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Developing Bebras-Style Computational Thinking Test Instruments for English Learning in Elementary School

Mutiara Wahyu Daniella

Department of English Education, Faculty of language and Arts,
Universitas Negeri Medan

Correspondence E-mail: mutiaraotsuko@gmail.com

ABSTRACT
The test instrument development research aims to determine the computational thinking ability of students towards English language learning. The type of research used is R&D with the 6-Stage Borg and Gall development model (Research and Information Collecting, Planning, Initial Product Development, Expert Validation, Revision Expert Validation, Product Implementation). The test instrument that is suitable for use has passed the eligibility standard stage, namely, validity, reliability and difficulty level. The research was conducted at SD Negeri 105855 PTPN II Tanjung Morawa with class IV research subject totaling 35 studentrs. Data from validator result using Cohen's kappa of 0.65 with strong category. In this study obtained 10 valid questions from 15 questions developed with a reliability value of 0.62 in the moderate category. Then the results of the student ability test show the average score of students 90.85 excellent category. The findings suggest that Bebras-style questions effectively measure the components of CT-decomposition, abstraction, pattern recognition, algorithmic thinking-and support meaningful English learning outcomes.

Keywords:
Computational Thinking 1,Bebras Style Questions 2, English Language Learning 3, Primary Education 4, Test Development 5

INTRODUCTION

In the Society 5.0 era, education must adapt to rapid technological developments by integrating skills such as computational thinking (CT) early in learning. Indonesian students' low PISA performance highlights the urgent need for innovation in teaching, particularly in English literacy. However, elementary English education often lacks

resources and strategies that promote problem-solving and reasoning. To address this, Bebras-style questions—originally developed to foster CT through engaging, contextual problems—offer a promising method. Yet their use in English learning remains underexplored. This study aims to bridge that gap by developing a test instrument that applies Bebras-style questions to English lessons.

METHOD

This study used Borg and Gall's Research & Development (R&D) model. The test instrument was developed through six stages: (1) research and information collecting, (2) planning, (3) initial product development, (4) expert validation, (5) revision, and (6) implementation. The population comprised 35 fourth-grade students at SDN 105855 PTPN II Tanjung Morawa. Data collection included observations, interviews, validation sheets, and student test results. Instruments were validated by experts using percentage scores and Cohen's Kappa analysis. Question items were analyzed for validity, reliability, and difficulty level.

RESULTS

1. Test Development and Validation

Based on needs and curriculum analysis, a test instrument with 15 Bebras-style English questions was developed. The validation stage was carried out by submitting a product instrument consisting of 15 English questions based on computational thinking skills using the bebras style and a validation sheet.

Table 1.Percentage of validator results

Aspect	Validator		Average	Criteria of Validity
	1	2		
Material	91%	86%	89%	Very Valid
Construct	83%	67%	75%	Very Valid
Language	94%	86%	90%	Very Valid

The results of the assessment on the items from the validator using the Cohen's Kappa method.

Table 2. Validator Analysis Using Cohen's Kappa

	Value	Asympotic Standardized Error[a]	Approximate T[b]	Approximate Significance

Measure of Kappa Agreement	0,659	0,313	2,106	0,03
N of Valid Cases	15			

2. Implementation

The validity of the test instrument was tested using the Product Moment correlation formula which showed that of the 15 items, 10 of them were declared valid. The test instrument is said to be valid when rcount> rtable, where the number of responses is 35 students, using the rtable value of 0.334.

Table 3. Validity test results

Questions' Number	R Count	R Table	Category
1.	0,129	0,334	Not Valid
2.	0,237	0,334	Not Valid
3.	0,023	0,334	Not Valid
4.	0,444	0,334	Valid
5.	0,366	0,334	Valid
6.	0,368	0,334	Valid
7.	0,368	0,334	Valid
8.	0,023	0,334	Not Valid
9.	0,368	0,334	Valid
10.	0,366	0,334	Valid
11.	0,368	0,334	Valid
12.	0,114	0,334	Not Valid
13.	0,498	0,334	Valid
14.	0,366	0,334	Valid
15.	0,366	0,334	Valid

The percentage of validity results shows that 67% of the items proved to be valid, while 33% of the items did not meet the validity criteria, as shown in Figure 1.

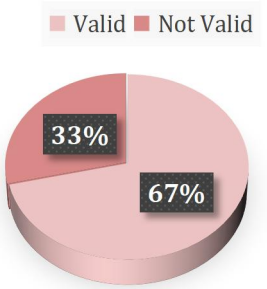

Figure 1. Validity test results

Calculation of the reliability of the test instrument using Cronbach's alpha formula, this formula is suitable as an analysis of multiple choice test instruments. The test instrument is said to be reliable when it produces fixed results if used at different times. The reliability result of the test instrument is 0.62, the reliability category is sufficient.

Table 4. Reliability results of test instruments

Number of Question Items	Reliability	Category
10	0,62	Moderate Correlation

The level of difficulty of the test instrument resulted in 15 questions considered easy.

No	Score Criteria	Difficuity Level
1.	0,85	Easy
2.	0,94	Easy
3.	0,94	Easy
4.	0,91	Easy
5.	0,88	Easy
6.	0,91	Easy
7.	0,91	Easy
8.	0,94	Easy
9.	0,91	Easy
10.	0,88	Easy
11.	0,91	Easy
12.	0,94	Easy
13.	0,88	Easy
14.	0,88	Easy
15.	0,88	Easy

Data from the analysis of students' computational thinking abilities on the development of test instruments with the material “How do you go to school?” It is stated that the ability of class IV students at SD Negeri 105855 PTPN II Tanjung Morawa obtained an average score of 90.85. The average is included in the excellent category.

DISCUSSIONS

The product results in the form of test instruments that can measure students' computational thinking skills. The test instrument developed on the material “How do you go to school?” in the form of multiple choice. A good instrument if it has met the eligibility standards, which include validity, reliability, objectivity, practicality and economy (Arikunto, 2018).

The testing stage of the research was carried out through an assessment given by the validator on the development of the test instrument. After the test instrument was validated, it was then tested on students as many as 35 respondents. The results of the assessment of the two validators, namely 1 English lecturer at Medan State University and 1 English teacher based on 3 aspects in terms of construct, material, and language aspects. Researchers designed a total of 15 questions, of which all questions were declared valid with minor revisions. Researchers designed a total of 15 questions, of which all questions were declared valid with minor revisions. Expert validation questionnaire instrument using Gutman measurement scale, namely (0) disagree; and (1) agree (Sani, 2022).

Furthermore, each item of problem solving was analyzed statistically using the Cohen's kappa validation method. The results of the Cohen's Kappa calculation reached a value of 0.61 with a strong category according to the criteria determined in the range of 0.61 <0.80. The significance value obtained is 0.03, meaning that the two validators have the same agreement on the test instrument developed because the significance value obtained is greater than the value used (0.03 <0.05). This states that the test instrument developed is feasible to use as a measurement of students' computational thinking skills.

During the process of conducting item validation tests, researchers used the SPSS application by applying the Karl Person product moment correlation formula and using the r table value with a significance level of 5%. Researchers only used 15 questions to be tested. In the item validity test with a total of 35 respondents and the rtable value used is

0.334, it was found that 10 out of 15 questions were declared valid. Valid questions are found in question numbers 4,5,6,7,9,10,11,13,14, and 15 and invalid questions are found in question numbers 1,2,3,8, and 12. Reliability aims to determine the level of consistency of an instrument when tested at different times. Questions that are tested for reliability are questions that are classified as valid, invalid questions cannot be tested for reliability. The reliability test results are 0.62 with a moderate correlation category

The average percentage of measurement results obtained in the construct aspect is 75%, the material aspect is 89%, and the language aspect is 90%. Thus, the average value of the two validators' assessments of the three aspects reached 85% with a very valid category. It can be concluded that the overall reliability of the test instruments developed is consistent or reliable. Test the level of difficulty of a test instrument classified into several categories. These categories include easy, medium, and difficult categories. The results of the difficulty level test obtained all questions in the easy category. The results of the students' computational thinking ability level obtained an average score of 90.85 with an excellent category. It can be concluded that students have good computational thinking skills.

CONCLUSIONS

In conclusion, this study successfully developed a test instrument to measure computational thinking skills among fourth-grade students using Bebras-style questions on the material "How do you go to school?". The results indicated that the instrument was valid, though some questions required revisions, and demonstrated moderate reliability. The difficulty level of the questions was appropriately categorized as easy for the target group, and the students performed excellently on the test.

However, the study does have limitations, particularly with the reliability of the instrument, which could be improved in future iterations. Additionally, the limited number of questions that passed validation suggests a need for further refinement and testing. For future research, it is recommended to expand the scope of the instrument by developing a broader range of questions that assess various aspects of computational thinking, and to test the instrument with a larger and more diverse student population. Further studies

could also explore the impact of integrating Bebras-style questions into other subjects to strengthen critical thinking and problem-solving skills across the curriculum.

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