Journal of Information Technology and Cyber Security 3(1) January 2025: 45-63 EISSN 2987-386X | PISSN 2987-3878
DOI: 10.30996/jitcs.12617

Early Detection of Student Problems Through a Knowledge-Based Systems-Based Counseling Approach

Nisrina Salsabil Rahmawati [1] and Suastika Yulia Riska [2,*]

[1,2] Department of Informatics Engineering, Institut Teknologi dan Bisnis Asia Malang, Indonesia
* Corresponding author: riska.suastika@asia.ac.id

Received: 09 January 2025
Accepted: 27 January 2025
Revised: 27 January 2025
Available online: 07 May 2025

To cite this article: Rahmawati, N. S., & Riska, S. Y. (2025). Early Detection of Student Problems Through a Knowledge-Based Systems-Based Counseling Approach. *Journal of Information Technology and Cyber Security, 3*(1), 45-63. https://doi.org/10.30996/jitcs.12617

Abstract
Higher education is an important phase in an individual's academic development, but it is often characterized by challenges such as academic pressure, time management, and student mental health. To overcome these problems, this research aims to develop a technology-based Counseling Expert System with a Forward Chaining approach to detect student problems and provide relevant solutions. The system is designed and implemented as a web-based platform that can be accessed anytime and anywhere, allowing students to answer questions related to the problems faced by students. The answers are processed in a knowledge base that is integrated with an inference engine to produce diagnosis and solution recommendations. The results of system testing using 30 data samples show results that are in accordance with expert judgment. This expert system can identify six types of student problems, such as laziness, skipping classes, adaptation difficulties, difficulty doing final assignments, decreased Grade Point Average (GPA or IP), and potential dropout, by considering 32 causal factors grouped into academic, time management, emotional, and social environment categories. This research proves that the Forward Chaining-based Counseling Expert System is effective as a flexible solution to support student well-being and better student academic achievement.
Keywords: counseling system, early detection, forward chaining, knowledge-based, student problems.

1. Introduction
Higher education is a level of advanced education after high school which is one of the important phases in an individual's academic journey (Quinlan & Renninger, 2022; Li, 2024; Siregar & Syarqawi, 2024). Through the lecture process, students have the opportunity to explore knowledge, skills, and develop their potential according to their field of interest (Sølvik & Glenna, 2022; Divjak, Rienties, Iniesto, Vondra, & Žižak, 2022; Juliawan, et al., 2023). Higher education levels include diplomas, bachelor's, master's, and doctoral, with varying study durations depending on the program taken (Hutauruk, Sutarmo, & Bachtiar, 2022; Amrullah, 2021). One of the key components in higher education is the Semester Credit System (SKS), which determines the amount of study load that must be completed to achieve graduation (Barus, et al., 2023; Sugitha, Bachtiar, & Wicaksono, 2024; Susanti, Harahap, Rambe, Daulay, & Berutu, 2024; Aipassa, Kusnandar, & Imro'ah, 2024).

To meet the credit load, students must undergo various intensive learning activities, such as lectures, discussions, assignments, research, and collaborative projects. However, the process is often fraught with challenges, including tight deadlines, heavy workloads, and academic pressures that can impact students' mental health (Sutopo, 2024; Andini, Mauliana, & Anggraini, 2024; Al Mustaqim, 2023). This condition has the potential to cause stress and anxiety, which can hinder academic achievement (Hawes & Arya, 2023; Singh, et al., 2022; Han, 2023). To overcome this, many universities provide Counseling Guidance services as psychological and academic support for students (Su, Hung, Chen, & Yuan, 2024; Permana, et al., 2023; Eva, Shanti, Hidayah, & Bisri, 2020).

Counseling Guidance Services aim to help students overcome various problems, both academic and non-academic, through guidance, motivation, and solutions from professional counselors (Suryawati, Kholili,

Susilo, Asrowi, & Surur, 2024; Liu & Liao, 2021; Mudrikah, Suherman, & Yustiana, 2024). In addition, this service also serves as a liaison between students and related parties to solve problems effectively (Hidayat, et al., 2024; Shminan, Choi, Barawi, Hashim, & Andy, 2021; El Mrabet & Ait Moussa, 2021; Su-Kubricht, Chen, Guo, & Miller, 2024; Nugroho & Nurdahlia, 2024). However, some students are reluctant to use these services for psychological reasons, such as embarrassment, fear of judgment, or the discomfort of talking directly to a counselor (Rasouli, Ghafurian, Nilsen, & Dautenhahn, 2024; Su-Kubricht, Chen, Guo, & Miller, 2024; Robertson, Gunn, & Piper, 2022; Wójcik & Rzeńca, 2021). On the other hand, conventional counseling services are also limited by operational hours, so that students who need help outside of working hours find it difficult to access these services optimally.

With the development of technology, the integration of counseling services into computer-based systems is a potential solution. This system allows students to access counseling services anytime and anywhere without having to meet with a counselor in person. Knowledge-based technology can be used to mimic the counselor's reasoning process through data and knowledge processing integrated into the system (Iatrellis, Stamatiadis, Samaras, Panagiotakopoulos, & Fitsilis, 2023; Truong & Nguyen, 2023; Desnelita, Irwan, & Gustientiedina, 2022).

One of the approaches used in knowledge-based systems is the Forward Chaining reasoning technique, which works by drawing conclusions based on user-provided facts (Chani, 2022). Forward Chaining reasoning techniques have been widely used to overcome student problems, including: 1) research on the diagnosis of insomnia in final year students using Forward Chaining (Wahid, 2021); 2) research on early detection Students' stress levels on final projects using Forward Chaining (Zaelani, 2024); 3) research on the diagnosis of Mental Health of Final Year students using Forward Chaining (Putri, Maulana, & Aditiawan, 2024); 4) research on depression in final year students with certainty factor and Forward Chaining methods (As Siddieq, 2024); dan 5) research on adolescent mental health counseling services using Forward Chaining (Setiawan, Tristono, & Susila, 2024). In addition to using the Forward Chaining method, research related to the diagnosis of student learning styles was carried out using the Backward Chaining method (Setiyadi, Hakim, Syahdan, Amalia, & Saifudin, 2024). The difference between Forward Chaining and Backward Chaining is that Forward Chaining starts from the initial facts to gradually deduce new information until reaching the final conclusion, while Backward Chaining starts from a goal or hypothesis, working backwards to find facts that support the goal (Tajrin, et al., 2024). Because the research case focuses on the consultation of student problems, the Forward Chaining method is applied to start from the initial facts or symptoms conveyed by the students to produce relevant solutions.

Through this approach, the system can detect student problems and provide appropriate recommendations based on the available data. Thus, this technology-based counseling service offers a more flexible, responsive, and accessible alternative, which is expected to support students' mental well-being and support students' academic achievement more optimally.

2. Methods

The student counseling expert system functions to help students who want to consult at a counseling bureau but are limited in time and place. Students only need to open their cellphones or laptops, then open the counseling website. This system will provide solutions to the problems they experience. When students run the website, the system will provide questions about the cause of the problem that has been stored in the knowledge base. The answers that have been given by the user will be processed to produce conclusions about the problems faced by students. The design of the expert system for counseling student problems is shown in Fig. 1.

The dataset used in the study is data on student problems from various study programs and various semester levels at the Institut Teknologi dan Bisnis Asia Malang. The data on causes or symptoms obtained from experts and data obtained from users will be represented into the knowledge base, then the data processed on the knowledge base will be processed again in the inference engine (Forward Chaining). Furthermore, the system will display solutions to student problems.

Based on the conditions that have been explained earlier, student problems need to be handled by counseling guidance. Student problems can be minimized by knowing what causes the problems felt by students and finding solutions to these problems. Based on the working hours of counseling and psychologists that are quite limited, the counseling expert system can help the consultation process that is carried out at any time without being bound by time and place.

Table 1 is a table of students' academic problems. In the table, it is known that there are 6 problems of students, namely laziness, truancy, adaptability, difficulty doing final projects, declining GPA, and drop-

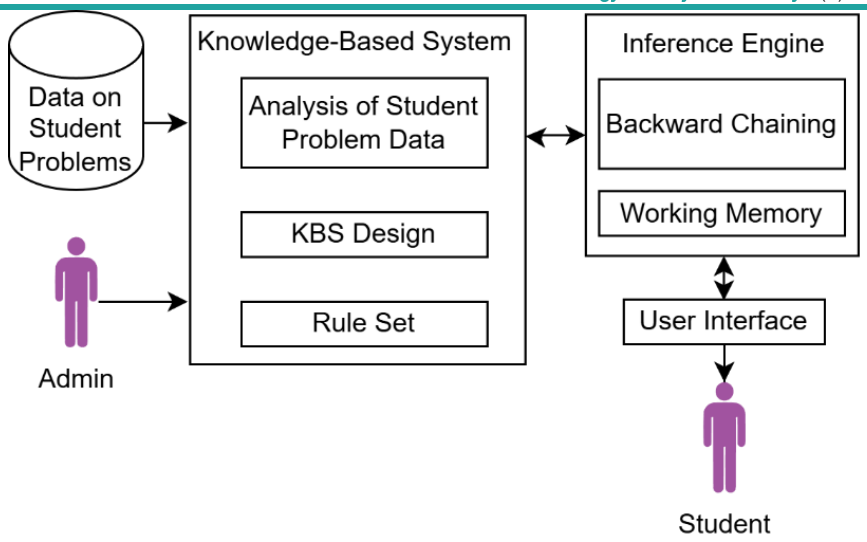

Fig. 1. Design of the expert system for counseling.

Table 1
Student problems.

No.	Problem	Problem Code
1	Lazy	M001
2	Skipping class	M002
3	Ability to adapt	M003
4	Difficulty completing the final assignment	M004
5	Decreased GPA	M005
6	Dropout	M006

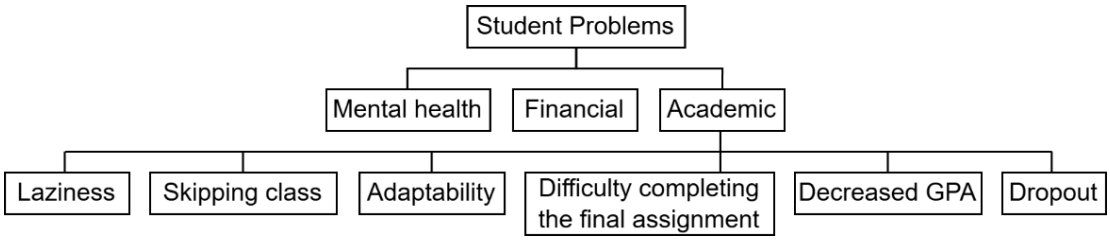

Fig. 2. Isolation of problem Areas.

ping out. Table 2 shows a table of the causes of student problems. Each cause is coded to make it easier to implement.

Table 3 shows some suggestions for solutions that students can do to overcome the problems experienced.

In creating a knowledge-based system, knowledge from experts must first be extracted and then presented in a form that can be processed by a computer. The first step in creating a knowledge-base system is to determine the isolation of the problem area (da Costa Câmara & Sari, 2021). The purpose of making area isolation is to limit the scope of discussion of student problems by knowing the main points of discussion in a wider domain (Yanti & Budiyati, 2020). The block diagram of the area isolation of the counseling expert system can be shown in Fig. 2, and the Decision target diagram is shown in Fig. 3.

Based on Fig. 3, there are 6 student problems caused by 32 factors or causes of student problems. There are 32 causes categorized into 4 categories, namely academic factors (K001), time management factors (K002), emotional factors (K003), and social environment factors (K004). Emotional factors are divided into 2 categories, namely the emotional of oneself (K3001), and the emotional of the surrounding environment (K3002). Similar to the K003 category, social environmental factors are also divided into 2 categories, namely environmental factors (K4001) and social factors (K4002). The dependency diagram of the counseling system is shown in Fig. 4.

The last step in creating a KBS system for counseling experts in detecting student problems is to write If-Then rule set 1 to rule set 9. If-Then rule is formed through the elaboration of the results of the reduction of the Decision Table. The writing of If – Then rule set 9 can be seen in Table 4.

Table 2
Causes of student problems.

No.	Cause Code	Cause Description
1	P001	Major not in accordance with interests
2	P002	Major not in accordance with abilities
3	P003	Time management is difficult
4	P004	Mood/emotions change drastically
5	P005	Too many tasks to handle
6	P006	Feeling different from others
7	P007	Variations in lecturers' behavior toward students
8	P008	Limited educational resources
9	P009	The environment is too noisy
10	P010	I'm studying because my parents asked me to
11	P011	Required to consistently excel
12	P012	Having problems with the relevant lecturers
13	P013	More preoccupied with work
14	P014	More concerned with organizational matters
15	P015	Dislikes the lecture schedule
16	P016	Doesn't like the courses
17	P017	The distance between home and campus is too far
18	P018	Frequently encounters travel problems
19	P019	There is inadequate transportation
20	P020	Gaming dependency
21	P021	The hours and rooms for the lectures suddenly changed
22	P022	Sleep-related disorders
23	P023	Missing content
24	P024	Incorrect associations
25	P025	Has limited social interactions
26	P026	Often experiences bullying
27	P027	Lack of self-confidence in abilities
28	P028	Victim of sexual harassment
29	P029	Perpetrators of sexual harassment
30	P030	It is difficult to contact/find supervisors
31	P031	Difficulty in obtaining research materials or data
32	P032	Motivational deficit

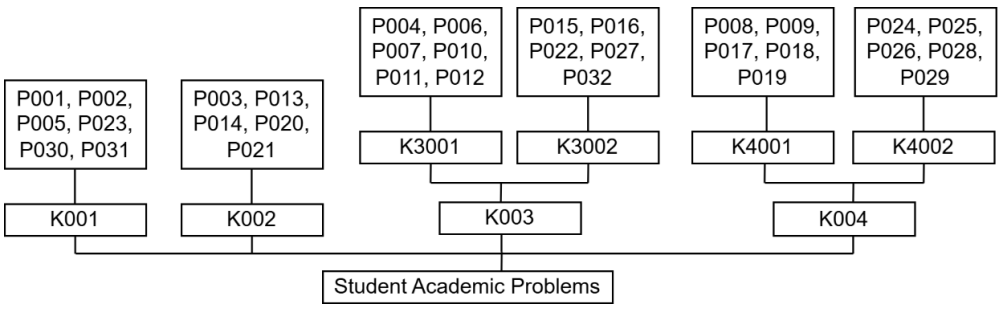

Fig. 3. Student academic problems.

This study applies Forward Chaining in the inference process. The Forward Chaining Step is shown in Fig. 5.

In the Forward Chaining rule process that has been formed, checks will be carried out one by one to find out whether the data being observed has met the premise of the predetermined rule (Hafizal, et al., 2023; Vratiwi, 2023). An example of the Forward Chaining process is shown in Table 5.

Based on the Forward Chaining process that has been carried out in Table 4, it is known that the diagnosis of the student's problem is M001 or Lazy. The Forward Chaining process is carried out by checking all the rules that have been formed. If a rule does not have the same premise as working memory, then the rule is removed from the queue.

3. Results and Discussion

The Student Problem Diagnosis Expert System was created in the form of a website. This is intended so that the expert system can be easily accessed anytime and anywhere. In the expert system for diagnosing

Table 3
Solutions to student problems.

No.	Solution Code	Solution Description
1	S001	Consider changing majors
2	S002	Choose courses related to your interests or abilities
3	S003	Prioritize tasks with the nearest deadlines
4	S004	Maximize your productivity during free time
5	S005	Avoid delaying assigned tasks
6	S006	Maintain mental health
7	S007	Seek support from others
8	S008	Do self-reflection
9	S009	Develop self-confidence
10	S010	Stay focused on learning
11	S011	Maintain good communication with lecturers
12	S012	Utilize available resources effectively
13	S013	Find a quiet location
14	S014	Set the right study time
15	S015	Make plans for the future
16	S016	Set clear goal boundaries
17	S017	Set realistic goals
18	S018	Identify and clarify the issue
19	S019	Identify long-term impacts and then reflect on priorities
20	S020	Set a time limit
21	S021	Learn good time management
22	S022	Seek internal motivation through quotes, videos, and other sources
23	S023	Consider boarding yourself
24	S024	Looking for traveling companions
25	S025	Evaluate the environment to avoid exposure to games
26	S026	Engage in social activities or organizations
27	S027	Establish a consistent sleep schedule
28	S028	Create a comfortable sleeping space
29	S029	Establish boundaries while socializing
30	S030	Develop social skills
31	S031	Try to get out of your comfort zone
32	S032	Don't wait for other people to invite you to hang out
33	S033	Notify the authorities
34	S034	Don't blame yourself
35	S035	Look for a positive environment
36	S036	Avoid looking at or talking about porn
37	S037	Schedule regular meetings with lecturers
38	S038	Make the most of your appointment time
39	S039	Utilize open data sources available online, such as government portals, data repositories, or academic databases
40	S040	Try to make direct observations, analyze documents, or use secondary data from previous research studies
41	S041	Expand data search
42	S042	Find inspiration

student problems, it consists of 2 parts, namely admin and user. The expert system sitemap can be seen in Fig. 6.

On the consultation website, there are two types of user access, namely admin and student. On the admin website page, what can be done by the admin includes:

1) Admins can add, change, and delete data on student problems shown in Fig. 7.
2) Admins can add, change, and delete data on the causes of student problems shown in Fig. 8.
3) Admins can add, change, and remove solutions to student problems shown in Fig. 9.
4) Admins can add, change, and delete the rule data shown in Fig. 10.

On the user dashboard page, students who want to do a consultation must answer questions about the causes of problems that occur to students. After all questions are answered, the system will bring up the results of the diagnosis and solutions to the problems faced by students. The consultation page is shown in Fig. 11, and the consultation results are shown in Fig. 12.

Table 4
If-Then rule set 9.

Rule	If-The
R137	IF P024 = Agree and P025 = Agree and P026 = Agree THEN K4002 Not good.
R138	IF P024 = Agree and P025 = Agree and P026 = Disagree and P028 = Agree THEN K4002 Not good.
R139	IF P024 = Agree and P025 = Agree and P026 = Disagree and P028 = Disagree and P029 = Agree THEN K4002 Not good.
R140	IF P024 = Agree and P025 = Agree and P026 = Disagree and P028 = Disagree and P029 = Disagree THEN K4002 Good.
R141	IF P024 = Agree and P025 = Disagree and P026 = Agree and P028 = Agree THEN K4002 Not good.
R142	IF P024 = Agree and P025 = Disagree and P026 = Agree and P028 = Disagree and P029 = Agree THEN K4002 Not good.
R143	IF P024 = Agree and P025 = Disagree and P026 = Agree and P028 = Disagree and P029 = Disagree THEN K4002 Good.
R144	IF P024 = Agree and P025 = Disagree and P026 = Disagree and P028 = Agree THEN K4002 Not good.
R145	IF P024 = Agree and P025 = Disagree and P026 = Disagree and P028 = Disagree and P029 = Agree THEN K4002 Not good.
R146	IF P024 = Agree and P025 = Disagree and P026 = Disagree and P028 = Disagree and P029 = Disagree THEN K4002 Good.
R147	IF P024 = Disagree and P025 = Agree and P026 = Agree and P028 = Agree THEN K4002 Not good.
R148	IF P024 = Disagree and P025 = Agree and P026 = Agree and P028 = Disagree and P029 = Agree THEN K4002 Not good.
R149	IF P024 = Disagree and P025 = Agree and P026 = Agree and P028 = Disagree and P029 = Disagree THEN K4002 Good.
R150	IF P024 = Disagree and P025 = Agree and P026 = Disagree and P028 = Agree and P029 = Agree THEN K4002 Not good.
R151	IF P024 = Disagree and P025 = Agree and P026 = Disagree and P028 = Agree and P029 = Disagree THEN K4002 Good.
R152	IF P024 = Disagree and P025 = Agree and P026 = Disagree and P028 = Disagree and P029 = Agree THEN K4002 Not good.
R153	IF P024 = Disagree and P025 = Agree and P026 = Disagree and P028 = Disagree and P029 = Disagree THEN K4002 Good.
R154	IF P024 = Disagree and P025 = Disagree and P026 = Agree and P028 = Agree THEN K4002 Not good.
R155	IF P024 = Disagree and P025 = Disagree and P026 = Agree and P028 = Disagree and P029 = Agree THEN K4002 Not good.
R156	IF P024 = Disagree and P025 = Disagree and P026 = Agree and P028 = Disagree and P029 = Disagree THEN K4002 Good.
R157	IF P024 = Disagree and P025 = Disagree and P026 = Disagree and P028 = Agree THEN K4002 Good.
R158	IF P024 = Disagree and P025 = Disagree and P026 = Disagree THEN K4002 Good.

Fig. 12 shows the results of the consultation that has been carried out by the user. The users of this research are students from various study programs, who are taking semester 1 to the final semester, where the student experiences problems in lectures. If the user wants to download the results of the consultation, the user can click the print button. After the print button, the file will be automatically downloaded. The testing of the system is carried out by involving a specialist who is a psychologist. The purpose of this test is to measure the level of conformity of the consultation results of the system that has been created. The test can be done by consulting with different inputs and the results of the consultation will be matched with data from experts. The test table can be shown in Table 6.

Based on Table 6, it can be concluded that from 30 samples of consultation trial data by users, the system can show results that are in accordance with the results of consultation with experts. Therefore. The expert counseling system created is in accordance with expert knowledge.

4. Conclusions

This study concludes that the Counseling Expert System to detect student problems is able to identify problems faced by students while providing suggestions for relevant solutions. The system works based on the answers provided by the user during the consultation process, so the output generated is highly dependent on the accuracy of the user's input. The system test using the Forward Chaining method on 30 problem data samples showed compatibility with the results obtained, proving the reliability of the system in diagnosing problems and providing appropriate recommendations.

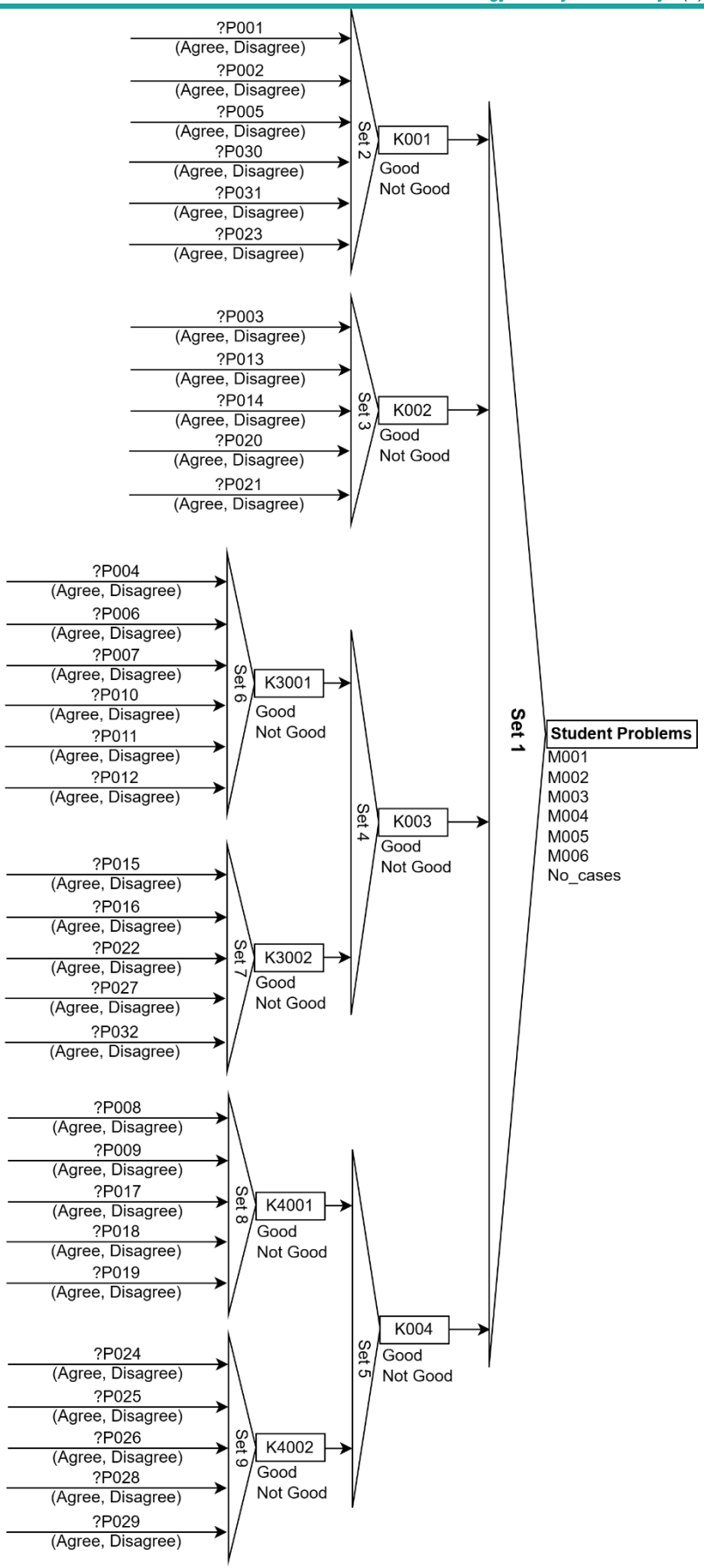

Fig. 4. Decision target diagram.

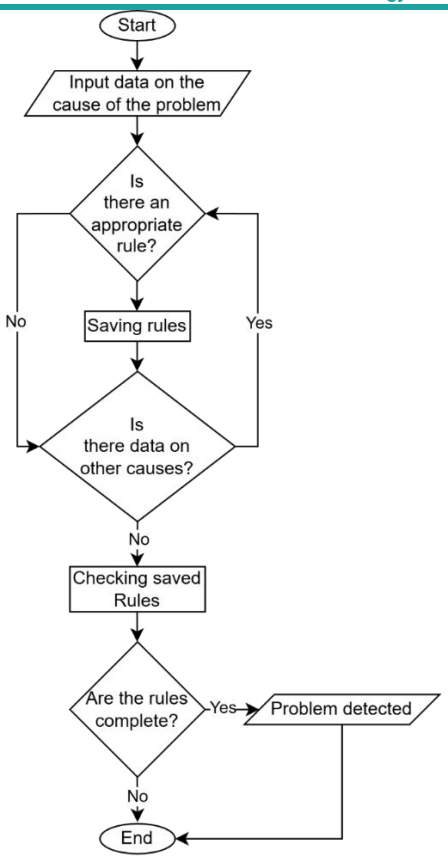

Fig. 5. Forward chaining flowchart.

Table 5
Forward chaining process in the case study.

User Interface	New Facts	Rules	Working Memory
P001?	P001 = Agree	R17-R40 Check rules 17–30 (premise 1 P001 = Agree) according to working memory. Check rules 31–40, not applicable (remove from queue).	P001 = Agree.
P002?	P002 = Disagree	Check rules 17–23, premise 2 does not match (remove from queue). Check rules 24–30, premise 2 according to working memory.	P001 = Agree, P002 = Disagree.
P005?	P005 = Agree	Check rules 24–27, premise 3 according to working memory. Check rules 28–30, premise 3 does not match working memory. Working memory: Then the rule is removed from the queue.	P001 = Agree, P002 = Disagree, P005 = Agree.
P030?	P030 = Disagree	Check rules 24, 25, and 26, premise 4 does not match working memory, then the rule is removed from the queue.	P001 = Agree, P002 = Disagree, P005 = Agree, P030 = Disagree.
P023?	P023 = Disagree	Rule 27, premise 5 corresponds to working memory.	P001 = Agree, P002 = Disagree, P005 = Agree, P030 = Disagree, P023 = Disagree, P031 = Agree, K001 = Good, P003 = Disagree, P013 = Disagree, P014 = Agree, P020 = Agree, P021 = Disagree, K002 = Good, P004 = Agree, P006 = Agree, P007 = Agree, K3001 = Not good, P015 = Agree, P016 = Disagree, P022 = Disagree, K3002 = Good, K003 = Not good, P008 = Agree, P009 = Agree, P017 = Disagree, P018 = Not good, K4001 = Good, P024 = Agree, P025 = Agree, P026 = Disagree, P028 = Disagree, P029 = Agree, K4002 = Not good, K004 = Not good.
| In working memory, it is known that K001 = Good, K002 = Good, K003 = Not good, and K004 = Not good, so the problem experienced by students is M001 (Lazy).			

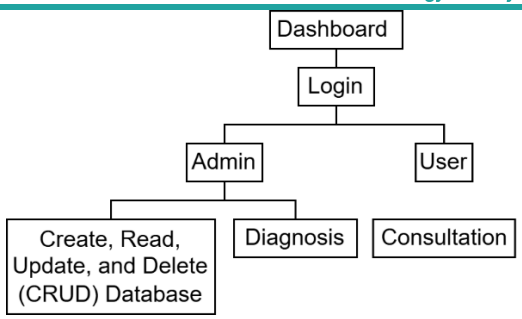

Fig. 6. Expert system sitemap for diagnosing student problems.

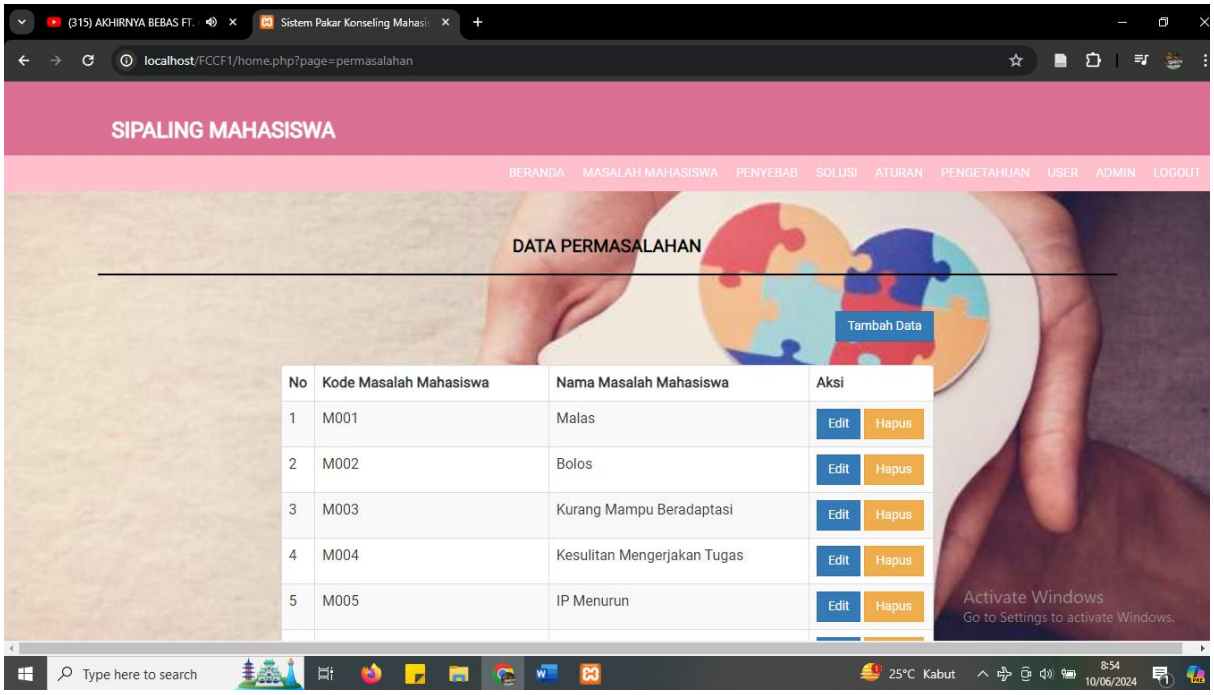

Fig. 7. Problem data view.

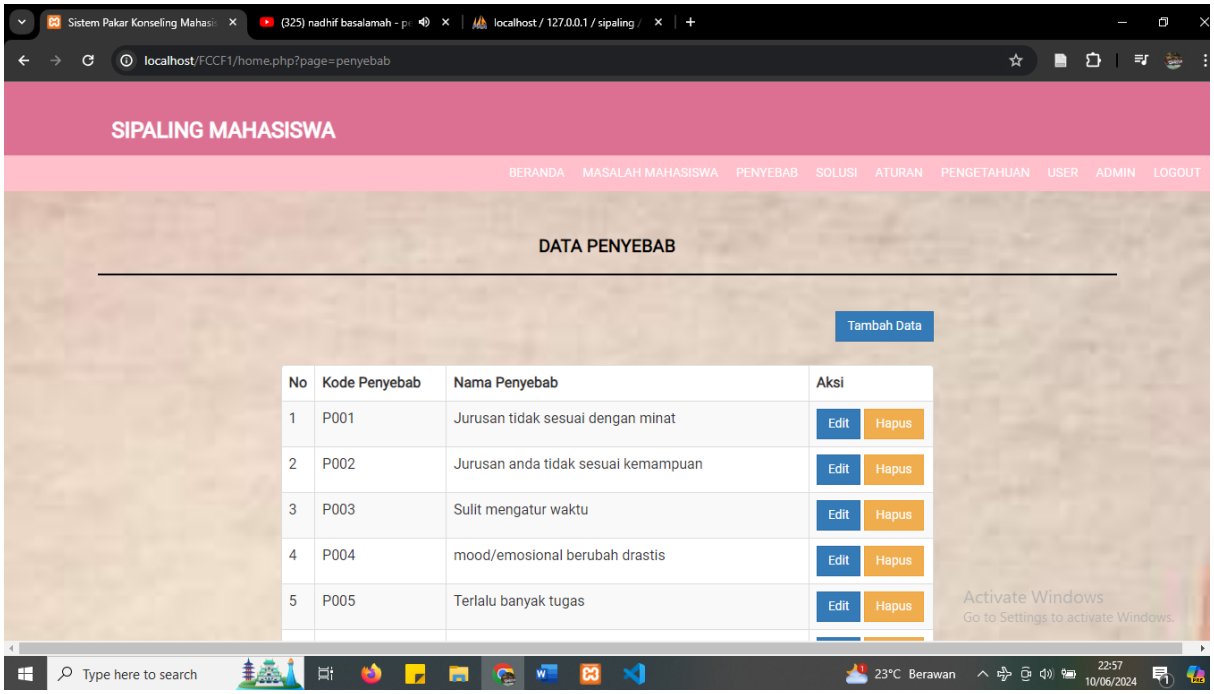

Fig. 8. Cause data view.

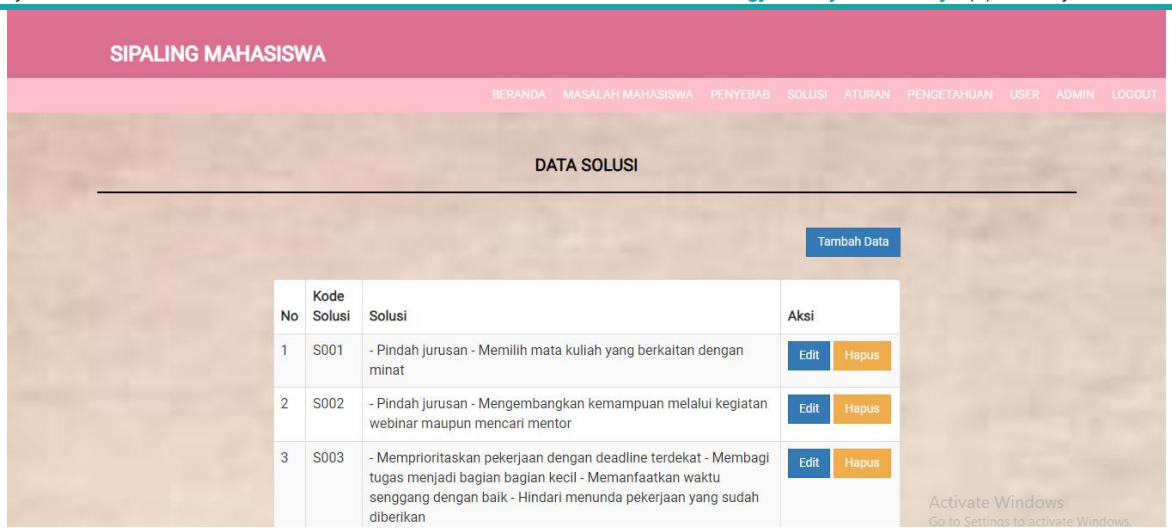

Fig. 9. Solution data view.

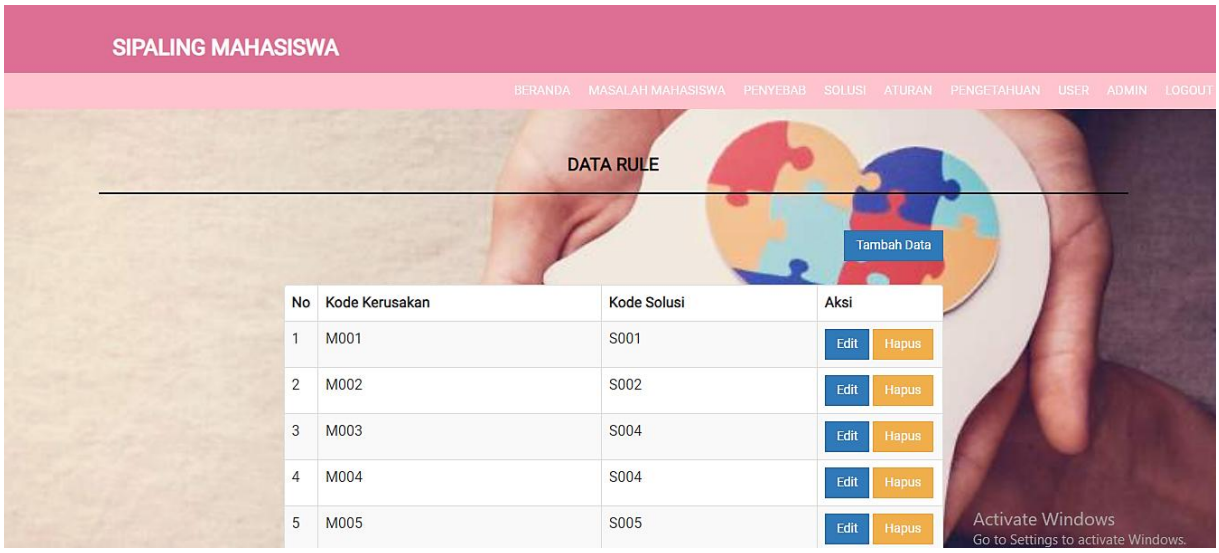

Fig. 10. Rule data view.

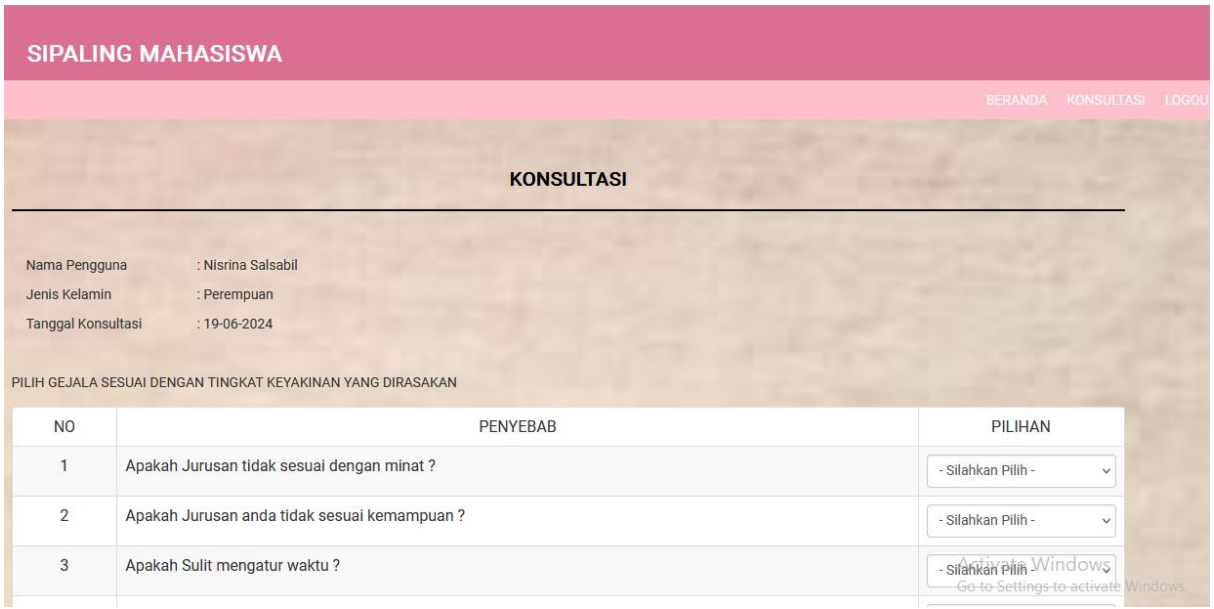

Fig. 11. Student consultation page.

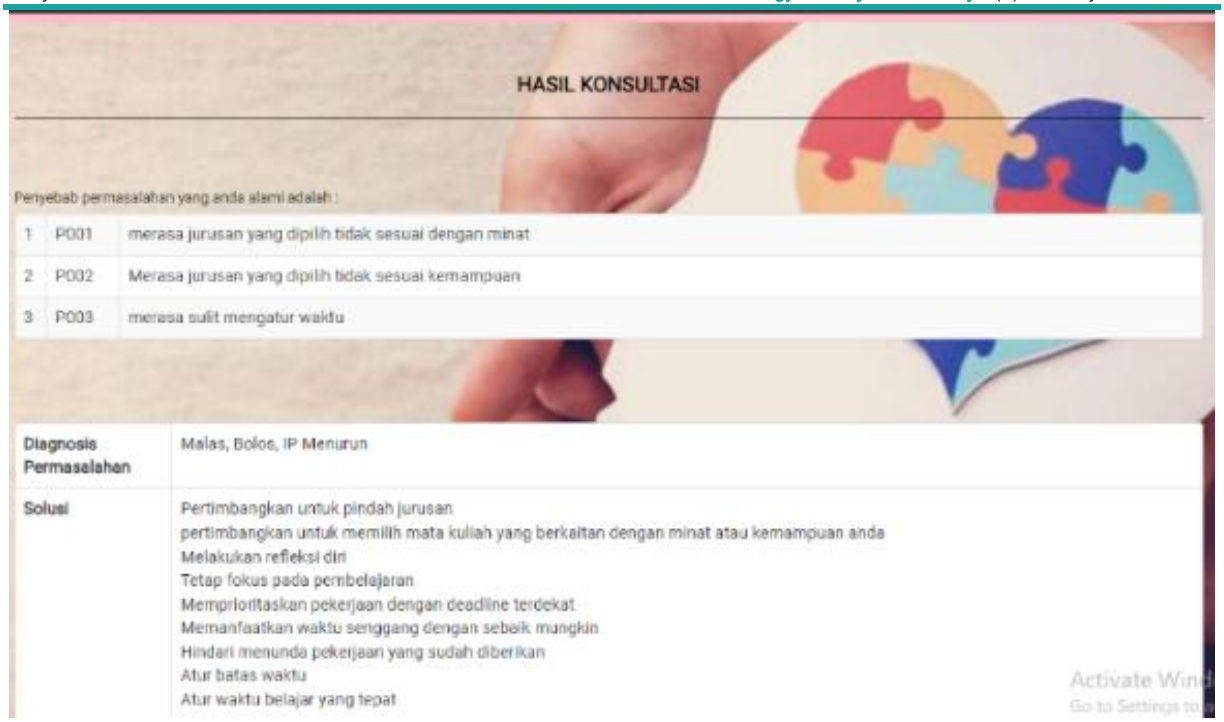

Fig. 12. Consultation results page.

Table 6
Consultation system testing.

No	Cause	System Diagnosis Results	Expert Diagnosis	Results Conformity
1	- Misassociation - Rarely Hang Out	Ability to adapt	Ability to adapt	Valid
2	- Too many tasks - Limited learning facilities - The environment is too noisy	Difficulty completing the final assignment	Difficulty completing the final assignment	Valid
3	- Feeling differentiated from others - There are differences in behavior from lecturers - College because ordered by parents - Required to always excel	Lazy	Lazy	Valid
4	- Dislike the course - The distance from home to campus is too far - Often experiencing travel problems	Skipping class	Skipping class	Valid
5	- Major Not in accordance with interests - The department is not in accordance with the ability	Lazy	Lazy	Valid
6	- Dislike lecture hours - Dislike the course	Decreased GPA	Decreased GPA	Valid
7	- More emphasis on work - More Organizational - Have problems with lecturers	Dropout	Dropout	Valid
8	- Too many tasks - Limited learning facilities	Difficulty completing the final assignment	Difficulty completing the final assignment	Valid

(continued on next page)

Table 6. *(continued)*

No	Cause	System Diagnosis Results	Expert Diagnosis	Results Conformity
	- Lack of confidence in abilities - Lecturers are difficult to meet			
9	- Difficult to manage time - Limited learning facilities - The learning environment is too noisy	Decreased GPA	Decreased GPA	Valid
10	- Inadequate transportation - Game Addiction - Sleep disorders	Skipping class	Skipping class	Valid
11	- Mood/emotional changes drastically - There are differences in lecturers' behavior towards students - Too many tasks - The environment is too noisy - Missing material - Lack of confidence in abilities - The supervisor is difficult to contact or meet	Lazy	Lazy	Valid
12	- Difficult to manage time - Mood/emotional changes often drastically - Required to always excel - More emphasis on work - Dislike of lecture hours - Dislike courses - The distance from home to campus is too far - Experiencing travel problems - Gaming addiction - Sleep disorders - Lack of motivation	Skipping class	Skipping class	Valid
13	- Difficult to manage time - Mood/emotional changes drastically - Too many tasks - More emphasis on work - More organizational - Dislike the course - The distance from home to campus is too far - Often experiencing travel problems - Gaming addiction	Skipping class	Skipping class	Valid
	- Difficult to manage time - Limited learning facilities - The learning environment is too noisy	Decreased GPA	Decreased GPA	Valid
14	- Majors are not according to ability - Mood/emotional changes drastically	Lazy	Lazy	Valid

(continued on next page)

Table 6. *(continued)*

No	Cause	System Diagnosis Results	Expert Diagnosis	Results Conformity
	- Feeling differentiated from others - There are differences in lecturers' behavior towards students - Limited learning facilities - Lecture hours and rooms suddenly changed - Missing material			
15	- The major does not match the interests - Majors are not according to ability - Difficult to manage time - Too many tasks - Required to always excel - Dislike lecture hours - Dislike the course - Inadequate transportation - Lecture hours and rooms suddenly changed - Missing material	Lazy	Lazy	Valid
16	- Difficult to manage time - Mood/emotional changes drastically - There are differences in lecturers' behavior towards students - Dislike lecture hours - Dislike the course - The distance from home to campus is too far - Gaming addiction - Missing material	Skipping class	Skipping class	Valid
17	- Mood/emotional changes drastically - Too many tasks - There are differences in lecturers' behavior towards students - Limited learning facilities - The environment is too noisy - Required to always excel - Have problems with related lecturers - Often a victim of bullying - Misassociation	Lazy	Lazy	Valid
18	- The major does not match the interests - Majors are not according to ability - Difficult to manage time - Mood/emotional changes drastically - Limited learning facilities - Have problems with related lecturers	Lazy	Lazy	Valid

(continued on next page)

Table 6. *(continued)*

No	Cause	System Diagnosis Results	Expert Diagnosis	Results Conformity
	- Often experiencing travel problems			
19	- Too many tasks - More emphasis on work - Dislike the course - Often experiencing travel problems - Inadequate transportation - Lack of confidence in abilities - Missing material - Lecture hours and rooms suddenly changed	Decreased GPA	Decreased GPA	Valid
20	- Difficult to manage time - Mood/emotional changes drastically - Feeling differentiated from others - Dislike the course - Dislike lecture hours - Gaming addiction - Lecture hours and rooms suddenly changed	Skipping class	Skipping class	Valid
21	- The major does not match the interests - Majors are not according to ability - Mood/emotional changes drastically - Feeling differentiated from others - There are differences in lecturers' behavior towards students - College because ordered by parents - Dislike the course - Often a victim of bullying	Lazy	Lazy	Valid
22	- The major does not match the interests - Majors are not according to ability - Difficult to manage time - Mood/emotional changes drastically - Too many tasks - The environment is too noisy - More organizational - Dislike the course	Lazy	Lazy	Valid
23	- Difficult to manage time - Too many tasks - Have problems with related lecturers - More emphasis on work - Often experiencing travel problems - Lecture hours and rooms	Skipping class	Skipping class	Valid

(continued on next page)

Table 6. *(continued)*

No	Cause	System Diagnosis Results	Expert Diagnosis	Results Conformity
	suddenly changed - Missing material - Lack of confidence in his abilities - Difficulty obtaining research materials or data			
24	- There are differences in lecturers' behavior towards students - College because ordered by parents - Required to always excel - Have problems with related lecturers - More emphasis on work - Sexual harassers	Dropout	Dropout	Valid
25	- Limited learning facilities - Have problems with related lecturers - More organizational - Sleep disorders - Rarely get along - Difficulty obtaining research materials or data - Supervisors are difficult to contact/meet	Difficulty completing the final assignment	Difficulty completing the final assignment	Valid
26	- Misassociation - Becoming a victim of bullying - Victims of social harassment - Rarely get along - More emphasis on work - Lack of motivation	Ability to adapt	Ability to adapt	Valid
27	- The major does not match the interests - Majors are not according to ability - There are differences in lecturers' behavior towards students - Limited learning facilities - Dislike lecture hours - Feeling differentiated from others	Lazy	Lazy	Valid
28	- Difficult to manage time - More emphasis on work - Dislike lecture hours - Dislike the course - The distance from home to campus is too far - Lecture hours and rooms suddenly changed - Lack of motivation	Skipping class	Skipping class	Valid
29	- Difficult to manage time - Too many tasks	Skipping class	Skipping class	Valid

(continued on next page)

Table 6. *(continued)*

No	Cause	System Diagnosis Results	Expert Diagnosis	Results Conformity
30	- More organizational - Dislike lecture hours - Inadequate transportation - The distance from home to campus is too far - Lack of motivation - Have problems with related lecturers - More emphasis on work - Dislike lecture hours - Difficult to manage time - Sexual harassers	Dropout	Dropout	Valid

5. CRediT Authorship Contribution Statement

Nisrina Salsabil Rahmawati: Conceptualization, Methodology, Data curation, Investigation, Funding acquisition, Resources, Software, Writing – original draft. **Suastika Yulia Riska**: Conceptualization, Supervision, Validation, and Writing – review & editing.

6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

7. Acknowledgments

The authors would like to thank the anonymous referees for their helpful comments and suggestions.

8. Data Availability

Data will be made available on request.

9. References

Aipassa, E. A., Kusnandar, D., & Imro'ah, N. (2024). Penerapan Algoritma Modified K-Nearest Neighbor (MK-NN) dalam Klasifikasi Kelulusan Mahasiswa (Studi Kasus: Prodi Statistika Universitas Tanjungpura). *Bimaster: Buletin Ilmiah Matematika, Statistika dan Terapannya, 13*(1), 89-98. Retrieved from https://jurnal.untan.ac.id/index.php/jbmstr/article/view/74062

Al Mustaqim, D. (2023). Strategi Terapi Alienasi Ilahiyah Uzlah Ibnu Athaillah untuk Mengatasi Stres Akademik pada Mahasiswa. *Matsnawi: Journal of Tasawwuf and Psychotherapy Studies, 1*(2), 9-31. Retrieved from https://e-journal.syekhnurjati.ac.id/index.php/matsnawi/article/view/223

Amrullah, N. (2021). Perkembangan dan Pendidikan Islam di Kanada. (N. Amrullah, Trans.) *JIPKL: Jurnal Ilmu Pendidikan dan Kearifan Lokal, 1*(1), 14-29. Retrieved from https://jipkl.com/index.php/JIPKL/article/view/2

Andini, A. P., Mauliana, D., & Anggraini, F. R. (2024). Pengaruh Kemampuan Perencanaan Waktu Terhadap Penurunan Stres Akademik Mahasiswa Universitas Airlangga. *Musytari: Neraca Manajemen, Akuntasi, Ekonomi, 12*(7), 1-10. Retrieved from https://ejournal.warunayama.org/index.php/musytarineraca/article/view/9066

As Siddieq, M. F. (2024). Sistem Pakar Diagnosa Depresi Mahasiswa Tingkat Akhir dengan Metode Certainty Factor dan Forward Chaining. *Kohesi: Jurnal Multidisiplin Saintek, 3*(7), 1-10. Retrieved from https://ejournal.warunayama.org/index.php/kohesi/article/view/3715

Barus, A., Liem, I., Sihombing, T., Sinaga, A., Sinambela, E., & Silalahi, S. (2023). Dispositions as an Important Component in Computing Curriculum in IT Del. *2023 IEEE International Conference on Data and Software Engineering (ICoDSE)* (pp. 85-90). Toba, Indonesia: IEEE. doi:https://doi.org/10.1109/ICoDSE59534.2023.10291337

Chani, N. P. (2022). Identifikasi BTS terhadap Penggunaan Listrik dengan Mengunakan Metode Forward Chaining. *Jurnal Sistim Informasi dan Teknologi, 4*(2), 36-41. doi:https://doi.org/10.37034/jsisfotek.v4i2.119

da Costa Câmara, L. S., & Sari, R. D. (2021). Penerapan Metode Backward Chaining untuk Mendiagnosa Gangguang pada Tanaman Padi (Studi kasus di Subdistrik Natarbora Timor-Leste). *JITET: Jurnal Inovasi Teknologi dan Edukasi Teknik, 1*(10), 715-723. doi:https://doi.org/10.17977/um068v1i102021p715-723

Desnelita, Y., Irwan, I., & Gustientiedina, G. (2022). *Model Rekomendasi Karir Mahasiswa Sistem Informasi Menggunakan Sistem Pakar.* Yogyakarta, Indonesia: Samudra Biru.

Divjak, B., Rienties, B., Iniesto, F., Vondra, P., & Žižak, M. (2022). Flipped classrooms in higher education during the COVID-19 pandemic: findings and future research recommendations. *International Journal of Educational Technology in Higher Education, 19*(9). doi:https://doi.org/10.1186/s41239-021-00316-4

El Mrabet, H., & Ait Moussa, A. (2021). IoT-school guidance: A holistic approach to vocational self-awareness & career path. *Education and Information Technologies, 26*, 5439–5456. doi:https://doi.org/10.1007/s10639-021-10548-6

Eva, N., Shanti, P., Hidayah, N., & Bisri, M. (2020). Pengaruh Dukungan Sosial terhadap Kesejahteraan Psikologis Mahasiswa dengan Religiusitas sebagai Moderator. *Jurnal Kajian Bimbingan dan Konseling, 5*(3), 122-131. doi:https://doi.org/10.17977/um001v5i32020p122

Hafizal, M. T., Putra, D. P., Wirianata, H., Nugraha, N. S., Suparyanto, T., Hidayat, A. A., & Pardamean, B. (2023). Implementation of expert systems in potassium deficiency in cocoa plants using forward chaining method. *Procedia Computer Science, 216*, 136-143. doi:https://doi.org/10.1016/j.procs.2022.12.120

Han, H. (2023). Fuzzy clustering algorithm for university students' psychological fitness and performance detection. *Heliyon, 9*(8). doi:https://doi.org/10.1016/j.heliyon.2023.e18550

Hawes, D., & Arya, A. (2023). Technology Solutions to Reduce Anxiety and Increase Cognitive Availability in Students. *IEEE Transactions on Learning Technologies, 16*(2), 278-291. doi:https://doi.org/10.1109/TLT.2023.3239985

Hidayat, M. N., Baharun, H., Aisyah, E. N., Zaini, A. W., Sanjani, M. A., & Hasanah, R. (2024). Bridging the Digital Divide: The Role of Public Relations in Enhancing Digital Inclusivity. *2024 10th International Conference on Education and Technology (ICET). 10*, pp. 59-66. Malang, Indonesia: IEEE. doi:https://doi.org/10.1109/ICET64717.2024.10778472

Hutauruk, M. R., Sutarmo, Y., & Bachtiar, Y. (2022). *Metodologi Penelitian untuk Ilmu Sosial Humaniora dengan Pendekatan Kuantitatif: Proposal, Kegiatan Penelitian, Laporan Penelitian.* Jakarta, Indonesia: Salemba Empat.

Iatrellis, O., Stamatiadis, E., Samaras, N., Panagiotakopoulos, T., & Fitsilis, P. (2023). An intelligent expert system for academic advising utilizing fuzzy logic and semantic web technologies for smart cities education. *Journal of Computers in Education, 10*, 293–323. doi:https://doi.org/10.1007/s40692-022-00232-0

Juliawan, I. W., Qondias, D., Suastini, N. W., Sucipto, I. M., Badriyah, R. D., & Pucangan, K. R. (2023). Pemahaman Mahasiswa Terhadap Aktivitas Merdeka Belajar Kampus Merdeka. *Jurnal Ilmiah Pendidikan Citra Bakti, 10*(2), 260-273. doi:https://doi.org/10.38048/jipcb.v10i1.951

Li, L. (2024). Reskilling and Upskilling the Future-ready Workforce for Industry 4.0 and Beyond. *Information Systems Frontiers, 26*, 1697-1712. doi:https://doi.org/10.1007/s10796-022-10308-y

Liu, Q., & Liao, X. (2021). Research on University Mental Health Education Based on Computer Big Data Statistical Analysis. *2021 2nd International Conference on Big Data and Informatization Education (ICBDIE). 2*, pp. 29-34. Hangzhou, China: IEEE. doi:https://doi.org/10.1109/ICBDIE52740.2021.00015

Mudrikah, S., Suherman, U., & Yustiana, Y. R. (2024). Peran Bimbingan dan Konseling dan Pengembangan Karir (BKPK) di Universitas dalam Mempersiapkan Karakter Bangsa Menuju Generasi Emas 2045. *Jurnal Ilmiah Ilmu Pendidikan (JIIP), 7*(3), 3374-3382. doi:https://doi.org/10.54371/jiip.v7i3.3750

Nugroho, P. W., & Nurdahlia, D. U. (2024). Pengembangan Model Tata Kelola Layanan Bimbingan dan Konseling Online Berbasis Website. *Southeast Asian Journal of Islamic Education Management, 5*(2), 187-208. doi:https://doi.org/10.21154/sajiem.v5i2.356

Permana, A. A., Hartati, R. S., Sudarma, M., Sukarsa, I. M., Ardinata, P. M., & Suranata, K. (2023). Digital Counseling for Cases of Resilience in Students Using the LSTM Model. (pp. 121-126). Badung, Bali, Indonesia: IEEE. doi:https://doi.org/10.1109/ICSGTEIS60500.2023.10424190

Putri, S. D., Maulana, H., & Aditiawan, F. P. (2024). Sistem Pakar Diagnosa Kesehatan Mental Mahasiswa Tingkat Akhir. *JATI: Jurnal Mahasiswa Teknik Informatika, 8*(3), 4118-4128. doi:https://doi.org/10.36040/jati.v8i3.9849

Quinlan, K. M., & Renninger, K. A. (2022). Rethinking employability: how students build on interest in a subject to plan a career. *Higher Education, 84*, 863-883. doi:https://doi.org/10.1007/s10734-021-00804-6

Rasouli, S., Ghafurian, M., Nilsen, E. S., & Dautenhahn, K. (2024). University Students' Opinions on Using Intelligent Agents to Cope with Stress and Anxiety in Social Situations. *Computers in Human Behavior, 153*. doi:https://doi.org/10.1016/j.chb.2023.108072

Robertson, N., Gunn, S., & Piper, R. (2022). The Experience of Self-conscious Emotions in Inflammatory Bowel Disease: A Thematic Analysis. *Journal of Clinical Psychology in Medical Settings, 29*, 344–356. doi:https://doi.org/10.1007/s10880-021-09778-0

Setiawan, A., Tristono, T., & Susila, C. B. (2024). Sistem Pakar Dan Layanan Konsultasi Kesehatan Mental Remaja Menggunakan Metode Forward Chaining Berbasis Website. *Pilar Teknologi: Jurnal Penelitian Ilmu-ilmu Teknik, 9*(1), 81-90. doi:https://doi.org/10.33319/piltek.v9i1.150

Setiyadi, Y., Hakim, I. A., Syahdan, M., Amalia, A. R., & Saifudin, A. (2024). Sistem Pakar Untuk Diagnosa Gaya Belajar Mahasiswa Dengan Metode Backward Chaining. *Jurnal Artificial Inteligent dan Sistem Penunjang Keputusan, 1*(4), 250-256. Retrieved from http://jurnalmahasiswa.com/index.php/aidanspk/article/view/906

Shminan, A. S., Choi, L. J., Barawi, M. H., Hashim, W. N., & Andy, H. (2021). InVesa 1.0: The Conceptual Framework of Interactive Virtual Academic Advisor System based on Psychological Profiles. *2021 13th International Conference on Information & Communication Technology and System (ICTS). 13*, pp. 112-117. Surabaya, Indonesia: IEEE. doi:https://doi.org/10.1109/ICTS52701.2021.9608182

Singh, M., Bharti, S., Kaur, H., Arora, V., Saini, M., & Kaur, M. (2022). A Facial and Vocal Expression Based Comprehensive Framework for Real-Time Student Stress Monitoring in an IoT-Fog-Cloud Environment. *IEEE Access, 10*, 63177-63188. doi:https://doi.org/10.1109/ACCESS.2022.3183077

Siregar, D. K., & Syarqawi, A. (2024). Efektivitas layanan informasi dengan teknik modeling untuk meningkatkan aspirasi karir pada siswa sekolah menengah atas. *Jurnal EDUCATIO : Jurnal Pendidikan Indonesia, 10*(1), 757-765. Retrieved from https://jurnal.iicet.org/index.php/j-edu/article/view/4533

Sølvik, R. M., & Glenna, A. E. (2022). Teachers' potential to promote students' deeper learning in whole-class teaching: An observation study in Norwegian classrooms. *Journal of Educational Change, 23*, 343–369. doi:https://doi.org/10.1007/s10833-021-09420-8

Su, S.-W., Hung, C.-H., Chen, L.-X., & Yuan, S.-M. (2024). Development of an AI-Based System to Enhance School Counseling Models for Asian Elementary Students With Emotional Disorders. *IEEE Access, 12*, 159121-159136. doi:https://doi.org/10.1109/ACCESS.2024.3483456

Sugitha, I. P., Bachtiar, F. A., & Wicaksono, S. A. (2024). Application of Students Graduation Prediction Model Using Decision Tree C4.5 Algorithm and Synthetic Minority Oversampling Technique (SMOTE). *2024 Seventh International Conference on Vocational Education and Electrical Engineering (ICVEE)* (pp. 175-181). Malang, Indonesia: IEEE. doi:https://doi.org/10.1109/ICVEE63912.2024.10823806

Su-Kubricht, L. P., Chen, H.-M., Guo, S., & Miller, R. B. (2024). Towards Culturally Sensitive Care: Addressing Challenges in Asian and Asian American Mental Health Services. *Contemporary Family Therapy*. doi:https://doi.org/10.1007/s10591-024-09716-w

Suryawati, C. T., Kholili, M. I., Susilo, A. T., Asrowi, A., & Surur, N. (2024). Enhancing Effectiveness of Guidance and Counseling Services Through Web-Based Interactive Media. *Ingénierie des systèmes d'Information, 29*(1), 37-48. doi:https://doi.org/10.18280/isi.290105

Susanti, S., Harahap, H. H., Rambe, J. P., Daulay, S. A., & Berutu, D. N. (2024). Pemahaman Materi Pembelajaran dalam Sistem Sks di Sekolah MAN 1 Medan. *ISTIQRA: Jurnal Hasil Penelitian, 12*(2), 287-301. Retrieved from https://jurnal.uindatokarama.ac.id/index.php/ist/article/view/3130

Sutopo, A. H. (2024). *Horison Digital: Mengubah Keterlibatan Mahasiswa di Kampus Global.* Tangerang Selatan, Indonesia: Topazart.

Tajrin, T., Pelupessy, P. R., Manaha, R. R., Tuhuteru, H., Sumah, J., Nivaan, G. V., . . . Rozy, A. (2024). *Konsep Dasar Sistem Pakar.* Payakumbuh, Indonesia: Serasi Media Teknologi.

Truong, V. P., & Nguyen, Q. H. (2023). A Knowledge-Based Consultant Student System Using Reasoning Techniques for Selection of Courses in Smart University. *Proceedings of International Joint Conference on Advances in Computational Intelligence (IJCACI 2022)* (pp. 597–605). New Delhi, India: Springer. doi:https://doi.org/10.1007/978-981-99-1435-7_49

Vratiwi, S. (2023). Perancangan Sistem Pakar Analisa Masalah Pada Kulit Wajah Menggunakan Metode Forward Chaining. *JoMMiT: Jurnal Multi Media dan IT, 7*(1), 1-8. doi:https://doi.org/10.46961/jommit.v7i1.735

Wahid, M. N. (2021). *Sistem Pakar Diagnosa Insomnia pada Mahasiswa Tingkat Akhir Universitas Islam Riau dengan Metode Forward Chaining Berbasis Web.* Pekanbaru, Indonesia: Universitas Islam Riau.

Wójcik, M., & Rzeńca, K. (2021). Disclosing or Hiding Bullying Victimization: A Grounded Theory Study From Former Victims' Point of View. *School Mental Health, 13*, 808–818. doi:https://doi.org/10.1007/s12310-021-09447-5

Yanti, S. N., & Budiyati, E. (2020). Aplikasi Sistem Pakar untuk Mendiagnosa Virus Covid-19 pada Manusia Berbasis Web Menggunakan Metode Forward Chaining. *Jurnal Informatika Universitas Pamulang (JIUP), 5*(4), 451-458. doi:https://doi.org/10.32493/informatika.v5i4.4944

Zaelani, M. (2024). *Sistem pakar deteksi dini tingkat stres mahasiswa terhadap tugas akhir menggunakan metode forward chaining dan certainty factor berbasis android.* Tangerang Selatan, Indonesia: Universitas Islam Negeri Syarif Hidayatullah. Retrieved from https://repository.uinjkt.ac.id/dspace/handle/123456789/76967