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Abstract

Time management and goal setting skills are essential for student academic success in higher education. Meanwhile, the recent advances of chatbots offer new opportunities to support goal setting in a conversational way. In this preliminary research, we investigate the effects of chatbots as a conversational goal setting tool for student learning. We developed a chatbot called Sammy that invites students to pledge their study goals and reflect on their goal completion. We conducted a 7-day study among 70 undergraduate students. Analysis on pre- and post-study surveys indicated a significant improvement in student perceived time management in learning goals. Analysis on student daily check-in with Sammy showed an upward trend of student satisfaction in goal completion and confidence in future goal setting. In the future, we will conduct a more comprehensive mixed-method analysis, improve the functionalities and usability of Sammy, and conduct longitudinal studies.

Keywords

Chatbots, conversational interface, goal setting, behavior change, learning.

Introduction

Time management and goal setting skills are essential for student academic success in higher education. This is more essential for students who have work and/or family responsibilities. Motivation theories have shown that goal setting and social accountability are effective mechanisms to stay on top of tasks. However, it might not be always easy for every student to find an accountability buddy and executing tasks. Meanwhile, the advancement of conversational agents (Luger and Sellen 2016), such as chatbots (Chaves and Gerosa, 2021), has provided promising opportunities for supporting student studies as an accountability buddy (Zhang et al. 2020). Recently, researchers have shown the potential and/or effectiveness of using chatbots in higher education, such as enrollment, student life, tutoring, career counseling (Yin et al. 2021). However, how to leverage chatbots to help students form healthy learning habits (such as setting goals) is understudied. Therefore, we aim at designing chatbots as an intelligent study buddy that college students can check in with.

This research-in-progress aims to explore the intervention effects of chatbots in supporting students' goal-setting behaviors in a conversational way by answering the following research questions: 1) What is the intervention effect before and after the study? 2) What is the temporal effect during the study? We designed and built a chatbot called "*Sammy*" as a study buddy and conducted a 7-day user study with 70 undergraduate students at a large public university in the United States. We found a significant improvement in participant reported time management skills and a trend of a temporal increase in their goal setting capabilities.

Related Work

In the education field, researchers have started to discuss the scenarios in teaching and learning where chatbots might be adopted (Winkler & Söllner, 2018; Hobert & Meyer von Wolff, 2019). In a review of educational chatbots for Facebook Messenger, Smutny et al. (Smutny & Schreiberova, 2020) evaluated 47

chatbots and found that most chatbots offered basic features such as sending messages and recommending resources. Since these features were not intelligent enough as AI teaching assistants, the authors suggested the appropriate integration of chatbots in learning. Despite the emerging effort in reviewing chatbots in educational technologies, most work focus on the design features, technologies (e.g., deep learning, NLP), but lacks the connection to theoretical pedagogical perspective in designing such systems.
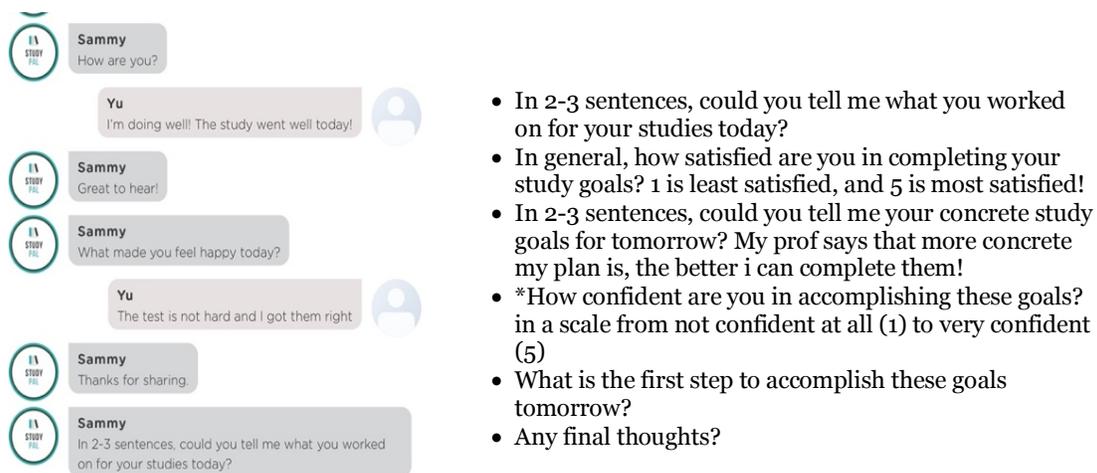
Meanwhile, research has explored using chatbots as a virtual coach to help users with behavioral intervention in a conversational way. For example, Foodbot designed by Prasetyo et al. (2020) is an mHealth application helps users to set goals for healthy eating. Another chatbot Tess, developed by Stephens et al. (2019), served as a behavioral coach to provide customized support for depression and anxiety to promote treatment adherence and behavior change. The most related work to our research is a chatbot called Learning Buddy (Du et al. 2021) that prompted students who are learning online to set up specific and measurable learning goals. Different from prior studies, we conducted a 7-day study to investigate the effects of a chatbot on behavioral change for learning.

Methodology

We started investigating the effectiveness of chatbots in helping student set study goals in a conversational style. To this end, we developed a chatbot called *Sammy* that chats with users every day to check in with their progress in goal completion from the previous day and setting goals for the next day. We used the chatbot as an experimental platform for two reasons. First, the conversational nature of a chatbot provides the sense of connectedness and interactivity of a study buddy compared with standard goal-setting and check-in tools. Second, chatbots have been commonly used by researchers to collect qualitative user data in an interactive way, e.g., interview (Xiao et al. 2020). The *Sammy* chatbot was designed as a check-in chatbot that was meant to lead a short daily conversation. Figure 1 shows a sample conversation screenshot of Sammy and the questions that Sammy asks users in a typical day. We slightly vary the wording each day to avoid the sense of repetitiveness for the students.

We designed and developed *Sammy* using Juji Studio, a no-code platform that supports developing chatbots in a convenient way. Juji Studio offers a user-friendly user interface that allows users to create a chatbot similar to creating a survey using tools like Qualtrics, Google Form. Juji Studio also provides chatbot templates of chatbots of various scenarios, such as job candidate interviews, front desk assistants. Developers can also set a database of pre-defined Q&A that could be used to respond to questions that exist in the database; questions that are not defined will be recorded in the system for developers to edit later.

We recruited participants from an upper-level Management Information Systems (MIS) class with an enrollment of around 120 students in a large public university in the United States. Students received extra credits for completing the study. The study was approved by the University's Institutional Review Board. The study consists of seven-day daily chatbot conversation and pre- and post-study surveys. Before the study, a pre-study survey was conducted to gather the baseline data of student perceived capabilities in

- In 2-3 sentences, could you tell me what you worked on for your studies today?
- In general, how satisfied are you in completing your study goals? 1 is least satisfied, and 5 is most satisfied!
- In 2-3 sentences, could you tell me your concrete study goals for tomorrow? My prof says that more concrete my plan is, the better i can complete them!
- *How confident are you in accomplishing these goals? in a scale from not confident at all (1) to very confident (5)
- What is the first step to accomplish these goals tomorrow?
- Any final thoughts?

Figure 1. Interface and dialog design of Sammy

managing time, setting goals, and making plans in their studies. The survey asked the participants to answer seven questions on a scale of 1-5 where 1 indicated totally disagree, and 5 denoted totally agree. The survey questions were adapted from time management questionnaire (FAU 2022). Then the chatbot Sammy conducted chatting-based interviews with the students for consecutive seven days. The research team emailed an URL link of Sammy to the participants every day at 6pm as a reminder for the daily check-ins. Participants were encouraged to finish the chats before they go to sleep that day, but not to make up for any missed day. Even though the chatbot asked the same questions every day, the detailed wording was slightly updated to adapt to each day, such as day of the week, greetings etc. After the seven days, participants filled out a post-study survey asking the same questions as the pre-study survey. Participants could fill out the pre- and post-study surveys and conduct the conversations on their laptops or phones. No chatbot training was conducted to students prior to the study.

Findings

The results were analyzed based on three sources of data: 1) the pre-study survey, 2) the daily chat logs throughout the course of a week and 3) the post-study survey. Among the 101 participants who registered for the study, 70 students have finished both the pre- and post-study research surveys and at least one chat throughout the study. They included 21 females and 49 males. All participants were full-time students taking 12 and more units during the semester. We examined our research questions using the datasets of the 70 participants, who have generated 458 chats in total, with an average of 6.54 chats per participant.

RQ1: What is the intervention effect before and after the study?

We compared participants' perception about time management and goal setting in studies before and after the intervention study. We conducted a paired sample t-test on the scores of questions from the pre- and post- survey surveys (results presented in Table 1). Overall, results indicate a significant increase in four questions: using time more effectively (Q3: M_before = 3.20, M_after = 3.54, t(69) =-2.23, p = 0.023), spend more time planning for their time (Q4: M_before = 3.36, M_after = 3.67, t(69) = -2.44, p = 0.017), better at meeting deadlines without rushing (Q5: M_before = 3.24, M_after = 3.60, t(69)= -2.30, p = 0.024), and more up-to-date on studies (Q6: M_before = 3.33, M_after = 3.83, t(69) = -3.38, p = 0.001). There is also a trend that students spent more time on academic matters (Q7: M_before = 3.44 , M_after = 3.70, t(69)= -1.76, p = 0.083). Participants' chatlog and post-study survey also reflect the above findings. For example, ID 7 in the post-research survey commented, *"Chatbot is very helpful in altering and reminding me of ongoing assignments/tasks/projects/tests. This seems like a great tool when further developed. It is a great experience working with the chatbot."*

However, no significance was found when comparing the priority in doing things before and after the study (Q1). It is possible that students' sense of priority might not easy to change in a short week period. It is

Questions	M (SD) before	M (SD) after	Diff.	P-value
Q1. I do things in order of priority	4.24 (0.85)	4.07 (0.94)	-0.17	0.187
Q2. I accomplish what needs to be done in my study.	4.11 (0.83)	3.81 (0.91)	-0.30	0.028*
Q3. I feel I use my time effectively.	3.20 (1.03)	3.54 (1.06)	0.34	0.023*
Q4. I spend enough time planning.	3.36 (1.05)	3.67 (0.91)	0.31	0.017*
Q5. I am able to meet deadlines without rushing at the last minute.	3.24 (1.27)	3.60 (1.24)	0.36	0.024*
Q6. I keep up-to-date on my homework assignments.	3.33 (1.15)	3.83 (1.00)	0.50	0.001*
Q7. I spend enough time on academic matters.	3.44 (1.06)	3.70 (1.11)	0.26	0.083

Table 1. A comparison of scores difference in pre- and post-study surveys: mean, standard deviation and p-value of a 2-tailed paired-samples t-test. *: p<0.05.

interesting to notice that the scores of task accomplishment significantly decreased after the study (M_before=4.11, M_after = 3.81, t(69)= 2.24, p = 0.028). By examining qualitative data from chatlogs, we found out external conditions might have influenced their assignment completion rate. There was a major project due in this course, and as reported by a participant: "*I underestimated the time it took to finish the work*" and "*I was so ambitious to include too much work in my plan but it didn't work out.*" Despite the upcoming deadlines, participants reported positive improvements on the other areas of time management.

RQ2: What is the temporal effect during the study?

We then examined if participants' self-reported measures changed over the course of the seven days. Every day Sammy asked students to create a study plan for the next day. The next day, Sammy firstly asked if participants met their goal and if not then asked the reason for non-completion of tasks. Sammy also asked participants to rate on a scale of 1-5 on their 1) satisfaction of completing goals today and 2) confidence in completing goals next day. We analyzed the following metrics of each day (Table 2): 1) number of students completed the chat, 2) number and percentage of students who completed their goals, 3) level of satisfaction in completing the study goals of the day, and 4) level of confidence in goal completion the next day.

First, the total number of students who completed the chat of the day has slightly decreased over the course of seven days from 69 to 61. Despite the slightly decreasing retention rate, the percentage of students who completed their goals steadily increased with the exception of a lower rate on Day 2 and Day 3, which are towards a weekend. A similar increasing pattern is observed for the satisfaction levels of completing the goals and the confidence levels of completing the goals for the next day. Further qualitative analysis on the chatlogs confirmed our findings. For example, as P7 wrote, "*I have a busy weekend and intend on setting time all day Sunday to do all my homework and studying.*" A bivariant correlation analysis indicates a significant relationship between the satisfaction level of the current day and the confidence level of the next day (r = 0.49, p<0.00). Further analysis will be conducted to identify any significance in the upward trend, but the preliminary descriptive data indicate that within a seven-day period, there is a trend of positive change in participant perception and behaviors about setting and executing goals.

Daily chatlogs also reflect the above findings. When students were satisfied with their current day of study, they were highly motivated, because Sammy helped them to quantify themselves and increase their awareness of planned study. "*I have class most of the day. I will study in between. I will meet with group at end of day to study I have a lot of other work to do but I will get it all done.*" -- P41. Meanwhile, not every day went well and some participants did not feel satisfied for some of those days. "*I'm going to sleep. All day.*" – P30. Under such circumstances, some participants still motivated themselves to perform better for the next day. "*I have class from 9AM to 3PM. I will then go to work until 9PM. After work I will go directly to the library to catch up on the studies I have missed this week as well as prepare for my finals next week.*" In addition, some participants reported rewarding themselves with good rest after finishing the

Day	Day of Week	# students chatted with Sammy	# students completed goals	% students completed goals*	Satisfaction in completing goals M (SD)	Confidence in goals next day M (SD)
1	Thu	69	N/A	N/A	N/A	3.90 (1.02)
2	Fri	65	41	63.08%	3.11 (1.36)	3.80 (1.04)
3	Sat	68	36	52.9%	3.22 (1.40)	3.81 (1.01)
4	Sun	64	47	73.4%	3.77 (1.20)	4.05 (0.88)
5	Mon	67	50	74.6%	3.84 (1.02)	4.09 (0.77)
6	Tue	64	47	73.4%	3.94 (0.89)	4.10 (0.84)
7	Wed	61	52	85.2%	4.15 (0.89)	N/A

Table 2. Chatbot Student Data Results *calculated based on the number of students completed tasks out of the total number of students chatted with Sammy on that specific day

majority of their goals. *"Since I finished most of my work for this week, I am going to rest."* – P25. Overall, students' daily check in data indicate a trend of positive changes in their satisfaction in completing goals and confidence in setting future goals. We will conduct further analysis to validate this finding.

Limitations and Future Work

In this work-in-progress, we started by conducting basic analysis on our collected data. In the future, we will conduct a more comprehensive mixed-method analysis. Additionally, Sammy is an early prototype with only basic conversational check-in capabilities and our study only lasted for seven days. We plan to improve the functionalities and usability of Sammy and investigate the longer-term intervention effect, such as a few weeks or months. We also plan to investigate whether there is any novelty effect when using the chatbot intervention tool and student behaviors without the extra credit incentives.

Conclusions

In this preliminary research, we investigate the effects of chatbots as a conversational goal setting tool for student learning. We developed a chatbot called Sammy that allow students to pledge and reflect on study goals. A 7-day study among 70 undergraduate students indicated a significant improvement in student perceived time management. Analysis on student daily check-in showed an upward trend of student satisfaction in goal completion and confidence in goal setting. Our work contributes to the information systems community by providing empirical evidence of the promising effects of chatbots as a conversational goal-setting tool for students, which might inspire future research and pedagogical design.

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