

Towards Building Mental Health Resilience through Storytelling with a Chatbot

Ethel ONG*, Melody Joy GO, Rebecalyn LAO, Jaime PASTOR & Lenard Balwin TO
College of Computer Studies, De La Salle University, Philippines
*ethel.ong@dlsu.edu.ph

Abstract: The prolonged lockdown from the COVID-19 pandemic has caused a dramatic increase in the number of mental health concerns in the community. Students are among those vastly affected. Their socio-economic and financial conditions add challenges to their academic difficulty and work-life balance that can fuel issues related to mental health and well-being. To cope with these challenges, they need to strengthen their resilience to possess the ability to face and recover from adversity. In this paper, we describe how a mental health chatbot can help strengthen the resilience skills of tertiary level students through daily conversations. These conversations are aimed at promoting one's well-being through self-assessment and care. Grounded on the use of narratives to encourage students to express their emotions, Seligman's PERMA model is utilized as a basis for evaluating the student's well-being and suggesting coping mechanisms to maintain one's positive mental health and emotions.

Keywords: Mental well-being, PERMA model, resilience, conversational agent, storytelling

1. Introduction

Natural or man-made disasters pose threats not only to lives and properties, but also to one's health and wellness. The prolonged lockdown from the COVID-19 pandemic has caused a dramatic increase in the number of mental health concerns in the community. Students are among those vastly affected. They continue to face academic challenges that are compounded by the shift to the online learning platform and independent self-paced learning within the confines of their household environment. On top of these, socio-economic factors, financial status, and the loss of face-to-face social contact with their peers may be affecting their psychological well-being and overall mental health.

The Philippine Mental Health Act is a response to the call for action to promote mental health and to enhance the delivery of services to the growing number of Filipinos who are experiencing mental disorders (Lally et al., 2019). The Act defines *mental health* as "*a state of well-being in which the individual realizes one's own abilities and potentials, copes adequately with the normal stresses of life, displays resilience in the face of extreme life events, works productively and fruitfully, and is able to make a positive contribution to the community*". Well-being and resilience can prevent or reduce the occurrence of mental health problems by equipping students with necessary skills to cope with the changes in their everyday activities and life stressors, maintain interpersonal relationships despite the absence of physical contact, and set realistic goals within the boundaries of their situations (Reachout.com). Resilience allows one to constantly adapt, thrive and regain a sense of well-being amidst the challenges and stresses caused by the pandemic (Castillo-Carandang, 2021).

Technologies can play a significant role in promoting disaster and safety education in general and mental health protection in particular by raising awareness and delivering information and services to help individuals and the community plan and execute health and safety intervention programs. The continued community quarantine and physical distancing due to the pandemic have led the public to rely on digital technology solutions for their day-to-day activities, including the management of their mental health (NIMH, 2020). These technologies offer a wide range of opportunities from helping an individual manage his/her medication, to teaching coping skills and predicting emotional state and well-being (NIMH, 2019). Researchers are starting to explore the use of conversational agents or chatbots as an alternative platform in providing self-care as well as remote telehealth services to support

one's health, including mental health (Fitzpatrick et al., 2017; Inkster et al., 2018), well-being (Sia et al., 2021), and children's emotional growth (Santos et al., 2020).

Students can practice self-care, be conscious of their mental health and well-being, and build resilience through constant conversations with family members, trusted friends, or caregiver. In this paper, we investigate the opportunity posed by a conversational storytelling agent in helping students assess and manage their well-being. We first give an overview of related studies on well-being assessment, building resilience, and storytelling chatbots. Then we present the conversational model utilized by our chatbot in assessing students' well-being, equipping them with resilience skills to cope with the effect of daily events on their mental well-being, and devising a plan of action to maintain optimal health. We end our paper with a discussion of our validation procedure.

2. Well-being, Resilience, and Storytelling

Well-being is strongly connected to mental health. Studies have shown that optimal well-being brought about by positive emotions, life satisfaction, and optimism can lead to stronger relationships, higher levels of productivity and success rates in school and at work, and better physical health (Butler & Kern, 2016; Diener & Chan 2011; Huppert & So, 2013). An important aspect in promoting well-being is the ability to continuously monitor it so that necessary measures can be taken to maintain optimal well-being while shifting negative state to one that is more positive (Huppert, 2014).

As a multi-dimensional construct, well-being can be measured using various scales. The *Scale of Positive and Negative Experience* (Diener et al., 2010) measures the respondent's perception on their relationships, self-esteem, purpose, and optimism. The *EPOCH Measure of Adolescent Well-being* (Kern et al., 2016) assesses positive psychological characteristics that might foster positive outcomes. Seligman's *PERMA* model (2011) identified 5 elements of well-being – positive emotion, engagement, relationships, meaning, and accomplishment. A corresponding instrument, the *PERMA Profiler* (Butler & Kern, 2016), allows individuals to monitor and measure their well-being to gain a better understanding of the positive and negative sides of each element. This can then be used to design intervention programs and to prescribe the necessary services in building and strengthening the elements of well-being (Kern et al., 2015; Seligman, 2018).

Resilience is a *strength-based* or an *empowerment-based* approach of coping and overcoming adversities and adapting to new situations (Giligan, 2003; APA, 2014). This can be inferred from a person's current state of being okay even when faced with a difficulty that he/she must overcome. Hu et al. (2015) reported the negative correlation between resilience and mental illnesses such as depression and negative emotions, and the positive correlation with life satisfaction, optimal well-being and positive emotions which are indicators of positive mental health. To build resilience among students requires understanding the activities that cause stress in their lives and deplete their energy as well as those factors that can help them recover. Such knowledge can be utilized to expand their window of tolerance to life stressors, detect signs of emerging distress or functional impairment, and be able to devise ways towards recovery (De Castro, 2021).

Storytelling is an important component in mental health recovery (Nurser et al., 2018). Our everyday conversations are grounded on stories and anecdotes of life events that inspire us and encourage self-reflection. In health care, storytelling builds rapport and trust between the caregiver and the patient to encourage self-disclosure and kindle empathy and understanding of the context (Drumm, 2013). It can shed light on our health and well-being (East et al., 2010) which can lead to improved and personalized services. Previous work have shown the use of storytelling chatbots that not only co-construct stories with children (Ong et al., 2018), but in the process of doing so, can also develop children's emotional intelligence (Santos et al., 2020). These storytelling chatbots have portrayed the roles of a peer, a learning companion, or a therapy assistant to encourage children to recount their stories and verbalize their emotions (Ong et al., 2018; Santos et al., 2020).

3. Conversation Flow

Our chatbot is intended to communicate with its human users through a text-based interface by integrating with existing messaging platforms such as Telegram which users can access via the web or their mobile devices. A session with the chatbot follows the conversation flow shown in Figure 1 which is adapted from Eren (Santos et al., 2020). The conversation commences with a welcome message, a self-introduction to break the ice, and an overview of positive psychology and well-being. This is followed by the *labelling* phase where the student's well-being is assessed using lexicon-based sentiment analysis and a combined NRC Emotion Lexicon (Mohammad, 2012) and PERMA Lexicon (Kern et al., 2016). Life events in the form of short story text that we share may reflect our thoughts and emotions; thus, analyzing the emotion expressed in this type of text would be a useful indication of our subjective well-being (Jaidka et al., 2020).



Figure 1. Conversation flow of the mental health chatbot.

Well-being assessment involves computing the average PERMA score from the PERMA weights associated with each of the words found in the student's input. Only words with part-of-speech tags *nouns*, *verbs* and *adjectives* are considered. The PERMA weights associated with a word were derived from the study of (Kern et al., 2016) which assigned a positive and a negative value to each of the five (5) elements of well-being as shown in Figure 2.

NRC	PERMA	category	weight
happy	blessed	POS_R	0.0978041080
happy	blessed	POS_P	0.2198306153
happy	blissful	POS_R	0.0978041080
concerned	sorry	NEG_E	0.0411426983
unassisted	alone	NEG_R	0.2287967165
party	party	POS_R	0.1298090188
party	party	POS_P	0.2216741979
party	party	POS_E	0.2206936654

Figure 2. Sample word entries in the NRC-PERMA Lexicon, where *category* indicates the positive (POS) and negative (NEG) aspects of a PERMA element and their associated *weight* values.

From the average PERMA score, the chatbot associates one of the following well-being states: *optimal*, *emerging* and *at risk*. A student with an *optimal* well-being is able to cope with occasional stress and perform his/her tasks effectively. Increased stressors can cause temporary impairment and a student at this state is said to have an *emerging* emotional problem. If this is allowed to continue for prolonged period without support or intervention, the student may become *at risk* of mental illness (Chowdhury, 2021). The goal of the chatbot, then, is to setup a conversation that can maintain an *optimal* state, shift the *emerging* state to one that is optimal, and encourage those *at risk* to seek help.

During the *listening* phase, dialogue moves that leverage on storytelling strategies employed by Orsen (Ong et al., 2018) are utilized. These include giving praise or positive *feedback* for actions that maintain an optimal well-being, and *pumps* to encourage the student to share details of story elements

(characters, objects, locations) and events that triggered their emotions and affected their well-being. These personal stories not only reveal one's mental well-being but can also convey actions that manifest resilience and coping strategies. Thus, throughout the listening phase, the chatbot tracks these actions and events in a *story event chain* and continues to update the PERMA score of the student.

Throughout the storytelling session, the chatbot iterates through the *labelling-listening* phases and encourages the disclosure of life events as it continuously assesses the student's well-being until the PERMA score is complete. A score is deemed complete if all five (5) PERMA elements have been accounted for; that is, the chatbot has an assessment of the student's well-being, whether positive or negative, for each of the five (5) PERMA elements. If the student is done with his/her story but the PERMA score is not yet complete, the chatbot turns to the PERMA Profiler to formulate its next response. The PERMA Profiler (Butler & Kern, 2016) contains 23 questions, 15 of which covers the five PERMA elements while the remaining 8 focus on *overall health, negative emotion, happiness, and loneliness*. These questions can gather more information regarding an individual to complete the PERMA assessment. For example, if the chatbot is missing an assessment regarding the student's relationship, it can pose the question "*How satisfied are you with your personal relationship?*" At the end of the story sharing phase, students are praised for their openness with responses such as "*Thank you for sharing with me*" and "*Thank you for trusting me with this. That really means a lot*".

Storytelling encourages self-reflection and enhances therapeutic care while building resilience (East et al., 2010; Nurser et al., 2018). In the *reflection* phase, actions that express a positive well-being are praised and students are encouraged continue practicing self-care and exhibit a positive mindset to maintain their optimal state with responses such as "*That sounds great! Keep up the positivity.*" Actions that show a shift in well-being from a positive to a negative state may lead to emerging distress; these need to be regulated in order to disrupt negative emotions and help the student to move to a more optimal state. This is a collaborative task that is performed during the *evaluation* phase when the chatbot and the student work together to formulate measures to maintain and/or improve the well-being.

For students who are at risk of mental illness, the chatbot formulates empathic responses to help them come to grips with their conditions. An empathic response is formulated by combining three dialogue moves: i) an *acknowledgement* of the challenges that the student is facing; ii) an *emphasis feedback* highlighting the chatbot's offer for help; and iii) a *praise feedback* for the student's openness and self-disclosure. Table 1 shows some of the templates for these dialogue moves. Once the student has acknowledged his/her condition, he/she is then encouraged to try human counseling, i.e., "*Are you willing to try counseling? It could really help you.*"

Table 1. *Templates for Various Empathic Responses*

Dialogue Move	Template
Acknowledgement	I'm sorry you are going through this. That sounds really challenging.
Emphasis Feedback	I'd like to help you the way you would help me. I am concerned that everything is not okay.
Praise Feedback	Thank you for trusting me with this. That really means a lot.

In the *evaluation* phase, the chatbot guides the student in formulating measures and strategies to sustain and to improve his/her well-being. These measures are adjusted according to the student's personal experiences and preferences as recorded in the story event chain and the computed PERMA scores. Since PERMA has been reported to be a good predictor of psychological distress (Forgeard et al., 2011), activities that can increase any one of the elements of well-being can be presented to the students as actionable items (Madeson, 2021). For example, if the student has a low PERMA score for the element *positive emotion*, the chatbot can suggest that the student "*spend time with people you care about*", "*do a hobby that you enjoy*", or "*listen to music*". On the other hand, if the student has a low PERMA score for the element *engagement*, the chatbot can prompt the student to "*participate in activities that you really love*", "*spend time with nature*", or "*do things that you excel at*". The specific entities, i.e., *people* and *hobby*, are extracted from the story event chain in order to personalize the responses according to the student's interests and social relationships.

The primary focus of the conversation is to maintain optimal health, and to shift a negative state to one that is more positive. This requires a different approach as compared to improving critical mental

health conditions. To maintain optimal help and disrupt negative emotions, the chatbot should have the ability to identify actions and events that may be causing distress to one's mental well-being, and to provide personalized consultations so that the recommended measures and strategies are aligned with the student's social environment and relationships. These tasks are accomplished with the use of rule-based NLP techniques for processing user inputs, detecting emotion, and formulating responses.

The PERMA model plays a major role in the chatbot's ability to assess the well-being by identifying how the shared events are affecting the individual positively or negatively. The PERMA element that is identified to have the lowest score is then used as the topic for discussion during the evaluation phase to formulate a plan of action to increase the low score which translates to recovering from negative states. Rule-based NLP story generation strategies and the use of commonsense ontology similar to Orsen (Ong et al., 2018) can provide the necessary information needed by the chatbot to understand the context of the student's story and to formulate meaningful responses.

4. Ongoing Work

Advances in AI and conversational interfaces motivate us to leverage on digital technologies to help address the growing concern on mental health conditions. In this paper, we described the conversation flow of our chatbot that utilizes well-being assessment based on Seligman's PERMA model (2011) to promote mental well-being awareness among College students and to strengthen their resilience especially in this challenging time of online learning and physical distancing. The conversation covers three main types of interventions to promote mental well-being, which include developing and strengthening of life skills, promoting social connectedness with family and friends, and increasing help-seeking behaviors (MacPhee, 2020).

Technology-based interventions are most effective when the target beneficiaries would find them useful and are engaged with the technology such that they would want to continue using them. To evaluate the users' perception on how conversing with the chatbot provided interventions and support, we will conduct validation with college students and collect two types of data for analysis: *chatbot evaluation* and *conversation logs*. The chatbot will be evaluated using three criteria: *performance*, *humanity* and *affect* which are based from (Radziwill & Benton, 2017) and were used in evaluating similar chatbots (Sia et al., 2021; Santos et al., 2020; De Nieva et al., 2020). *Performance* measures how well the chatbot uses the PERMA Model and the commonsense ontology in well-being assessment and response generation to give appropriate recommendations. *Humanity* measures the chatbot's ability to fulfill its role as a storytelling peer who listens and empathizes with the shared stories and experiences. *Affect* measures the chatbot's ability to make the experience comfortable for the user such that they would want to seek it for advice in future sessions. Experts, specifically psychologists and guidance counselors who gave the project a multidisciplinary perspective through their recommended strategies for well-being assessment and interventions, will also evaluate the chatbot to give their feedback on the potential use of conversational AI in preventive healthcare and positive psychology.

Future work would include the use of a hybrid approach combining rule-based NLP and ML models for input understanding and response generation. Neural conversational models trained on empathetic dialogue datasets (Beredo et al., 2021) can provide the chatbot with candidate responses that it can rank according to the context of the student's story as reflected in his/her PERMA score and story event chain. This reduces the reliance on a semi-manually populated commonsense ontology to provide the chatbot with the knowledge it requires in processing the input text and in formulating meaningful and empathic responses that are aligned to the personal story being narrated by the student.

References

- APA (2014). *The road to resilience*. Washington, DC: American Psychological Association.
- Beredo, J., Bautista, C.M., Cordel, M. & Ong, E. (2021). Generating empathetic responses with a pre-trained conversational model. *Text, Speech and Dialogue 2021*, LNCS vol. 12848. Springer, Cham.
- Butler, J. & Kern, M. (2016). The PERMA-Profilier: A brief multidimensional measure of flourishing. *International Journal of Wellbeing*, 6(3), 1-48.
- Castillo-Carandang, N. (2021). Wellbeing and being Filipino. Webinar Series 2: Well-being and Cultural Relevance, 1st Philippine Mental Health Research Summit, 19 July 2021. Philippine Council for Mental Health (PCMH) Technical Committee on Research and the National Center for Mental Health.

- Chowhury, M. R. (2021). What is the mental health continuum model? Retrieved from <https://positivepsychology.com/mental-healthcontinuum-model/>
- De Nieva, J. O., Joaquin, J. A., Tan, C. B., Te, R. K. M. & Ong, E. (2020). Investigating Students Use of a Mental Health Chatbot to Alleviate Academic Stress. *Proceedings of the 6th International ACM In-Cooperation HCI and UX Conference*, 1-10. ACM.
- Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S. & Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research*, 97(2), 143-156.
- Diener, E. & Chan, M. (2011). Happy people live longer: Subjective wellbeing contributes to health and longevity. *Applied Psychology: Health and Wellbeing*, 3(1), 1-43.
- Drumm, M. (2013). The role of personal storytelling in practice. Iriss.
- East, L., Jackson, D., O'Brien, L. & Peters, K. (2010). Storytelling: An approach that can help to develop resilience. *Nurse Researcher*, 17(3), 17-25.
- Fitzpatrick, K. K., Darcy, A. & Vierhile, M. (2017). Delivering Cognitive Behavior Therapy to young adults with symptoms of depression and anxiety using a fully automated conversational agent Woebot: A randomized controlled trial. *JMIR Mental Health*, 4(2), e19.
- Forgeard, M. J. C., Jayawickreme, E., Kern, M. L. & Seligman, M. E. P. (2011). Doing the right thing: Measuring well-being for public policy. *International Journal of Wellbeing*, 1, 79-106.
- Giligan, R. (2003). Promoting children's resilience – Some reflections. Glasgow Centre for the Child and Society.
- Hu, T., Zhang, D. & Wang, J. (2015). A meta-analysis of the trait resilience and mental health. *Personality and Individual Differences*, 76, 18-27.
- Huppert, F. A. (2014). The state of wellbeing science: Concepts, measures, interventions, and policies. *Introduction to Wellbeing: A Complete Reference Guide*, vol. 6. John Wiley & Sons.
- Huppert, F. A. & So, T. T. C. (2013). Flourishing across Europe: Application of a new conceptual framework for defining well-being. *Social Indicators Research*, 110(3), 837-861.
- Inkster, B., Sarda, S. & Subramanian, V. (2018). An empathy-driven, conversational artificial intelligence agent (Wysa) for digital mental well-being: Real-world data evaluation mixed-methods study. *JMIR mHealth and uHealth*, 6(11):e12106.
- Jaidka, K., Giorgi, S., Schwartz, A., Kern, M. L., Ungar, L. H. & Eichstaedt, J. C. (2020). Estimating geographic subjective wellbeing from Twitter: A comparison of dictionary and data-driven language methods. *Proceedings of the National Academy of Sciences of the USA*.
- Kern, M. L., Waters, L. E., Adler, A. & White, M. A. (2015). Multidimensional approach to measuring well-being in students: Application of the PERMA framework. *The Journal of Positive Psychology*, 10, 262-271.
- Kern, M. L., Benson, L., Steinberg, E. & Steinberg, L. (2016). The EPOCH Measure of Adolescent Well-being. *Psychological Assessment*, 28(5), 586-597.
- Lally, J., Samaniego, R. & Tully, J. (2019). Mental health legislation in the Philippines: Philippine Mental Health Act. *BJPsych International*, 16(3), 65-67. Cambridge University Press.
- Madeson, M. (2021). Seligman's PERMA+ model explained: A theory of wellbeing. Retrieved from <https://positivepsychology.com/perma-model/>
- MacPhee, J. (2020). *Promoting student mental health in difficult days*. Inside HigherEd.
- Mohammad, S. M. (2012). From once upon a time to happily ever after: Tracking emotions in mail and books. *Decision Support Systems*, 53(4), 730-741.
- NIMH (2019). *Technology and the Future of Mental Health Treatment*, National Institute of Mental Health Information Resource Center.
- NIMH (2020). *Digital Mental Health: Innovating in a Time of High Anxiety*, National Institute of Mental Health Information Resource Center.
- Nurser, K. P., Rushworth, I., Shakespeare, T. & Williams, D. (2018). Personal storytelling in mental health recovery. *Mental Health Review Journal*, 23(1), 25-36.
- Ong, D. T., Gilig, L. K., De Jesus, C. R., Alburo, J. B. & Ong, E. (2018). A dialogue model for storytelling with children. *Proceedings of the 26th International Conference on Computers in Education*, 205-210. APSCE.
- Radziwill, N. & Benton, M. (2017). Evaluating quality of chatbots and intelligent conversational agents. *Software Quality Professional*, 19(3), 25-36.
- Reachout.com. *Wellbeing and resilience*. Retrieved from: <https://schools.au.reachout.com/articles/wellbeing-and-resilience>
- Santos, K. A., Ong, E. & Resurreccion, R. (2020). Therapist vibe: Children's expressions of their emotions through storytelling with a chatbot. *Proc. Of Interaction Design and Children Conference*, 483-494. ACM.
- Seligman, M. (2011). *Flourish: A visionary new understanding of happiness and well-being*. Free Press.
- Seligman, M. (2018). PERMA and the building blocks of well-being. *Journal of Positive Psychology*. Routledge
- Sia, D. E., Yu, M. J., Montenegro, J., Daliva, J. L. & Ong, E. (2021). Investigating the acceptability and perceived effectiveness of a chatbot in monitoring the well-being of students. *Proc. of AsianCHI Symposium*. ACM.