

The Design of a Gamified App for Supporting Undergraduates' Resilience

Iolie Nicolaidou and Loizos Aristeidis

Cyprus University of Technology, Department of Communication and Internet Studies, Limassol, Cyprus

iolie.nicolaidou@cut.ac.cy

loizosaristeidis@gmail.com

Abstract: Supporting students in building psychological resilience is crucial considering the COVID-19 pandemic's effect on the population's mental health. Psychological resilience refers to finding ways to cope with stress and achieve goals despite obstacles. It is an important life skill that has become highly relevant in the post-pandemic era. Mobile devices and applications are becoming integral to users' self-monitoring of health data for their access, convenience, and cost advantages. Most resilience apps target specific professional groups, are not gamified, and lack solid theoretical foundations. Phone-based sensor data collected using Internet of Things (IoT) technology allow for new ways to measure psychological health and provide personalized recommendations. However, none of the existing gamified apps on resilience used IoT. None of the existing resilience apps refers to behavioral change techniques. The proposed resilience app addresses these gaps in the literature. This paper describes the design of a prototype for a gamified, theory-based mobile app that utilizes IoT to provide personalized data and support undergraduates' resilience in the "new normal" of the pandemic. The poster also provides preliminary data on undergraduates' feasibility and usability evaluation of the prototype, focusing on first-year students. Users set one of three goals daily (focusing on studying, engaging in physical exercise, and socializing), monitor their progress towards achieving them, and receive points and badges when reaching their goals. Goal setting, progress monitoring, and self-reflection at the end of each day are connected to a) self-reported data (e.g., through the use of a short, validated mental health survey that automatically calculates users' level of anxiety) and b) objectively measured data through the use of IoT (accelerometer and noise sensors) in the app. Users can share their badges on their social media networks. Thirty first-year undergraduates (M=18.41 years old, SD=0.57) tested the prototype resilience app and completed an evaluation questionnaire examining feasibility and usability. Neutral to positive responses (M=3.32 out of 5) were received for all functions indicating feasibility. Design usability was evaluated as satisfactory (System Usability Score=70.3). Future research will evaluate the app in a quasi-experimental setting. Implications for the design of gamified mobile apps for health are drawn.

Keywords: design for social change; gamified applications; resilience; COVID-19 pandemic; higher education

1. Introduction

During the COVID-19 pandemic, educational institutions were shut down worldwide, which impacted over 60% of students and caused a massive disruption of the education system. Studies conducted since the pandemic outbreak uncovered a significant elevation of COVID-19-related anxiety among students in European countries (Nicolaidou et al., 2021). The COVID19 pandemic is anticipated to result in long-term adverse mental health effects on the population (Golden et al., 2021). Therefore there is an urgent need to support students' psychological resilience. Psychological resilience refers to finding ways to cope in crises, overcome daily challenges, cope with stress, and achieve goals despite obstacles. It is an important life skill that has become highly relevant in the post-pandemic era.

2. Literature Review

Mobile devices and associated software applications are fast becoming integral to users' self-monitoring of health data for their access, convenience, and cost advantages. As the potential of smartphone apps and sensors for healthcare continues to expand, there is a concomitant need for open, accessible, and scalable digital tools, as are smartphone mental health apps (Torous et al., 2019; Nicolaidou et al., 2019).

A literature review revealed several attempts to develop and validate resilience apps within the last five years. Most resilience apps target adults belonging to specific professional groups (e.g., Litvin et al., 2020) and not the general public, are not gamified (e.g., Wood et al., 2017), and do not have strong theoretical foundations. Phone-based sensor data collected using IoT technology allow for new ways to measure psychological health and use them to provide personalized recommendations. None of the existing gamified apps on resilience used IoT, and none referred to behavioral change techniques. Moreover, prevention and wellbeing are underdeveloped in mental health apps.

The proposed resilience app addresses these gaps in the literature. It utilizes behavioral change techniques to support resilience as a prevention intervention by implementing a gamified approach combined with IoT technology that addresses the needs of a general, non-clinical undergraduate student population.

3. Design of the Student Stress Resilience app

The resilience app is expected to provide personalized recommendations based on user input in self-reports, the user’s goal-setting, and sensor data (IoT) that allows real-time engagement. Three goals were deemed as the most relevant for students during pandemic lockdowns, based on the World Health Organization recommendations for mental health: focusing on studying, engaging in physical exercise, and socializing (Figure 1: tab Goals). Goal setting and progress monitoring are connected to the use of both self-reported data and objectively measured data through the use of IoT (accelerometer and noise sensors). Concerning self-reported data, users can take a short, validated mental health survey that automatically calculates their level of anxiety (Figure 1: tab Measure), and they can set and monitor goals related to studying (e.g., focused studying for 30 minutes). Concerning objectively measured data using phone-based sensor data, the app uses the accelerometer for the user to set and monitor goals related to physical exercise and a noise sensor for the user to set and monitor goals related to socialization.

Figure 1 shows goal setting in the “Goals” tab, self-reported anxiety test for the “Measure” tab, progress and badges in the “Progress” tab, and leaderboard, points, and ability to share progress on social networks in the “Social” tab.

The app generates reminders at a time the user chooses to engage, logs past app use, and has a simple and intuitive interface and interactions. Its prototype can be [downloaded for testing](#).

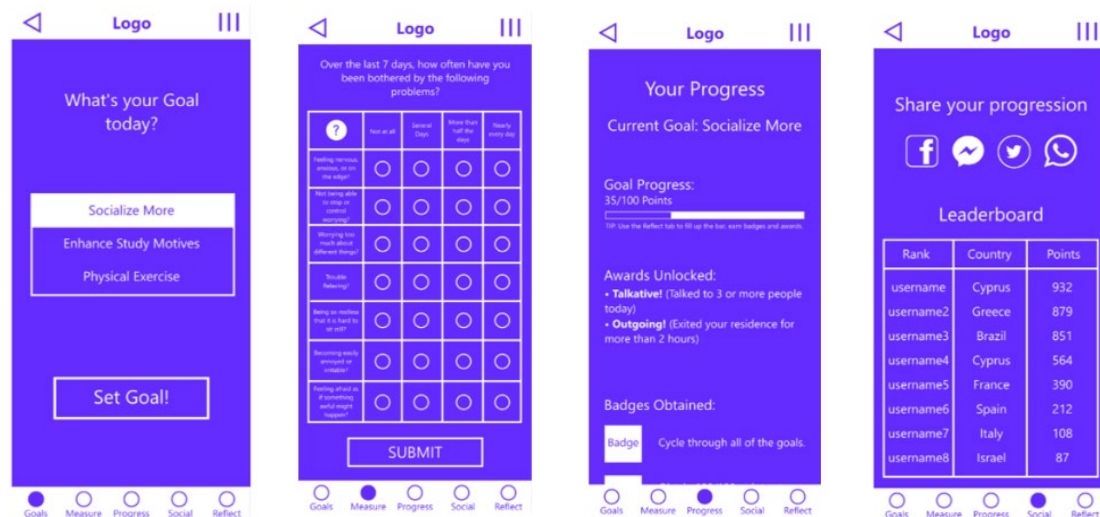


Figure 1: Screenshots of the prototype of the resilience app showing Goals, Measure, Progress, Social, and Reflect tabs

4. Evaluation of feasibility and usability

The evaluation of the prototype’s feasibility was based on a questionnaire including ten statements using a 5-point Likert scale ranging from 1= “not at all useful” to 5= “extremely useful,” evaluating each app functionality separately. It was completed after testing the app so that users could familiarize themselves with each demonstrated functionality before they were asked to evaluate it. The evaluation of the prototype’s usability was based on the System Usability Scale, a standardized instrument that includes ten statements using a 5-point Likert scale.

In November 2021, 30 first-year undergraduates (M=18.41 years old, SD=0.57, min=18, max=20) tested the prototype resilience app face-to-face and completed the evaluation questionnaires examining feasibility and usability. Neutral to positive responses (M=3.34 out of 5, which is between “somewhat useful” and “very useful”) were received for all functions indicating feasibility. Design usability was evaluated as satisfactory (System Usability Score=70.3).

Before this study, in April 2021, 74 participants ($M=21.86$, $SD=1.78$, $min=18$, $max=24$), most of whom were third/fourth-year students (86.5%, 64/74), tested the prototype and completed an evaluation questionnaire examining feasibility and usability. Positive responses ($M=3.77$ out of 5) were received for all functions indicating feasibility and acceptance of the design, and usability was evaluated as satisfactory (SUS score=72.5). The study was conducted online due to social distance measures and university closures imposed due to the COVID-19 pandemic (Nicolaidou et al., 2022).

A comparison between the two samples of students using an independent samples t-test showed that students attending higher years in university than the first year evaluated the feasibility of the app significantly higher ($M=3.76$, $SD=0.82$) than first-year students ($M=3.34$, $SD=0.72$) ($t(99)=2.39$, $p=0.019$). A correlation analysis including students of both studies ($n=104$) between their age ($M=21.31$, $SD=3.02$) and their evaluation of feasibility scores ($M=3.6$, $SD=0.84$) resulted in a statistically significant, moderate positive correlation ($r=0.27$, $p=0.005$). This finding indicates that older students who were potentially more mature and experienced in overcoming university life challenges were more inclined to appreciate the potential value of a gamified application for resilience.

Future research will evaluate the app in a quasi-experimental setting.

5. Implications for the design of gamified mobile apps

Mobile health apps often feature dense sections of psychoeducational text. To overcome this limitation, app designers can provide users with specific, brief, and accessible recommendations and resources using minimal text. App designers can embed validated mental health surveys that are easy to complete (e.g., GAD-7 in Figure 1, tab Measure) and can be scored automatically so that users can immediately receive an interpretation of their score. IoT can seamlessly provide data that can be valuable a) for the users to understand their routines (e.g., with respect to studying), b) for the developers to improve the app design, and c) for researchers interested in examining the effectiveness of mental health apps and their connection to behavioral change and learning.

References

- Golden, E. A., Zweig, M., Danieleto, M., Landell, K., Nadkarni, G., Bottinger, E., Katz, L., Somarriba, R., Sharma, V., Katz, C. L., Marin, D. B., DePierro, J., & Charney, D. S. (2021). A Resilience-Building App to Support the Mental Health of Health Care Workers in the COVID-19 Era: Design Process, Distribution, and Evaluation. *JMIR Formative Research*, 5(5), e26590.
- Litvin, S., Saunders, R., Maier, M. A., & Lüttke, S. (2020). Gamification as an approach to improve resilience and reduce attrition in mobile mental health interventions: A randomized controlled trial. *PLOS ONE*, 15(9), e0237220. <https://doi.org/10.1371/journal.pone.0237220>
- Nicolaidou, I., Tozzi, F., Kindynis, P., Panayiotou, M., & Antoniadis, A., (2019). Development and usability of a gamified app to help children manage stress: an evaluation study. *Italian Journal of Educational Technology*, 27(2), 105-120. <https://doi.org/10.17471/2499-4324/1050>
- Nicolaidou, I., Aristeidis, L., Christodoulou, C., & Lambrinos, L. (2021). Co-creating a gamified app for enhancing students' emotional resilience in times of crisis (COVID-19), *INTED2021 Proceedings*, p. 4169-4175 [10.21125/inted.2021.0850](https://doi.org/10.21125/inted.2021.0850)
- Nicolaidou, I., Aristeidis, L., & Lambrinos, L. (2022). A gamified app for supporting undergraduate students' mental health: A feasibility and usability study. *Digital Health*, 8, <https://doi.org/10.1177/20552076221109059>.
- Torous, J., Wisniewski, H., [...] et al. (2019). Creating a Digital Health Smartphone App and Digital Phenotyping Platform for Mental Health and Diverse Healthcare Needs: An Interdisciplinary and Collaborative Approach. *Journal of Technology in Behavioral Science*, 4(2), 73–85. <https://doi.org/10.1007/s41347-019-00095-w>
- Wood, A. E., Prins, A., Bush, N. E., Hsia, J. F., Bourn, L. E., Earley, M. D., Walser, R. D., & Ruzek, J. (2017). Reduction of Burnout in Mental Health Care Providers Using the Provider Resilience Mobile Application. *Community Mental Health Journal*, 53(4), 452–459. <https://doi.org/10.1007/s10597-016-0076-5>