

APPLICATION OF THE DEMPSTER SHAFER METHOD IN AN EXPERT SYSTEM TO DETECT ONLINE GAME ADDICTION

¹MARYANA, ²NURDIN*, ³TAUFIQ, ⁴NURUL WILDA, ⁵MUHAMMAD FIKRY, ⁶ARNAWAN HASIBUAN

^{1,4,5}Department of Informatics, Universitas Malikussaleh, Lhokseumawe, Aceh, Indonesia.

^{2,3}Department of Information Technology, Universitas Malikussaleh, Lhokseumawe, Aceh, Indonesia.

⁶Department of Electrical Engineering, Universitas Malikussaleh, Lhokseumawe, Aceh, Indonesia.

E-mail: ¹maryana@unimal.ac.id, ²nurdin@unimal.ac.id* (Corresponding Author), ³taufiq@unimal.ac.id, ⁴nurul.200170183@mhs.unimal.ac.id, ⁵muh.fikry@unimal.ac.id, ⁶arnawan@unimal.ac.id

ABSTRACT

The increasing popularity of online games among college students has given rise to various problems, one of which is online game addiction. The impacts of online game addiction include academic, social, and psychological aspects in students. The purpose of this study is to build an expert system to diagnose online game addiction using Dempster Shafer, using questionnaire data distributed to 264 students as a dataset and 211 students as training data. The Dempster Shafer method uses expert confidence values to determine how much a symptom can influence the likelihood of a case occurring. Research on this expert system used 16 symptoms and 3 levels of addiction: mild addiction, moderate addiction, and severe addiction. The results of the study using 53 test data showed the Dempster Shafer method has an accuracy rate of 73%, resulting in 39 moderate addictions. With this system model, it is hoped that it can provide information and solutions for people who have experienced addiction so that prevention and recovery can be carried out to avoid fatal consequences.

Keywords: *Online Games, Expert System, Dempster Shafer Method, Game Addiction Symptoms.*

1. INTRODUCTION

As technology continues to develop rapidly, currently technological developments in the field of online games have become a trend in many circles, starting from children, teenagers and adults. The development of information technology is able to create and develop space for society to move globally, so that without us realizing it, humans live in two worlds of life, namely real social life and virtual social life [1].

Around the world, both adults and children now enjoy playing online games as a kind of pleasure. Online gaming has grown increasingly captivating and addicting as a result of technological advancements [2]. According to an empirical research of social media in China, while many individuals can play online games in a healthy way, some people are prone to online game addiction, which can have an effect on public health [3]. Teenage depression in the Philippines can also be exacerbated by internet gaming addiction [4]. With its impact on middle school students' heart health behavior during the COVID-19 epidemic, digital gaming addiction can also upset the equilibrium

between virtual and real life, leading to social, scholastic, and even physical health problems [5].

It is critical to identify online game addiction since it has a significant impact on children's engagement in the learning process and mental development [6]. Video game addiction symptoms in teenagers are influenced by both contemporaneous levels of online communication and video game play, and those who are very socially active online report lower symptoms of game addiction [7]. Thirty research provide empirical evidence that gaming addiction does occur in certain teenagers and that online gamers spend more time planning, organizing, and playing the game as their addiction worsens [8].

The method used to detect online game addiction in this study uses the Dempster Shafer method. The Dempster Shafer method is an approach to dealing with uncertainty [9]. The Dempster-Shafer theory was first introduced by Arthur P. Dempster and Glenn Shafer [10]. The goal of the Dempster-Shafer mathematical theory is to demonstrate that the probability of an event may be calculated by combining disparate pieces of information

(evidence) based on reasonable reasoning and belief functions.

This research aims to develop an expert system capable of diagnosing online game addiction using the Dempster Shafer method. The output of this expert system is mild, moderate, and severe addiction, along with their solutions. This research is important because the expert system model can facilitate the diagnosis of online game addiction using the Dempster Shafer method, thereby determining the accuracy of the method and also producing a good expert system.

The results of this study should help prevent and cure online game addiction more effectively. As a result, this study could be very beneficial in protecting the general public's health as well as those of online gamers. Prior research has attempted to detect and prevent online gaming addiction using a range of methods, such as behavioral analysis and psychological surveys. However, these methods are often insufficient to appropriately assess an individual's level of danger and addiction.

Besides that, there are several other studies that have been conducted by researchers including, research Clustering and Mapping of Agricultural Production Based on Geographic Information System Using K-Medoids Algorithm [11]. Optimization and computing model of fish resource supply chain distribution network [12]. Robust optimization approach for agricultural commodity supply chain planning [13]. Mixed integer linear programming model for integrated fish supply chain planning [14]. Comparison of Triple Exponential Smoothing and ARIMA in predicting cryptocurrency prices [15]. Sentiment analysis of user reviews on BSI mobile and action mobile applications on the Google Play Store using multinomial Naive Bayes Algorithm [16]. Design of a real-time object detection prototype system with YOLOv3 (You Only Look Once) [17]. Tokopedia and shopee marketplace performance analysis using metrix google lighthouse [18].

2. LITERATURE REVIEW

There are several related previous studies which became a literature review in this study, as research conducted by [19], this research detecting online game addiction using fuzzy logic with the tsukamoto method uses five input variables are used in this system: thinking about games all day and feeling sick when not playing them; playing games for longer periods of time and getting less sleep, playing games to the point of forgetting real life and ignoring other activities, others failing to bar playing games and

continuing to do so, and being easily agitated and arguing with friends or family. The output variables are no addiction, mild addiction, and severe addiction. Online gamers were used in this study. The findings indicated that light addiction was 15%, severe addiction was 20%, and no addiction was 65%. Another related study compared the Naïve Bayes and Dempster Shafer methods for diagnosing COVID-19. The results of a percentage test, which compared the system's diagnosis with expert diagnoses, showed that the Naïve Bayes method had 96% accuracy, with 48 diagnoses based on expert diagnoses from 50 test data sets. Meanwhile, the Dempster Shafer method had 40% accuracy, with 20 diagnoses based on expert diagnoses from 50 test data sets [20]. Research on the implementation of an expert system in diagnosing skin diseases using the Dempster Shafer method, with skin disease variables, namely Tinea Cruris, Tinea Manus, Tinea Versicolor, Tinea Imbricata, Tinea Barbae, Tinea Nigra Palmaris, Candidiasis, Mycetoma, and Chromomycosis. The accuracy results in this study were 68.8%. [21]. This study successfully processed data and provided disease diagnosis results based on selected symptoms using the Dempster-Shafer method. Expert system research using the Dempster-Shafer method yielded an accuracy value of 84.38% [22]. Another study conducted by [23], compared the Bayesian Network and Dempster-Shafer methods for the early diagnosis of eye diseases. The eye disease variables used were watery eyes, tired eyes, itchy eyes, watery eyes, and thick yellow eye discharge. The Bayesian Network method produced a higher probability of 6 out of 10 correct diagnoses, while the Dempster-Shafer method produced a higher probability of 4 correct diagnoses, making the Bayesian Network method more effective. Comparative analysis research of expert systems for diagnosing cattle diseases using Bayesian Network and Dempster Shafer, where the percentage results of the Dempster Shafer method were higher, namely 87.2%, compared to the Bayesian Network method, namely 75.3% [24]. Problems with online gaming are not the only thing that can impact high school pupils' academic achievement. The social environment at school, family social support, and self-motivation are other elements that could affect kids' academic achievement. Rules governing the usage of electronics in schools can be strengthened by advising parents to keep an eye on their kids when they use them [25]. Research on the co-occurrence of addictive behaviors and drug use is growing, and other research findings suggest that gaming disorders can co-occur with a variety of other addictive behaviors (such as alcohol use disorders or

compulsive social media usage) [26]. In addition to providing new opportunities for clinical interventions in addicted gamers, these findings empirically support a direct relationship between frequent online gaming and the wide field of behavioral and drug addiction research [27]. They may also improve the assessment of addiction risk in large populations of frequent gamers. Based on existing empirical data, it is suggested that internet gaming addiction is a continuum, with risk factors and etiology coming before "full-blown" addiction, which is then followed by negative outcomes and possible treatment [28].

3. RESEARCH METHODOLOGY

3.1 Description of Problem Formulation

The likelihood of someone developing an addiction to online gaming is very high because so many people enjoy playing these types of games. Online gaming addiction is a serious concern, as the symptoms experienced by online gaming addicts are often overlooked, making it difficult for some to detect their addiction. This has led researchers to develop an expert system capable of systematically diagnosing online gaming addiction using the Dempster-Shafer method. This research is important because the expert system model can facilitate the diagnosis of online gaming addiction using the Dempster-Shafer method, thereby determining the accuracy of the method and producing a robust expert system. In order to help people quickly and effectively determine their mental health while playing online games, a detection system model is required to assess the degree of addiction to playing online games as soon as possible. This model is an online game addiction detection system.

3.2 Research Stages

The steps taken in the research on the application of the Dempster Shafer method for detecting online game addiction are as follows:

1. Literature Review.

In conducting research, the author requires a literature study to obtain relevant references. The reference sources used include journals, books, and the internet related to the research topic.

2. Data collection

Data collection in this study uses primary data. Primary data is data obtained directly from data collection. In this case, the researcher conducted direct observations at the Health and Psychology Services Unit of Dr. Fauziah Bireuen Regional

Hospital to conduct interviews with a psychiatrist, with the aim of obtaining information regarding the symptoms that appear and solutions if someone is addicted to online games. Next, the researcher created a questionnaire aimed at Informatics Engineering students so that researchers could obtain information regarding the level of online game addiction.

3. System Design

System design aims to describe the system's workflow, which will facilitate system development. This design uses the Unified Modeling Language (UML) as a method for visualizing the process.

4. System Implementation

The implementation stage is the step where the previously created design is implemented using a programming language, resulting in an expert system application for diagnosing online game addiction.

5. System Testing

In this stage, testing is performed on the system developed during the system implementation process. System testing also serves to ensure that the implementation meets the specified requirements.

Based on the steps taken in this research, the research stages can be described in Figure 1.

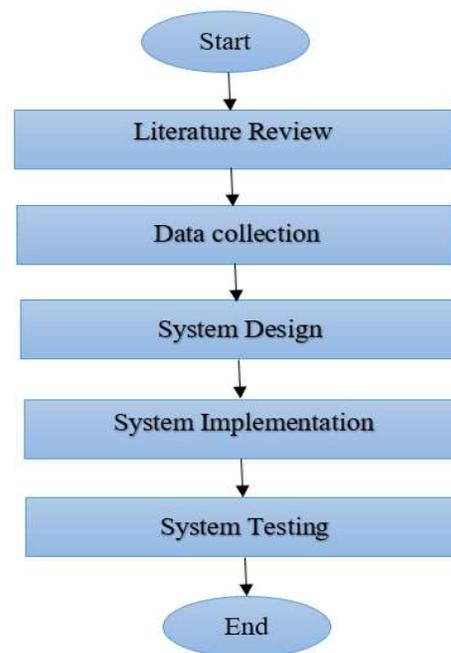


Figure 1: Research Stages

3.3 Dempster Shafer Method System Scheme

The following is a schematic of the Dempster Shafer method system in the research of expert systems for detecting online game addiction in Figure 2.

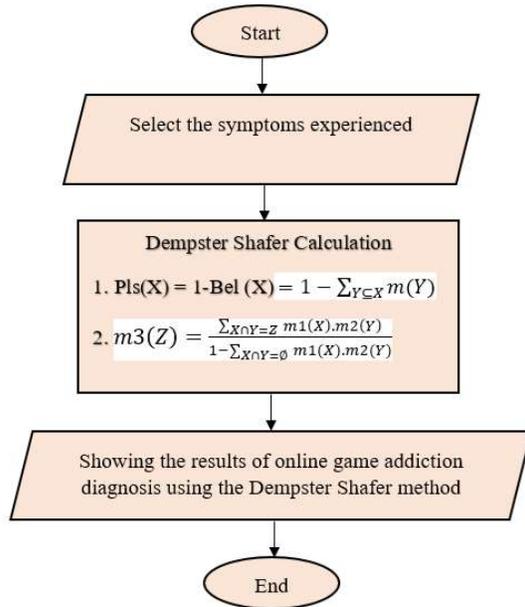


Figure 2: Dempster Shafer Method System Scheme

The description of the Dempster Shafer method system scheme is as follows:

1. Start is the initial process of the system.
2. Next, the user will be asked to select the symptoms they are experiencing from the available symptoms. Once the symptoms are successfully input, the system will begin the calculation process using the Dempster Shafer method.
3. The system will display the Dempster Shafer calculation results in the form of Mild, Moderate, and Severe Addiction along with the solutions.
4. Finish is the final process of the system.

3.4 Dempster Shafer method

Dempster Shafer's method is a method also known as the theory of belief functions for experts. This method is used to combine pieces of information and calculate the probability of an event. This theory is able to provide the right combination, clear representation and is able to provide the right uncertainty value. This theory still requires experts to be able to embed expert thinking into the Dempster-Shafer method [29].

$$Bel(X) = \sum_{Y \subseteq X} m(Y) \quad (1)$$

$$Pls(X) = 1 - Bel(X) = 1 - \sum_{Y \subseteq X} m(Y) \quad (2)$$

Information:

- Bel(X) : Belief(X), meaning the value of trust or certainty of X which is
- Pls(x) : experiencing symptoms
- Plausibility(X), meaning the value
- m(X) : of distrust or uncertainty X is
- m(Y) : experiencing symptoms
- Mass function from evidence (X)
- Mass function form evidence (Y)

In Dempster Shafer's theory, it is also known that there is a frame of discernment (θ) and a mass function (m). This FOD is a universe of discussion from a set of hypotheses, so it is often called the environment. If θ contains n elements, then there are 2^n subsets of θ . A sub-set is a subset of the results of a combination of θ elements, while n elements are the number in the discussion universe of a group of hypotheses in θ . If it is known that X is a subset of θ , with m_1 as the density function and Y is also a subset of θ with m_2 as the density function. Then the combination function m_1 and m_2 will be formed as m_3 with the following formula:

$$m_3(Z) = \frac{\sum_{X \cap Y = Z} m_1(X).m_2(Y)}{1 - \sum_{X \cap Y = \emptyset} m_1(X).m_2(Y)} \quad (3)$$

Information:

- $m_1(X)$: Mass function form evidence (X), X
- $m_2(Y)$: disease with symptoms 1
- $m_3(Z)$: Mass function form evidence (Y), Y
- Mass function form evidence (Z), Z
- $X \cap Y$: is the probability value of the new
- \emptyset : density resulting from Slices $m_1(X)$ and $m_2(Y)$ divided by 1 minus the empty Slice (\emptyset) of $m_1(X)$ and $m_2(Y)$
- Disease X slice of disease Y
- Conflict evidence, from $m_1(X)$ slice $m_2(Y)$ produces an empty Slice

3.5 Data Collection and Variable Type

Symptom data collection in this study used data from psychiatrists and physicians. The data from the physicians was then compiled into a questionnaire to be distributed to online game players via Google Forms. The questionnaire was customized based on the symptoms. A total of 264 participants completed the questionnaire using 53 test data sets. This study used 16 input variables (G1–G16) and 3 output

variables (K01, K02, K03). The variables used in this study are symptoms related to online game addiction, namely: G1 (Often playing online games), G2 (Sleep time is reduced due to playing online games), G3 (The amount of time playing games continues to increase), G4 (Feeling angry and annoyed if you can't play games), G5 (Often falling asleep when there are activities because playing online games until late at night), G6 (Feeling lethargic if you don't play online games in a day), G7 (Often being reprimanded by parents/friends/siblings because you often skip meals when playing online games), G8 (Feeling less concentrated when doing other activities (campus/work/sports) because you think about online games), G9 (Feeling gloomy and stressed when parents tell you to stop playing online games), G10 (More interested in playing online games than doing college assignments), G11 (More interested in playing online games than doing household chores), G12 (Often spending money to buy data to be able to play online games), G13 (Enthusiastic when someone asks and discusses online games), G14 (To escape from problems at home/on campus), G15 (Forgetting real life), and G16 (Reduced relationships with others). Meanwhile, the output generated by this expert system is (K01) mild addiction, (K02) moderate addiction, and (K03) heavy addiction along with their solutions.

4. RESULT AND DISCUSSION

4.1 Results of the Application of the Dempster Shafer Method

The Dempster-Shafer method is an expert system method that relies on expert belief values. Belief (Bel) is a measure of the strength of evidence in supporting a set of propositions. A value of 0 indicates no evidence, and a value of 1 indicates certainty. Expert belief values are values assigned by experts to a phenomenon. The following data is obtained in the form of expert belief values in Table 1.

Table 1: Belief Symptoms and Values

Addiction Level	symptom	Belief value
Mild	(G1) Often plays online games	0,6
	(G2) Sleep hours are reduced due to playing online games late at night	0,6

Moderate	(G3) The amount of time spent playing online games continues to increase	0,9
	(G6) Feeling lethargic if you don't play online games in a day	0,6
	(G13) Enthusiastic if someone asks and discusses online games	0,8
	(G1) Often plays online games	0,6
	(G2) Sleep hours are reduced due to playing online games late at night	0,6
	(G3) Feeling angry and annoyed if you can't play online games	0,9
	(G4) Feel like you often fall asleep when there are activities because you play online games late at night	1
	(G5) Feeling lethargic if you don't play online games in a day	0,6
	(G6) Often reprimanded by (parents/friends/relatives) because they often miss meal times when playing online games	0,6
	(G7) Feeling less concentrated when doing other activities (campus/work/sports) because you think about online games	0,8
	(G8) Feeling gloomy and stressed when parents tell you to stop playing online games	0,6
	(G9) Feeling angry and annoyed if you can't play online games	1
	(G10) More interested in playing online games than doing college assignments	0,8
	(G11) More interested in playing online games than doing homework	0,8
	(G12) Often spend money to buy quotas to be able to play online games	0,6

	(G13) Enthusiastic if someone asks and discusses online games	0,8
	(G14) To escape from problems at home/on campus	0,8
	(G15) Forgetting real life	1
	(G16) Relationships with other people diminish	0,8
Heavy	(G1) Often plays online games	0,6
	(G2) Sleep hours are reduced due to playing online games late at night	0,6
	(G3) Feeling angry and annoyed if you can't play online games	0,9
	(G4) Feel like you often fall asleep when there are activities because you play online games late at night	1
	(G7) Feeling less concentrated when doing other activities (campus/work/ sports) because you think about online games	0,8
	(G8) Feeling gloomy and stressed when parents tell you to stop playing online games	0,6
	(G9) Feeling angry and annoyed if you can't play online games	1
	(G14) To escape from problems at home/on campus	0,8
	(G15) Forgetting real life	1
	(G16) Relationships with other people diminish	0,8

The following is the addiction diagnosis data and solutions in Table 2.

Table 2: Addiction Diagnosis and Solutions

Code	Addiction Level	Solution
K01	Mild	Limit yourself in playing online games and start looking for other hobbies/activities to divert your attention from online games.

K02	Moderate	Start consulting the nearest psychologist and doing cognitive behavioral therapy.
K03	Heavy	Consult a psychiatrist for further treatment.

Determination of IF THEN rules for diagnosing online game addiction in Table 3.

Table 3: Rules

No	Rule (IF THEN)
1	IF G1 AND G2 AND G3 AND G6 AND G13 THEN K01
2	IF G1 AND G2 AND G3 AND G4 AND G5 AND G6 AND G7 AND G8 AND G9 AND G10 AND G11 AND G12 AND G13 AND G14 AND G15 AND G16 THEN K02
3	IF G1 AND G2 AND G3 AND G4 AND G7 AND G8 AND G9 AND G14 AND G15 AND G16 THEN K03

The test data is some of the data selected to perform manual calculations using the Dempster Shafer method. The data used is in Table 4.

Table 4: The Dempster Shafer Case

Symptom Code	Information		Diagnosis
	Yes	No	
G1	✓		?
G2		✓	
G3		✓	
G4		✓	
G5	✓		
G6		✓	
G7		✓	
G8		✓	
G9		✓	
G10		✓	
G11		✓	
G12		✓	
G13	✓		
G14	✓		
G15		✓	
G16		✓	

The steps in manual calculations using the Dempster Shafer method are as follows: Patient 1 experienced symptoms of G1, G5, G13 and G14, the solution using the naive Bayes method was as follows: The first step is to determine the initial Density (m) value which consists of belief and plausibility values. For

the belief value, use the equation 4 formula and the plausibility value use the equation 5 formula, namely:

- a. G1(Frequently plays online games)
Belief value $m1(K01, K02, K03) = 0.6$
The plausibility value $m1(\theta) = 1 - 0.6 = 0.4$
- b. G5 (Feel like you often fall asleep during activities because you play online games late at night)
Belief value $m2(K02) = 0.6$
Plausibility value $m2(\theta) = 1 - 0.6 = 0.4$

Next, look for the new density ($m3$) using formula 3, in Table 5.

Table 5: Calculation of Combinations of $m1$ and $m2$

	$m2(K02) 0,6$	$m2(\theta) 0,4$
$m1(K01, K02, K03) 0,6$	$(K02) 0,36$	$(K01, K02, K03) 0,24$
$m1(\theta) 0,4$	$(K02) 0,24$	$(\theta) 0,16$

Then the density $m3$:

$$m3(K02) = \frac{0,36 + 0,24}{1-0} = 0,6$$

$$m3(K01, K02, K03) = \frac{0,24}{1-0} = 0,24$$

$$m3(\theta) = \frac{0,16}{1-0} = 0,16$$

- c. G13(Enthusiastic if someone asks and discusses online games)
Belief value $m4(K01, K02) = 0,8$
Plausibility value $m4(\theta) = 1 - 0,8 = 0,2$

Combination of densities to find the new density $m5$ in Table 6.

Table 6: Calculation of Combinations $m3$ and $m4$

	$m4(K01, K02) 0,8$	$m4(\theta) 0,2$
$m3(K02) 0,6$	$(K02) 0,48$	$(K02) 0,12$
$m3(K01, K02, K03) 0,24$	$(K01, K02, K03) 0,192$	$(K01, K02, K03) 0,048$
$m3(\theta) 0,16$	$(K01, K02) 0,128$	$(\theta) 0,032$

Then the density $m5$:

$$m5(K02) = \frac{0,48 + 0,12}{1-0} = 0,6$$

$$m5(K01, K02) = \frac{0,192 + 0,128}{1-0} = 0,32$$

$$m5(K01, K02, K03) = \frac{0,048}{1-0} = 0,048$$

$$m5(\theta) = \frac{0,032}{1-0} = 0,032$$

- d. G14(To escape from problems at home/on campus)
Belief value $m6(K02, K03) = 0,8$

Plausibility value $m6(\theta) = 1 - 0,8 = 0,2$

Combination of densities to find the new density $m7$, in Table 7:

Table 7: Calculation of Combinations $m5$ dan $m6$

	$m6(K02, K03) 0,8$	$m6(\theta) 0,2$
$m5(K02) 0,6$	$(K02) 0,48$	$(K02) 0,12$
$m5(K01, K02) 0,32$	$(K02) 0,256$	$(K01, K02) 0,064$
$m5(K01, K02, K03) 0,048$	$(K02, K03) 0,0384$	$(K01, K02, K03) 0,0096$
$m5(\theta) 0,032$	$(K02, K03) 0,0256$	$(\theta) 0,0064$

Then the density $m7$:

$$m7(K02) = \frac{0,48 + 0,256 + 0,12}{1-0} = 0,856$$

$$m7(K02, K03) = \frac{0,0384 + 0,0256}{1-0} = 0,064$$

$$m7(K01, K02) = \frac{0,064}{1-0} = 0,064$$

$$m7(K01, K02, K03) = \frac{0,0096}{1-0} = 0,0096$$

$$m7(\theta) = \frac{0,0064}{1-0} = 0,0064$$

It can be seen from the results above that the highest probability value is $m7(K02)$, so students who experience symptoms often play online games, feel that they often fall asleep during activities because they play online games late at night, are enthusiastic when someone asks and discusses online games, and to escape from problems at home/on campus is included in the diagnosis of "moderate addiction" with a probability value of 0.856.

4.2 Testing the Dempster Shafer Method

The following are the test results using the Dempster Shafer method using 53 test data in Table 8.

Table 8: Dempster Shafer Method Test Results

No.	Symptom	Diagnosis	
		Dempster Shafer	Expert
1	G1, G5, G13, G14	K02	K01
2	G1, G10, G11, G13, G14	K02	K02
3	G1, G2, G3, G4, G6, G7	K02	K02

4	G1, G2, G12, G13	K02	K01
5	G1, G5, G9, G11, G12, G13	K02	K02
6	G1, G2, G6, G7, G9, G14	K02	K02
7	G2, G3, G11, G13	K02	K01
8	G1, G2, G3, G4, G5	K02	K02
9	G1, G2, G11, G13	K02	K01
10	G2, G6, G7, G13, G14	K02	K02
11	G1, G2, G9, G11, G12, G13	K02	K02
12	G1, G3, G13, G14	K02	K01
13	G2, G4, G6, G7, G11, G12, G14	K02	K02
14	G1, G4, G6, G13, G14, G15	K02	K02
15	G1, G2, G10	K02	K01
16	G1, G3, G4, G5, G6, G7, G8, G09, G10, G11, G15, G16	K02	K03
17	G1, G6, G7, G10, G11, G12	K02	K02
18	G2, G5, G13, G16	K02	K01
19	G2, G6, G7, G8, G11, G12	K02	K02
20	G1, G2, G13, G14, G15	K02	K02
21	G1, G11, G12, G13, G14	K02	K02
22	G2, G3, G13, G14, G16	K02	K02
23	G1, G2, G4, G12, G13	K02	K02
24	G1, G2, G3, G13, G15	K02	K02
25	G1, G3, G4, G10, G11, G13, G14	K02	K02
26	G1, G2, G3, G12, G14	K02	K02
27	G1, G4, G13, G14	K02	K01
28	G1, G2, G11, G13, G14, G15	K02	K02

29	G2, G8, G10, G11	K02	K02
30	G1, G2, G11, G12, G13	K02	K02
31	G1, G2, G10, G11, G13, G14	K02	K02
32	G1, G2, G3, G10, G11	K02	K02
33	G2, G5, G8	K02	K01
34	G2, G4, G12, G13, G14	K02	K02
35	G1, G9, G13, G14, G15	K02	K02
36	G1, G2, G6, G7, G13, G14	K02	K02
37	G1, G4, G9, G10, G13, G15	K02	K02
38	G1, G6, G7, G12, G14, G15	K02	K02
39	G2, G4, G9, G10, G11, G14, G15	K02	K02
40	G1, G2, G3, G5, G14	K02	K02
41	G1, G2, G3, G6, G7, G13	K02	K02
42	G1, G3, G6, G7, G12	K02	K02
43	G1, G4, G11, G14	K02	K01
44	G1, G2, G4, G5, G6, G7	K02	K02
45	G1, G3, G4, G6, G7, G10, G11	K02	K02
46	G1, G3, G6, G14	K02	K01
47	G1, G9, G10, G11, G14	K02	K02
48	G1, G3, G4, G12, G14	K02	K02
49	G1, G6, G7, G10, G11, G13, G14	K02	K02
50	G1, G2, G10, G11	K02	K01
51	G2, G3, G11, G13	K02	K01
52	G6, G7, G8, G12, G13, G14	K02	K02
53	G1, G6, G7, G10, G11, G13, G14	K02	K02

The accuracy of the Dempster Shafer method based on the calculation results of the Dempster Shafer method on systems with expert diagnosis can be calculated as follows:

$$\frac{\text{Amount of Test Data Appropriate}}{\text{All Test Data}} \times 100\% = \frac{39}{53} \times 100\% = 73\%$$

From the results of 53 data calculations using the Dempster Shafer method compared with the expert diagnosis results, there are 39 Dempster Shafer calculation results that match the expert diagnosis so that the Dempster Shafer method in the system has an accuracy rate of 73%.

4.3 System Implementation

System implementation is the process of using a system to solve existing problems. This system is implemented to explain in detail the appearance and function of each section created on each form. The following is a system implementation

1. Dashboard Page

The dashboard is the first page that appears when the system is launched. The dashboard contains several menus accessible to the admin, including the consultation menu, student data menu, symptom data menu, solution data menu, Dempster Shafer menu, and the change password menu as shown in Figure 3.

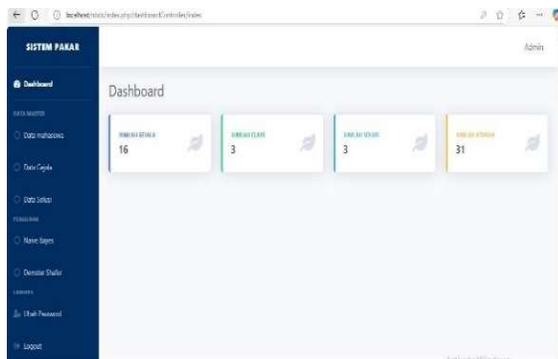


Figure 3: Dashboard Page

2. Symptom Data Page

On the symptom data page, the admin can see the code, symptom name, belief value and the admin can also access editing, deleting and adding student data in Figure 4.

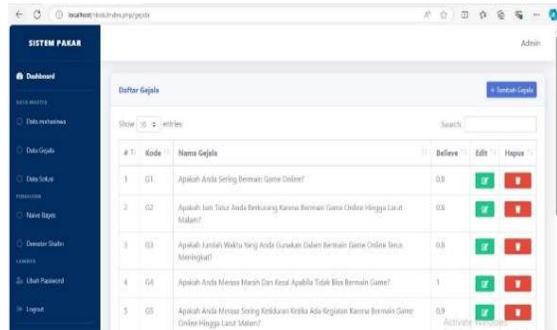


Figure 4: Symptom Data Page

3. Solution Data Page

On the solution data page, admins can view the code, addiction level, and solutions. They can also manage solution data, such as editing, deleting, and adding solution data, as shown in Figure 5.

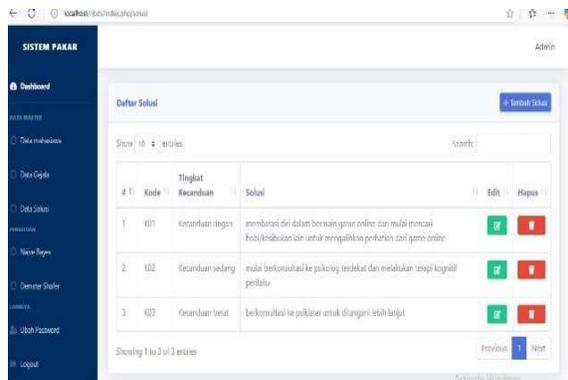


Figure 5: Solution Data Page

4. Consultation Page

This page is for consultation. Users can fill in several available symptoms of online gaming addiction. Symptoms related to online gaming addiction are pre-compiled, and users can answer "yes" or "no." The system will then process and display the selected symptoms for diagnosis. Users can also reset the list to select new symptoms, as shown in Figure 6.

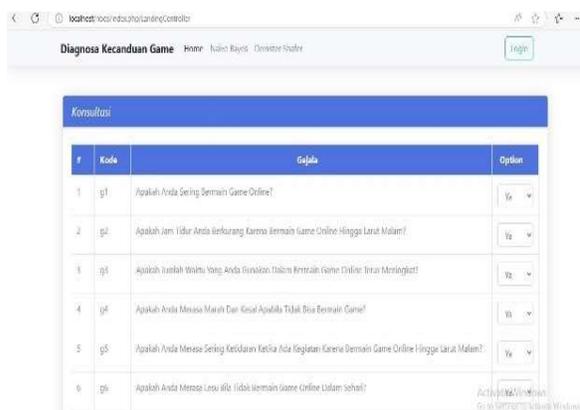


Figure 6: Consultation Page

5. Dempster Shafer Method Rule Page

This page is the rule page for the Dempster Shafer method, which will be used for Dempster Shafer testing. On the rule page, the admin can manage menus such as adding and deleting rules, as shown in Figure 7.



5. CONCLUSIONS

This study used the Dempster Shafer method to diagnose online gaming addiction using data from expert interviews. Based on the results of testing the Dempster Shafer method to diagnose online gaming addiction using 53 test data, the accuracy obtained was 73% with 39 diagnoses matching expert diagnoses and resulting in 39 moderate addictions. The Dempster Shafer method can be used to diagnose online gaming addiction.

Further research is recommended to use other methods within expert systems as comparisons to determine which method is better. This model can be developed by adding more variables and rules, making it even more intelligent. This expert system for diagnosing online game addiction is expected to benefit students in preventing addiction.

Figure 7: Dempster Shafer Method Rule Page

6. Dempster Shafer Method Test Results Page

This page is the test results page using the Dempster Shafer method, which previously filled in the symptoms on the consultation page in Figure 8.

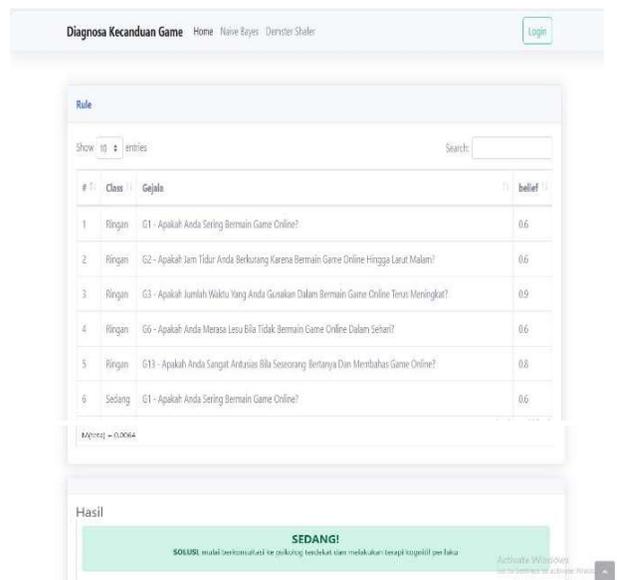


Figure 8: Dempster Shafer Method Test Results Page

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