

Original Research

**Speech Intelligibility In Preschoolers Using Indonesian Intelligibility In Context Scale**

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**ABSTRACT**

**Background:** *The intelligibility in Context Scale (ICS) is one of the speech intelligibility assessment procedures that measures how clearly an individual's speech can be understood by seven different communicative partners. Recently, ICS has been translated into more than 60 languages across the world including Indonesian language. It is important to know about ICS and how to use it in Indonesia.*

**Methods:** *This quantitative research is designed with a descriptive comparative method. The population of this study is preschool-aged children (4-6 years old) in Semarang City. The number of respondents in this current study is 158 respondents which consists of 20 children with parental concerns and 138 children without parental concerns. Data analysis is performed using descriptive and bivariate analysis. A Mann-Whitney U test is used for the bivariate analysis. Data collection was carried out in Semarang City in August–September 2021.*

**Results:** *The total average ICS score in this study is 3.96. Children's speech is best understood by parents and least understood by strangers. There is a difference in average ICS scores for paternal education ( $p = 0.037$ ), paternal income ( $p = 0.002$ ), and parental concerns ( $p = 0.01$ ).*

**Conclusion:** *The Indonesian ICS can be used as a screening test to assess children's speech proficiency. Paternal education, paternal income, and parental concerns have a direct impact on children's average Indonesian ICS score. The lower the average Indonesian ICS score of the child, the lower his or her speech intelligibility.*

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**INTRODUCTION**

Speech intelligibility is a perceptual judgment regarding the percentage of words in a speech that can be understood by the listeners. Children who have speech intelligibility problems have communication problems. It was defined as a speech disorder. Speech disorders have a high prevalence in preschoolers. An estimated 14.7% of preschoolers have problems with articulation (Oyono et al., 2018). Mullen & Schooling, (2010) reported that approximately 75% of preschoolers referred due to

possible communication difficulties were identified as having articulation or speech intelligibility problems.

Communication difficulties in various contexts with and interlocutors can result from the poor intelligibility of one's speech (McLeod, Crowe & Shahaiean, 2015). Most, Ingber, & Heled-ariam, (2012) mentioned that speech intelligibility is very important in social skills, building and maintaining social relationships when communicating with peers. Poor speech intelligibility can affect the quality and functionality of a person's life, even causing frustration, an unwillingness to speak, and feelings of anger (Van Doornik, Gerrits, McLeod, & Terband, 2018).

Speech intelligibility is influenced by many factors, such as content and communication context. Furthermore, language structure, length of utterance, conversational context, quality of voice, the intelligibility of speech acoustic signals, familiarity, as well as the presence of visual clues from individuals can also affect speech intelligibility (Kent, Miolo & Bloedel, 2016). McLeod, (2020) added that speech intelligibility can be influenced by age, gender, the presence of speech sound disorders or other communication disorders in the speaker, the relationship and propinquity of the listener and speaker, language and dialects, communication disorders in the listener, the type of measurement of speech intelligibility and the response, as well as the environment, which includes noise.

There are many types of speech intelligibility measurement techniques, and there is no standard procedure for measuring children's speech intelligibility. Gordon-Brannan, (1994) explains that there are three common ways of measuring speech intelligibility: 1) In the *open-set word identification procedure*, the examiner must transcribe a sample of speech and calculate the percentage of words that can be identified; 2) in the *closed-set word identification procedure*, the listener identifies the word that is read or imitated by the speaker from a previously assigned list of words; 3) in the *rating scale procedure*, the listener is asked to assess how clearly the individual speaks with the point scale.

Intelligibility in Context Scale (ICS) was developed as a screening tool for parents in measuring children's speech intelligibility based on the *International Classification of Functioning, Disability and Health–Children and Youth (ICF-CY)* (Kim, Ballard & McCann, 2016). ICS is a parent's rating scale of the child's speech intelligibility with seven communicative partners (parents, immediate family, extended family, friends, acquaintances, teachers, and strangers). ICS has been translated into over 60 languages, including Indonesian.

The ICS has a range of scores between 1-5 for each question (McLeod, 2020). However, research regarding ICS is still only carried out in 14 countries with 14 different languages and has never been carried out in Indonesia. This study aims to determine the average score of the Indonesian ICS in preschool-age children in Semarang City and find out the difference in the average ICS score based on socio-demographic variables (sex, age, parental education, parental occupation, parental income) and speech-language variables.

## **MATERIAL AND METHODS**

This research is quantitative research with a comparative descriptive research design. Data collection was carried out in Semarang City in August–September 2021 through the online distribution of Indonesian ICS questionnaires to parents of preschool students from 9 kindergarten schools in Semarang. The population of this study was

preschool children (4-6 years) with area sampling techniques where samples were taken from five areas of Semarang City.

The children were selected from a private kindergarten in Semarang. The respondents to this study were 158 respondents consisting of 20 children with parental concerns and 138 children without parental concerns. Parents are asked to fill in informed consent forms first if they are willing to be respondents to this study.

Subsequently, parents are asked to fill in personal data that includes the child's name, the child's age, the child's school, the relationship of the questionnaire filler with the child, the parental education, the parental occupation, the parental income, the main language of the child, the parental concern toward their child's speech development. Then parents are asked to judge from a scale of 1 (never) to 5 (always) concerning how often their child's speech is understood by seven different interlocutors for the past month. After all the data was collected, it was descriptively analyzed and tested using Mann-Whitney U for bivariate analysis.

The determination of whether the child will have typical or atypical speech development is based on parental concern. If the parent chooses 'yes' then the child is considered to have atypical speech development, while if it is 'not' then the child is considered a typical child.

## RESULTS

The average Indonesian ICS score in this study can be described based on seven different interlocutors and the total average ICS score as a whole, in typical children and in atypical children. Indonesia's average ICS score is illustrated in Table 1.

**Table 1.** Mean score of Indonesian ICS

<b>Communicative Partners</b>	<b>Overall</b>	<b>Typical</b>	<b>Atypical</b>
Parents	4.85	4.90	4.50
Immediate members of family	4.35	4.45	3.70
Extended members of family	3.84	3.88	3.55
Child's friends	3.91	4.00	3.30
Acquaintances	3.62	3.74	2.80
Child's teachers	4.27	4.34	3.80
Strangers	2.85	2.90	2.55
<b>Total</b>	<b>3.96</b>	<b>4.03</b>	<b>3.46</b>

The table above shows that the total average ICS score in this study was 3.46, and the average ICS score was higher in typical children ( $M = 4.03$ ) than in atypical children ( $M = 3.46$ ). The child's speech is most often understood by the interlocutor who is most familiar with the child, namely the parent, and will decline as the familiarity between the interlocutor and the child declines. This is indicated by the lowest Indonesian ICS score obtained from strangers.

The descriptive data of respondents in this study consisted of the number and percentage of respondents as well as the average score of the Indonesian ICS based on socio-demographic variables and child speech-language variables. The distribution of respondent data can be seen in Table 2.

**Table 2.** Data distribution

Independent Variables		Typical			Atypical			Total mean
		n	%	M	n	%	M	
Sex	Male	76	55.07	3.96	12	60	3.38	3.88
	Female	62	44.93	4.11	8	40	3.57	4.05
Age	4:0-4:11 years	58	42.03	4.00	10	50	3.20	3.88
	5:0-6:11 years	80	57.97	4.05	10	50	3.71	4.01
Paternal Education	High school and below	66	47.83	3.91	9	45	3.11	3.82
	Above high school	72	52.17	4.14	11	55	3.74	4.09
Maternal Education	High school and below	59	42.75	3.90	6	30	3.12	3.83
	Above high school	79	57.25	4.13	14	70	3.60	4.05
Paternal Occupation	Nonprivate	12	8.70	3.95	3	15	3.52	3.87
	Private	126	91.30	4.04	17	85	3.45	3.97
Maternal Occupation	Nonprivate	76	55.07	4.04	7	35	3.69	4.01
	Private	62	44.93	4.02	13	65	3.33	3.90
Paternal Income	Below Regional Minimum Wages	45	32.61	3.81	6	30	2.95	3.71
	Above Regional Minimum Wages	93	67.39	4.14	14	70	3.67	4.08
Maternal Income	Below Regional Minimum Wages	92	66.67	3.98	11	55	3.47	3.92
	Above Regional Minimum Wages	46	33.33	4.13	9	45	3.44	4.02
Main Language	English Language	131	94.93	4.03	18	80	3.48	3.96
	Regional Languages	7	5.07	4.10	2	20	3.29	3.92

n= number of respondents, %= percentage, M= average score of Indonesian ICS

Table 2 shows that higher mean scores were obtained in girls, children who were more mature (4:0–4:11 years), children with higher parental education (above high school), children with private paternal occupation, children with nonprivate maternal occupation, and children with higher parental incomes. Bivariate analysis was carried out using the Mann-Whitney U test to find out whether there was a difference in the average Indonesian ICS score based on socio-demographic variables and child speech-language variables statistically. The results of the Mann-Whitney U test were described in Table 3.

**Table 3.** Results of Bivariate analysis

Independent Variables	p
Sex	0.169
Age	0.319
Paternal Education	0.037

	<b>Independent Variables</b>	<b>p</b>
Maternal Education	Above high school	0.105
	High school and below	
Paternal Occupation	Nonprivate	0.590
	Private	
Maternal Occupation	Nonprivate	0.324
	Private	
Paternal Income	Below Regional Minimum Wages	0.002
	Above Regional Minimum Wages	
Maternal Income	Below Regional Minimum Wages	0.525
	Above Regional Minimum Wages	
Main Language	English Language	0.815
	Regional Languages	
Parental Concern	Typical	0.001
	Atypical	

Table 3 shows that the difference in the average ICS score is only obtained in the variables of paternal education ( $p = 0.037$ ) and the father's income ( $p = 0.002$ ), where the higher the education and income of the father, the higher the average ICS score will be. The difference in the average ICS score was also found in the parental concern variable ( $p = 0.001$ ), where children without parental concern had a higher average ICS score than children with parental concern.

## **DISCUSSION**

### **The difference in average ICS scores by sex**

Gender seems to have an effect on speech sound acquisition, especially at the age of three (Muluk et al., 2014). The girls have a better speed for developing their abilities, especially in language skills. At the moment, basic skills differ between boys and girls. After that, the boys can reach the same level of ability.

Results from the Mann-Whitney U test showed that there was no difference in the average ICS score based on the sex of the child ( $p = 0.169$ ). If the average ICS score of girls is compared with the average ICS score of boys, the average result of the girls' ICS scores is higher than the average ICS score of boys. Pham, McLeod & Harrison, (2017) and Neumann, Rietz & Stenneken, (2017) also found that there was no significant difference in the average ICS score by sex.

Although the two studies were examined at a younger age, namely 2:0–5:11 years, where previous studies showed that girls had a faster development of speech sounds compared to boys at an early age of development, there was still no significant difference in speech intelligibility between boys and girls. From previous studies, it can be concluded that there is no difference in speech intelligibility between the sexes of children.

### **The difference in average ICS scores by age**

Previous studies have shown a positive correlation between age and improved articulation ability in typical children. McLeod & Reilly, (2007) showed a decrease in articulation errors and the proportion of speech sound disorders as age increased from preschool age to grades 6 and 12. The maturity of the articulator and phonological

abilities of typical children continues to increase until it reaches approximately the age of 8 years, at which age children, in general, have acquired many speech sound systems from adults.

Based on the test results, there is no difference in the average ICS score with the age of the child ( $p = 0.319$ ). The average ICS score in children aged 5:0–6:11 years is higher than in children aged 4:0–4:11 years, in both typical or atypical children and overall. This can be influenced by the age of the respondents in this study, which is 4-6 years old, where the intelligibility of children's speech at the age of 4 years should have reached 100%, although there may still be speech errors (Bauman-Waengler, 2016).

One ICS study in Fiji also showed that there was no significant association between age and speech intelligibility due to the fact that most of the children in this study were older than preschool age. Meanwhile, ICS is designed to identify preschoolers at risk of speech sound disorders, and the age of children in the study outside the age at which many speech errors occur (Hopf, McLeod, & McDonagh, 2017). From the above, it can be concluded that a mature age cannot make a significant difference in speech intelligibility.

### **Differences in average ICS scores based on parental education**

Parental education is one of the components of the child's environment, so it is one of the risk factors that is widely studied in relation to language and speech development. Keating, Turrell, & Ozanne, (2001) examined 12,000 children aged 0–14 in Australia using a combination of household income, parental employment, and parental education to demonstrate socio-economic status. The study reported that there was no significant association between SES and pediatric speech disorders.

The results of the Mann-Whitney U test showed that there was a difference in the average ICS score on paternal education ( $p = 0.037$ ), but not for maternal education ( $p = 0.105$ ). These results differed from the results of an ICS study in Vietnam that found significant differences in the average ICS-VN score and maternal level of education, not in fathers (Pham, McLeod & Harrison, 2017). The father's level of education can support the mother's involvement in playing with and interacting with the child.

The involvement of the mother in the child's life predicts the child's development of speech and language. Fathers who have a higher level of education are better able to provide resources and learning opportunities for their children compared to fathers with lower levels of education (Tamis-LeMonda & Cabrera, 2013). Then it can be concluded that the level of education of the father can have an effect on the difference in speech intelligibility of the child.

### **The difference in average ICS scores by parental occupation**

The results of this study showed that there was no difference in the average ICS score for paternal ( $p = 0.590$ ) or maternal ( $p = 0.324$ ) occupations. ICS research in Italy also found no significant relationship between parental occupation and children's speech intelligibility (Piazzalunga *et al.*, 2020). The average ICS score of children with fathers working as private workers overall is higher than that of non-private workers.

Meanwhile, the average ICS score of children with mothers who work as non-private workers is higher than that of children with maternal work as private workers. The majority of respondents to this study were non-working mothers (50.38%), so working mothers had less chance of spending time together with their children than housewives. Where this can affect the duration and intensity of giving speech-language

stimulation to the child. Pratomo, Adriani, & Akhyar, (2016) show that non-working mothers have an influence on the child's language development.

### **The difference in average ICS scores based on parental income**

Several previous studies have also examined the relationship between household income and children's speech skills. ICS research in Germany found a significant but weak association between socioeconomic status, including household income, and child speech intelligibility (Neumann, Rietz, & Stenneken, 2017). Corresponding with the study by McLeod, Crowe, & Shahaian, (2015) which showed no relationship between socioeconomic status and the intelligibility of the child's speech.

The results of the Mann-Whitney U test showed that there was a difference in ICS scores with paternal income ( $p = 0.002$ ), whereas there was no difference in ICS scores with the mother's income ( $p = 0.525$ ). The average ICS score of children with a paternal income above the regional maximum wage is higher than the average ICS score of children with a paternal income below the regional maximum wage. Low socio-economic status is not strongly related to a child's speech sound disorder but can affect other factors such as attention to health and stimulation of speech-language at preschool age which can be likely to cause speech sound disorder.

Higher paternal incomes can affect the ability to provide facilities, resources, and opportunities for families to live healthier lives, including in the provision of nutritious food and the children's speech-language development (Tamis-LeMonda & Cabrera, 2013).

### **The difference in average ICS scores by primary language**

The results of the Mann-Whitney U test showed that there was no difference in the average ICS score with the main language used by the child, with a p-value of 0.815 ( $p > 0.05$ ). Both typical children who use Indonesian and Regional Languages as the main language have a higher average ICS score than children with atypical speech development. Other ICS studies also found no link between children's primary language and their ICS scores (Hopf, McLeod & McDonagh, 2017; McLeod, Crowe & Shahaian, 2015).

### **The difference in average ICS scores based on parental conservatism**

This study found that there were differences in the average ICS scores of typical children with atypical children, characterized by a p-value of 0.001 ( $p < 0.05$ ). Parents who suspected their child's speech development was atypical had a lower average ICS score ( $M = 3.46$ ) than parents who had no suspicion of their child's speech development ( $M = 4.03$ ). Lousada et al., (2019) examined 76 children aged 47–74 months, consisting of 25 children identified as atypical according to parental or teacher concern and 51 children identified as typical. This study found that children with parental concern regarding their speech had significantly lower average ICS scores ( $M = 3.91$ ,  $SD = 0.59$ ) compared to children without parental concern ( $M = 4.78$ ,  $SD = 0.36$ ).

ICS research in Vietnam has also been conducted on 181 children aged 2:0-5:11 years. The results showed that there were significant differences in the ICS mean score between the group of children without parental concern and the group of children with little concern from parents ( $p = 0.03$ ) or with full concern from parents ( $p < 0.001$ ). But there is no difference between a group of children with little parental concern and a group with full parental concern. This can also be seen from the average ICS score,

namely children without concern ( $M = 4.63$ ,  $SD = 0.67$ ), with little concern ( $M = 4.29$ ,  $SD = 0.67$ ), and full concern ( $M = 3.96$ ,  $SD = 0.70$ ) from parents (Phạm, McLeod & Harrison, 2017).

McLeod, Crowe & Shahaieian, (2015) examined 803 Australian children aged 48–65 months. The study found significant differences between the group of children with parental concern ( $M = 3.9$ ) and the group of children without parental concern ( $M = 4.6$ ),  $t(796) = 16.8$ ,  $p < .001$ , Cohen's  $d = 1.00$ . This study also showed that the average ICS has proven effective in determining whether children who are identified or unidentified have speech problems and speech sound disorders.

Based on the results of this study and the results of previous studies, it can be concluded that parental concern is one of the components that needs to be considered in the ICS assessment. Children who are identified as having atypical speech development based on parental concern will have a lower average ICS score compared to children without parental concern. The limitations of this study are that there are still variables that have not been examined, such as the comparison of ICS scores of children using one language with multi-lingual children, intelligence factors, and biomedical conditions of children.

Then, this study only used parental concern as a determinant of whether the child experienced typical or atypical speech development, while further assessments such as the calculation of the percentage of speech intelligibility and the Percentage of Consonants Correct (PCC) through speech sampling could not be carried out due to time constraints and the lack of assessors. The sample of respondents at this age starts from the age of 4-6 years, so the difference in speech intelligibility may not be very significant because 4-year-olds should already have 100% speech intelligibility. The sample of respondents in this study was only preschool-aged children in Semarang City, so it was not enough to describe the intelligibility of speech in preschool children throughout Indonesia.

## CONCLUSION

The average Indonesian ICS score in this study was 3.96, with a higher ICS mean score obtained in the absence of parental concern ( $M = 4.03$ ,  $p = 0.001$ ), children with higher paternal education ( $p = 0.037$ ), and higher paternal income ( $p = 0.002$ ). The child's speech is most often understood by the parents and weakens with the weakening of the child's familiarity relationship with the interlocutor which is characterized by the lowest of ICS mean scores obtained in the interlocutor of strangers. Indonesian ICS can be used as a screening tool to identify children who are at high risk of having speech intelligibility problems.

Further research is expected to examine several issues that are limited in this study. Further research can examine children in a more extended age group than this study. Further research is also expected to conduct deeper speech intelligibility assessments, such as the percentage of speech intelligibility and PCC, to find out whether the poor ICS mean score is a predictor of the poor percentage of speech intelligibility and PCC. Other variables that have not been studied in this study can also be studied in later studies.

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