysis of test results and revisions before the final stage of determining instrument items. From various research articles, instrument development has been carried out according to the stages that must be passed, and the results of the analysis show that most of the instruments developed obtain valid and reliable results to be used as a new child development monitoring tool.

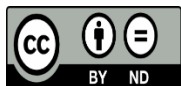
6. Conflict of Interest

The author states that there is no conflict of interest in this study

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