Digital Counseling for Cases of Resilience in Students Using the LSTM Model

1st Agus Aan Jiwa Permana
Faculty of Engineering and Vocational
Universitas Pendidikan Ganesha
Buleleng, Indonesia
agus.aan@undiksha.ac.id

2nd Rukmi Sari Hartati
Faculty of Engineering
Udayana University
Denpasar, Indonesia
rukmisari@unud.ac.id

3rd Made Sudarma
Faculty of Engineering
Udayana University
Denpasar, Indonesia
imadesudarma@unud.ac.id

4th I Made Sukarsa
Faculty of Engineering
Udayana University
Denpasar, Indonesia
sukarsa@unud.ac.id

5th Pande Made Sindu Ardinata
Faculty of Engineering and Vocational
Universitas Pendidikan Ganesha
Buleleng, Indonesia
pande.sindu@undiksha.ac.id

6th Kadek Suranata
Guidance and Counseling Program
Universitas Pendidikan Ganesha
Buleleng, Indonesia
kadek.suranata@undiksha.ac.id

***Abstract*—Indonesia is moving towards becoming a developed country, so preparing human resources is very important. Especially for mental health. One of them is student resilience in Indonesia. Surveys show that 10–20% of Indonesian teenagers experience mental disorders, as well as the impact of COVID 19. The aim of this research is to determine the level of student resilience. If resistance is low then counseling is immediately carried out. Counseling is inflexible and not private so many students don't do it. This causes counseling not to occur. Apart from school hours being busy with intra and extra curricular activities, students' time to participate is limited. School counselors need to conduct counseling by utilizing technology to make the counselor's work easier. It is necessary to develop a digital counseling model for resilience cases based on deep learning. The method used is long short-term memory (LSTM). In deep learning, it is necessary to set hyper parameter values. In this case, it uses 128 neurons, 2 layers, learning rate 0.001, and epoch 10. This model has been tested and can help counselors identify the level of student resilience with training accuracy of 94% and testing accuracy of 96% with comparison of training and testing data (80% : 20%).**

Keywords—resilience, digital, counseling, model, LSTM

I. INTRODUCTION

Indonesia is a beautiful country with a diversity of cultures and biological resources. With a population of nearly 300 million people, it will further strengthen Indonesia's aspirations to become a developed country. The government has issued several strategic plans for health, education, maritime affairs, agriculture, plantations, and renewable energy. However, there is one national asset that must receive special attention, namely child development. These children will inherit the next 20 years of progress. By entering free competition, children need to be prepared both in knowledge and mentally [1].

An aspect of children's mental development that is important to know is their mental resilience [2]. There are several potential factors to increase student resilience, as well as their relationship to anxiety and social resources already in use in Japan [1]. Given the hard and challenging life there, the child's mental resilience must be well guarded.

When a child enters a new environment, a lot of new things can be learned. Like meeting friends, meeting teachers, meeting places, and knowing habits and challenges different from the conditions he experienced in the past. It is assumed that a primary school child rises to high school first, and of course, there are a lot of changes in him both personally and in his hormones as well as his appetite [3]. It is impossible for a teacher to equalize the condition of all children because they come from different families, both in terms of economics, comfort, gender, age, and the role of parents [4]. So the values in school cannot be used as a benchmark to determine that the child is intelligent and has high resilience.

The fact that the Indonesian educational system employs grades to assess students' learning outcomes contributes to the widespread belief that a child who performs well in school also receives good grades [5] The important thing should be to see the child's process of going through challenges in his life following learning at school, surviving to solve all existing challenges, and being able to reduce the anxiety that burdens a child's life because of fear of failure. Students need to receive character and mental education so that they have a strong mentality when they graduate [6]. So to improve mental strength, one way is to use counseling at school. More guidance and counseling teachers in schools, especially in Indonesia, are unemployed or do not play much of a role, perhaps in some schools their numbers are very limited so they cannot provide services to large numbers of students[7].

In the current era, this should not happen again because technology can help. school counselors in Indonesia have a challenge to help students with efficiency. One solution is to use digital counseling, which can be internet-based, which is a new method [8]. However, in practice, Indonesian school counseling needs to be examined for its effectiveness and feasibility. For the counseling process to run effectively, a digital counseling model is needed that can help provide appropriate and effective decisions for conducting student mental health analysis, especially in terms of resilience. Education that is full of pressure requires academic resilience, and it is important for students who need measuring tools to determine it [9]. This can be used to uncover this study as well as reveal the need for students to learn effective learning mechanisms and develop life skills to build and strengthen resilience and improve their mental well-being [10]. Understanding their academic resilience experiences can provide important insights to maximize their learning and enhance their academic achievement [11].

Based on previous research that developed e-counseling using questionnaires, it still places the burden on counselors to analyze the results of the questionnaires one by one. Regarding the problems faced, a consultant who can examine hundreds of questionnaire results will require quite a lot of time. Counselors as humans can also feel tired and in a bad mood which can disrupt the assessment process and become less objective. So this research can be carried out assisted by using models. The model that will be developed is AI based. With the development of artificial intelligence, a model can be developed to help counselors in schools.

The presence of AI will impact digital services for individuals and enrich existing literature regarding the use of digital service technology.This provides practical implications for practitioners to better design and develop AI-based models to enhance smart services [12]. With regard to mental health, a lot of research has been done with AI. The deep learning approach is LSTM. Small short-term memory networks (LSTMs) use Swish as an activation function to predict the intensity of depression. We conducted extensive experiments to demonstrate the effectiveness of this method. Based on previous experiments, as they are still in the same research on mental health that is still associated with depression, the authors tried to develop a model to help consultants analyze the test results spread by the lift in a short time.

II. LITERATUR REVIEW

A. Children's Mental Health

Mental health is defined as the promotion of positive physical, mental, and social wellbeing [13]. Mental health is important to maintain in order to stay healthy. Everyone desires good health, especially mental health. If a person has a good mental condition, he will be able to interpret life, enjoy life, appreciate the surrounding environment, and have a feeling of calm and serenity. As in the slogan, With a healthy body, there is a healthy mind too. It means that we always have to keep our minds in good condition and healthy.

Because children who have a good mentality, can manage stress, don't panic easily, don't get nervous, and aren't easily influenced will be able to have a more enjoyable day[14]–[16]. They can solve academic problems and challenges in life. Able to explore deeper potential, have good competence, and be able to avoid bad environmental influences. Able to control emotions well when dealing with friends, teachers, and the school environment. With a good mentality, learning at school is also easier to accept. Good mental resilience will bring many positive influences to the child.

The surprising thing during a pandemic is research [17] By involving 235 respondents, the results of this research were truly surprising and revealing 99 people had mild anxiety, 38 people had moderate anxiety, 60 people had mild stress, and 14 people had mild depression due to learning during the pandemic. This case shows that the level of mental resilience is very fragile.

Adolescent students at the high school level usually experience hormonal fluctuations and changes in attitude, so they require special attention. These changes can affect attitudes, character, achievements, or other things in school and personal life. Research data that has been conducted shows that students who experience increased stress can then have poor academic grades and emotional problems [18].

High school students, especially, experience many changes in the environment, body and hormonal changes commonly experienced by teenagers. The changes that occur can affect levels of stress, anxiety and depression. This is experienced by students in various countries which can hinder academic activities [19]. Students need to receive scheduled counseling guidance by utilizing counseling technology to make it easier to provide services and immediately provide solutions to students' mental problems [19].

This mental health problem is also faced in various countries, not just Indonesia. Some people experience severe depression that makes them isolate themselves from others, drop out of school, or, even worse, commit suicide. So that in Malaysia, remote mental health monitoring research has been developed to help facilitate early intervention and refer to counseling sessions to seek psychiatric help [20][13].

Research in Selangor, Malaysia found that 9.2% of students had a negative mood. 5% have interpersonal problems. 8.3% limited effectiveness. 9.8% suffered from anhedonia, and 10.6% had negative self-esteem. Facts in the field show that female students experience stress more easily than male students [21]. Research in Selangor, Malaysia, found that in the results for the scores for the five factors, 9.2% had a negative mood. 5% have interpersonal problems. 8.3% had ineffectiveness. 9.8% had anhedonia, and 10.6% had negative self-esteem. Female students are more stressed than male students [22].

B. Digital Counseling Model

The current condition of the problems faced is increasingly complex, so it takes a short time to think, analyze, and make observations to make the right decisions. Humans as social beings are busy with world affairs at work, their environment, careers, and personal matters that require a touch of technology. So that nowadays many digital terms appear, such as e-health, e-mail, e-learning, and even e-counseling.

E-counseling has just emerged and has been widely discussed about its existence, which is said to have not been able to replace a counselor or psychologist. From the many references that discuss this, the authors can say that e-counseling is digital-based counseling that is used to make the work of psychologists or counselors easier.

E-counseling has been widely developed to assist counselors in providing counseling services, especially over long distances. Ease of obtaining data and fast calculations were the main things in this technology before the emergence of AI. AI then gives new hope to digital counseling with its ability to recognize data according to cases that occur and offer effective decisions to counselors in conducting counseling.

So that digital counseling can be used in collecting data, analyzing cases, and making decisions. How to do that. This can be done with the combination of multi-criteria decision assistance (MCDA) and artificial intelligence (AI), which is increasingly being used in the decision-making of complex real-world problems [23].

This is even easier to do with deep learning. Research [24] model by starting to fetch data from Twitter, labeling it, and doing the learning in a supervised way. The model developed here is to assist counselors in making decisions based on questionnaire data distributed to students with several criteria, labeling the data according to their level of resilience, and then conducting training in a supervised manner to be able to recognize this data. Why is this model needed to help

counselors? Because students who have to attend counseling number in the hundreds, the time needed for effective decisions is short. When checking the results of counseling, the counselor may be in an unfit condition, having problems with someone, or not in the mood, so this model can be used as a tool to assist counselors in making the right decisions depending on the cases in the field.

C. Academic Resilience

Resilience is a person's ability to recover from problems, be optimistic and enthusiastic about facing the future. Resilience also means the ability to overcome life's stresses to continue acting positively. Students who have a high level of resilience tend to have better problems solving abilities. Students also have good resilience in facing challenges, are able to maintain good mental and emotional health. Based on this description, resilience is needed which allows people to be able to adapt well in the face of difficulties, trauma, tragedy, threats or other sources of stress [25].

Factors that influence the level of student resilience are social support from family and friends, gender, the ability to solve problems, adapt to change, think positively towards oneself and others, and be able to regulate emotions. So the process of cultivating resilience must receive support from all parties, including teachers, parents and the environment. This resilience is what later known as academic resilience. [25].

The current development of information makes students critical, intelligent, free of opinion, bored quickly, and unable to directly see problems in the real world, so they need to be given good mental education. Because mentally strong people can face all kinds of situations under the pressure of life, which is dynamic and changes at any time and in a variety of environments, Resilience is also not a matter of the value written on the report card but of the actions taken when experiencing problems to get that value. So don't let academic stress arise. Under these conditions, it is necessary to develop programs to improve academic resilience, and students' mental health status must also be considered in this research [13], [26]–[29]. Looking at the current phenomenon, individuals interact more with cyberspace than socializing. With low levels of direct social interaction, teenagers are vulnerable to unpleasant treatment on social media, so they need to instill resilience to grow self-confidence, solve problems, overcome challenges, and be free from panic and stress. So he can resist negative influences on himself and his environment [30].

D. Counseling Program

With various cases that occur in students who commit a lot of deviant acts, drink alcohol, use drugs, and engage in bad behavior at school and at home, it is proof that they are having mental problems. When studying at school, children have different abilities, including different comprehension abilities. It's difficult to control, to be given positive understanding, and to do bad things to friends and teachers at school. This is even worse if they have the wrong association and get radical doctrines that oppose human values. Schools are required to provide counseling services to students through a counselor who helps students solve personal, social, academic, or emotional problems. Counselors can conduct interviews, observations, tests, and group discussions to help students understand problems and find ways to solve them. To improve counseling, Turkey has formed counseling volunteers to provide services both in person and online [31]. With the problems faced by a person at school, work environment or residence when conditions cannot adapt to situations, causing discomfort, anxiety, stress, which if prolonged will lead to depression. Many studies have shown that personal or family problems can trigger stress [32][33][29].

There are stages or ways of doing counseling, such as face-to-face and online. The face-to-face stage is considered conventional and is usually reserved for patients with severe conditions. Along with technological developments, consultations are now able to use chat, email, and questionnaires. However, these stages can be carried out according to the patient's condition; the most important thing is to know the initial condition of the patient's mental health so that it can proceed to the next, such as therapy [34], [35][36], [37].

III. Development of a Digital Counseling Model for Resilience

The development of a digital mental health counseling model for students is a process that has stages. Currently, the process of developing this model involves several entities, such as counselors who are teachers in schools, researchers, students, and schools. This process has steps, and each stage will be explained in more detail. The general procedure for developing this model in detail can be seen in Fig.1.

The objectives of this research are specific, measurable, and achievable. This will help in determining the features and functions of the digital counseling model that will be developed. It is clear here that this model was developed for robustness. The data collection process was carried out in two secondary schools, in SMP Negeri 2 Kubutambahan and SMP Negeri 3 Singaraja, Buleleng Regency, Bali, Indonesia. In the 2017–2018 academic year it took approximately 3 months [38].

A. Data Analysis and Collection

After the data is collected, the next step is to analyze it. The remaining 280 data were directly provided by the author in previous research. Resilience data in previous research was collected using student self-reporting on a resilience scale.

Students choose one of four alternative answers for each question on the questionnaire, namely inappropriate (TS); not quite right (KS); quite suitable (CS); and very precise (SS). Each item was scored 1 for TS responses, 2 for KS, 3 for CS, and 4 for SS.

The resilience scale used in this research is the Indonesian version of the psychological subscale Resilience Youth Development Module (RYDM) for Secondary Schools. Based on existing data at that time, labeled by experts according to their level of resistance. Based on this, all data is processed first so that it can be used in the training process.

B. Model Development Process

After the After the data has been analyzed, the next step is to design a digital counseling model as shown in Fig. 1, the data collection process at school then the data is validated by a researcher who is also a counseling expert. Then through pre-

processing to form a dataset, so that it can be studied by machines, data normalization is carried out, then the LSTM-based model is developed, the dataset is ready to be trained and tested to find the best accuracy.

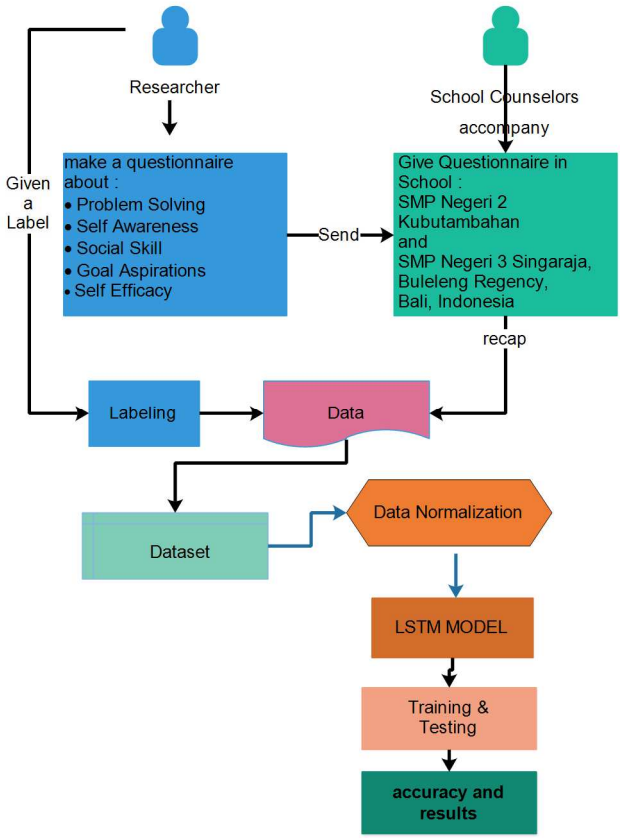

Fig. 1. Stages of Digital Counseling Model Development for Resilience

After the LSTM based model has been successfully developed, its feasibility is first tested by setting parameters such as learning rate, selecting the activation function, and displaying the number of epochs. This method is to check whether the model being developed can run well. This research experienced problems with accuracy in hyperparameter settings. Table 1, shows the hyperparameter settings in the architecture two layers with epoch reaching 100 which is the initial setting.

After getting the appropriate hyperparameter settings, the training process is then carried out. After the data pattern can be learned by the machine, testing is then carried out. The testing process is carried out to determine whether the model developed is in accordance with the initial aims and objectives. The important thing is to get the best accuracy and test results according to the author's expectations.

IV. Method

In the model development process, this research uses several approaches and methods. The method will be described in detail in the following discussion.

A. Dataset Formation Process

The data collection process used a method, namely conducting field observations, which the author carried out by coming to the school and communicating with the counselor. After that, the author gave the questionnaire to the counselor to help distribute it to class VII students. Students fill out the questionnaire accompanied by a counselor to make it easier when problems arise and they don't understand the instructions. The questionnaire has 14 question items with values 1–4. The total data provided from previous research is 280 data. The participant's respond to the scale by selecting one of four response alternatives to each question, namely inappropriate (TS); less appropriate (KS); sufficiently appropriate (CS); and very appropriate (SS). Each item is scored 1 for a TS response, 2 for KS, 3 for CS and 4 for SS [38]. Based on these 280 datasets, it is then normalized to a value of 0–1 to facilitate machine learning. Normalization formula in Eq. 1 [39].

$$Xnorm = Xlow + \frac{Xhigh - Xlow}{Xmax - Xmin} \times (X - Xmin) \quad (1)$$

Information:

Xnorm : Data that has been normalized.
X : Data that has not been normalized.
Xlow : Smallest range (0).
Xhigh : Largest span (1).
Xmax : The largest value of the data.
Xmin : The lowest value of the data.

B. Software Design Method

The model development process is more effective, flexible and adaptive to change, making it suitable for short-term software development with occasional changes, this is what underlies this research using the agile method. Agile relies on a very high level of customer involvement in every phase of the project. Planning, design, development, testing, release, and feedback are in a constant cycle within a defined time period [40].

Several stages in the Agile method are: Planning, Analysis, Design, Implementation, Evaluation, Launch, Maintenance. Apart from being agile, the process uses a deep learning algorithm long short-term memory (LSTM). LSTM has two hidden layers and large bias.

As seen in Fig. 2, the process of calculating input values, weights, and determining decisions in LSTM. LSTM is a development of a Recurrent Neural Network which has two dense layers that have been tested to predict depression, mental disorders, and suicide [35].

LSTM is one generation of RNN, previously RNN also had several types such as RNN Elman, RNN Jordan, RNN Fully. RNN network is an improvement of Artificial Neural Network (ANN) which is modified by adding memory cells so that in learning it can save the memory that comes from of input, output, or both. The drawback of the RNN is the huge gap between the relevant information and the overall information. So that short-term memory is also needed which can be carried out by LSTM [41].

The LSTM also has this chain-like structure, but the iterative module has a different structure, with the four neural networks interacting in a very special way. The advantage of LSTM over other RNNs is that they have multiple gates that can add to the information pool and combine it.

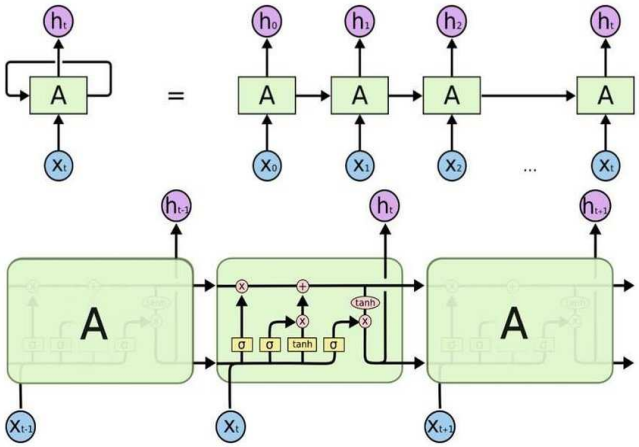

Fig. 2 Differences between RNN Memory and LSTM

There are four gates in the LSTM: forget gates (use Eq. 4), input gates (use Eq. 2 and 3), input modulation gates (use Eq. 5), and output gates (use Eq. 6 and 7). The four gates have their respective functions to collect, classify, and process data. Fig. 2 shows, the difference between RNN architecture and LSTM. LSTM networks are more complex with layered memory blocks in each hidden layer using the following formula [41].

$$\text{Input } X = \sigma\,(A \,.\, X + b) \quad (2)$$

$$\text{Input}_t = \sigma(X_t \,.\, L_t + U_t \,.\, h_{t-1} + b_t) \quad (3)$$

$$\text{Forget}_t = \sigma(X_t \,.\, L_f + U_f \,.\, h_{t-1} + b_f) \quad (4)$$

Cell State Vector :

$$Z_t = f_t \,.\, Z_{t-1} + \tanh(X_t \,.\, L_z + U_z \,.\, h_{t-1} + b_f) \quad (5)$$

$$\text{Output}_t = \sigma(X_t \,.\, L_o + U_o \,.\, h_{t-1} + b_o) \quad (6)$$

$$\text{Hidden Layer } h_t = \text{Output}_t \,.\, \tanh(Z_t) \quad (7)$$

TABLE I. TEST RESULT NUMBER OF NEURONS

Results Test I (Dense : 2, Epoch : 100, LR : 0.001, Neuron ?)			
Neuron	*LossTraining*	*Training Acc.*	*Testing Acc.*
32	0.6023	0.6786	0.7143
50	0.6039	0.7009	0.7321
64	0.5892	0.7054	0.7143
100	0.5933	0.6920	0.6964
128	0.6016	0.7009	**0.7321**

The first test was carried out on the percentage of dataset comparisons that had fairly good accuracy in the comparison 80% for training data and 20% for testing data. Next look for the number of epochs for good accuracy. As seen in Table 1, the number of neurons ranged between 32, 50, 64, 100, and 128. The best accuracy was obtained when there were 128 neurons. The best accuracy was found at 128 neurons.

The second stage of testing is finding the right learning rate setting. As can be seen in Table II, the search process for learning rates 0.001, 0.01, 0.05, 0.5 gets the best results at a value of 0.001 because has a small error value and high accuracy.

TABLE II. TEST RESULTS OF LEARNING RATE

Results Test II (Dense : 2, Epoch : 100, LR: ?)				
Learning Rate	*Neuron*	*Loss Training*	*Training Accuracy*	*Validation accuracy*
0.001	128	**0.5673**	0.683	0.6964
0.01	128	2.0532	0.4911	0.4821
0.05	128	0.7308	0.5357	0.5179
0.5	128	0.6553	0.6607	0.6964

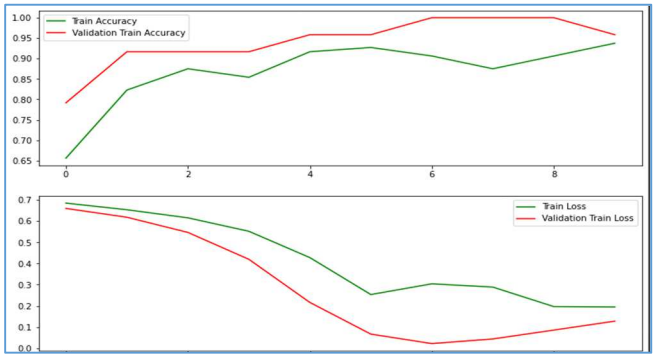

Fig. 3 Graphs During Training and Testing

The next process is to determine the best accuracy of the model being developed because using all the data for the learning process apparently cannot produce the best accuracy, namely 68% for training and 60% for testing. Lastly, the cause is the possibility that the field data used has a high similarity so that the machine can differentiate the data. Based on Table III, it can be seen that with a dataset of 150, the best accuracy value was obtained, namely 94% in training and 96% in testing. The graphic results can be seen in Fig.3.

TABLE I. RESULT OF NUMBER DATASET TESTING

Results Test III (Dense: 2, Epoch : 10, LR : 0.001, Neuron: 128) Number Dataset (DS) : ? , Totally : 280				
Numb. of DS	*Neuron*	*Loss Training*	*Training Accuracy*	*Validation accuracy*
100	128	0.1320	0.9625	0.9500
120	128	0.1950	0.9375	0.9583
150	128	0.2132	0.9417	**0.9667**
180	128	0.4197	0.8611	0.9444
200	128	0.4491	0.8438	0.8250
220	128	0.5486	0.7500	0.8182
250	128	0.5773	0.7150	0.7000
280	128	0.6040	0.6875	0.6071

V. RESULT AND DISCUSSION

Testing is carried out by comparing the training values with various tests such as 60:40, 75:25, 80:20, and 90:10 to produce a constant convergent graph with a ratio of 80:20. Then proceed with the analysis of the learning rate results of 0.001, 0.01, 0.05, and 0.5 and obtain convergent results at LR 0.001 (epoch 100) in Table 1. In the second experiment, Table 1 looks for the most effective learning amount. neurons and found 128 neurons. By continuing to try to improve accuracy, more experiments were carried out so that accuracy could

increase to 96%, as shown in Table III. The developed model can perform learning well, with a maximum accuracy of 96% for testing. The convergent graph during training and testing can also be seen in Fig. 3.

VI. Conclusion

Based on the problems faced in the field by counselors and students regarding mental health, counseling can be done digitally without being limited by space and time. To assist counselors during consultations, a digital counseling model was developed. The model developed has benefits in processing data, assisting analysis, helping make decisions, and providing information to counselors in counseling. The best results from the model testing carried out achieved the best accuracy of 96%, meaning it is suitable to be used to determine student resilience. The next research step is to be able to develop a model that can detect students based on their life stories. Indonesia's land area is fertile, prosperous, vast and has a population of 300 million people. Indonesia is optimistic that it will reach a golden age and progress in 2045.

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