JAIA – Journal Of Artificial Intelligence And Applications
Journal Homepage : http://jurnal.sar.ac.id/index.php/JAIA/

Expert System to Detect the Level of Parental Stress in Online Learning by Using Forward Chaining Method

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Article Info

Received : Feb 14, 2022
Revised : Mar 24, 2022
Accepted : Apr 16, 2022

Keywords :

Expert System
Covid-19
Online Learning
Forward Chaining

Abstract

This research was aimed to make an expert system application to detect and identify the parental stress level in online learning by using the Forward Chaining method. The system was designed and implemented based on Desktop by using basic programming language. The data were collected through questionnaire consisted of 30 questions. The final score would determine the stress level of the respondents. The respondents were chosen by using random sampling technique. XAMPP data with the results obtained from 150 respondents who have educational backgrounds; elementary school (4 respondents), junior high school (6 respondents), high school (120 respondents), associate degree (11 respondents), bachelor degree (9 respondents).There were 123 respondents do not work, and 27 respondents were working parents. The findings showed that from 150 respondents there were 22% or 33 respondents were at normal level, 6% or 9 respondents were at mild level of stress, 8% or 12 respondents were at moderate level of stress, and 64% or 96 respondents were at severe level of stress. It was concluded that this application can be used to detect the parental stress level in online learning. It was also expected through the use of this application can help parents to detect their stress level earlier and find solution of it in order to avoid the negative impact of their problems.

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1. Introduction

The outbreak of COVID-19 pandemic or coronavirus disease all over the world disturb several aspects of people life, included the education system in Indonesia. This contagious virus was confirmed spreading in Indonesia on 2nd March 2020. The government declared several regulations in order to reduce the transmission of this virus namely, physical distancing, movement restrictions, work from home, and study from home. Furthermore, the Ministry of Education and Culture issued Circular Letter Number 4 in 2020 concerning to education system implementation during COVID-19 pandemic namely to conduct teaching and learning process in online learning.

Online learning or remote learning is the most applicable method in teaching and learning process during the COVID-19 pandemic in order to mitigate the transmission of the contagious COVID-19 [1]. It means that online learning is not an option, but it was a necessity method in this pandemic, thus the teaching and learning process can be conducted to avoid the learning loss. In fact, students need parental involvement while they are learning from home especially for elementary and junior high school students. The parents also need to monitor, support and motivate their children in online learning, even the parents should teach their elementary children too, so that their children will achieve good learning outcomes and socioemotional well-being [2]. In conclusion, the parents have a wider range of duties namely as a supervisor and home-schooling teaching besides doing the domestic works during the pandemic.

Online learning makes parents closer to their children since it will improve communication between them. However, online learning also becomes a challenge not only for teachers and students, but also for parents. Especially for parents who conducted working from home since it increase their burden during this pandemic. This condition makes parents have to do many works beyond their limits which lead to facing stress. Stress is a feeling of mental press and tension that could produce anxiety, negative emotions and feelings namely press, pain, sadness or serious psychological disorder [3] [4]. Stress could make someone's life unwell, damage social relationship in the family and cause several diseases namely depression, hypertension, sudden death and stroke that reduce the productivity and quality of life [5] [6].

There are many parents experiencing stress and depression due to their works and guide their children in online learning during COVID-19 pandemic. According to a study conducted by Alisma et al. that discussed working parents experienced stress during helping their children at home during pandemic, it was found that 87% of the respondents (75 respondents) experiencing parenting stress regarding to the difficulty in dividing their time in working and helping their children at home [7]. A research done by Johnson et al. found that parents have experienced worsen mental health issue due to COVID-19 pandemic namely, parental stress, burnout, anxiety and depression [8]. The incidental closure of schools and public facilities forced all parents pass new daily routines which challenge them to be full time parents, do home-schooling for their children at home while they are working from home too [9]. This transition seemed as mainly stressful for all parents that strive to defend the border between work, children and domestic duties that affected their lifestyle [10]. In conclusion, stress is unhealthy and could result in biological, psychological and social problems in someone's life or even can harms another people so that there is must be a solution to mitigate this condition. In addition, the parents should know how to solve their problems by determining their stress level from home.

Based on the problem describes above, the researchers were encouraged to conduct a research entitled Expert System Application to Detect the Level of Parental Stress in Online Learning by Using Forward Chaining Method in Pekanbaru in 2021 in order to help the parents in determining their stress level and solve their problems too. According to Garuda Cyber Indonesia, expert system, the forward chaining is a method that performs forward tracking, starting from taking facts and ending with the conclusions. This forward chaining method starts from facts that are already known by the expert system then uses a user-defined premise which the premise is adjusted to the facts using a certain rule. This process will produce new facts which will be used to reach a final conclusion after there are no more rules that the premise match with the facts.

There are the steps that must be taken in creating a rule-based Forward Chaining System, namely: (a) Problem definition, (b) Defining Input Data Forward CHAINING System requires data beginning to start inference, (c) Defining Data Control Structure, (d) Initial Code Writing, e) System Testing, (f) Interface Design and (g) System Evaluation.

Several researches have investigated the use of Expert System and Forward Chaining on several topics. First, the study conducted by Nurcholis et al. who investigated the use of Expert System Application to diagnosed stress level experienced by the final year students that combined Certainty Factor Methods and android-based Forward Chaining method. The results of this study found that through manual calculations on one of the data obtained from 200 students achieve the same level of confidence, each confidence level was 97.97% and it was diagnosed with mild stress [11]. Furthermore, Levina and Birowo investigated the use of Forward Chaining method to determine the results of job stress screening. This design was create to conduct the screening of job stress based on knowledge from the experts to detect risk and facilitate consultation between users and experts. This study concluded that the application made by the researcher can decide the symptoms of job stress risk [12]. In addition, Farajullah et al. had done a research about Expert System to detect anxiety by using web-based Forward Chaining Method. The results of this study produced a web-based Expert System to diagnose anxiety through the use Forward Chaining method. The result of Alpha test showed that this Expert System application was appropriate to use to detect anxiety independently [13].

Among the previous studies done by the researchers discussed about Expert System and Forward Chaining method, a research about Expert System application to detect the level of parental stress in Online learning by using Forward Chaining Method was still limited and needed. In order to fill this gap, the researchers conducted a study on expert system to detect the parental stress level in online learning to identify and measure the parental stress level by using the Forward Chaining method where the system was designed and implemented based on Desktop by using basic programming language .

2. Research Methods

2.1. Methods

This study was aimed to creating Expert System application by using Forward Chaining method which this method performs forward tracking that started from taking facts and ended with conclusion.

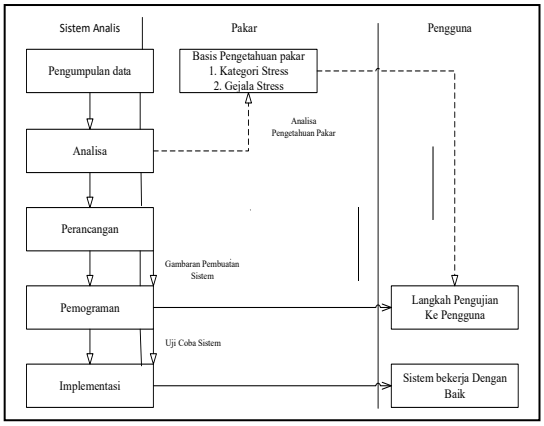

Figure 1. Research Framework

2.2. Data Collection

The data were collected through questionnaire that consisted of 30 questions or premises. The questionnaires were written in Bahasa Indonesia to anticipate language barriers among the respondents and it easily understood by the respondents. The respondents were chosen by using random sampling technique. The respondents were 150 parents in Pekanbaru who have educational backgrounds; elementary school (4 respondents), junior high school (6 respondents), high school (120 respondents), associate degree (11 respondents), bachelor degree (9 respondents). There were 123 respondents do not work, and 27 respondents were working parents. This researched was conducted from 17th November 2021 until 7th January 2022.

2.3. Analysis

Knowledge of psychology is very important to understand so that there are no errors in diagnosis. The importance of knowledge about psychology also affects the information that will be conveyed to users as learning materials and the introduction of stress levels of parents in dealing with online learning. A psychologist as an expert has limitations such as fatigue and the costs to be incurred are also relatively expensive for just consulting. Therefore, based on the analysis of the problem above, this system was expected to be a choice of alternative solutions to assist in understanding the condition of parental stress levels and provide information in the form of appropriate handling in dealing with stress.

A. Stress Indicator

The sources of knowledge of this expert system consist of symptoms that experienced by each parent. The symptoms obtained from various sources of information such as books, journals, the internet, as well as from interviews with an expert she is the alumnus of Psychology at the State Islamic University), Dianita Pratiwi. Stress based on the level and the value that determines the category of stress, namely; normal with a scale of 0-149, mild stress 150-199, moderate stress 200-299, severe stress more than 300 and table 2 contains 30 symptoms of stress disease where the weight value is determined by experts and published book.

Table 1. Stress Level Category

Kode Stress	Kategori Stress
KS1	Normal (Normal)
KS2	Stress Ringan (Mild)
KS3	Stress Sedang (Moderate)
KS4	Stress Berat (Severe)

Table 2. Stress Symptoms

No	Kode Gejala	Nama Gejala	Bobot Nilai
1	KG 01	Ingin Marah	24
2	KG 02	Sakit Kepala	53
3	KG 03	Merasa Letih Ketika Mengajar Anak Selama Covid	30
4	KG 04	Pembelajaran Anak Terasa Sulit	11
5	KG 05	Memukul Saat Mengajar Anak	11
6	KG 06	Merasa Bosan Dengan Pembelajaran Anak	38
7	KG 07	Kesulitan Berkonsentrasi Saat Mengajar Anak	24
8	KG 08	Tidak Dapat Tidur	16
9	KG 09	Sering Merasa Cemas Memikirkan Nilai Anak	24
10	KG 10	Tumbuh Rasa Kesal Bahkan Benci Pada Anak	44

11	KG 11	Merasa Lelah Untuk Berfikir	24
12	KG 12	Kehilangan Semangat Pada Apapun	24
13	KG 13	Munculmpikiran Untuk Bunuh Diri	53
14	KG 14	Selalu Muncul Rasa Bersalah	24
15	KG 15	Sering Melamun	24
16	KG 16	Mudah Tersinggung	24
17	KG 17	Menyakiti Diri Sendiri	53
18	KG 18	Kehilangan Rasa Ingin Merawat Diri	24
19	KG 19	Sering Menangis	24
20	KG 20	Mudah Panik	24
21	KG 21	Memisahkan Diri Dengan Orang Lain	18
22	KG 22	Daya Ingat Menurun	53
23	KG 23	Keringat Berlebihan	53
24	KG 24	Kondisi Emosi Yang Berubah Rubah	29
25	KG 25	Jantung Berdebar Kencang	53
26	KG 26	Tubuh Gemetar Dan Kelelahan	53
27	KG 27	Timbul Anggapan Semua Yang Dilakukan Orang Tua Salah	24
28	KG 28	Ilang Arah Dan Tujuan Hidup	25
29	KG 29	Susah Berfikir Positif	29
30	KG 30	Ceroboh	24

B. Knowledge Representation

After the data collection process was completed, next the data was represented into a knowledge base and the rules base which was then coded, organized and described in the form of a decision tree so that was becomes a systematic form. By using a decision tree, the researchers could easily see and identify the relationship between personality types and their characteristics. Based on the results of the knowledge representation from the decision table and decision tree that have been made, the rules or production rules were obtained which were usually written in if-then form (IFTHEN). Next, the System Algorithm was created to determine the stress level of parents during the pandemic.

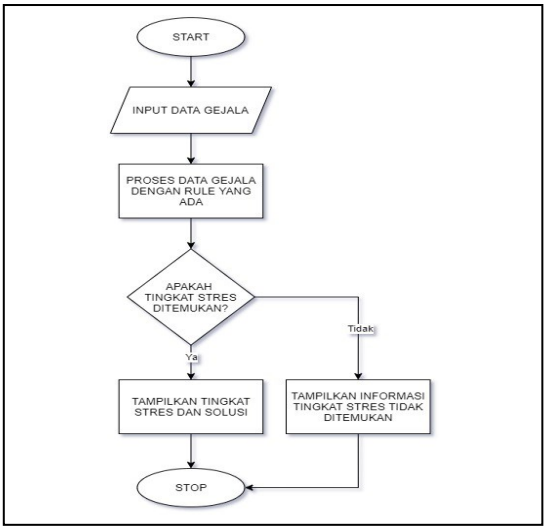

Figure 2. System Algorithm

2.4. System Design

To create a system design application that can be described as follows:

A. UML (Unfied Modeling Languange)

UML is a global form of software development that is built using object-oriented programming techniques. The UML tools used are Use Case diagrams, Activity diagrams, Sequence diagram and Class diagram.

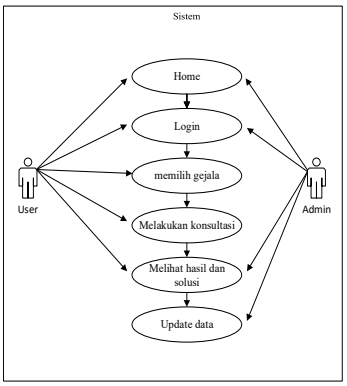

Figure 3. Use case diagram

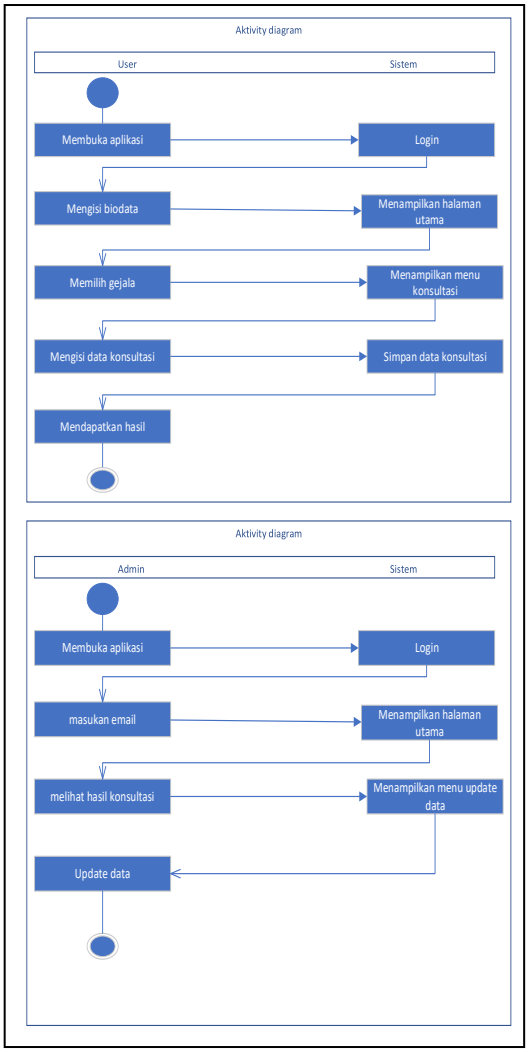

Figure 4. User and Admin Activity Diagram

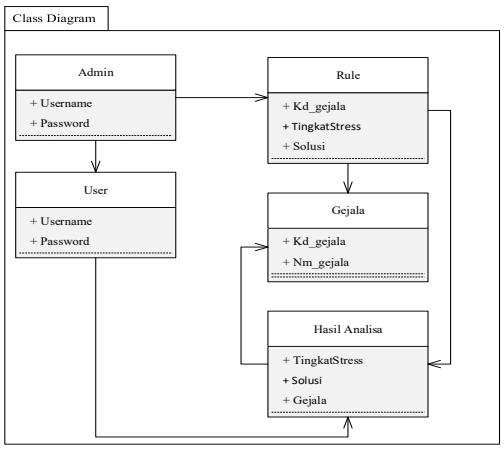

Figure 5. Class diagram

B. Detailed Design

Detailed design was needed to describe the workflow of a system in detail. With the construction of this detailed design, the shape of the application display would be known namely the main page, main menu view, symptoms menu, result menu, solution menu, etc.

2.5. Programming

After carrying out the design process on the next application, the process of making applications that have been designed in the previous stage was implemented into the PHP and MySQL programming languages to prepare basic data. After the design was implemented, the next stage was a trial to test the suitable program.

2.6. Implementation

In the implementation stage, the features in the expert system were tested to measure the stress of parents in online learning during the pandemic. At this stage, the entire interface and its features would be displayed and how to use the expert system

3. Results and Discussion

3.1. System View

In this application there is a login menu that contains a username and password which is useful for maintaining the security of users or admins who want to use the system which can be seen from the following picture:

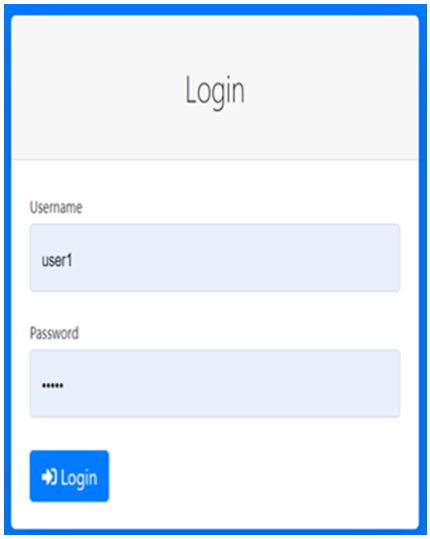

Figure 6. Login Menu

In this menu there are users and admins who will use the application, each of which

has a different username and password in order to maintain security.

A. User Main View

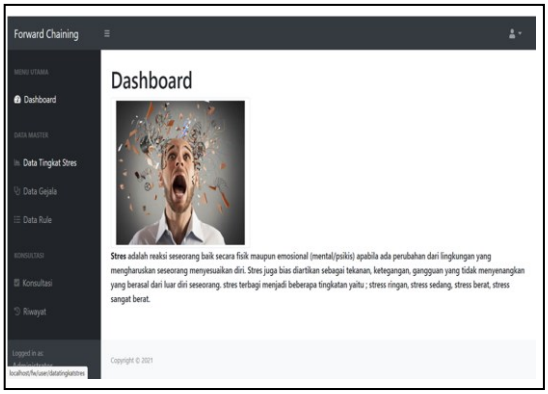

Figure 7. User Dashboard View

In this stage the main menu displays for the user where in this view there is a dashboard in which there is an explanation of the stress and there is a consultation menu and a history menu.

1) Consultation Menu

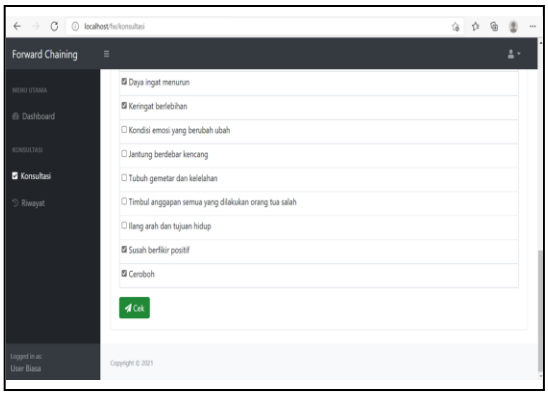

Figure 8. Consultation View

This consultation menu displays several symptoms determined by the researchers which the symptoms data were obtained from journals and experts. This symptom menu was filled in according to the symptoms experienced by the user to get the results that were categorized to normal, mild stress, moderate stress and severe stress level. After the users chose the symptoms, the diagnostic result will appear as shown in the picture above. The diagnostic result can be saved and the results will be entered in the history menu.

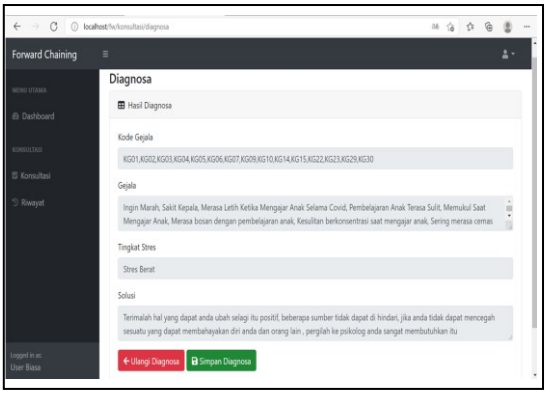

Figure 9. Diagnostic Result

2) Consultation History

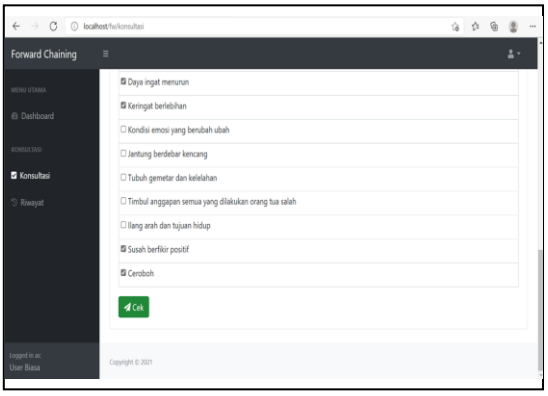

Figure 10. Consultation History

This history menu is part of one of the menus contained in the user menu where this menu stores the results that the user did when selecting symptoms in the consultation menu.

B. Admin Main View

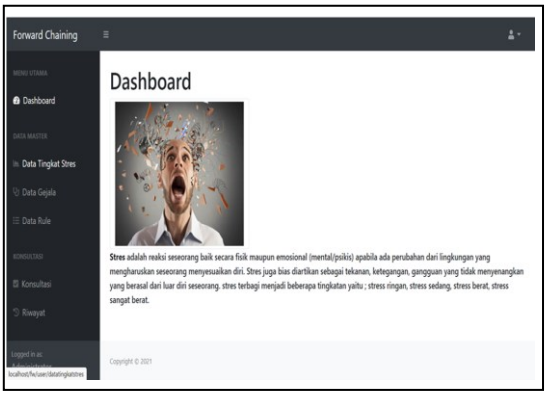

Figure 11. Admin Dashboard View

In this admin main view there are several menus, including the same dashboard as the user which contains a brief explanation of stress, and there is a stress level data menu, a symptom data menu, and a rule menu.

1) Stress Level Data

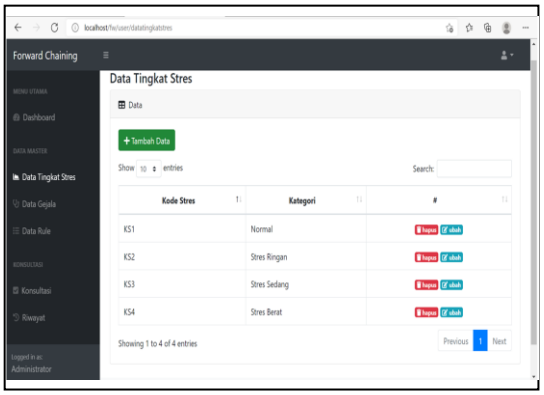

Figure 12. Stress Level View

This consultation menu displays several symptoms determined by the researchers which the symptoms data were obtained from journals and experts. This symptom menu was filled in according to the symptoms experienced by the user to get the results that were categorized to normal, mild stress, moderate stress and severe stress level. After the users chose the symptoms, the diagnostic result will appear as shown in the picture above. The diagnostic result can be saved and the results will be entered in the history menu.

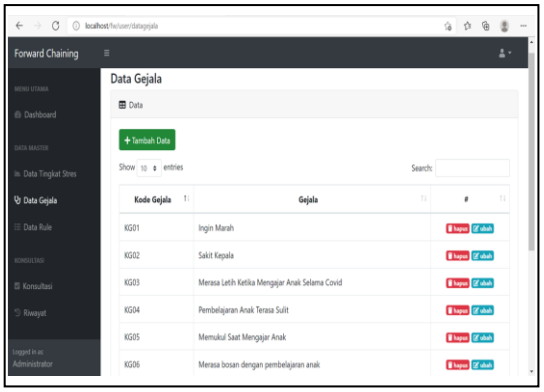

Figure 13. Stress Level View

There are several levels of stress, namely normal levels which mean no serious problems occur, mild stress levels that may experience pain but are not so serious. The level of moderate stress in this level means that the user experiences pain but can still control it and the level of severe stress which is defined in the category of illness that requires help from a psychologist to overcome it.

2) Symptoms Data

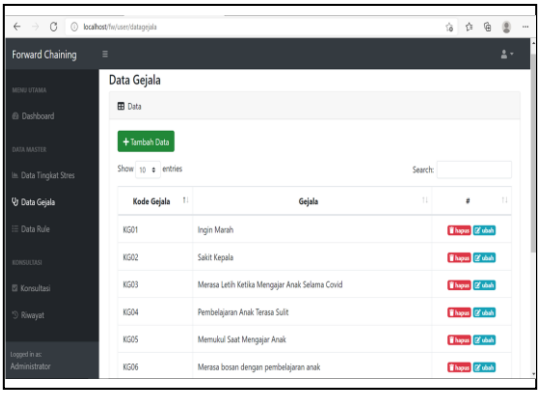

Figure 14. Stress Symptoms

There are some displays in the symptom menu in which there are several symptoms that are managed by the admin which these symptoms can be removed or some other symptoms can be added.

3) Data Rule

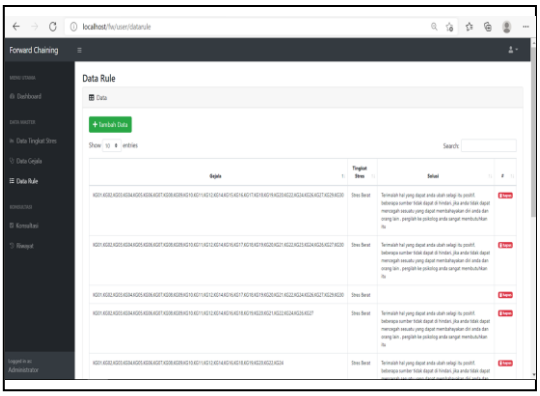

Figure 15. Data Rule

Next, there is the rule menu in which there are symptoms, levels and solutions where the data is obtained from experts so that the results are more valid.

XAMPP data with the results obtained from 150 respondents who have educational backgrounds; elementary school (4 respondents), junior high school (6 respondents), high school (120 respondents), associate degree (11 respondents), bachelor degree (9 respondents).There were 123 respondents do not work, and 27 respondents were working parents. The findings showed that from 150 respondents or parents there

were 22% or 33 respondents were at normal level, 6% or 9 respondents were at mild level of stress, 8% or 12 respondents were at moderate level of stress, and 64% or 96 respondents were at severe level of stress.

Table 3. The Result of Parental Stress Level

Stress Categorize	Respondents	Percentage
Normal	33	22%
Mild Stress	9	6%
Moderate Stress	12	8%
Severe Stress	96	64%

3.2. System Testing

At this stage, trials and assessments were carried out to 30 parents through the questionnaires. It was conducted on November 17, 2021 until January 7, 2022 to find out the extent to which this website meets the needs of users with the assessment and results seen in the following table:

Table 4. The Result of Parental Stress Level

No	Pertanyaan	SS	S	TS	STS
1	Tampilan Website menarik	17	11	2	0
2	Website mudah digunakan	16	9	5	0
3	Website mudah dipahami,dibaca dan dimengerti	15	8	7	0
4	Website dapat membantu dalam melakukan diagnosa pada orang tua terkhusus saat pembelajaran online	21	9	0	0
5	Website bermanfaat bagi orang tua siswa untuk mengetahui tingkat stress yang dialaminya	21	9	0	0

In conclusion, the majority of the respondents agree that this expert system application can be used to detect parental stress level in online learning during the pandemic. They agreed that the website is interesting, easy to use, understandable, useful, and detect their stress level appropriately. By combining the Expert System and Forward Chaining method in the application, the respondents or users are convenient since they can detect their stress level easily via the application. This finding was in line with the studies conducted by Simamora & Irina and Levina & Birowo who found that Expert System and Forward Chaining method can detect the stress level of people [14].

4. Conclusion

This Expert System application can be used to detect the parental stress level in online learning during COVID-19 pandemic. The majority of the respondents agreed that this application was convenient to use since they can detect their stress level easily. It was also expected through the use of this expert system application, parents not only detect earlier their stress level but also can achieve solution of their stress to avoid the negative impact of it. The researchers recommend to further researchers to find more symptoms of stress level and develop application that can be used by all people, not only during the COVID-19 pandemic.

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