



## Validity and Reliability Diagnostic Test Computational Thinking Based on Local Wisdom

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**Abstract:** This study aims to analyze the validity and reliability of the diagnostic test instrument used to measure computational thinking skills based on local wisdom. This method of research is instrument development research. The subjects of this research were students of computer science and information technology undergraduate programs at Bumigora University, totaling 108 students using a random sampling technique. Data collection techniques using tests. The data analysis technique of instrument content validity was determined based on Aiken's V formula, instrument construct validity using EFA, and instrument reliability using Cronbach Alpha. Based on the results of this research, the content validity of the instrument has a high validity index, the construct validity of the instrument items is declared feasible, and the reliability of the instrument has a high-reliability coefficient. So, this instrument is declared valid, reliable, and suitable for use to measure local wisdom-based computational thinking diagnostic tests.

### Article History

Received: 08-09-2023  
Revised: 14-10-2023  
Accepted: 06-11-2023  
Published: 16-12-2023

### Key Words:

Validity; Reliability;  
Diagnostic Test  
Instrument;  
Computational  
Thinking; Local  
Wisdom.

**How to Cite:** Ria, R., & Susilowati, D. (2023). Validity and Reliability Diagnostic Test Computational Thinking Based on Local Wisdom. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, 9(4), 1142-1149. doi:<https://doi.org/10.33394/jk.v9i4.8991>



<https://doi.org/10.33394/jk.v9i4.8991>

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## Introduction

The rapid development of the fields of science and technology makes humans need to hone computational thinking skills in order to adapt to the transition from the industrial era 4.0 to the industrial era 5.0 (Lestari et al., 2023; Rosyda & Azhari, 2020). These computational thinking skills can be honed by incorporating computational thinking skills into education. Computational thinking skills are defined as a method to train the ability to think in solving problems with reasoning and analysis so as to create solutions (Rosadi et al., 2020; Supatmiwati et al., 2021; Qomariah et al., 2023). Therefore, computational thinking skills mentally equip students to overcome the challenges of problems in everyday life. In addition, computational thinking also fosters a mindset that emphasizes creativity and critical thinking in solving problems (Shanmugam et al., 2019; Saritepeci, 2020).

By applying the core principles of decomposition, pattern recognition, abstraction, and algorithm design (Fry et al., 2023; Lopez-Parra, 2023), students are able to approach problems that are complex problems with structured and adaptable strategies. The application of computational thinking enables learners to utilize technology as a tool for creative problem-solving (Karaahmeto lu & Korkmaz, 2019; Durak, 2020). In order to nurture learners to become creative problem solvers, there is a growing need to implement computational thinking into the educational curriculum (Kong & Abelson, 2019). Thus, integrating computational thinking into education not only prepares for a digital future but also develops globally competent thinkers who can thrive in a more complex world. Essentially, computational thinking is transferable to disciplines outside of computer science (Shin et al., 2022), enabling individuals to unravel complex problems in various fields.



Therefore, computational thinking skills can also be applied to information technology research learning. Information technology research teaches students to conduct research to solve problems in the field of information technology. The problem faced by students in information technology research is the difficulty in applying information technology knowledge to solve problems in society. Therefore, students need to hone computational thinking skills to solve problems in the field of information technology that they encounter in everyday life. Seeing the importance of applying computational thinking skills for students, educators need to develop a diagnostic test instrument to measure students' computational thinking skills in information technology research learning. Especially measuring computational thinking skills to solve problems in society related to local wisdom.

The choice of developing an instrument in the form of a diagnostic test is because diagnostic tests can be used to determine the types of difficulties faced by students in a lesson so that a solution can be given to the problems they experience (Iriyadi et al., 2022; Suseno & Susongko, 2021). The urgency of the local wisdom-based computational thinking diagnostic test, which has the aim that students can recognize the role of information technology research in solving problems in everyday life, is adjusted to local culture. This is because combining local cultural values with information technology research learning can have a positive impact, namely increasing students' cognitive abilities in applying information technology research knowledge in everyday life (Anggraeni & Mundilarto, 2020; Hidayati et al., 2020; Ramdiah et al., 2020).

In essence, the development of a diagnostic test instrument to measure computational thinking skills based on local wisdom, especially in the Sasak tribe on Lombok Island, is an important effort that has the potential to revolutionize computational thinking education and skill development. Local wisdom on Lombok Island, which is often embedded in cultural traditions and community practices, brings invaluable insights into problem solving and holistic thinking that can be seamlessly integrated with computational concepts. By combining these two elements, educators can design assessments that are appropriate to students' cultural contexts while developing their capacity for computational thinking. Such instruments not only recognize the diversity of students' backgrounds but also foster a more inclusive and equitable educational environment where students' cultural identities are celebrated and utilized as a basis for skill development. By creating an assessment instrument that bridges the gap between computational skill thinking and local wisdom, educators not only promote a more comprehensive form of education but also unlock the potential for innovative problem-solving drawn from the rich tapestry of human experience.

Based on the analysis of research that has been conducted by several previous researchers, the studies conducted focus on developing computational thinking tests in learning Mathematics, Science, Biology, and Informatics in K12 (Kurniawati et al., 2019; Susilowati et al., 2021; Fauziyah et al., 2023; Setiarini et al., 2023). The development of the computational thinking test has not been associated with local wisdom and no computational test development has been found in information technology research learning in higher education. Thus, referring to several previous studies, the novelty of this research is to produce assessment products in the form of local wisdom-based computational thinking diagnostic tests in information technology research learning.

For the integration of local wisdom into the assessment of computational thinking skills to be truly effective, the diagnostic test instrument used as an assessment must be valid and reliable. Validity and reliability are important aspects of measurement and scientific research. This is because the estimation of validity and reliability helps ensure that the instruments used in research produce accurate, consistent, and reliable data. Thus, the

purpose of this study is to analyze the validity and reliability of the diagnostic test instrument used to measure local wisdom-based computational thinking skills in information technology research learning.

### Research Method

This method of research is instrument development research. The instrument development method used is the Oriondo & Antonio (1998) development model, which includes three stages, namely: (1) design, (2) trial, and (3) instrument measurement. The research design of the diagnostic computational thinking test instrument based on local wisdom is intended to determine the validity and reliability of the instrument. The subjects of this study were students of the Bachelor of Computer Science and Bachelor of Information Technology study programs at Bumigora University, totalling 108 students with random sampling techniques who have taken information technology research courses. Data collection techniques using tests. Data analysis techniques to estimate content validity, construct validity, and composite score reliability are as follows.

#### Content Validity

The estimation of content validity used to determine the agreement of these experts used the validity index proposed by Aiken (Aiken's V). According to Wicaksono (2022) and Batubara & Siregar (2022), Aiken's v formula and the interpretation of the validity index are shown in Table 1.

**Table 1. Aiken's V**

Formula	Description	Validity Index		
$V = \frac{\sum s}{n(c-1)}$	V	Index of rater agreement regarding item validity	0,8	High
	s	$r - lo$	0,4-0,8	Medium
	r	Rater's preferred category score	< 0,4	Less
	lo	Lowest score in the category scoring		
	n	Number of raters		
	c	Number of categories that can be selected rater		

#### Construct Validity

The Estimation of construct validity in this study using factor analysis techniques in the form of Exploratory Factor Analysis (EFA). Measurement of the instrument construct with EFA states that the instrument item is declared feasible or not if the Kaiser-Meyer- Olkin Measure of Sampling Adequacy test results > 0.50 and the Barlett's Test of Sphericity test results Sig. value < 0.05 (Harmurni, 2019; Yamin, 2021).

#### Reliability

The estimation of instrument reliability in this study used the Cronbach Alpha technique. According to Subando (2022) and Istiyono (2020) the formula and interpretation of the reliability coefficient are shown in Table 2.

**Table 2. Cronbach Alpha**

Formula	Description	Reliability Coefficient	
$\alpha = \frac{k}{k-1} \left( 1 - \frac{\sum p_i}{k} \right)$	Reliability coefficient instrument	0,80-1,00	Very High
	The number of items in the instrument	0,60-0,80	High
$k = \frac{1}{1 - \alpha}$	The number of items in the instrument	0,40-0,60	Moderately
		0,20-0,40	Low

$\alpha = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2}\right)$	$\sum \sigma_i^2$	Number of item variants instrument	0,00-0,20	Very Low
		Total score variance		

## Results and Discussion

### Content Validity Results

The results of the calculation of content validity using Aiken's V formula are shown in Table 3.

**Table 3. Aiken's V**

Instrument Item	Expert 1		Expert 2		Total S	Aiken's V	Category
	Score	S	Score	S			
Case 1-Question 1	5	4	5	4	8	1,00	High
Case 1-Question 2	5	4	5	4	8	1,00	High
Case 2-Question 3	5	4	4	3	7	0,88	High
Case 2-Question 4	5	4	4	3	7	0,88	High
Case 2-Question 5	4	3	5	4	7	0,88	High
Case 3-Question 6	5	4	5	4	8	1,00	High
Case 3-Question 7	5	4	5	4	8	1,00	High
Case 4-Question 8	5	4	4	3	7	0,88	High
Case 4-Question 9	5	4	5	4	8	1,00	High
Case 5-Question10	5	4	5	4	8	1,00	High

Based on Table 3, the results of content validity given by two experts in the field of computer science on ten items of local wisdom-based diagnostic computational thinking test instrument have an average Aiken's V value of 0.85 with a high validity index category. Thus, it can be concluded that the local wisdom-based computational thinking diagnostic test instrument has met the valid criteria.

### Construct Validity Results

The results of the calculation of construct validity using EFA are explained as follows.

#### 1) Kaiser-Meyer-Olkin (KMO) and Barlett's Test

**Table 4. KMO and Barlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.634
Bartlett's Test of Sphericity	Approx. Chi-Square
	df
	Sig.
	140.176
	45
	.000

Looking at Table 4, the KMO value = 0.634 > 0.5 and the Barlett's Test value = 0.000 < 0.05, so that the instrument items are declared feasible and meet the requirements for factor analysis.

#### 2) Anti Image Matrices

Anti Image Matrices requirements as sample coverage in measuring the Measure of Sampling Adequacy (MSA) value > 0.5, so the requirements for factor analysis using EFA are met. The MSA value for each instrument item found on the diagonal of the matrix shows that all instrument items consisting of 10 test instrument items have an MSA value > 0.5 so that the local wisdom-based diagnostic computational thinking test instrument items are declared feasible.

### Reliability Results

The results of the calculation of instrument reliability using the Cronbach Alpha formula are shown in Table 5.



**Table 5. Cronbach Alpha**

Cronbach's Alpha	N of Items
.628	10

Based on Table 5, the analyzed instrument items have a Cronbach Alpha value of 0.628 with a high-reliability coefficient category. Thus, the local wisdom-based diagnostic computational thinking test items used in this study were declared reliable.

### **Discussion**

Based on the results of the instrument content validity analysis, Aiken's  $V = 0.85 > 0.8$  is included in the category of instruments that have a high validity index (Batubara & Siregar, 2022). This finding is supported by research conducted by Sa'diyyah et al. (2021) and Maksum et al. (2022), which stated that the computational thinking test instrument has high instrument validity. However, both studies only focused on the validity of computational thinking instruments in mathematics learning. The findings of this study are also reinforced by the research of Arfiansyah et al. (2023) which states that the computational thinking instrument has a high validity index. However, the research of Arfiansyah et al. (2023) focused the computational thinking instrument for thematic learning. So, it can be concluded that the difference between this research and the three previous studies is that it lies in estimating the content validity of the computational thinking instrument in information technology research learning.

Meanwhile, the results of the construct validity analysis using EFA, when viewed from the KMO value = 0.634, the Bartlett's Test value = 0.000 < 0.05 and the MSA value > 0.5 so that the instrument items are declared feasible (Harmurni, 2019; Yamin, 2021). This finding is supported by research conducted by Junpho et al. (2022) and Sovey et al. (2022), which states that the computational thinking test instrument has instrument construct validity that is feasible to use in research. However, the two studies only focused on the construct validity of the computational thinking instrument with the research subject of high school students, while the study estimated the construct validity of the computational thinking instrument with the subject of college students.

Meanwhile, the results of the instrument reliability analysis of the calculation results show that the instrument has a Cronbach Alpha value of 0.628, including in the category of instruments that have a high-reliability coefficient because it is in the range of 0.6 - 0.8 (Istiyono, 2020). The findings of this study are supported by research conducted by Anistyasari et al. (2022), which states that the reliability of the computational thinking instrument has a high-reliability coefficient. However, the study focused on estimating the reliability of computational thinking instruments in digital literacy learning. In addition, research by Hidayat et al. (2023) also stated that the reliability of the computational thinking instrument had a high-reliability coefficient, but the research focused on Hybrid learning. Meanwhile, the findings of research conducted by Polat et al. (2021), Sovey et al. (2022), and Gok & Karamete (2023) also reinforce the research of this study found that the computational thinking instrument has a high-reliability coefficient. However, the three studies focused on estimating reliability with student subjects in high school. Thus, it can be concluded that the difference between this study and the five previous studies is that it lies in estimating the reliability of the computational thinking instrument in learning information technology research with the research subjects of university students.

Thus, the theoretical implications of the results of this study provide evidence showing that the development of local wisdom-based computational thinking diagnostic test instruments is valid and reliable so that it meets the quality requirements as a good measuring



instrument. Meanwhile, the practical implications of the results of this study can be used to measure local wisdom-based computational thinking diagnostic tests in information technology research learning.

### Conclusion

Based on the results and discussion, it can be concluded that the estimated content validity of the instrument using Aiken's V has a validity index with a high category. Meanwhile, the results of estimating construct validity using EFA stated that the instrument items were declared feasible. In connection with that, the results of the estimation of instrument reliability using Cronbach Alpha also stated that the instrument had a high-reliability coefficient. Thus, the diagnostic computational thinking test instrument based on local wisdom in learning information technology research meets the requirements of a good instrument, namely valid and reliable.

### Recommendation

Future researchers can estimate construct validity using the Confirmatory Factor Analysis (CFA) approach to confirm the results of research that has been analyzed for construct validity using the EFA approach in this study. In addition, prospective users of the instrument are advised to utilize this instrument to measure as well as improve the ability of computational thinking based on local wisdom in learning information technology research.

### Acknowledgment

The researcher would like to thank all those who have helped in this research. Especially to the Ministry of Education, Culture, Research and Technology of the Republic of Indonesia which has provided grants for Beginner Lecturer Research.

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