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Model development measurement of interests based on expert system

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Abstract -This article aims to develop an expert-based interest-based measurement model to provide an overview of the interests that can assist in decision making of vocational interest decisions in the vocational field to be on the right target. The method used by designing vocational interest measurement instrument by producing four personality types used as knowledge base is Tangible, Thinking, Flexible and Entrepreneur (TTFE) and integrated with expert system concept which makes a practical and efficient measurement model. The generated interest measurement model can help students quickly to overview the interest in decision making majors for higher education, can conduct online consultation, documentation, and can be used as a documentation file consultation portal at an institution.

1. Introduction

Measurement is a branch of applied static science that builds the basis for better test development, resulting in tests that function optimally, valid and reliable. While the psychological measurement is a measurement of certain psychological object. The object of measurement is called as *psychological attributes* or *psychological* traits, namely the characteristic features that characterize or underlying behavior. Behavior is the expression or the expression of the characteristic features that can be observed. Future challenges for the students are preparing themselves in career selection. This process usually begins from high school or equivalent which is the most important stage for students. In shaping the future requires support from parents, teachers, friends and the surrounding environment to get opinions, information and guidance in the choice, especially with the elderly [1][2][3]

At Level High School or equivalent is a crucial time in making career choices, students choose a major of study and will continue to pursue a higher, such as preparation for entering college as a real career path. Higher education is a knowledge center which creates, delivers, and learning for society [4]. Students should be able to build your predictions for the future, to solve the problem with existing knowledges[5]. In this case Holland classifying three classes for students who have graduated from



high school or equivalent [6][7]. The first continuing education to the higher educational department, the second career interests (working in a company or institution) and the third is self-employed (build their own business independently). Holland also said to be a lack of compatibility between the interest of the work to be selected, in order to obtain satisfaction on the job later.

Selection of appropriate career with a personality will make a person able to develop themselves and maximize all the potential that they have. An independent person is a person who brave, willing to learn and willing to practice based on the experience of his life. Majors related to the type of personality of each human being [8]. Each personality type is a product of the interaction characteristics derived from a variety of cultural influences, peers, hereditary factors, biological, parents, social class, and physical environment.

Career preparation requires the right information because it affects the decision making of further studies on students [9][10]. With the information on the advanced study of the students, then the decision-making process there is no doubt [11]. The process of selecting courses that are not based on the orientation of this career, have an impact on several things: (1) the study process is not maximized; (2) the study process that is not maximized resulting in mastery ability (learning achievement) is low, it means that potential students are not actualized; (3) the reformulation of career orientation is the risk when a new consciousness emerging changes in choice of study / career will result in waste of resources, funding, age, and delays in the stages of human development. Further research studies decision making [12].

In the measurement of interest, many interest test tools have been used such as *Strong Interest Inventory (SII)*, *Self-Directed Search (SDS)*, *Jackson Vocational Interest Survey (JVIS)*, *Career Assessment Inventory (CAI)*, *Kuder, Rothwell Miller Interest Blank (RMIB)*. IIS interest test tools work measurement, measurement of SDS interest test tools Activities, Competencies, *Occupations* and *Self-Estimates*, JVIS interest test tool measurement job roles and work style, CAI interest test tool measurement VV (*the vocational version*) and EV (*the enhanced version*) activities, school subjects, and jobs. CAI interest test instrument devoted to the career seekers who do not pursue higher education. Kuder interest test tool measurement measure like and dislikes with ten kinds of variables. Likewise with RMIB interest test tool choose a job that likes and dislikes to give weight, the number of variables to be selected 12 variables [12][13].

The use of existing test tool by using pencil filling, calculation of interests test results partly manually, so that the test results can be known in three days or a week after the test. Measurement of interest that there cannot be done consultation with a psychologist and limited only to the measurement of interest only [6]. Related information requested and talent is not obtained easily. So existing measurement model is not practical and efficient to use.

Development of interest measurement model uses an expert system to facilitate the testing of interest to the students [14][15]. Various methods in search *rulebase* used in expert system such as *forward chaining* and method of such uncertainty *certainty factor* [16].

In this study developed a measurement model student interests vocational fields to assist students in making decisions subject to be taken at universities are interested in. The development of this model produced a model TTFE (*Tangible, Thinking, Flexible, Enterprener*). This measurement model will help students in decision making and can be used as a portal counseling at school.

2. Literature Review

2.1 Psychological Measurement

Measurement is an essential part of scientific activity. Science measurements (*measurement*) is a branch of applied statistical science that aims to build the foundations of a better test development so as to produce a test that function optimally, valid, and reliable. Measurement is the rule to assign the number to an object such that it represents the number of attributes [17]

While the psychological measurement is a measurement of the specific psychological object. The object of measurement referred to as psychological attributes psychology or psychological traits, the traits that characterize or underlying behavior. The behavior itself is an expression or the expression of these traits, which can be observed. But not all things can be observed psychological.

The construct is a hypothetical concept used by experts who are trying to build a theory to explain the behavior. Indicators of a psychological construct obtained through various sources such as the results of research, theory, observation, interview, elicitation (especially to construct attitude). Psychological measurement activities often referred to as a test. The test is to observe the activities or collect a sample of the individual's behavior in a systematic and standardized. Called "sample behavior", because the tests only get the data at a specific time and under specific conditions and contexts. That is, when the test took place, it is expected data obtained is representative of the measured behavior as a whole.

Steps construct psychological tests

Measures drafting tool of psychological tests:

- a) Identify the intended use of the test
- b) Domain to identify behaviors and indicators that represent the constructs
- c) Make test specification (lattice)
- d) Writing items based on lattice by taking into account the criteria of item writing.

To write the item well, there are a number of criteria as proposed by Wang (1932), Thurstone (1929), Bird (1940), Edwards and Kilpatrick (1948). Such criteria were initially used to draw up a scale of attitude, but it will also help to arrange items from other scales. These criteria are the following items writing.

2.2 Interests Test Tool

Interest is a fusion of desire and willingness to develop if there is motivation. Interest is essentially an admission of something relations between themselves with something beyond themselves. Tests interest (*interest test*) is a type of test instrument used in the assessment of an individual's interest in various types of activities. Most of the interest inventories designed to assess an individual's interest in various fields of work. Some inventory also provides an analysis of interest in the school curriculum or field of study, which in turn is associated with career decisions. The types of tests of interest include *Strong Interest Inventory (SII)*, *Self-Directed Search (SDS)*, *Jackson Vocational Interest Survey (JVIS)*, *Career Assessment Inventory (CAI)*, *Kuder, Rothwell Miller Interest Blank (RMIB)*.

2.3 Expert system

An expert system is a system designed to be able to do reasoning like an expert in a field of certain expertise. The expert system itself is an *artificial intelligence* program that combines the knowledge base with the inference system. It is part of *software* the high level of specialization trying to duplicate the functions of an expert in a field of expertise. The user interface is designed for the needs of using object oriented methods.

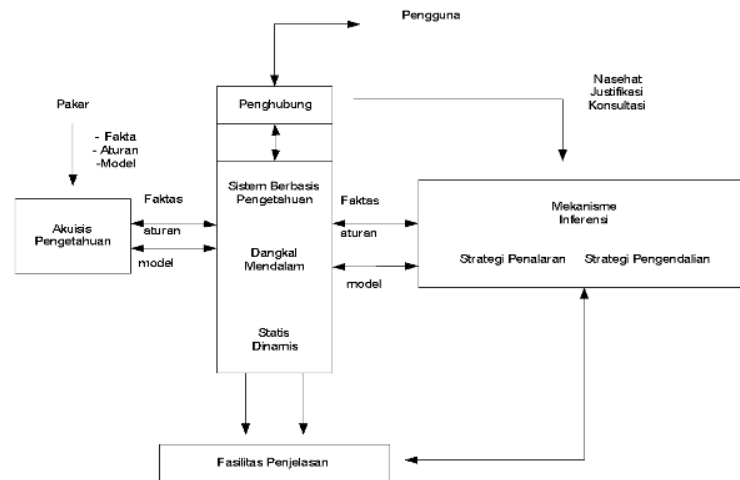


Figure 1. Structure of Expert System

In Figure 1, we can see clearly all the components that make up the expert system that Knowledge Acquisition, Knowledge Representation, Inference Mechanism and explanation facilities.

3. Methodology

Methods of research and development (*Research and Development/ R & D*) are included in the category of research "need to do", the research results will be used to assist in the work, so that the work is aided by the products resulting from R& D it will be more productive, effective and efficient. Therefore, methods of research and development (R & D) is used for the preparation of this dissertation. Methods of research and development (R & D) is included in the combination of research method model *sequential/* sequence. 4D development model consists of four main stages, namely, *define* (restriction), *Design* (design), *Develop* (development) and *Disseminate*(deployment).

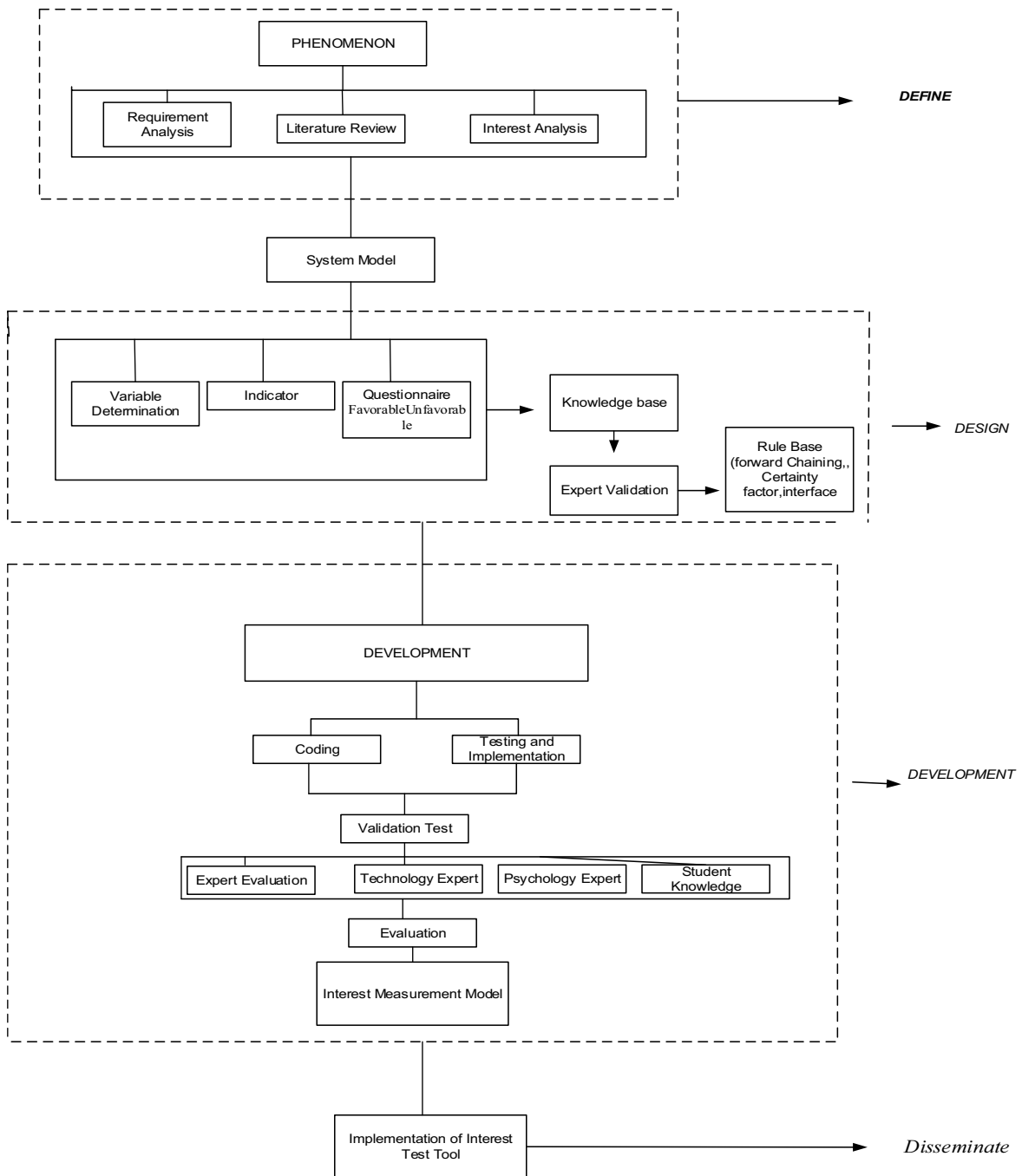


Figure 2. Four D Development Model

In Figure 2 describes the stages of development used in designing the measurement model. Stages define discovered the problem, the stages of design undergo design variables, indicators, statements and expert system integration. At the development stage perform system development, validation testing, and evaluation and implementation phase assay Disseminate interest.

4. Results and Discussion

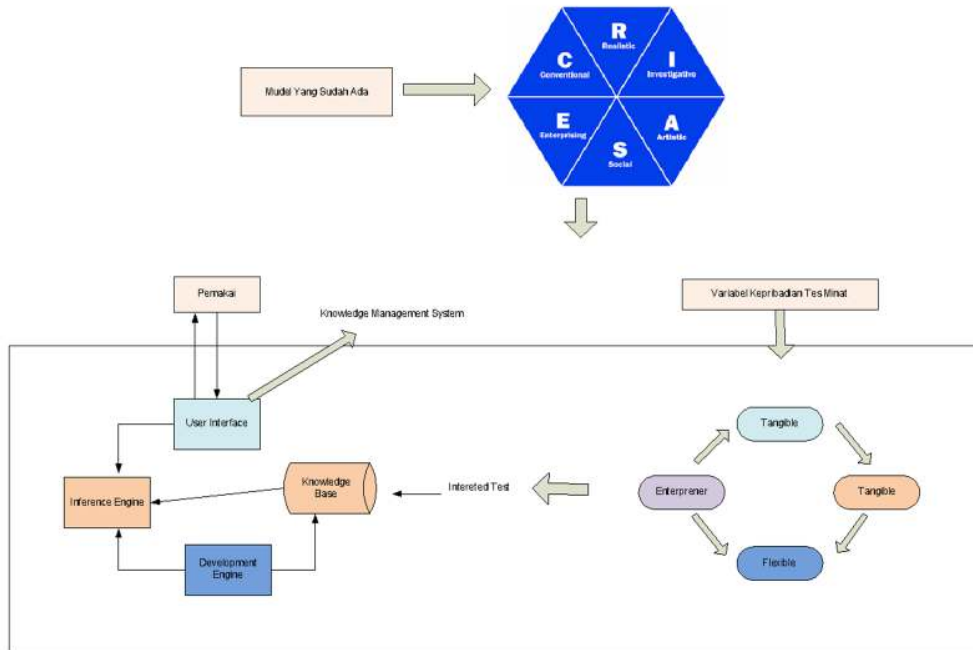


Figure 3. Model TTFE

In Figure 3 describes phase or step development of predictive models majors Expert System based on student interest. Analyzing the existing model, by taking the data to experts and literature. From this analysis resulted in four new variables are *Tangible*, *Thinking*, *Flexible* and *Enterprener*. Of the four new variables do knowledge representation and make the knowledgebase. From *Knowledge Base* Inference their mesing to process and adjust the existing rules on the *Knowledge Base*.After processing the data with their Inference engine user interface design. Expert systems are built conceptually *Knowledge Management System*. To identify, create, describe, and distribute knowledge (knowledge transfer) to be reused, it is known and studied Back

Factor Analysis

In item analysis, the reliability of Alpha Cronbach obtained is 0.979 from 60 items. Which means the reliability among respondents is good. And all items are reliable, because of the magnitude of 0.3. Factor analysis conducted in this study aims to simplify the variables that affect interest through the analysis of Main Components so that it can form factors which meet the criteria or rules as a variable form (new variable). Here's the process of factor analysis performed on the four initial variables of independent variables:

4.1 Kaiser Mayer Olkin (KMO) and Barlett's Test

KMO and Barlett's Test were used to assess whether the variables to be analyzed have the feasibility to serve as factor-formers. The following analysis results of KMO Test and Barlett's Test of research variables.

Table 1. Results of Feasibility Analysis of Research Variables

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.816
Bartlett's Test of Sphericity	74.288
df	6
Sig.	.000

Based on the results in Table 1, it is known that Kaiser-Mayer Olkin Measure of Sampling Adequacy shows a score of 0.816 with a significance of 0,000 because the value is above 0.600 ($0.816 > 0.600$) and significantly above 0.050 then all the variables are feasible for further analysis.

4.2 Anti Image Matrices Correlation Test

The results of Anti Image Matrices analysis with Measures of Sampling Adequacy (MSA) of the four variables to be factored can be seen in Table 2

Table 2. Results of Analysis of Anti Image Matrices (MSA) Research Variables
Anti-image Matrices

		Tangible	Thingking	Flexible	Enterprener
Anti-image Covariance	Tangible	.512	-.136	-.006	-.066
	Thingking	-.136	.255	-.142	-.063
	Flexible	-.006	-.142	.267	-.130
	Enterprener	-.066	-.063	-.130	.370
Anti-image Correlation	Tangible	.877^a	-.378	-.016	-.153
	Thingking	-.378	.778^a	-.544	-.205
	Flexible	-.016	-.544	.777^a	-.413
	Enterprener	-.153	-.205	-.413	.863^a

Measures of Sampling Adequacy(MSA)

Based on MSA results in Table 2, each variable is above 0.500, thus the variable can be declared for further process.

4.3 Factoring Process

Factoring processing aims to determine the number of factors formed from the analysis of factors conducted. The method used is Principal Component Analysis. The result of the process of factoring has 2 parts, namely (1) Communalities is a value that shows the contribution of each component to the internal factor which is expressed with the Extraction in percentage. (2) Knowing the number of factors formed through Total Variance Explained. Following each description of the factoring process:

4.3.1 Communalities (Role Factor)

Based on data analysis that has been done to the four variables it can be seen that there are 4 variables to be analyzed in factor analysis. To know the contribution of each component to the factors that formed can be seen in Table 3.

Table 3. Result Analysis of Communalities.

Communalities		
	Initial	Extraction
Tangible	1.000	.651
Thinking	1.000	.855
Flexible	1.000	.829
Entrepreneu r	1.000	.774

Extraction Method: Principal Component Analysis.

Based on Table 3 it can be explained that Tangible variables can be explained 65.1% by the factors formed, the Thinking variable can be explained 85.5%, Flexible variable can be explained 89.7% and Entrepreneur variable can be explained by 77.4% of the factors formed. The greater the communality of a variable the more closely related to the factors formed.

4.4 Total Variance Explained

The following results of Total Variance Explained analysis to determine the number of factors that formed from the analysis of factors conducted.

Table 4. Result of Total Variance Explained

Component	Total Variance Explained					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.109	77.714	77.714	3.109	77.714	77.714
2	.458	11.459	89.173			
3	.270	6.747	95.920			
4	.163	4.080	100.000			

Extraction Method: Principal Component Analysis

Based on Table 4 it can be explained that the factor formed is only one factor with the number Eigenvalues > 1. In the table above can be observed that the factors formed with eigenvalues 3.019

then known factor variance is $(3.019 / 4) \times 100\% = 75.5\%$. Thus the factor formed is able to explain 75.5% of the variability of the four original variables.

To further explain the number of factors formed can be seen in Figure 4.

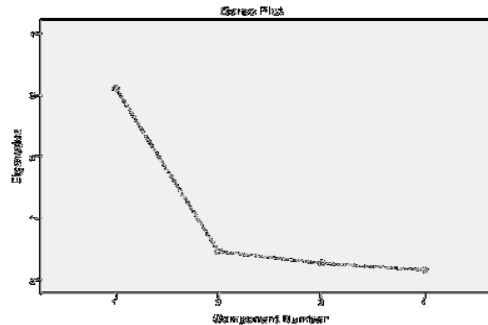


Figure 4. Graph Scree Plot Factor Formation

Based on Figure 4 Scree Plot, it can be seen that there is only one factor passing the eigenvalue above 1.0. Thus the factor formed in the analysis was done by 1 factor and for next the formed factor is named "Factor Shaper Interest" This factor is a reduction or summary of four components initially namely Tangible, Thinking, Flexible and Entrepreneur.

4.5 Loading Factor and Setup Factor

Orthogonal Rotation Varimax was performed to obtain high loading factor on one component and low loading factor on other variables. Grouping was done by considering the number of coefficients contained in the variable row and column factors. However, due to the factor that formed only one then there is no factor rotation. Rotated Components Matrix results can be seen in Table 5.

Table 5. Rotated Component Matrix

Component Matrix ^a	
	Component
	1
Tangible	.807
Thinking	.925
Flexible	.910
Entrepreneu	.880
r	

Extraction Method:
Principal Component
Analysis.

a. 1 components extracted.

Based on the results in Table 5 Rotated Component Matrix above, that there is only one group of factors covering all components to be analyzed.

5. Conclusion

1. With the development of interest-based measurement model expert system can provide a snapshot of interest in decision making in continuing education in the field of vocational college.
2. The resulting measurement model is *Tangible, Thinking, Flexible and Entrepreneur (TTFE)* is valid, effective and efficient.

3. With this interests test tool students directly get information on colleges associated with the interest generated by the test. And related information regarding the interest and articles about talents and career path. Besides, students can consult with teachers online.
4. This test tool can be used as a test portal interest in schools. Because it can perform data storage, data reporting and discussions between students and between teachers and between students and teachers.

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