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CERTAINTY FACTOR METHODS IN IDENTIFYING INTERESTS AND TALENTS OF ELEMENTARY SCHOOL CHILDREN AL IKHLAS TAQWA

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ABSTRACT

Psychologists and child education experts always remind the importance of knowing interests and talents from an early age to provide a stimulus to children from an early age, because the provision of the stimulus affects the future of children. This study aims to (1) To make calculations in mathematical models to calculate and analyze the interests of children's talents using applications. (2) To create a web-based information system that can facilitate teachers and parents in determining the interests of children's talents at the Al-Ikhlas Taqwa Plus Elementary School using the Certainty Factor method. The method used in this research is the research and development (R&D) method using the certainty factor. The population in this study were all students of SD Plus Al Ikhlas Taqwa Medan T.P 2021/2022 starting from grades 3-6. Sampling was done by purposive sampling technique. Data collection was carried out by interviews, material expert test questionnaires, and media experts, and the results of the children's talent interest questionnaire were processed using the Certainty Factor. The results of this study are the results of interest and talent analysis based on 7 intelligence criteria and also the highest summary results from several criteria with one of the tests yielding a percentage of 93.58% in the field of linguistics.

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1. INTRODUCTION

The development of information technology at the time of the industrial revolution 4.0 was growing rapidly, which can be seen from various sciences, especially expert systems, fuzzy logic, data mining and others [1]. There is no doubt that almost every facet of life today is gradually associated with technology. This happens because technology creates efficiency and makes it easy for humans to get work done [2]. When a person is born into the world, then that person brings potential differences in the form of talent or personality. The most important part to improve all types of intelligence or expertise lies with parents who should do various ways including identifying children's talents as early as possible so that they can develop properly [3]. Children are born with different talents and personalities based on moral factors, namely psychological conditions in which the development of children's talents is dependent on the child's self and emotions. This will assist children in developing concepts and being optimistic and confident in developing their talents. Personality is a distinct and individual aspect of a person's behavior that can influence a person's ability to adapt to their surroundings [4].

Experts in psychology and child education always remind us of the value of identifying interests and talents at a young age so that we can stimulate children since early stimulation influences a kid's future. Children who receive the correct stimulation will, of course, have more ideal benchmarks for honing their talent interests than children who do not receive the necessary stimulation to advance their talent interests. The stimulation itself is a variety of triggers for children's learning or processing of instruction, including play opportunities, learning facilities, and even readings or stories [5]. According to research [6], parents should consult psychologists, particularly child psychologists, when having trouble identifying their children's interests and talents. Parents should reconsider consulting, though, given the abundance of psychologists and the hefty consultation costs. As a result, the majority of parents merely show interest in their children's gifts in light of what they observe, sometimes even pressuring them to develop their talents in line with parental desires. While some of the interests of children's talents need to be cultivated, this desire is undoubtedly distinct from innate talent in children, which will hinder their successes.

The Elementary School Plus Al-Ikhlas Tagwa, one of the national standard educational institutions, is a school that uses three languages, namely Arabic, English, and Indonesian. Al-Ikhlas Tagwa Elementary School Plus offers a wide range of extracurricular activities in the areas of art, athletics, and computing. By making all the necessary preparations, the school's teaching and learning activities undoubtedly make an effort to produce a nation with a quality generation. So far, Al-Ikhlas Tagwa Elementary School has carried out manual learning evaluations such as knowing that children who are categorized as intelligent are children who are in the top 10 in the rankings each semester, have not yet reached the level of determining children's intelligence based on the interests and talents of each child. Therefore, the manual system is also considered less efficient and effective.

This study included students in grades 3-6 because children at this age begin to think logically about concrete events and classify objects into different forms, but they have not yet reached the problem-solving stage. Concrete events are mental actions that can be repeated or recalled, and are usually associated with concrete objects. Children can coordinate some characteristics with concrete operations, allowing them to focus on more than one object's quality. At this concrete operational stage, a child can do something mentally that was previously only possible physically. The ability to divide something into several different subs or classifications in order to determine the relationship is the most important aspect of knowing concrete operational steps [7]. As a result, it is necessary to analyze the interests of children's talents using a web-based expert system to make it easier for parents, teachers, and children to discover the interests of children's talents based on their fields and desires.

Expert systems are a subset of artificial intelligence (AI) technology derived from the term Knowledge-Based Expert System[8]. Expert systems are a subset of artificial intelligence, or a computer system that can mimic the knowledge of an expert or expert with certainty about his knowledge in a specific field [9]. The expert system is created in the form of software based on expert knowledge to carry out the decision-making process based on symptoms provided with a high level of certainty [10]. The main goal of an expert system is to efficiently transfer or socialize an expert's expertise and knowledge to people who are not experts [11]. To identify web-based children's talent interests, an expert system was built using the PHP MySQL programming language. PHP MySQL is typically used in the development of websites that run in a browser, and PHP can dynamically process and manage data [12]. These PHP and MySQL programs are typically

combined into a single package known as XAMPP. "XAMPP stands for X (four operating systems), namely Apache, MySQL, PHP, and Perl" [13].

This study applies a method that can measure the level of certainty related to a rule or fact, namely using the Certainty Factor method in making decisions [14]. The reason is that this method or theory can provide certainty of an expert's thinking and also know the problem being faced by illustrating the expert's level of confidence. The Certainty Factor method can also mark rules based on general information that form a conclusion [15]. The system information obtained will determine the types of interests and talents based on the nature/type of intelligence. This expert system can be an option or a tool that can assist educators, guardians of students, or even these students in knowing their interests and talents based on the explanations given regarding an expert's intelligence and those related to the interests and talents in terms of types, characteristics or stimulation of future talent interests to be more effective [16].

2. RESEARCH METHODS

The RnD method is used in this study, which is carried out quantitatively using calculations from the Certainty Factor. To build this expert system application, the author employs the certainty factor method as an inference model in this writing. The RnD (Research and Development) method is used to create a product, which is then tested to determine its success. The following are the steps in the RnD method:

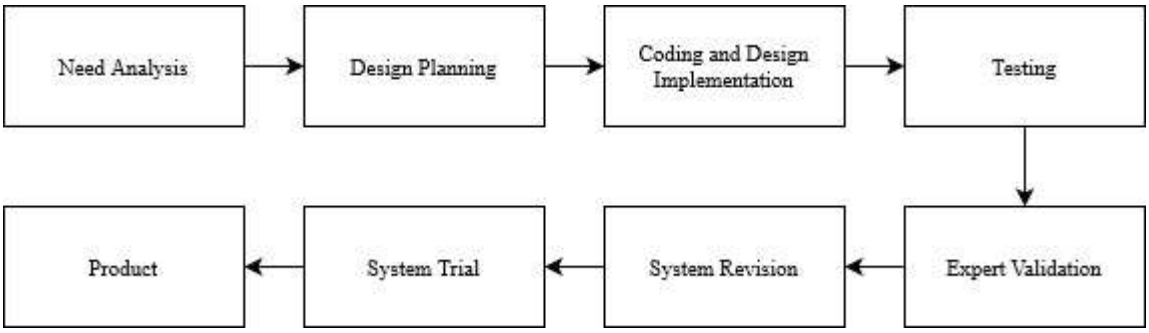

Figure 1. RnD Research Flow

2.1 RnD Research Stages

At the needs analysis stage, it is performed to identify and evaluate needs or constraints so that the system built can function properly; thus, needs analysis is performed, which consists of two stages, namely problem analysis and needs analysis. After all, needs have been identified; the next step is to create a system capable of determining the first step in identifying children's talent interests by employing the Certainty Factor calculation method. Beginning with expert decision trees, general system architecture, flowcharts (information system flow), use case diagrams, ERD, and DFD.

After the system is formed, the next step is to code it to create the system according to the design using the MySQL database with the XAMPP connector to connect PHP and the database that was created. Next, begin the system testing phase to identify any errors that may arise during testing and determine whether the system is functional or not. Validate the system with experts who will be used to determine the system's feasibility. If the system is feasible, it can already be implemented at SD Plus Al Ikhlas Taqwa school as a new product in identifying children's talent interests using a certainty factor.

2.2 Data Collection Technique

a. The interviewer and resource person conduct the question and answer process face to face to find out directly the information or information requested by a resource person [11]. The interview was conducted to obtain valid information regarding the arrangement of students in developing the talents and interests of students at SD Plus Al Ikhlas Taqwa by interviewing the teacher at SD Plus Al Ikhlas Taqwa who was said to be one of the experts. Interviews were also conducted with a counseling

guidance lecturer who knows psychological information related to the interests of children's talents and the weighting of scores for each question that will be used for the question questionnaire.

b. Questionnaire data collection techniques were used by posing a variety of questions or statements to students who served as respondents to the questionnaire.

2.3 Knowledge-Base

This expert system for determining interests and talents includes seven different types of interests and talents and 49 questions as intelligence on interests and talents criteria. **Table 1** contains an interpretation of the Certainty term value, and **Table 2** contains an explanation of intelligence criteria for interests and talents, as well as CF values expert.

Table 1. Certainty Term

Certainty Term	MD/MB
Unknown	0,2
Maybe	0,4
Probably	0,6
Almost certainly	0,8
Definitely	1

Table 2. CF (Expert) value weighting for Children's Intelligence Criteria

Knowledge Code	Criteria Intelligence	Variable Name Knowledge	CF Expert
G001	Linguistic Intelligence (Language)	My hobby is reading books	0,8
G002		I love to tell stories, including funny stories and fairy tales	0,4
G003		When angry and annoyed I usually often mention words that cause other people to hear it upset.	0,4
G004		One of my hobbies is making up stories.	0,4
G005		I feel happy when discussing.	0,6
G006		I find it easy to socialize and chat with new people	0,8
G007		I like to write down the activities I do in a diary.	0,6
G008	Logical Intelligence (Mathematics)	I like to find out new things and how things work	0,4
G009		When I managed to find the answer to the calculation problem, I felt happy	0,8
G010		I feel happy when I study math.	0,8
G011		I like to play puzzles, sudoku, or monopoly.	0,6
G012		When my toy breaks, I like to find out the cause and find a solution to fix it	0,6
G013		I love guessing games and crossword puzzles.	0,4
G014		I like to convey unique ideas when playing with friends.	0,4
G015	Spatial Visual Intelligence (imagination)	Drawing is one of my hobbies	0,8
G016		When I'm not doing anything, I often daydream.	0,4
G017		I like to doodle on books or papers.	0,6
G018		When reading, I prefer to look at pictures than write.	0,4
G019		when I close my eyes, I can imagine something.	0,8

Knowledge Code	Criteria Intelligence	Variable Name Knowledge	CF Expert
G020		I like to see art exhibitions, cars or motorbikes, and paintings.	0,4
G021		I like to display wall pictures or photos in the room.	0,6
G022	Kinesthetic	I like and often exercise, one of which is gymnastics	0,4
G023	Intelligence	When I see an object, I not only see it but like to touch it	0,6
G024	(Brain and	When talking I like to move my hands.	0,8
G025	Body)	When memorizing, I have to write over and over again to remember it	0,4
G026		During class hours I like to play with pencils/pens and tap my fingers	0,4
G027		I love to try, figure out and take my toys apart and then put them back together again.	0,8
G028		I enjoy trying new things	0,6
G029	*Musical*	I can play musical instruments.	0,8
G030		My hobby is singing	0,6
G031		I often listen to songs or music	0,4
G032		I can remember songs well from many songs.	0,6
G033		When I'm studying and reading, sometimes I'm listening to music.	0,8
G034		Music is one of my favorite subjects.	0,4
G035		I aspire to be a singer or musician.	0,4
G036	Interpersonal	When studying I like to work together in groups.	0,4
G037		I like to share tasks when working in groups	0,4
G038		I like to meet new people to make friends	0,4
G039		Some friends often tell stories and ask for advice from me	0,8
G040		When before the exam, I ask mom or dad to ask again about the subject matter that will be tested tomorrow.	0,8
G041		I have several close friends and companions.	0,4
G042		I can get along or make good friends with other people.	0,8
G043	Intrapersonal	I am an independent person and do things without the help of others	0,4
G044		I like to ask questions or discuss with my parent's things I don't know.	0,4
G045		I like to cook with my mother in my spare time.	0,4
G046		I am very confident and confident in myself.	0,8
G047		I know what my strengths and weaknesses are.	0,6
G048		I have a strong belief and do not easily follow others.	0,8
G049		I can take responsibility for what has been done.	0,6

2.4 Certainty Factor

Certainty Factor is a good algorithm for carrying out the inspection process based on existing conditions. [17]. This method is in the form of metrics that are usually used in expert systems. this method is suitable for expert systems that diagnose something that is not necessarily trueIn expressing the degree of confidence used a value called Certainty Factor (CF) forassumes an expert's degree of confidence in a data [18]. The following is the basic formulation of Certainty factor:

$$CF[P,E] = MB[P,E] - MD[P,E] \quad (1)$$

Where:
CF = Certainty Factor
MB = Measure of Belief
MD = Measure of Disbelief
E = Evidence/facts
P = Probability

The basic formula is used if there is no CF value for each criterion of children's talent, interest, and intelligence [19]. The rules for the combination of certainty factors used to identify talent interests are:

1. Certainty Factor for single premise rules:

$$CF_{symptom} = CF\ [user] * CF\ [expert] \quad (2)$$

2. If there are rules with similar conclusions or more than one symptom, then CF is then calculated with the equation:

$$CF_{combine} = CF_{old} + CF_{symptoms} * (1 - CF_{old}) \quad (3)$$

3. Meanwhile, to calculate the percentage of interest in talent, the equation is used:

$$CF_{percentage} = CF_{combine} * 100 \quad (4)$$

3. RESULTS AND DISCUSSION

This expert system detects the level of intelligence on website-based children that can facilitate in determine the level of intelligence, interests, and talents of children using the Certainty Factor method with a description implementation as follows:

3.1. Expert Decision Tree

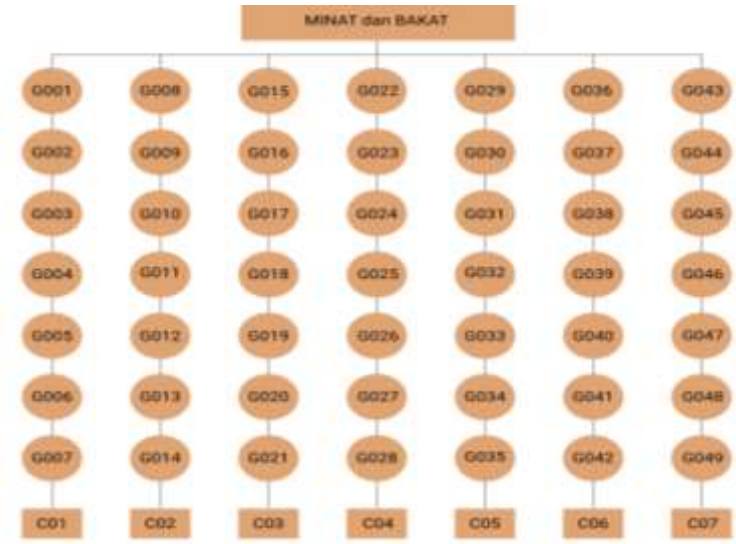

Figure 2. Expert Decision Tree

From the results of the analysis each child is free to choose 49 questions that will be asked later in the system. There are 7 areas of interest and talent in this study which will be the classification of each child. So that each child will get a percentage score for each area of intelligence in their respective fields **Theorem 1**.

3.2 Use Case Diagram

Use case diagrams are an overview of the system in the form of diagrams that describe the functions contained in the system and the exposure of interactions between actors and the system will build. There are four major symbols in the Use Case Diagrams: (1) Actor (2) Use cases (3) Associations (4) System boundary [20].

Figure 3. Use Case Diagram

3.3 User Interface

The user interface is a view that is used for communication between systems and users of the expert system [21]. Appearance the home page is the start page when first time accessing the determination expert system application interests and talents of elementary school students here are the home page users are shown in Figure 4. The consultation page is a page that used by elementary school students to conduct consultations determination of interests and talents. On the student consultation page must fill in personal data Figure 5 and choose the characteristics of interests and talents according to the next student's criteria to get the results of the consultation as indicated in Figure 6:

Figure 4. Home Page

Figure 5. Student Consultation Page

Figure 6. Talent Interest Criteria Page

3.4 Calculation of Certainty Factor

By using a sample of one child, the CF calculation process starts from the Knowledge code (G001) to (G007) Linguistic intelligence criteria where:

$CF\ [H,E]_1 = CF\ [H] \times CF\ [E]$
$= 0,8 * 0,2$
$= 0,16$

$CF\ [H,E]_2 = CF\ [H] \times CF\ [E]$
$= 0,4 * 0,4$
$= 0,16$

$CF\ [H,E]_3 = CF\ [H] \times CF\ [E]$
$= 0,4 * 1$
$= 0,4$

$CF\ [H,E]_4 = CF\ [H] \times CF\ [E]$
$= 0,4 * 0,2$
$= 0,08$

$CF\ [H,E]_5 = CF\ [H] \times CF\ [E]$
$= 0,6 * 0,8$
$= 0,48$

$CF\ [H,E]_6 = CF\ [H] \times CF\ [E]$
$= 0,8 * 0,8$
$= 0,64$

$CF\ [H,E]_7 = CF\ [H] \times CF\ [E]$
$= 0,6*0,2$
$= 0,12$

After that, look for the CF combined value for each intelligence criterion using the 3rd equation, namely:

CF combine $= CF[h_1,e_1] + CF[h_1,e_2] * (1-CF\ [h_1,e_1])$
$= 0,16 + 0,16 * (1-0,16)$
$= 0,2944$

CF combine = CF old + CF[h_1,e_3] * (1-CF old)
= 0,2944 + 0,4 * (1-0,2944)
= 0,57664

CF combine = CF old + CF[h_1,e_4] * (1-CF old)
= 0, 576648 + 0,08 * (1-0,57664)
= 0,6105088

CF combine = CF old + CF[h_1,e_5] * (1-CF old)
= 0,6105088 + 0,48 * (1-0,6105088)
= 0,797464576

CF combine = CF old + CF[h_1,e_6] * (1-CF old)
= 0, 797464576 + 0,64 * (1-0,797464576)
= 0,927087247

CF combine = CF old + CF[h_1,e_7] * (1-CF old)
= 0,927087247 + 0,12 * (1-0,927087247)
= 0,935836778

After obtaining the value of each criterion, the next step is to find the percentage of the CF Percentage value using equation 4th as follows:

CF $_{persentase}$ = CF $_{Combine}$ * 100 %
= 0,935836778 * 100%
= 93,58 % **(Field of Linguistics)**

Figure 7. Results of Analysis of Talent Interest in the System

4. CONCLUSIONS

1. The expert system used to identify children's talent interests is generally intended to help improve the results of interest and talent tests conducted with valid instruments and conducted by certified counselors or psychologists providing these test tools that are useful for weighting the value of children's talent interests.
2. The use of the certainty factor method in identifying the interests of children's talents at SD Plus Al Ikhlas Taqwa Elementary School has a high accuracy value summary of 93,58% or maybe even more because each criterion has a different level of accuracy.

3. The existence of this talent interest system can help parents and educators (teachers) to start knowing or consulting. This system can also assist a psychologist in adding other types of intelligence, indicators of intelligence, and adding questions related to existing types of intelligence by storing them in a computerized manner.

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