Facilitating Giving and Receiving Support in Existing Social Groups with a Journaling Chatbot

by

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ABSTRACT

A chatbot was designed to promote positive mental health by facilitating giving and receiving support within existing social groups. Surveys and interviews were conducted to evaluate the suitability of journaling prompts for use by the chatbot. A 2-week in-the-wild study was conducted with 4 groups of 4-6 friends (*n=20*). Twice a week, the chatbot asked a personal question to a group, collected and shared answers among that group, then directed each user to respond to another user's answer.

Exit interviews indicated that: (1) some chatbot interactions led to later interactions outside of the chatbot, (2) participants learned new things about their group members, even those they had other frequent contact with (3) the social aspect of the chatbot affected user's responses to journaling prompts. Pre-study and post-study survey results suggest that, after using the chatbot for two weeks, individuals felt closer to their social group and enjoyed sharing updates with their friends and families more. Based on these results, the presented chatbot could be used to encourage meaningful social interactions that may not happen spontaneously and strengthen existing social relationships.

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2 Introduction

Mental illness is a major problem in the United States, with approximately one in five Americans affected by some form of mental disorder each year [31]. Preventive mental health practices - like self-reflection, mindfulness, and journaling - are one avenue of enhancing positive mental health [2][35][25]. Computer interfaces like apps and web tools can make treatment and preventive care more accessible by providing flexibility in time and location [26]. Chatbots may be an especially scalable and accessible modality for preventative care as they can be implemented on popular messaging platforms such as SMS and Facebook Messenger. These platforms are already well adopted – it is estimated that over 80% of people ages 18-44 with internet access in the United States use Facebook Messenger [11]. Users may already be familiar with the interfaces of those platforms. Chatbots for mental care have been used for CBT [6], self-compassion exercises [18], and exchanging positive messages [23].

Traditionally chatbots are designed for one-to-one conversations between a single user and a conversational agent, and do not allow for interactions within groups of people. A group-based chatbot that mediates conversations within a group could potentially increase social support and utilize social motivation for preventive mental health care activities. In this thesis, I explore how a group-based chatbot can be used to encourage positive social interactions that may not happen organically and motivate users in completing preventive mental care journaling activities. This thesis presents a chatbot for group-based preventive mental care that asks users journaling prompts and shares responses among a user's group, a pre-existing social group designated by the user.

A group-based chatbot utilizing existing social groups can promote positive mental

health by strengthening social relationships, encouraging self-reflection, and facilitating support-giving and support-receiving. The prompted sharing format of the chatbot encourages users to share their feelings on personal topics that may not arise in casual conversation. The structured activity nature of the chatbot allows for equitable sharing opportunities within the group, and normalizes sharing as part of a prescribed activity, removing some of the social burden that can occur with initiating conversations. This thesis presents (1) the design of a group-based chatbot for existing social groups designed to promote self-reflection and peer support, (2) a survey- and interview-based study (n=*9* participants) on the design of appropriate prompts for reflection exercises with social groups, and (3) results from a longitudinal study with four social groups (n=*20* participants) who used the chatbot in their day-to-day life.

3 Related Work

Social support, or having support available through friends, family, and community [19] has been well correlated with low depression and positive mental health [21, 19, 12], and with positive affect [33, 24, 1]. In a survey-based study with 1,378 college students, Hefner and Eisenberg found that students with lower quality social support were more likely to experience mental illness [12]. In a longitudinal study with 244 college students Nosakarhe et. al. [24] found that a positive social interaction was the best predictor of calmness. The chatbot described here facilitates social support, which is directly related to positive mental health.

Previous studies have shown that technology-mediated social support can effectively promote positive mental health and mitigate anxiety and depression [34, 17]. Rice et. al. found that social interactions with at-home friends mitigated anxiety and depression among homeless youth, while face-to-face interactions with street-based peers increased risk of anxiety and depression [27]. The nature of the social relationship is an important factor in its relation to mental health, and technology can help people connect with those individuals with whom they have positive relationships. The chatbot presented in this thesis allows users in self-selected small groups, helping facilitate interactions within a group that they have explicitly opted in to.

Technology-mediated social support platforms frequently connect groups of strangers with a common challenge or goal, often within a professionally moderated ecosystem [29, 28]. Connecting with strangers using technology has the benefit of anonymity, and the large reach of online communities can allow users to find people with closely shared experiences and identities. However, there are known benefits from social interactions

among people with close ties [4, 3]. A meta-analysis by Frost et. al. found that when Facebook was used specifically to send supportive messages and encourage interactions among friends, it had a positive effect on mental health; however, more general usage was correlated with negative mental health effects. Particularly, having a large number of friends and spending a long time on Facebook were associated with negative effects on mental health [7]. The chatbot presented in this thesis was designed to allow users to benefit from facilitate interactions with people already in their network, without incorporating aspects of social media associated with negative mental health. The chatbot is limited to within a small, close group and has a timed schedule of interactions, mitigating the negative mental health effects of continuously browsing and ruminating on updates from large networks associated with social media platforms like Facebook.

Previous studies with chatbots promoting positive mental health have largely focused on an interaction between a chatbot and a single user. Woebot delivered CBT and reduced depressive symptoms to a group of college students [6]. Lee et. al. tested a care-giving and care-receiving chatbot, Vincent, and suggested that having users deliver care to the chatbot was particularly effective [18]. However, there are differences in support received from an AI agent and a person, since human-human and human-chatbot conversation may differ both in content [8] and effect [13]. In the presented work, a chatbot is used to facilitate people giving and receiving support to each other. To my knowledge, there is one prior study on a group-based chatbot – Sunny facilitated sharing positive messages between groups of friends. A longitudinal study with Sunny suggested that the chatbot encouraged interactions that would not happen organically [23]. The chatbot presented herein focuses on prompting journaling activities, sharing responses within a social group, and encouraging one-on-one follow-ups within the group. Compared to the focused sharing of positive messages as in [23], journaling may be more flexible. Journaling can support different types of sharing and support, like offering help to others in overcoming challenges and meeting goals. Cycling through a variety of dif-

ferent prompts (e.g. gratitude, self-affirmation/capitalization) may also help motivate continued participation in the activity as it changes each interaction.

Journaling is an exercise where individuals simply write about their emotions and thoughts, sometimes with a given prompt. Journaling, particularly when focused on emotions and cognition [32], can have mental health benefits [15]. The presented chatbot employs shared journaling, where participants respond to prompts and the responses (with the author's permission) are shared among their small social group. Chatbots have been used to guide journaling in the past [16], including the previously mentioned chatbot Woebot that employed CBT [6]. However, to the authors' knowledge, previous journaling chatbots were designed for one-to-one conversation between the chatbot and user. The group-based element in the presented chatbot may help motivate continued participation in the exercises, and help mitigate high drop-out issues that often occur with technology-based programs [5, 20]. While journaling is normally a private activity, this chatbot adds a social element to a typically non-social activity.

4 Group Journaling Chatbot

The presented group-based chatbot facilitates journaling exercises within an existing social group. Twice a week, the chatbot prompts all the users in a group with a journaling exercise in the form of a question, such as "Who made a positive difference in your life recently?". The chatbot receives sharing permission for each individual message from a user. The next day, the chatbot shares all the responses among the members of the group. Then, the chatbot asks each user to respond to a randomly selected user's response, by sending a direct message.

4.1 Design

4.1.1 Prompt Design

The journaling prompts were split into seven categories: self-affirmation, challenges, personal goals, self-compassion, gratitude, mental health, and social support. Self-affirmation prompts encourage thinking about personal successes to reinforce self-esteem and self-worth. Challenge-related prompts encourage reflecting on negative experiences and how to react and overcome them in the future. Personal goals encourage users to set and reflect on short-term and long-term goals. Self-compassion prompts encourage users to be kind to themselves. Gratitude prompts encourage users to think about what they are grateful for. Mental health check-in prompts encourage self-awareness of mental health, and can help users ask for support from other group members. Social support prompts encourage reflecting on positive social relationships. Table 1 contains a table of example prompts for each category.

Table 1: Prompt categories and sample prompts

Category	Prompt
Self-Affirmation	What's something you did an awesome job at recently?
Challenges	Anything you wish that went better this week?
Personal Goals	What's a personal goal you have right now, and how are you doing on it?
Self-Compassion	Was there a time recently where you were too hard on yourself?
Gratitude	What's something that made you smile this week?
Mental Health	How's your work-life balance been recently?
Social Support	Who made a positive difference in your life recently?

The categories and prompts were selected based on a survey of prior studies, technologies, and tools [10, 30, 22, 37, 36, 9]. For instance, gratitude exercises have been associated with social support [37] and positive mental health [36]. Prompts in the selected categories were designed to elicit responses that would be both interesting and appropriate to share with a small, close social network.

The prompts were designed to facilitate sharing information and starting conversations, with the goal of increasing the number and quality of social interactions within the group. The wording of the prompt are varied slightly based on the day of the week to ensure relevance, e.g. "What's something new you want to try this week?" on Monday and "What's something new you want to try this weekend?" on Thursday.

4.1.2 Conversation Flow

The chatbot has two types of interaction days: Prompt Days and Interaction Days (Figure 1). On a Prompt Day, the chatbot asks the same journaling prompt to all users in a group, and asks for permission to share each user's response. Figure 2 shows a sample Prompt Day conversation. On an Interaction Day, the chatbot shares all the responses among the group members, then asks each user to react to another randomly selected user's response via a response message. Figure 3 shows a sample Interaction Day conversation. In the conducted study, Prompt Days were on Mondays and Thursdays, while Interaction

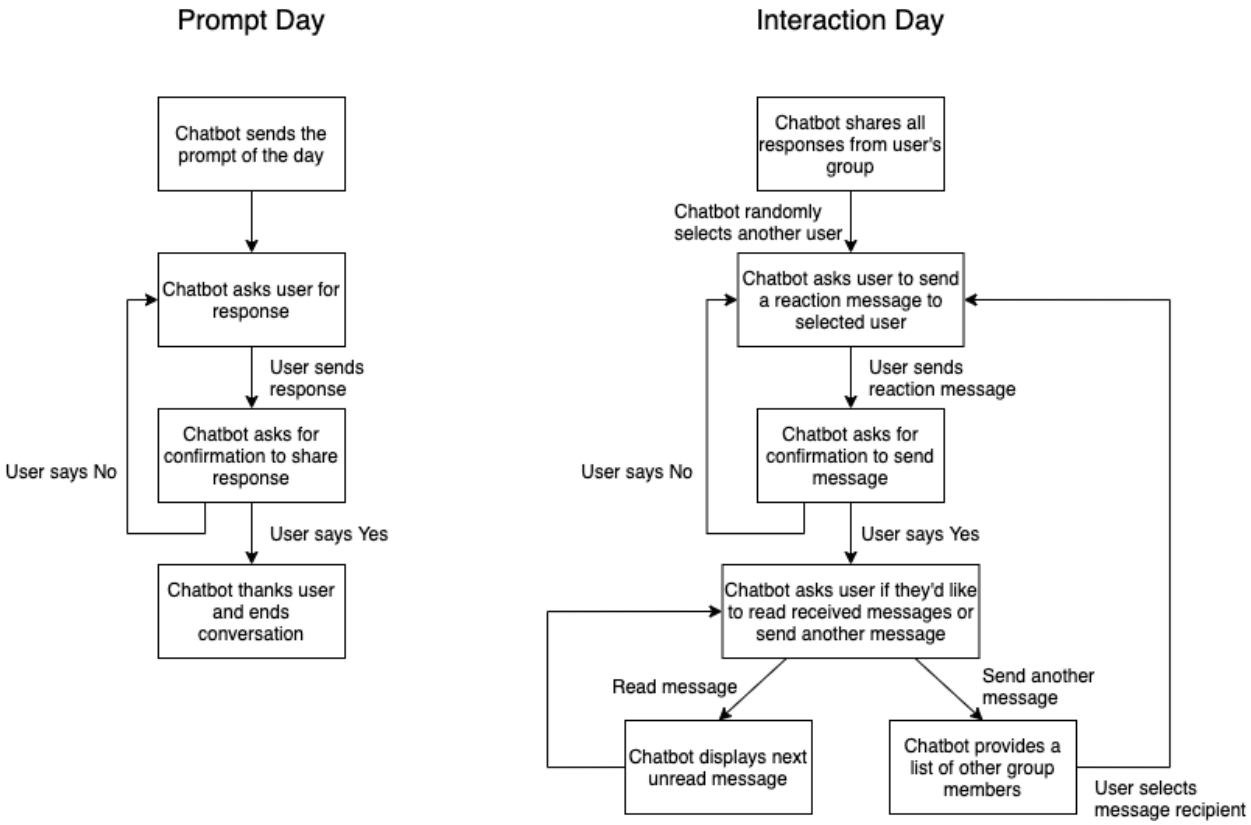

Figure 1: Conversation flow of the chatbot interactions for Prompt Days and Interaction Days. Unlabeled arrows represent automatic transitions that happen without user input.

Days were on Tuesdays and Fridays. The timing and spacing of the days were selected to give users adequate time to respond during the cadence of a week. Users can respond to the chatbot at any time during the day at their convenience, and do not have to respond immediately after receiving a prompt or message from the chatbot.

On Prompt Day, the chatbot sends everyone in a group the same prompt, along with a friendly greeting. After receiving a response, the chatbot asks for explicit consent to share the response with a yes-no question, "Okay if I share this with your friends tomorrow?", followed by the text to be shared (Figure 2). The chatbot asks for permission for each message, to ensure that users always have control over what is shared with the

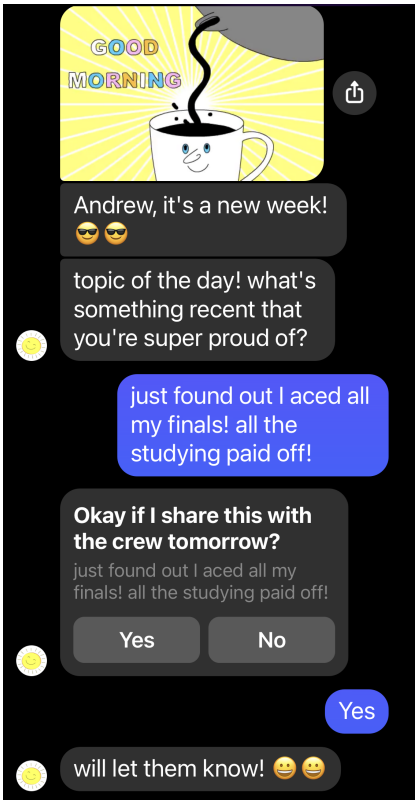

Figure 2: Sample Prompt Day conversation

group. If a user did not respond on Prompt Day or did not consent to share any message, the chatbot will use "no update" as that user's response.

Each Prompt Day is followed by an Interaction Day (Figure 3). On an Interaction Day, the chatbot shares the responses from the day prior with the group as a whole, and asks each user to send a message to another randomly selected user. The chatbot asks for explicit permission to share each response message to ensure that users can edit and control all messages sent via the chatbot. Once users sends the first reaction message, they are free to send more reaction messages to anyone and read any received reaction messages. This condition was designed to encourage users to both send and receive messages using the platform, and to ensure that each user in the group receives at least

one message on an Interaction Day. On each Interaction Day, a user should send and receive at least one reaction message.

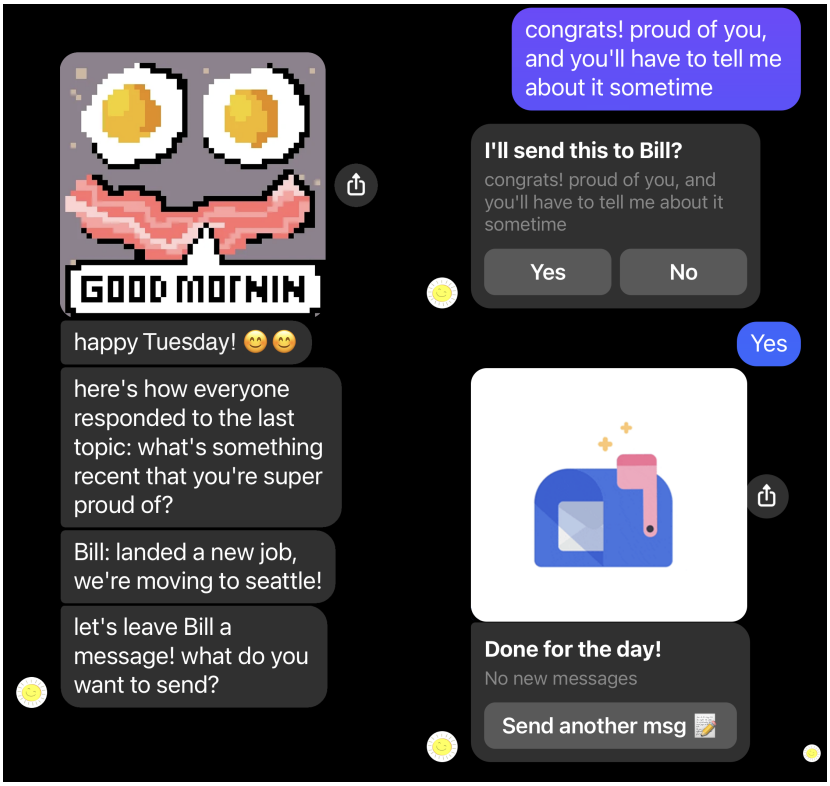

Figure 3: Sample Interaction Day conversation

4.1.3 Conversation Design

Lowercase was used to make the dialog friendly and inviting [38], and imitate conversation texting. The chatbot has a conversational style consistent with its target audience [14], which for the conducted study was primarily college students in their early 20s. The chatbot also uses GIFs frequently, both while greeting users and confirming when a message has been sent through the chatbot (Figures 2, 3).

4.2 Implementation

The chatbot was implemented as a Facebook Messenger chatbot – users send messages to the chatbot as they would to a Facebook friend. The chatbot's backend server was implemented in Node.js and communicates with the Facebook Messenger API to send and receive messages. The backend uses a PostgreSQL database to store all user data. The backend server and database is hosted on Heroku, a platform-as-a-service provider.

As an anti-spam measure, Facebook Messenger chatbots are only allowed to message users in a 24-hour window after the last message the user sent. As such, on Prompt Days, users need to message the chatbot first to start the interaction. Since Interaction Days immediately follow Prompt Days, the chatbot can message users directly on Interaction Days unless the user did not participate in the preceding Prompt Day.

A state machine keeps track of each individual user's state during interaction. Each state represents a different stage in completing the day's tasks. Upon receiving a message, the chatbot responds based on the message contents and the user's current state, then updates the user's state accordingly.

5 Methodology

Two studies were conducted: a survey- and interview-based preliminary design evaluation (*n=9*) to evaluate the suitability of the prompts and overall chatbot design prior to deployment, and a 2-week user study (*n=20*) to evaluate the chatbot's design and utility.

5.1 Pre-deployment Surveys and Interviews

The chatbot's dialog and prompts were evaluated using a two-part online survey and an interview. During the survey, participants were asked to evaluate the chatbot's dialog and prompts. During the interview, participants were shown a live demo of the chatbot and asked for qualitative feedback.

In the survey, participants first reviewed screenshots with sample chatbot conversations with a test user for both Prompt and Interaction Days. Users were asked to rate the chatbot in terms of clarity ("Very Unclear/Confusing" to "Very Clear") and naturalness ("Not at all natural. Uses words/phrasings that real people would never use" to "Completely natural. As if messaging a real person"). Participants were then asked to provide words that describe the chatbot's "personality" from the dialog. Then, each participant reviewed a random subset of 20 prompts. For each prompt, participants answered whether or not they were comfortable answering the prompt, whether or not they were comfortable sharing their answer with their friends, and how interested they were in hearing how their friends responded.

5.2 Longitudinal Deployment

In the longitudinal user study (*n=20*), four groups of 4-6 friends used the chatbot over a two-week period. Participants completed both a pre-study and post-study survey about social support among their groups and their habits on sharing things with others. The pre-study survey also included questions about communication habits and planned events during the study period, to help the researchers identify potential external factors that might affect participants' behavior and mood. The post-study survey included questions about their experience using the chatbot. Following the post-study survey, participants were interviewed for feedback on their experience with the chatbot in the study.

During a two-week study with two Prompt Days per week, users respond to four different prompts. The prompts for the study were selected based on the results of the survey-based evaluation of prompt design, and to span unique categories. The prompts selected and their categories were: "What's something that went really well this past weekend?" (self-affirmation), "What's a personal goal you have right now, and how are you doing on it?" (personal goals), "Who made a positive difference in your life recently?" (social support), and "Anything you wish that went better this week?" (challenges).

5.3 Participants

All participants were university students and recent graduates. Participants in the pre-deployment survey- and interview-study were recruited through word-of-mouth and were not compensated. Participants in the longitudinal study were university students recruited via email advertisements on university mailing lists. The advertisements called for groups of 3-8 friends/family interested in talking to a wellbeing chatbot for medi-

ating conversation in groups. Participants in the longitudinal study defined their social group when registering. Each person in the social group was required to individually register for the study for a group to be eligible for participation. Each participant in the longitudinal study was paid 50 dollars.

Groups were selected randomly for participation among those groups with an appropriate number of registered participants (4-6) who were in the same timezone. Participants enrolled in the longitudinal study reported living in the same university residence as their group members, and having frequent in-person contact with each other. These characteristics were not selection criteria for participating, and were discovered after participant selection.

6 Results and Discussion

6.1 Pre-deployment Surveys and Interviews

Table 2 contains statistics on the ratings of reviewed prompts. The number of reported responses differ slightly from prompt to prompt because respondents were shown a random selection of prompts to minimize survey response fatigue. Generally, participants were comfortable answering the presented prompts. Participants were least comfortable sharing prompts related to self-compassion, challenges, and their families. Participants were most interested in their friends' responses to questions regarding gratitude and self-affirmation, especially those asking about recent positive events.

Interviewees generally thought the chatbot's speech was clear (*average 4.44/5, std 0.52, n=9*) and fairly natural (*average 3.89/5, std 0.33, n=9*). Some words participants use to describe the chatbot were *positive*, *happy*, *excited*, and *friendly*, in line with the targeted personality. One participant thought the "chatbot seems a little too happy", but thought "that was the point" i.e. appropriate for its perceived use (participants were told the chatbot was for encouraging conversations in existing social groups).

Multiple interviewees commented on the mismatch of the chatbot's enthusiastic personality and the subject of certain prompts. Particularly, the chatbot asked "What hasn't been going so well recently?" and the sample response described an unfortunate, sad event. However, the chatbot responded with enthusiasm using emojis and repeated punctuation. Based on this feedback, the chatbot design was modified to respond neutrally for prompts that might elicit response with negative affect.

Table 2: Prompt ratings from pre-deployment survey

Prompt	Mean (std)		
	Answer[1]	Share[1]	Interest[2]
What's something you did an awesome job at recently? *n=7*	3.0 (0.0)	2.86 (0.33)	4.29 (0.42)
What's something that went really well this past weekend? *n=5*	3.0 (0.0)	3.0 (0.0)	4.8 (0.37)
Anything you wish that went better this week? *n=5*	3.0 (0.0)	2.8 (0.37)	4.4 (0.73)
What's a recent personal challenge and how'd you get through it? *n=6*	3.0 (0.0)	2.17 (0.35)	4.0 (0.53)
What hasn't been going so well recently? *n=5*	3.0 (0.0)	2.2 (0.37)	3.8 (0.89)
What's a personal goal you have right now, and how are you doing on it? *n=6*	3.0 (0.0)	2.83 (0.35)	4.17 (0.64)
What's something you want to change this week? *n=6*	3.0 (0.0)	2.5 (0.46)	4.17 (0.83)
What's something new you want to try this coming weekend? *n=6*	3.0 (0.0)	2.67 (0.44)	4.0 (0.93)
What's a long-term personal goal you have for the next year+? *n=5*	3.0 (0.0)	2.6 (0.45)	4.4 (0.73)
Was there a time recently where you were too hard on yourself? *n=5*	3.0 (0.0)	2.2 (0.37)	3.6 (0.73)
Are you being kind to yourself? *n=7*	2.86 (0.33)	2.29 (0.42)	3.57 (0.85)
What's something you want to do to treat yourself this week? *n=5*	3.0 (0.0)	2.8 (0.37)	4.4 (0.73)
What's something that made you smile last week? *n=6*	3.0 (0.0)	2.83 (0.35)	4.83 (0.35)
What are you grateful for this week? *n=6*	3.0 (0.0)	2.83 (0.35)	4.17 (0.99)
What was the best thing that happened last week? *n=6*	3.0 (0.0)	3.0 (0.0)	4.5 (0.46)
When was the last time you did something to relax, what'd you do? *n=7*	3.0 (0.0)	2.71 (0.42)	3.71 (0.65)
Have you been taking care of yourself recently? *n=8*	3.0 (0.0)	2.38 (0.46)	4.25 (0.62)
How's your work-life balance been recently? *n=6*	3.0 (0.0)	2.83 (0.35)	4.17 (0.99)
How is your family doing? *n=6*	3.0 (0.0)	2.33 (0.69)	3.17 (0.64)
Who made a positive difference in your life recently? *n=6*	3.0 (0.0)	2.83 (0.35)	4.67 (0.44)
Who's someone you just need to catch up with? *n=7*	3.0 (0.0)	2.57 (0.68)	3.71 (0.82)

[1] Answering if comfortable answering/sharing, *1=No, 2=Maybe, 3=Yes*

[2] Answering "I am interested in knowing how my friends would answer this question." From *1=Strongly disagree* to *5=Strongly agree*

6.2 Longitudinal Study

Participants in the longitudinal study used the chatbot for 2-weeks and completed pre-study and post-study surveys as well as an exit interview on their experience.

Some technical difficulties occurred during the study. These difficulties may have affected some aspects of the results, particularly the usability and smoothness of the technology, but did not fundamentally alter the study. Users had to message Sunny first on Prompt Days because of a Facebook Messenger anti-spam measure. Some members of groups received a different prompt due to timing anomalies twice during the study ("When was the last time you did something to relax, what'd you do?" instead of "Who made a positive difference in your life recently?"; and "What are you grateful for this week?" instead of "What went really well this weekend?"). In these cases, the responses to each prompt shown to participants were compiled and delivered via the chatbot as usual. One user had trouble with the Facebook Messenger interface and did not read any received reaction messages, this participant was omitted from the analysis as reading messages was an integral part of the study.

The study results may have been affected by mood- and behavioral changes due to the start of midterm exams during the study period. The results were also likely affected by group dynamics (Table 3). Several groups reported that they had known each other for only 2-3 months prior to the start of the study. The participating groups were part of a university's on-campus "pod" system, which allows undergraduate students to have indoor, in-person social interactions like meals only with a pre-registered network of up to 6 peers. This is a unique and distinct social dynamic.

Table 3: Group information and usage practices

Group	Age	Group Dynamics	Usage Observations	Interesting Feedback
1 *(n=6)*	18-19	Most met half a year ago, others have longer history	High usage of emojis, emoticons, exclamation marks. Long responses, messages. Some optional messages sent	Preferred combining Prompt and Interaction Days. Sharing of a negative event led to in-person check in
2 *(n=6*)*	18-19	All members met 3 months ago	Almost no usage of emojis, emoticons, exclamation marks. Long responses, messages. No optional messages sent	Group still getting to know one another. Many enjoyed having prompts to think about and learning about others
3 *(n=5)*	19-20	3 members met 1.5 years ago, other 2 members met half a year ago	Low usage of emojis, emoticons, exclamation marks. Varying length of responses, messages, depended on user. Some optional messages sent	Some really liked chatbot and personality, others preferred directly inputting responses and messages in an app. One user used responses that were ”easy to explain”
4 *(n=4)*	20	3 members met half a year ago, last member joined group 3 months ago	High usage of emojis, emoticons, exclamation marks. Very long responses, messages. Many optional messages sent	Chatbot interactions frequently led to outside interaction. One user felt sharing a goal in prompt response made them ”feel accountable” and supported goal completion

*One user’s data omitted from analysis (6.2)

Table 4: Changes in pre- and post-survey responses for selected questions

Question	Mean (std)		Change	p
	Pre	Post		
"How close would you describe your assigned social circle?"[1]	5.05 (0.92)	5.42 (0.66)	0.37	0.049
Average of "How close are you to this member" for each group member[1]	4.95 (1.01)	5.12 (0.70)	0.17	0.37
Average of "How aware are you of this member's weekly activities..." for each group member[2]	4.48 (1.16)	4.99 (0.92)	0.51	0.02
Average of "How aware are you of this member's goals and aspirations." for each group member[2]	4.54 (1.19)	4.78 (0.99)	0.24	0.33
"I enjoy sharing my feelings with others."[3]	3.42 (1.20)	3.90 (1.04)	0.47	0.003
"I try to stay up to date with what's going on with my friends' and family's lives."[3]	4.52 (0.58)	4.11 (0.70)	-0.42	0.01

[1] From *1=Not close at all, strangers/acquaintances* to *7=Very close*
[2] From *1=Not at all aware* to *7=Very aware*
[3] From *1=Strongly disagree* to *5=Strongly agree*

6.2.1 Quantitative Results

The pre-study and post-study surveys included identical questions about social support among the group and dispositions to share personal information. Table 4 shows differences in participant responses to selected questions in the pre- and post-survey. Most participants completed the survey immediately after the study. However, one group completed the survey 3 days after the study ended due to a religious event.

The results suggest that participants felt closer to their group ($p = 0.049$) and more aware of the day-to-day of each member in their group, on average ($p = 0.02$) after using the chatbot. Participants also rated how close they felt to each member in their group – the average of these ratings also increased pre-study to post-study, but was not statistically significant ($p = 0.37$).

The results also suggest that after using the chatbot, users seemed to enjoy sharing their feelings with others more ($p = 0.003$). Perhaps users were more comfortable sharing personal information after frequently doing so over the study period. Interestingly, participants disagreed more with the statement "I try to stay up to date with what's going on with my friends' and family's lives" ($p = 0.01$). This may be because users felt less of a need to stay up to date because the chatbot would do so for them, or because after using the chatbot users realized that there were things going on in their friends' lives that there were previously unaware of.

The lengths of messages written by users were analyzed. There was a slight positive relationship between prompt response length and the corresponding required reaction message (*slope=0.18, confidence intervals at 95% [0.05, 0.32]*). Longer responses may have more content for users to comment on. Also a short reaction message to a long, thoughtful response could be seen as rude, since it may indicate the sender is uninterested.

Table 5: Selected interview questions

Question
Does your group usually talk about the things brought up in the prompts?
Did a message sent by Sunny ever start a conversation outside of Sunny?
Did the chatbot affect conversations between your group members?
Did the chatbot help you stay more up-to-date with what's going on in your group member's lives?
What did you think about the Prompt/Interaction Day schedule?
What did you think about the frequency of interacting with the chatbot, 4 days a week?
Did you feel pressured to respond to the chatbot because everyone else was using it?
Did you feel pressured to respond to the chatbot on Prompt Days because otherwise your group would see "no update"?
Would you use something like this day-to-day?
Did you like the chatbot form or would you have preferred another platform?

6.2.2 Interview Results

Participants were interviewed for feedback on their experience with the chatbot. Two researchers independently coded the interview transcripts to record general observations. Then, similar observations were grouped into themes. The major themes identified through this process are: (1) some chatbot interactions led to later interactions outside of the chatbot, (2) participants learned new things about and felt more up-to-date with their group members (3) the social aspect of the chatbot affected how users responded to the journaling prompts, and (4) personalizing chatbot interaction for each group could improve user experience.

Two of the four groups reported that chatbot interactions led to later interactions outside of the chatbot, most frequently in-person. The other two groups felt that chatbot interactions stayed within the chatbot. The most common form of later interaction was from someone sharing a prompt response about an upcoming activity and another person later asking about the activity. The chatbot provided "conversation material" for later interactions, as one participant mentioned. During the study, another type of later

interaction was in providing support. One such instance was when a participant shared they were having a rough time, another participant reached out in-person to help.

The prompt "What's a personal goal you have right now, and how are you doing on it?" frequently led to later interactions, most commonly to check-in on a participant's progress towards the goal shared. Most participants shared short-term goals for the week. Reaction messages were generally about giving advice and suggestions from past personal experience as well as words of encouragement. Some reactions were invitations to work on the goal together because the reaction sender was also working on a similar goal. One such reaction message was "I have the same goal...I'm down to check-in and keep each other on track." Another participant also felt that by sharing a goal publicly, they felt "held accountable" which helped them complete the goal.

Many participants felt that they learned more about the other members of their group, especially for group members they had less frequent contact with. One participant remarked that the chatbot helped give "an idea of how [the others] were doing" if they didn't get a chance to "interact with [someone] in person that day." Even for friends with frequent contact, one participant said the chatbot allowed for "a new perspective on their friends' lives."

Most participants mentioned that the prompt topics weren't usually discussed in normal conversation within the group. All participants reported they hadn't discussed those topics with every other group member or had only discussed certain aspects of the topic e.g. short-term versus long-term goals. They appreciated how the chatbot facilitated interactions with everyone in a direct, straightforward manner. One participant also reported that they learned an interesting thing about a close friend that they previously just hadn't thought to ask about.

The sharing nature of the chatbot affected how users responded to journaling prompts, as compared to how they would have responded privately for self-reflection. Participants

said their responses were based on genuineness as well as on privacy, appropriateness for the activity, and public perception. Many participants said they simply just had personal secrets they weren't open to sharing, even to close friends. One participant said they picked responses that would be "easy to explain" in a text message. Another participant did not use the first answer that came to mind because they felt the circle would react negatively. Interestingly, one participant also reported that the happy, enthusiastic personality of the chatbot encouraged them to write "positive news" in responses and messages.

Many participants reported that they enjoyed reading the other prompt responses, more than writing responses or exchanging messages. Interestingly, one participant felt it was "necessary to put [their] own response" since they wanted to see everyone else's responses. Almost no one said that they felt pressured to send a prompt response to avoid the default response of "no update." Instead, participants were generally motivated to interact with the chatbot because they enjoyed using the chatbot or felt committed to the study. Participants said that they did not grow tired of the chatbot over the two-week period, with many reporting that they were excited to see new prompts. Some participants reported feeling more engaged near the end of the study because they were more familiar with the chatbot.

Participants were mixed on the frequency and format of chatbot interactions. Many participants thought interacting 4 times a week was just right. The remaining participants said they would have preferred more frequent interaction because they either enjoyed using the chatbot or preferred having a more consistent schedule (Monday-Friday or everyday). Some liked the Prompt Day and Interaction Day split because it gave them more time to think about their prompt response and lowered the time commitment per day. Others preferred combining the days because some prompts were outdated by the time users could react to them e.g. reacting with words of encouragement to "I want to

finish [my homework] by tomorrow." The difference in opinion suggest that personalizing frequency and format of interaction to each group could improve user experience.

All but one participant enjoyed the happy, enthusiastic personality of the chatbot. Many offered that they particularly enjoyed seeing the variety of GIFs and emojis. Some participants also added that they thought the chatbot's name and profile picture supported the happy "persona." Words that participants used to describe the chatbot include *fun*, *cute*, *bubbly*, *funny*, and *cheery*. All but one participant said they would not prefer a more neutral personality, and one participant said that a neutral personality would have been "less engaging."

Participants were mixed on the implementation of the shared journaling activity as a Facebook messenger chatbot, as compared to other hypothetical modalities. All participants used Facebook Messenger regularly and some appreciated how the chatbot blended in with their other contacts, as if it were a real person. Some participants said they might have preferred a standalone app where users directly input responses and messages. Another implementation suggestion was a chatbot that shared prompts within a group chat directly, so users saw responses directly in real-time.

7 Conclusion

These results suggests that the chatbot could be used to facilitate social support giving and receiving, which is well-associated with positive mental health. Pre-deployment surveys suggest that users were most open to sharing and interested about prompt responses about positive news e.g. gratitude, self-affirmation. Longitudinal study survey results suggest that participants felt closer to their groups and more open to sharing their feelings about personal topics after using the chatbot. Exit interviews indicated that some chatbot interactions led to later interactions in-person, such as checking in on a goal or offering support to someone having a bad day, and that the chatbot prompted interesting discussion outside of normal conversation. During the study, participants felt they learned new things about and saw different aspects of their group members, even those with frequent in-person contact.

8 Future Work

One direction for future work could be in testing the chatbot on larger and more diverse populations. This study's participants were limited to university students in the same living group who had a history of 3 months on average. A couple participants suggested that they would really enjoy using the chatbot with their high school friends, who they did not see frequently in day-to-day life. The format of the chatbot might also be well-suited for friend groups of older adults who are not geographically co-located. Wider studies or a public release could help understand the chatbot's utility for other populations.

During the user study, some participants were very open to sharing and frequently wrote a paragraph or more for prompt responses, while others only wrote one or two sentences. A future study could include personality tests for participants to explore how individual personalities and group composition affects chatbot usage.

Users were most excited to see how their group responded to prompts, which may have helped encourage participation. Future studies could explore if the tool could be made more engaging by adding additional social elements.

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