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Trends, Technology, and Implementation of Digital Counseling in a Human Mental Health

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Abstract

This research discusses various trends, methods, and implementation of the art of digital-based counseling services. With increasing public awareness of mental health, since the womb, parents have thought about how to form good character and mental health for their children. Purpose of this study is to utilize digital counseling services to help early detection of depression and the resilience of children and adolescents in dealing with life's problems. This research collects articles according to the topic, then looks at cases handled, types of data, and methods used in both synchronous and asynchronous-based digital counseling. The next stage is research grouping based on research objects, data, methods, results, and deficiencies in research. The focus of the research is on cases of depression, and resilience, with machine learning methods. Digital counseling has been widely used for early detection in cases of depression, drug abuse, youth suicide, and alcohol addiction among adolescents.

Keywords : digital counseling, mental health, depression, resilience

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INTRODUCTION

Indonesia has a very large number of inhabitants. With this large demographic number, it is an advantage for the State of Indonesia. The advantage provided by this demographic is having unlimited human resources like China [1].

productive age who are not working. Then many found employees who work not following their expertise. Many students drop out of school, many students do not graduate, and many do even graduate not on time. There are also issues of suicide, the suitability of study programs, and mental health for adolescents. Other priority problems are related to drugs and depression [2]–[4].

Several types of research approaches have been used, such as quantitative descriptive, qualitative descriptive, mixed method, descriptive statistics, asynchronous, clinical approach, and research overview. In the process of therapy for therapeutic already using forms of communication such as Chatbot, Chat, Email, Telephone, and Video. In addition, there are also methods in modeling such as Gooseeker Analysis Modeling, Descriptive Models, and Structured Online Training.

Based on research data that has been carried out to facilitate a detailed explanation of the results of each research, will be explained in detail and the results obtained from the research. There are several approaches used in the research that has been conducted, such as research on the comparative effect of internet-based and face-to-face cognitive behavioral counseling [5] . In the research conducted, a total of 90 junior high school students in the Buleleng district were involved in resilience which stated that there was no significant difference in the effectiveness of internet-based cognitive with behavioral and face-to-face counseling. The results of this study indicate that the process of internet-based cognitive behavior takes less time and effort for counselors than face-to-face. In other cases with more severe emotional levels and psychological challenges, online counseling can be useful to complement traditional (face-to-face) counseling [6].

This research involved 30 students conducted at the University of South Africa (Unisa) without taking into account the measurement of cost-effectiveness. The results of the study show that e-counseling should not be a substitute for traditional face-to-face counseling and psychotherapy, particularly in more severe emotional situations. The counselor needs to know how much awareness a person has that understands the problems experienced that require counseling.

Research on the importance of this level of awareness has been carried out by Tripska et al. [7] who knew the level of awareness of Czech pharmacy students who experienced moderate stress depression during their studies where it was found that men were less interested in attending counseling than women, the results showed that 59% of people were aware of joining the program online counseling. The weakness of this research is that counselors need to increase the role of men in a more private counseling process, for example online and practically without direct medical action.

Students who are addicted to drugs are also given knowledge about each other through online training so that they can provide knowledge and attitudes towards drug abuse and their confidence in providing addiction counseling is significantly enhanced by a paired assessment involving 245 students with health-related backgrounds [4].

Online training was also given to 15 people about online counseling. Participants are willing to attend workshops or take courses on online counseling because they believe that knowing about online counseling will increase their chances of helping more people in Turkey. All participants had a positive view of online counseling, and they thought it was time for online counseling to be incorporated into counselor education in Turkey [8].

Counseling research is also conducted in Ghana [9] with analysis focused on providing answers to research questions based on students' life stories and their impact on their academic work. This analysis also leads to the utilization of ICT tools used in counseling services in high schools, due to the low level of facilities to support information and communication technology (ICT) in schools. With supporting facilities in schools, online counseling activities are easier to implement because they can use the media as a tool for counseling with websites, telephone, mobile phones, smartphones, email, video conferencing, chat, message, google form, chat, virtual media, hangouts, social media and the internet [10], [11].

However, there are still rules or ethics that online counselors must pay attention to, namely how to establish relationships, confidentiality, and legal aspects so that counseling ethics can be maintained properly[12]–[14].

E-counseling activities at student schools can select prospective students to select study programs for university [15]–[17]. Other research is about counseling in choosing the appropriate study program and choosing an internship that is in accordance with one's competence [18]–[21]. Even at the company level [22], [23] also developed the same research in the employee needs assessment (ENAI) project which was developed to strengthen the existing system and has gone through formative and summative evaluations. The results of the ENAI evaluation show that the system will be able to provide convenience to three levels (employer, employee, and counselor) in the management of personal life counseling in public and private organizations in Malaysia.

Some of the problems that a person faces either at school, in the work environment, or in the living environment when conditions cannot adapt to the current situation can cause anxiety, then stress continues, which if protracted will lead to depression. Research shows conditions at school due to personal or family problems can trigger stress [7], [9], [24]–[33].

In social cases in the community, cases of the mental condition of the partner of someone who experiences drug and alcohol abuse are also found [34], [35]. Another issue is how online counseling can support spouses of individuals with alcohol or drug use problems. Problematic use of alcohol and other drugs (AOD) can severely impact partners or partners, with increased risks of experiencing domestic violence, financial stress, health problems, and relationship challenges.

Having a problematic mental condition will affect other people so their partner needs therapy and counseling to restore mental health. [4], [34] explained that by carrying out tests through training programs, participants' knowledge and attitudes towards drug abuse and their confidence in providing addiction counseling significantly increased. This can be used as an alternative to making yourself and others aware of the impact of the dangers of drug abuse.

METHOD

In the digital counseling process, there are several methods that have been used in previous research. Of course, in this case, the process carried out in digital counseling has some differences in methods and implementation. Therefore, it is better for us to describe some of the methods that have been used in this process either synchronously or asynchronously. When examined in the outline there are 3 methods used, namely qualitative, quantitative, and mixed methods.

Based on the tests used, also vary from the Holland personality test, the pre-test, the post-test, and the standardized Joanna Briggs Institute. Based on the way the data is collected,

observations, questionnaires, chat, clinical approaches, and surveys are used, using synchronous and asynchronous approaches. Data processing uses statistics, AI, NLP, RF, SVM, modeling, ANN, DT, Classification, chatbot, RNN, PCA, LSTM, GRU, and EEG. It is then interesting to explain further, especially to find out which methods are more effective in solving problems in different cases.

In conventional counseling, many counselors use questionnaires to assist in collecting data. The data is then processed by looking at the pre-test and post-test scores. It is widely used, with the contents of the questionnaire adopting questionnaires that already use standards such as Holland, Grotberg, the Connor Davidson Resilience Scale, and Joanna Brings. The questionnaire used must undergo a lengthy analysis, then be tested in several cases, tested in several countries to obtain a certain desired standard in the case at hand. Questionnaires are used in the process of specialization, selection of study programs, determining places for internships, and entrepreneurial skills [5], [15], [16], [21], [24], [36]–[40]. Weaknesses in this research and the authors have also done it, the test process is boring because there are many questions giving time to answer them. In addition, it requires supervision in answering the questionnaire. Regarding the results of the analysis, some are processed for several days or weeks to determine the user's response, but there are also those that are automated so that results can appear in a matter of minutes.

Digital counseling research is also used to determine a person's level of depression, determine the level of resilience, make a diagnosis of illness, and emotional conditions, and detect the mental health of patients in carrying out dangerous actions such as suicide and shooting [6], [9], [11], [35], [36], [40]–[46].

In this study, the results of the processed data are presented in the form of percentage values to provide an overview of the conditions that exist in each research. still uses 15 questions to observe suicide cases using 37 weighted indicators that cause people to commit suicide. The advantage of this research is that it already uses the RF algorithm to help detect suicides.

Data processing from digital counseling that uses questionnaires usually uses statistics. This is done to analyze the data obtained and provide a perspective picture to the counselor of the approach taken related to the counseling goals. Does the research show statistically significant positive or vice versa [12], [47].

The development of the methods used in digital counseling is then in a more sophisticated direction by using artificial intelligence (AI). Research using AI was used to compare results based on different measurement metrics (accuracy, memory, and precision), with the model achieving the highest accuracy of 96% for anxiety and 96.8% for depression (Ahmed et al., 2020). Malaysia uses AI in the form of an expert system for diagnosing mental health (MeHDES) to assist psychology in diagnosing and treating patients who not only contribute to psychotherapists in Malaysia but also contribute economically to Malaysian society [48].

Digital counseling has also been developed involving natural language processing (NLP) by revealing 682 conversations related to suicide intentions which are displayed in graphic form and processed with a computer [42]. In the same case [43] developed a machine learning algorithm that can effectively and accurately identify possible suicide attempts in medical students using the Random Forest (RF) method. The results were surprising as much as 26.4% had suicidal ideation, 7.6% had suicidal plans, and 14.0% were involved in a suicide attempt. Mental stress is a major problem today, especially among young people.

Increasing stress nowadays causes many problems like depression, suicide, heart attack, and under great stress. So that in the research conducted [49] as many as 206 student data were taken from the Jaypee Institute of Information Technology for a dataset that will be used to analyze how these factors affect one's mind. The highest accuracy recorded by the support vector machine (SVM) was 85.71%.

There is the research developed using modeling, one of which is in China. The mental health service model is mainly divided into three types: medical, educational, and community. The social model of mental health services is called psychological counseling. Psychological counseling is called a client and those who provide services are called counselors who are also called psychological consultants. These consultants do not have the right to prescribe medication. The research [50] uses modeling analysis, Gooseeker content analysis, and the TextMind psychological analysis system. The research analyzed 163,377 online reviews from 2,375 psychological consultants taken from China's leading online psychological consultation platform where the comparison of patients was 37,842 men and 125,535 women. This shows that women are more aware of counseling and open to online counseling than men, as is the case in the Czech Republic [7]. The result of counseling

using modeling is that the phone gets the most preferred among users. Text counseling has strong privacy protections and video and face-to-face counseling is more authentic and comprehensive. Authentic assessment is to provide several tasks and a comprehensive assessment a thorough assessment related to input, process, and output. [51] in his research developed a model to help psychologists, because more than 70% of patients do not want to consult a doctor in the early stages of depression, leading to a worsening of their condition. Meanwhile, people are increasingly frequenting social media to express emotions and share daily life on social media. Twitter is used and has been used successfully to help detect a person's physical and mental illness.

The use of artificial neural networks (ANN) has been used in digital-based counseling. This is evident from research [52] which involved as many as 4,840 medical students in this study and the results found an increase in the level of alcohol consumption among doctors and medical students where ANN was able to differentiate drinkers with low and high risk. Research with ANN was also carried out [53] to diagnose stress using EEG and ECG signals. The target population is 24 individuals aged between (18-23) years who take a stress test, with EEG and EKG recorded simultaneously. The signals obtained are processed using semi-supervised machine-learning techniques. The ability of ANN to detect stress is 78.31%, which is better than the decision tree (DT) (71.08%) and RF (69.87) methods.

In the case of decision support to determine majors, the classification method is used, namely K-Nearest Neighbor (KNN) which is used to classify study programs (Yeni Kustiyahningsih, 2013). By using the KNN and SMART methods it can be said that it is more optimal than the indicators or criteria entered objectively with results that are closer to the data accuracy of 62.5%. In the case of selecting student activity units that match the interests and talents of students (Ailmi et al., 2020). The Naive Bayes classification method applied to the system produces an accuracy rate of 73.91%. In the process of improving mood, there is unique research conducted [54] that combines numerical computation with data mining in the form of unique features in songs known as music information retrieval (MIR) which can be used for therapy in the field of psychology using the method KNN. The developed system is capable of classifying with 86.55% accuracy for *.wav file formats. Classification with KNN with EEG data has also been carried out to detect depression with an accuracy of up to 99.1% [55]. In addition to EEG data, research conducted by [56] has used magnetic resonance imaging (MRI) to predict a reduction in depressive symptoms with the C4.5 algorithm with an accuracy of 83%. In the case of performance-related classification, research [57] uses the C5.0 algorithm in making decisions on 184 performance data with an accuracy of 96.08%. Research [58] on music continues by involving two KNN and ID3 algorithms. The system has been able to classify the types of moods, namely satisfaction, joy, depression, and anxiety where the results of the KNN algorithm are quite good, namely 86.55% at a value of k = 3 and an average processing time of 0.01021. Meanwhile, using ID3 obtained an accuracy of 59.33% and an average processing time of 0.05091 seconds.

Digital counseling already uses chatbots to provide counseling services. Research conducted [59] found chatbots to be safe and easy to talk to. Chatbots can create other options for users who don't want to receive face-to-face care, but there are many ethical aspects to consider. The platform can be programmed to recognize the natural language entered by users and can recognize their intent to provide a more coherent response. The proposed platform architecture will consist of a bot engine (API.ai), a web application, and a chat platform such as Facebook Messenger or Skype. Chatbots were also developed to provide services in the field of tourism in Bali so that they can provide brief information to obtain information because the questions asked are immediately answered with a success rate of up to 76% [60].

With the development of the recurrent neural network (RNN) network, digital counseling already uses the Elman Recurrent Neural Network (ERNN) network of 110 data, so that it can provide accurate information to the department to make the right decision to evaluate the feasibility of students taking internships outside the region [61] with an accuracy of 87.5%. The next development was tested on 20 people which resulted in 95% accuracy [19]. In other cases, there is research using the Hopfield Neural Network to maximize power flow problems associated with additional costs for optimal solutions [62] which may later be used as a solution for therapy in the counseling world.

The latest research on digital counseling has used the development of the latest RNN algorithms, namely LSTM, and GRU. [63] has conducted research by predicting users who experience depression and estimating the intensity of their depression through the use of Twitter social media data with an accuracy of 91.92%. Another research is to develop a

framework capable of detecting depression by involving 671 participants asking questions with the help of a webcam and microphone when answering questions using the bidirectional LSTM (BiLSTM) and LSTM methods which produce 87.77% and 86.81% accuracy.

Research in the field of LSTM continues [64] by collecting data via Twitter, but this time LSTM is combined with statistics, namely the PCA technique. Then, stemming and lemmatization and powerful one-hot and PCA techniques were activated on the datasets for data cleansing. 99% accuracy. Principal component analysis (PCA) is an analytical technique used in statistics and data science. By utilizing this analysis technique, it will be possible to summarize the information contained in large data tables down to some smaller summary index sets or appropriate groups. Research on the efficient detection of depression from textual social content was also carried out [65] researching a similar study which later found that textual is promising when used with deep learning that applies the GRU, Bi GRU, LSTM, Bi LSTM methods the result is an accuracy of 80 %, 81%, 80%, 81%. The testing process is divided into several stages. The first stage is the data used for the training and testing process. This process will begin with data collection via Twitter and data collection using a questionnaire. Twitter data will be filtered according to research needs. After the data cleaning process, the data obtained is stored and used for training. The data obtained from the questionnaire is also stored and checks are related to duplication of data and if there is data that does not match. The data obtained is then used for the training and testing process. The data collection process uses a questionnaire, where for example the questionnaire used is called STAR which is valid and standardized for data collection and interviews[66]. Questionnaires such as STAR are suitable for collecting textual counseling data.

With the method that has been used before, of course, the data used for training and testing must be considered with a higher percentage for training than testing. Why is it like that, based on previous experience it turns out that the learning process requires a long long time until the developed model can understand real data. In NLP processing, it is recommended to do data cleansing first, especially from data taken from Twitter. The process of cleaning the dataset, URLs, retweets, mentions, removing punctuation, changing letters to lower or vice versa (upper) and stop-words have been removed from the dataset [64]. The stop-word process is to remove prepositions, pronouns, and conjunctions which can sometimes change the meaning of a negative sentence into a positive one. Whether this is necessary, sometimes it is necessary to reduce the size of the dataset, and depends on the goals we want to achieve. If you want to conduct training on sentiment analysis, you should not remove stopwords [67].

The next process for processing text data is to change it to basic words (stemming) only by cutting off the ends of words such as leafs to become leafs and leaves to become leaves. In a condition according to research objectives, there are related things that have the same meaning or avoid diversity of meanings, so lemmatization is needed here, namely changing a basic word by knowing the meaning of the word. So the words leafs and leaves go through a process of lemmatization which means leaf.

The method used for stemmed text is using the One-Hot encoding and PCA methods for feature extraction from these words (Amanat et al., 2022). The one-hot method is used to convert word features into binary patterns used in machine learning prediction models, for example, 1 means depression, and 0 means vice versa. One of the algorithms used here is TF-IDF to identify and measure the frequency of all depressive words from the dataset. Research in Hong Kong using 5,682 conversations related to suicide, 682 of these conversations revealed suicide intentions with 80% random training samples and 10% for model validation. The encoding process in this research uses word2vec with the BiLSTM method (Xu et al., 2021). Word2vec can capture semantic relationships between words, meaning that it can provide a similarity score with similar words.

The method in the labeling process can be assisted by an expert, namely a consultant or counselor. So that the data used in the training process is valid and has been labeled according to knowledge in the realm of counseling, although sometimes special cases are found, those who can provide solutions are experts. In some cases, Chinese labeling uses Gooseeker text analysis software to import the specified label word for classification matching [50]. In the process of valuing indicators of depression [51] such as depressed mood and reduced interest assisted by doctors who usually check whether these symptoms appear over a certain period to make a final decision. Despite all doubts, these criteria are well validated and there are many real-world cases over the years.

The model is developed according to the case that you want to take and then based on existing research you can use several existing methods or do a combination of several existing

methods to produce something by the research objectives. The Multimodal Depressive Dictionary Learning Model (MDDL) framework is a model developed for depression and non-depression based on EEG [51]. The EEG used is a single channel to minimize costs and monitor the patient's mental health with an accuracy of 99.1% using the KNN method. The model was tested by comparing several algorithms such as Naive Bayes (NB) with 76.5% accuracy, Logistic Regression (LR) with 81.3% accuracy, Support Vector Machine (SVM) with 86.7% accuracy, and Random Forest (RF) with 87.4% accuracy. Another model called knowledge-aware risk assessment (KARA) is the first comprehensive deep learning model that combines linguistic patterns from counseling texts and external domain knowledge in Hong Kong (Xu et al., 2021). Because it incorporates two-sided information, it should allow higher-resolution modeling to detect suicide risk. The testing of this model is compared with another method, namely BiLSTM. the accuracy of the BiLSTM is 95.1% while the KARA model is 98.4% for testing on non-crisis conversations. KARA is developed using a suicide knowledge graph (SKG) which represents the semantic relationship between the two corresponding concepts. In the following, a list will be presented regarding the use of methods in digital counseling, the amount of data, and the results as shown in Table 1

Table 1. List of Methods in Digital Counseling

No	Method	Type	Dataset	Result
1	Holland	Text	131	measuring personality in CBT counseling
2	Connor Davidson Resilience Scale	Text	0	measure resilience related to mental resilience
3	Grotberg	Text	0	resilience case
4	Joanna Brings	Text	50	counselor research
5	Statistik	Text	592	counselor research
6	AI	Text	3500	96% accuracy for anxiety cases, and 96.8% for detecting depression
7	NLP	Text	682	98.4% accuracy in detecting suicides
8	RF	Text	1402	accuracy case of depression 26.4% had suicidal ideation, 7.6% had a suicide plan, and 14.0% were involved in a suicide attempt
9	SVM	Text	206	accuracy of 85.71 for detecting suicide
10	ANN	Text	4840	53.03% accuracy for detecting low and high-risk drinkers
11	DT	EEG	24	decision tree (DT) accuracy in stress detection 71.08%
12	RF	EEG	24	accuracy in stress detection 69.87
13	ANN	EEG	24	accuracy in detecting stress 78.31%
14	KNN	EEG	15	99.1% accuracy for depression detection
15	KNN	Text	65	accuracy of 62.5 to determine majors in schools
16	KNN	audio	400	86.55% accuracy for the mood category
17	NB	Text	418	accuracy of 73.91% for interest selection
18	C4.5	MRI	24	83% accuracy for depression cases
19	ID3	audio	400	59.33% accuracy for the mood category
20	Chatbot	Chat	25	76% accuracy for appropriate responses
21	ERNN	Text	110	87.5% accuracy for the eligibility case
22	ERNN	Text	20	95% accuracy for the apprentice case
23	LSTM	Text, Video, Audio	671	86.81% accuracy for depression cases
24	Bi LSTM	Text, Video, Audio	671	87.77% accuracy for depression cases
25	LSTM	Twitter	6562	91.92% accuracy for depression cases
26	LSTM + PAC	Twitter	4000	99% accuracy for depression cases

RESULT AND DISCUSSION

Previously, the question arose of what research was related to the field of digital counseling. The next question is how is the implementation of digital counseling on the patient's mental health. Based on this, it can be explained that digital counseling is a new area in counseling which is still a hot topic of conversation in society. One of its strengths is being able to help counselors or consultants to analyze a person's mental state, talents, emotions, and behavior just as is done conventionally. What is noteworthy is that this system can help general cases, but if the case is severe then face-to-face counseling is needed. The fact is that with the existence of digital counseling, the counseling process can be made easier with communication via chat, telephone, email, filling out questionnaires, Twitter, audio, and video as support.

The data used has the same dimensions, namely based on binary or 0 and 1. However, the processing of text, audio, and video data is different. Various research in the field of digital counseling has been developed in various social environments such as schools, hospitals, workplaces, and universities providing an understanding that this research really needs to be developed in the future. Various methods in the fields of computer science, statistics, and mathematics are used to help provide the best results, the best recommendations, and the best decisions.

The development process takes quite a long time because you have to consult with experts and evaluate the throughput issued. However, in its implementation in real cases it will require less time to carry out the analysis, is simpler, and can provide a quick response to the patient. On the counselor side, it can be ascertained that this model is a complement and a tool in the analysis of patient mental health and requires supervision from counselors and consultants on the results produced by the system for special cases that are classified as severe and require immediate therapy.

Based on this, the authors would like to propose the idea of developing a digital counseling model to detect depression and resilience in students by using deep learning so that it can be useful for counselors in conducting early detection in counseling services on campus for students.

CONCLUSION

In digital counseling, the counseling process is also scheduled just like conventional counseling. Patients can also choose the synchronous (direct) method by making observations by communicating directly via video call or live and asynchronously or indirectly such as using websites, questionnaires, chat, email, and telephone. However, this process also requires a clinical approach with the patient so that counseling goals can be effective and achieved. There are 10 studies that conduct counseling via a standardized and validated questionnaire. In the follow-up process, there are two studies that utilize pre-test and post-test using statistics. There are 22 studies that have used machine learning in the process of developing digital counseling models involving 22,941 clients that have been developed and implemented at this time. Overall there is 26 research related to digital counseling that has been developed in the fields of education, hospitals, communities, campuses, and counselors to continue to support the performance of online counseling that is needed at this time. In this era, social media such as Twitter, data text, video, and audio are also growing rapidly and there are a lot of them in the big data era so that they become datasets that can be used for digital counseling purposes. Primary and secondary data collection will be carried out more easily according to the needs of the application that will be developed later with certain methods to get the appropriate results..

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