

Validity of the Expert System based VIT Model (*Vocational Interest Test*)

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Abstract— The purpose of this study was to produce a valid expert system-based VIT (*Vocational Interest Test*) model. Recruitment or student admission plays an important role for the success of a vocational education. Therefore, using a valid student admission tool is important which will result good and quality students, and this can be seen in the admission process through the right means and tools. The novelty of the product developed was to be able to calibrate vocational interest instruments developed from Holland's theory with information technology and knowledge based system. This research product is in accordance with the Vocational Education Spectrum which consists of 9 Areas of Expertise, 48 Expertise Programs and 142 Expert Competencies that are in line with 21st Century Competencies to produce a vocational interest test model and a vocational interest software based on innovative expert system and in supporting the right decision making (Decision Support System). The type of research used is Research and Development (R & D) using the Four-D (4D) model. To produce valid products, expert validity is used. Based on the data analysis, the results of the study were obtained: (a) Book of Vocational Interest Test model, (b) Vocational Interest Test Software Product, (c) Application Usage Handbook, (d) Vocational Interest Test Socialization Handbook that has fulfilled the valid terms and conditions .

Keywords— *Vocational Interest Test (VIT), Expert System, Holland's Theory, Vocational High School, Selection System*

I. INTRODUCTION (*HEADING I*)

Education is an important aspect in human life. Therefore, education is needed in accordance with the change of era that requires individuals to be able to develop their own potential based on the expertise that is needed later for both the students themselves and the community. Vocational school that is also called vocational education is oriented to the demand of industrial markets that require skilled workforce. The basic principle of developing vocational education

refers to one of the founders of vocational education, *Father of Vocational Education in the United State*, an intellectual from the United States named Charles Allen Prosser as cited in Roynaldo, D and Martinez, JR (2007: 73) who explain 16 principles or characters of vocational education which the government is trying to do now by reducing public education and increasing vocational high schools (SMK). The reason of such policy is because there are many unemployees from secondary education due to the lack of skills of the graduates and the incompatibility of the needs of the industrial market with the expertise of each secondary school graduate. This condition makes unemployment rate increase.

Vocational education in Indonesia is at the level of secondary education called Vocational High School. Types of vocational education are arranged in the spectrum of vocational education consisting of 9 Areas of Expertise, 48 Skills Programs and 142 Skill Competencies as outlined in the Decree of the Director General of Primary and Secondary Education, number: 4678 / D / MK / 2016 dated September 2, 2016. The government program, through the Minister of Education and Culture, targeted a ratio of vocational and general secondary education to be 70:30, 70% of vocational schools and 30% of high schools until 2014. This target was not reached until the deadline and then dropped to 60:40 until 2014, but the target cannot be reached until now.

Vocational education is an education that prepares students to enter the workforce. Paryono, Southeast Asian Minister of Organization Regional Center for Vocational and Technical Education and Training (SEAMEO VOTTECH) Brunei Darussalam explained that vocational education must have education where the point is not only ready for work, but must have adjustments such as training and providing general knowledge. Vocational education is not a stand-alone

discipline, but is influenced by the surrounding scientific disciplines, such as industry and economics. Vocational education should affect industrial and economic development. The relationship between vocational and technical education can be seen in Figure 1.



Figure 1. Relationship between Vocational and Technical Education and Surrounding Factors (Source: World Bank 2012)

The figure above must be strong, because if the relationship is weak there will be a high rate of unemployment, inefficient and the migration of workers to other places (brain drain). Vocational graduates from the beginning are prepared to enter the workforce so that after graduation the students will immediately work or become entrepreneurs. The phenomenon is many vocational high school graduates are unproductive, and this fact is reinforced by the data provided by BPS in Catalog No. 57 of February 2015. The data of Open Unemployment Rate (TPT) according to education in August 2014 for Vocational High School education occupies the highest position that is 11.24 percent, followed by High School TPT at 9.55 percent, while the lowest TPT is at the lower elementary school level, which is 3.04 percent. This data is explained in Table 1.

Table 1. Open Unemployment Rate (TPT) according to the Highest Education Graduates Year 2012-2

Pendidikan Tertinggi yang Ditamatkan	2012 ⁽¹⁾		2013 ⁽²⁾		2014 ⁽³⁾	
	Agustus	Februari	Agustus	Februari	Agustus	Februari
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. SD ke bawah	3,59	3,55	3,84	3,68	3,04	3,04
2. Sekolah Menengah Pertama	7,80	6,22	7,50	7,44	7,15	7,15
3. Sekolah Menengah Atas	6,69	9,45	9,79	9,33	9,55	9,55
4. Sekolah Menengah Kejuruan	9,97	7,72	11,21	7,31	11,24	11,24
5. Diploma (DIP)	6,23	5,72	5,35	5,67	4,18	4,18
6. Universitas	5,83	5,10	5,39	5,31	3,69	3,69
Jumlah	8,13	5,88	8,17	5,70	7,44	7,44

This data shows the gap between government expectations and the fact. Vocational schools are supposed to prepare students to enter the workforce but it turns out that graduates of vocational schools are the

highest contributors to unemployment in Indonesia. The initial survey conducted in February 2015 in several vocational schools in the city of Payakumbuh, both for State Vocational Schools and Private Vocational Schools, showed that the process of new student admission did not place students in specialization or majors in accordance with their abilities, interests and talents.

In the admission selection process, the students were only tested in which the committee gave selection questions from certain subjects. This is identified to be the main cause of students' lack of competence which results in their unpreparedness to face the demands of the work world which in turn has an impact on high unemployment in our country. If not anticipated quickly, this situation will cause major problems for Indonesian people. The basic concept of this theory is also explained by Holland (in Anggalih, 2013) in which majors relate to the type of personality of each human being. Holland further explained that each type of personality is a product of interaction whose characteristics come from various cultural influences, peers, biological heredity, parents, social class, culture, and physical environment. An individual will prefer several activities that are appropriate to his personality type. This also applies in learning in which someone will choose some learning activities that are appropriate to his/her personality type.

The phenomenon occurring today is majors often cause problems because majors in vocational schools are related to important and complex public affairs. Public interest is important because majors mean the deployment of one's life direction such as specialization and the type of work someone has, the values he adheres to and the personality that he carries. Public interest is also complex because it involves intelligence and human ability to learn, as well as concerning social class competition since majors are seen as laying the position of students and their families in society, even concerning emotional control in the sense of acceptance of parents and students if students do not enter the majors they want.

Vocational students are graduates of Junior High Schools (SMP) and Madrasah Tsanawiyah (MTs) and package B. They will choose a level of further education that suits their interests and desires. From the initial observations in February 2015 in several schools in the Payakumbuh City, the authors saw the phenomenon that many students who did not enter the department of interest are now working in the field which is not in accordance with their expertise after graduating from school. This can be caused by several factors, namely: (1) the majors system which only considers the report card value with the stipulation of the average standard value determined by the school through the Headmaster's decision letter; (2) students themselves have never been mapped for the description of their interest based on a measuring instrument that is able to express their interests and preferences for work which can estimate the environment of their

interactions to determine their interests and preferences. On the one hand this department allows students to have a greater choice of majors in higher education than other majors, in addition to many jobs that only accept students from science majors, so that unconsciously is also followed by social prestige in the sense that students and their families are classified as smart people (Satria, 2011).

The reality is that every human being was born unique with different talents and personalities. In school, the differences of each student must be considered because it can determine both the poor and bad student achievement. Snow (in Anggalih, 2013) found that individual differences between students in schools include differences in cognitive abilities, achievement motivation, interests and creativity. Due to the existence of these individual differences, the function of education is not only in the teaching and learning process, but also counseling guidance, selection and placement of students in accordance with the individual capacity, the design of appropriate teaching systems and teaching strategies that are based on individual characteristics.

If students make a mistake in choosing a major, learning achievement will be low and cause uncertainty in self-actualization. Furthermore, students do not understand the reason for choosing the major, where to go after graduation and what their goals are (Wicaksono, 2009). Majors in high school are not only determined by academic ability but also must be supported by interest factors, because the characteristics of a science require the same characteristics of the person who studies it. Each personality type has a repertoire of attitudes and skills characteristics to overcome environmental problems and tasks. In order to overcome this problem, Vocational Schools must be able to change their learning patterns starting from the beginning when students enter school. The basis is that when we say that students have an interest in a particular topic or activity, our intention is that they consider the topic or activity interesting and challenging. In other words, interest is a form of intrinsic motivation. Students who pursue a task that interests them experience significant positive effects such as pleasure, excitement, and joy (Hidi, Renninger, & Krapp, 2004; Schiefele, 1998).

Students who are interested in a particular topic devote more attention to the topic and become more cognitively involved in it (M.A. McDaniel, Waddill, Finstad & Bourg, 2000; Hidi & Renninger, 2006). They also tend to study it in a more meaningful, organized and detailed manner, for example by linking it with prior knowledge, forming visual images, giving examples, linking ideas, drawing conclusions, and identifying their application (Pintrich & Schrauben, 1992; Renninger, Hidi & Krapp, 1992; Schraw & Lehman, 2001; Tobias, 1994). Moreover, students who are interested in what they learn are more likely to experience conceptual change when it makes sense (Andre & Windschitl, 2003; Linnenbrink & Pintrich,

2003). Even students who are interested in what they learn show high academic performance and are more likely to remember the subject matter in the long run (Garner, Brown, Sanders, & Menke, 1992; Hidi & Harackiewicz, 2000).

In fact, determining the majors of interest in accordance with their talents, interests and personalities is something difficult for students. This is due to their lack of knowledge about the major. This becomes worse by the unavailability of jobs with their specialization. Vocational schools as a vocational education institution that should prepare their students with the competencies they will carry in entering the workforce have not been able to place students in choosing specialization according to their abilities, personality, interests, and talents. In fact, the quality of resources greatly influences the change and progress of Indonesia in the future although Indonesia's human resources are still in the category (Medium Human Development) which was initiated by the United Nation Development Program. A country will develop and advance, if it is in line with the development and progress of the quality of its human resources (Firdaus, Ahmad Yaris et al, 2013). This can be seen in Figure 2 of the Human Development Index published on October 5, 2009.

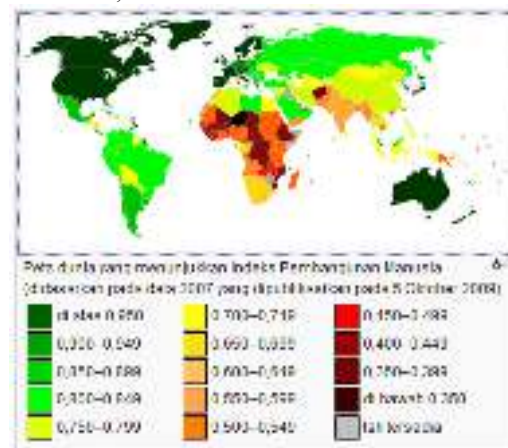


Figure 2. Human Development Index (Source: UN Human Development Report 2010)

Based on the description of the problems described above, it is important to develop a model of vocational interest test for Junior High School students before the students choose specialization or what major they will take while attending Vocational High School. The model of interest measurement tool used today is the Rothwell Miller Interest Blank (RMIB). The weakness of the Rothwell Miller Interest Blank (RMIB) is that it only provides a general description of one's interest without seeing whether someone can or cannot, such as someone who is interested in singing but actually his singing ability is still lacking.

Another drawback is the Rothwell Miller Interest Blank (RMIB) model only classifies jobs in twelve

categories, while the current type of work is very large and there are several types of work that need other categories. Based on this, the researcher needs to develop a model of measuring the vocational interest test for junior high school students, which in addition to determining interest is also supported by emotional maturity and big effort. This is important so that students can be placed according to specialization of competence or majors that match their abilities, interests and talents. Furthermore, the students can develop the potential that is in them when they enter the community later. The aim is to decrease unemployment rate in vocational schools graduates by testing in the beginning before students determine the chosen specialization.

Vocational interest will also affect job readiness, so it is very important to develop an assessment model that can measure the vocational interest of a student based on an effective, creative and innovative expert system so that vocational schools as a school that prepares professional middle-manpower to enter the workforce are able to put students in accordance with their vocational interests in meeting the needs and desires of stakeholders.

II. THEORETICAL FRAMEWORK

A. Definition of Vocational Interest

Interest is the cause of the driving force that compels someone to pay attention to certain situations or activities and not others, or interest as a result of effective experience that is influenced by the presence of someone or an object, or because of participating in an activity (Dyimyati in Arif, 2015).

The definition of interests according to Tidjan (in Arif, 2015) is a psychological symptom that shows concentration of attention to an object because of feelings of pleasure. From this definition, interest can be interpreted as a concentration of attention or reaction to an object such as certain objects or certain situations which are preceded by a feeling of pleasure towards the object. The vocational interest referred to in this study is the interest of Junior High School students in choosing or planning vocational training related to their profession or occupation based on their abilities and interests. Holland and Nichols (in Yudhi Satria, 2011) found that someone will leave a field because he has no interest, and he will look for fields that are in line with his interests and talents. In their research they document with a comprehensive assessment and provide an objective and subjective picture of learning.

Holland in Arif (2015) views career or vocational selection as an expression or extension of personality into the world of work, which is followed by identification of certain occupational stereotypes. Holland further views self-oriented capital as the key to

individual occupational choices. Individuals strive to obtain a career or position with the aim of carrying out their potentials, stating their attitudes and values, taking part in them, and avoiding various roles and problems that are not desired and agreed upon. Determining the career of a large group of careers or jobs requires someone to make a selection or assessment of his career or job. This degree of career choice is determined to what extent the individual is fit in choosing the job he wants to enter later.

B. Vocational Interest Theory

The success of the TPF (Talents Compass Psychological Fingerprints) fingerprint system in applying the Holland Vocational Interest theory accurately and becoming the first fingerprint system implementer in the world that has successfully applied this theory, has received a positive response from tens of thousands of TPF clients. Through this application, clients can see their work interests (vocational interest), career levels, career trends and the desired work environment. For clients who are in the stage of determining study majors in high school or university, this application allows them to see courses that are appropriate to their personality. As a result, the TPF fingerprint system is now proven to be an important instrument in the recruitment and promotion process of employees in the industrial world and the process of study majors in the world of education.

The Vocational Interest Theory developed by John Holland (in Phillips & Jome, 2005) has until now been recognized as the most widely used and popular theory in Vocational Psychology (Phillips & Jome, 2005). In general, this theory refers to the understanding that a person's job choice (vocational choice) has a strong correlation to personality and work environment (person-environment fit). In short, Holland believes that both individuals and the work environment can both be characterized into six types, namely Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. These six types are then placed in RIASEC hexagonal models that are interrelated with each other. With the following conditions: the contiguous nature shows the closeness of the personality and work environment, and the nature of the diagonal opposite shows both opposition in personality and in terms of work environment preferences.

C. Basic Personality Theory of Holland

Personality is an important element in achieving one's success. Experts have formulated a variety of personality theories with various assumptions and different individual environmental backgrounds. The concept of personality that emphasizes the interaction between the environment and individuals that is most often used is Holland's personality theory (Sharf, 2010). Many studies of Holland's theory have been used by researchers especially in studying the phenomenon of career selection that supports individual success. Holland's main theory focus is on the understanding of

vocational behavior to produce practical ways of helping people both youth, adult and even elderly in determining their careers both in education and the world of work (Louis, 2010).

The concept of interest regarding work and occupation is the result of a combination of one's life history and overall personality, so that certain interests eventually become a personality trait in the form of self-expression in the field of work, academic studies, core hobbies, various recreational activities and many other favorites. In short, it can be said that vocational interest is the most important personality aspect. That is why interest inventory is seen as a personality test. Indications of interest are a person's preference for certain activities, while dislike becomes contraindicated. Holland himself developed several tests that can help people know themselves, such as: The Vocational Preference Inventory in 1977 and Self-Directed Search in 1979 (Arif, 2015).

D. Century Competence

According to the Ministry of Education and Culture, the characteristics of the 21st century are the availability of information anywhere and anytime, the implementation of machine usage (computing), the ability to reach all routine work (automation), and the ability to do anywhere and anywhere (communication). Shifting the development of education towards ICT is one of the 21st century education management strategies including institutional governance and human resources. (Soderstrom, From, Lovqvist, & Tornquist, 2011) <https://pgsd.binus.ac.id/2017/08/08/pendidikan-abad-21/> accessed February 4, 2018. 21th Century Readiness is a readiness to welcome the 21st century. UNESCO created four pillars of learning to welcome the 21st century, namely:

1. *Learning to know*
2. *Learning to do*
3. *Learning to be*
4. *Learning to live together*

The education that builds 21th Century Learning partnership competencies is the 21st century learning framework that requires students to have the skills, knowledge, and abilities in the fields of technology, media and information, learning skills, innovation, and life skills. In facing the 21st century people are required to learn more, in different ways and approaches.

The new 21st century learning concept that leads to the development of creative problem solving skills needs to be a focus of development of Technical and Vocational Education Training (TVET) learning strategies so that the future impact of TVET learning is clear and relevant to the development of technology, science, and culture in Indonesia. An effective TVET learning strategy is an actual world-based, contextual work-based, competency-based, comfortable, safe, easy and cheap learning contextual learning strategy. TVET is expected to play a role to produce knowledgeable and skillful and productive workers.

The need to be involved in problem solving as well as critical and creative thinking is at the core of learning and innovation (Trilling & Fadel, 2009, p 50). The 21st century education system emphasizes and develops these competencies explicitly through curriculum changes, which aim to prepare students to be able to solve complex problems related to competitive and globally connected life. The 21st century competences are:

1. Critical Thinking, the ability to design and manage projects, solve problems and make effective decisions using various tools and resources (Fullland, 2013, p. 9). Critical thinking is needed by students to obtain, process, interpret, rationalize, and critically analyze information in decision making in a timely manner. Digital tools and sources can support critical thinking processes.
2. Communication, effectively communicating verbally, in writing and with various digital tools and also the ability to listen (Fullland, 2013, p. 9).
3. Collaboration
The ability to work with teams, learn and contribute to learning, social networking skills, empathy and collaboration with others. (Fullland, 2013, p 9).
4. Creativity and Innovation.

Creativity is important for social development, the ability to compete in business, and the ability to generate economic growth. Creativity is a new concept, idea, or product that meets the needs of the world. Innovation contains elements of creativity and is often described as the realization of new ideas in order to be able to make a useful contribution to certain fields (Fullland, 2013). The 21st century competencies have measurable benefits for many people and areas of life and are therefore very important for all students. These competencies can be identified on the basis that they make measurements contributing to the attainment of education, relationships, employment, health and welfare, and do it for all individuals (Rychen, 2003, p 66-67).

III. RESEARCH METHODOLOGY

The research methodology used is Research and Development with ADDIE (Analysis, Design, Development, Implementation and Evaluation) development procedures. The flow of research and development procedures with the Four D's framework contains stages with the following activities:

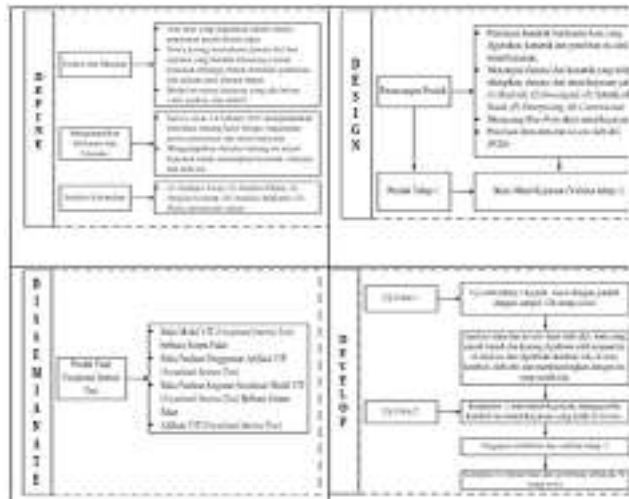


Figure 3. Four D's Research and Development Procedures

IV. RESULTS

A. The Result of Expert System-based VIT (Vocational Interest Test) Model Validity

Based on the validation results of the validator or experts that:

- The results of the validity of the Book of Expert System-based VIT (Vocational Interest Test) Model from the validator are: 1) Component Aspects have an average score of 0.78 with valid categories, 2) Construction Aspects of the Model have an average score of 0.76 with valid categories, 3) The Overall Aspect has a score of 0.80 with a valid category.



Figure 4. The Chart of Expert System-based VIT Model Book Validation

- The validity test results on the Expert System Based VIT (Vocational Interest Test) Book of Socialization from the validator are: 1) Component Aspects have an average score of 0.81 with valid categories, 2) The Book Construction Aspect has an average score of 0.79 with valid categories, 3) The Overall Aspect has a score of 0.75 with a valid category.



Figure 5. The Chart of Expert System-based VIT Model Socialization Book

- The results of the validity of the Instructions for Use of VIT (Vocational Interest Test) from the validator are: 1) Component Aspects have an average score of 0.77 with valid categories, 2) The Aspect of Book Construction has an average score of 0.81 with valid categories, 3) Overall Aspects has a score of 0.75 with a valid category.

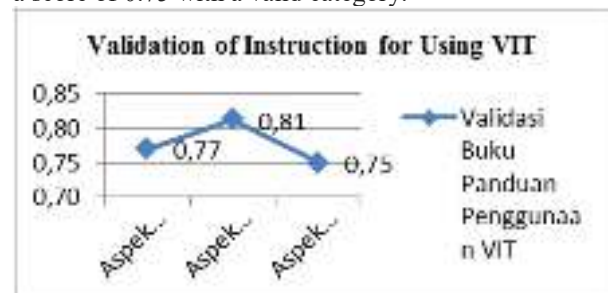


Figure 6. The Chart of Validation of Instructions for Using VIT Application

- The results of the validity of the VIT (Vocational Interest Test) application of the validator are: 1) The VIT-Use (Policy) aspect has an average score of 0.80 with a valid category, 2) The VIT-Readlines aspect has an average score of 0.78 with a valid category, 3) Capability aspect has an average score of 0.81 with a valid category, 4) VIT-Impact aspects have an average score of 0.80 with valid categories and 5) Overall aspects have a score of 0.85 with a valid category.

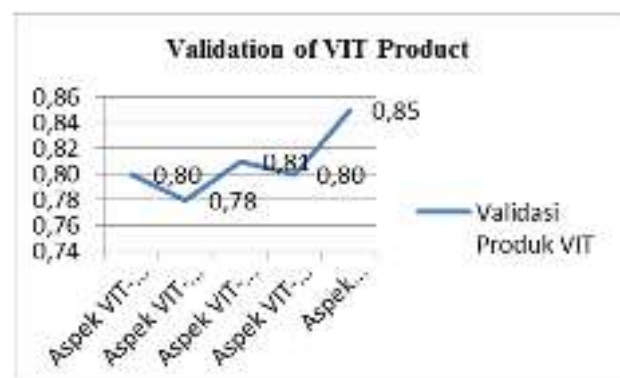


Figure 7. The Chart of VIT Application Validation

- f. Validity test results on the Language Aspects of the product of this study include: 1) Book 1: VIT model (Vocational Interest Test) has an average score of 0.80 with a valid category, 2) Book 2: Book VIT (Vocational Interest Test) has an average score 0.82 with a valid category, 3) Book 3: The VIT Application Guide (Vocational Interest Test) has an average score of 0.78 with a valid category.

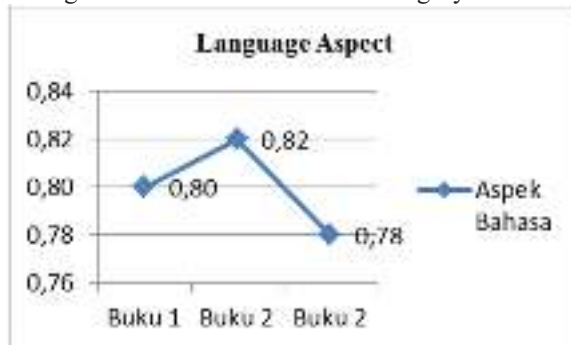


Figure 8. The Chart of Language Aspect Validation

V. CONCLUSION

Based on the method of research product development and discussion that refers to the purpose of this study, it can be concluded as follows:

1. Research has produced a Vocational Interest Test (VIT) model to determine vocational interests of prospective Vocational High School students.
2. A Vocational Interest Test (VIT) model is produced to determine the vocational interest of prospective vocational students that are valid, practical and effective.

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