DEVELOPMENT OF PROGRAMMING ABILITY TEST APPLICATION FOR INFORMATICS STUDENTS

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Abstract. An ability that comes from within ourselves is often referred to as talent. Ignorance of talent will be very detrimental because it can cause discomfort in carrying out their work. One talent that cannot be separated from the development of technology is programming talent. This study aims to determine the ability of programming talent possessed by someone. The study was conducted with a case study of Informatics Engineering students at Universitas Negeri Surabaya. Through this research, an application will be produced to test the ability of student talents in the field of programming. The method used in this study is R & D (Research and Development) with 6 stages. Validation of the questions obtained 91.87% results and was declared very valid to be used as test material, while the overall product validation obtained results of 92.94% and in a very feasible range. There is a significant correlation between programming talent (test scores) with programming.

1. Introduction
Delays in realizing talent, interests, and abilities can cause mistakes in choosing majors at an educational level. It becomes a significant problem in someone's life because it determines future success. These problems can occur to anyone, including the Informatics Engineering students of Universitas Negeri Surabaya on their talent in programming. [6] This can cause difficulties for a student to be able to continue their education in the field. From the exposure of the problem, the need for analysis to find out the talents possessed by someone is very important to determine future success, therefore, in this case, the Programming Talent Ability Test Application will be developed to be applied to Informatics Engineering students at Universitas Negeri Surabaya. The application developed in this study uses HTML programming language, PHP with the help of JQuery with MySQL database and fisher-yates algorithm for randomizing questions and answers[1].

2. Method
The type of research used in this study uses R & D (Research and Development), by developing a test of the ability of programming talent in students[9]. Meanwhile, the approach used in this study is quantitative. The subjects in this study were Informatics Engineering students who tested their programming talent abilities. The place of research is a place that is used to carry out research activities and data collection until it reaches the specified results[2]. This research was carried out in the Informatics Engineering Department of Surabaya State University. The time of research is the time planned for this research to be carried out or when this research activity takes place[3].
This research was conducted in the odd semester of the 2018/2019 academic year. The population in this study were students of the Informatics Engineering Universitas Negeri Surabaya. The sample in this study were 38 Study Program students of Information Management D3 students, 37 Information Technology Education S1 students, 39 Informatics Engineering S1 students, and 40 Information Systems S1 students, the number was one class per study program. The design procedure in this study used the development of Research and Development research with 6 stages.

a. Potential stages and problems
The ability of programming talent test is the potential developed. This potential stems from the problem of ignorance of students about their programming talent, because programming talent is a milestone in the success of Informatics Department students. Knowledge of talent can benefit students because then they can decide what next steps they will take to realize their dreams in the future.

b. Data collection phase
Steps taken in this phase include[4]:
- In making initial observations, problems were found when the number of students who complained about the difficulty of programming, and the emergence of uncertainty over the direction chosen by students.
- Conduct studies on various ways to create programming skills aptitude test applications from various relevant sources of books and journals.
- Data Information obtained from the environment of Informatics students and the studies that have been carried out will be used to create an application for the aptitude test program.

c. Product design phase
- Scoring system
  Appraisal design for test talent programming skills with multiple-choice item objective tests. From the test, a score will be obtained to obtain information from the test instrument. Scoring techniques in this study used a score addition technique for the correct answer and a score of 0 for the wrong answer / not filled in.
- Randomization of questions and answers
  The Fisher-Yates algorithm is used in randomizing questions and answers[5]. The explanation of randomization of questions and answers begins with the steps used to generate a random permutation. Randomization of questions 1 to N can be explained as follows[7]:
  1. Write questions from question number 1 to question N.
  2. Choose a random K question between 1 and the number of questions that have not been crossed.
  3. Count from the bottom and cross out the K questions that have not been crossed out, and write the question elsewhere.
  4. Repeat step 1 and step 3 until all the questions have been crossed.
  5. The sequence of questions written in step 3 is a random permutation from the initial question.
• Design and display design
  This research development is based on the design of the Context Diagram which is also referred to as data flow diagram level 0. This diagram illustrates the scope of a system[8].

d. Design validation stage
  Validation in this application product is carried out by informatics lecturers as application experts and lecturers in the field of mathematics and programming as a question validator[9].

e. Design revision stage

f. Product testing phase
  In the stage of a product, testing carried out to Informatics Engineering students of the State University of Surabaya with one class in each existing study program.

3. Results and Discussion
  The validators are expected to be able to provide input and suggestions to improve the application of the ability to test programming skills and determine the appropriateness of this application. Validation results are used as a reference for the feasibility of using instruments in the research process. To calculate the percentage results, use the following formula[10]:

\[ \frac{v}{p} = \frac{t}{c} \times \frac{s_{t}}{s_{i}} \times 100\% \]

with

\[ c \quad s_{i} = \text{higher skills, } s_{i} \quad \text{0 it } \quad x \quad \text{sum of } \quad x \quad \text{sum } \]

Based on the results of the evaluation of the validator scores obtained 98%, so it can be concluded that the application media Talent Ability Test Programming included in the criteria is very valid.

Results of question validation
  Question validation is used as a supporter of the improvement of the questions tested in the application of aptitude programming skills tests so that the tests tested are following the objectives of this study.
  Based on the results of the material validation of the programming talent ability test questions, the highest value given by the validator is 4 and the lowest is 3 by referring to two assessment aspects, namely aspects of content validation and language aspects and writing questions, can be illustrated in the following diagram:
Figure 1

Fill Validation
From Figure 1 it is known if the questions 3, 4, 7, 11, 12, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 28, 29, and 30 get a percentage of 100% so the question is declared valid in content and accordance with the measurement criteria for programming talent. The percentage of 87.5% is obtained by the questions 1, 2, 6, 8, 9, 10, 13, 20, 21 and 27 seen from Figure 1, thus the question is declared valid and following the measurement criteria for programming talent. Percentage of 75% which means the question is quite valid in content only found in question 5. From the explanation above it can be concluded that the questions in terms of content validation are following the criteria in programming talent, namely numerical reasoning, logical reasoning, and nonverbal reasoning[11].

Language and Writing
From the figure, it is known that questions 3, 4, 16, 17, 18, 19, 20, 28, 29, and 30 get a percentage of 100% so that the problem can be understood in terms of language and writing. On the questions 6, 7, 11, 13, 14, 15, 21, 22, 23, 24, 25, 26, and 27 got a percentage of 87.5% and thus these questions were stated to be understood to be used as a test question for programming talent. The percentage of 75% is obtained questions 1, 2, 5, 8, 9, 10, 11, and 12.

Validation results are used as a reference for eligibility in the use of instruments in the research process. To calculate the overall results of question feasibility validation, use the formula found in chapter 3. Validation results are stated to be very feasible if the percentage reaches the assessment range of 81% -100%. Obtained the results of question validation is 91.87%. From the explanation above, conclusions can be drawn if the questions presented are very understood in terms of language and writing, so that they can be used to conduct programming aptitude tests[12].

Discussion of test results and student grades
The results of the student's programming talent test were used to determine the correlation between the talents and abilities of students in terms of programming. At this stage, the educator compares the values obtained by students with the values obtained from the Mathematics course and the value of Programming Basics. The results of the correlation of talent abilities with programming performance can be seen from the application of programming talent ability tests on the admin home page, where there is a value evaluation graph with the following results.
In the correlation test also obtained sig (2-tailed) of 0.000 where sig <0.05 or 0.01, the result means there is a significant correlation between talent and programming performance, so conclusions can be drawn rejecting H1 and accepting H0 = There is a significant correlation between talent programming (test scores) with programming performance (average Math scores and Basic Programming test values).

4. Conclusion
This study obtained 2 results of validation namely question and product validation and question validation. Validation of the questions obtained a result of 91.87% and was declared very valid / very feasible to be used as a test material for the ability of programming talent in students. While for product validation consisting of aspects of Technical Quality, Display Interface, and Content Quality aspects, the overall result is 92.94%. It can be concluded if the validation results in the range of 81% - 100% of products are very feasible to be used as a means of testing the ability of programming talent to students.

5. References
[1] Bergersen, Gunnar Rye. 2011. Inferring Skill from Tests of Programming Performance: Combining Time and Quality.
[2] Bergersen, Gunnar Rye. 2015. Measuring Programming Skill Oslo: Department of Informatics Faculty of Mathematics and Natural Sciences University of Oslo.
[3] Gnambs, Timo. 2015. What makes a computer wiz? Linking personality traits and programming aptitude. Osnabrück University, Germany.
[4] Gustafsson Jan-Eric dan Gunnar R. Bergersen.2011. Programming Skill, Knowledge, and Working Memory among Professional Developers from an Investment Theory Perspective.
[5] J. P. Guilford. 1982. Psychometrics Methods. New Delhi, Tata-McGraw Hill.
[6] Louzada , Francisco, dkk. 2015. iSports: A web-oriented expert system for talent identification in soccer. DOI 10.1016/j.eswa.2015. 09.007.
[7] M. Berry. 2010. *The essential similarity and differences between mathematical modeling and programming*. Canada: heriton School of Computer Science.

[8] Nithiya Devi, dkk. 2016. *Shuffling Using Enhanced Fisher Yates Shuffle Algorithm*. India: Department of ECE SNS College of Engineering, Coimbatore. DOI 10.4010/2016.1121.

[9] Permadi, G. S., Vitadiar, T. Z. 2017. *SISTEM INFORMASI LAPORAN DANA BANTUAN OPERASIONAL SEKOLAH (BOS) BERBASIS DESKTOP* (Studi Kasus Pada SMP Negeri 3 Ponorogo). INOVATE Vol 2 No 1.

[10] Román-González. 2018. *Can computational talent be detected? Predictive validity of the Computational Thinking Test*. https://doi.org/10.1016/j.ijcci.2018.06.004

[11] Saeed, dkk. 2014. *Fisher-Yates chaotic shuffling based image encryption*.

[12] Seels, B. B., & Richey, R. C. 1994. *Instructional technology: The definition and domains of the field*. Washington, DC: Association for Educational Communications and Technology.