Using chatbot as a goal-setting facilitator in an online course: students' performance and teacher's perception

Weijiao Huang
Faculty of Education
The University of Hong Kong
Hong Kong SAR, China
wjhuang1@connect.hku.hk

Nicole J. Tavares
Faculty of Education
The University of Hong Kong
Hong Kong SAR, China
tavaresn@hku.hk

Jiahui Du
Faculty of Education
The University of Hong Kong
Hong Kong SAR, China
dujiah@connect.hku.hk

Khe Foon Hew
Faculty of Education
The University of Hong Kong
Hong Kong SAR, China
kfhew@hku.hk

Abstract—**Many institutions have been adopting a fully online teaching and learning mode due to the COVID-19 pandemic. This requires a high level of self-regulation from students. Students' goal-setting skills play a key role in their self-regulated learning, especially at the beginning stage of learning. This study explored the use of a chatbot to guide students to set learning goals for an online undergraduate course. The social presence framework was adopted to facilitate students' interaction with the goal-setting chatbot. A mixed-method case study design was used to evaluate students' behavioral engagement, perceived social presence, goal-setting, and their level of satisfaction with the chatbot. The results indicated students' positive goal-setting experience with the chatbot. Moreover, their degree of satisfaction with the chatbot significantly influenced the learning goals they set for the online course. Students' and teacher's interviews were conducted to gain insights into future chatbot design.**

Keywords—goal-setting, chatbot, online learning, social presence

I. Introduction

Many universities are facing a sudden shift to a fully online teaching and learning mode from in-person courses due to the continuing COVID-19 pandemic. In such an online learning environment, all instruction and assessments are conducted virtually. For example, students watch recorded instructional videos, read references uploaded onto the Learning Management System, or attend online lectures via video-conferencing platforms (e.g., Zoom). However, this requires a high level of self-regulated learning skills [1]. Students are expected to take charge of the learning process. Those with goal-setting skills are capable of deciding on the intended outcomes of a learning effort [2]. Goal-setting is a key component of self-regulation skills in students' online learning [3].

Goals refer to the desired outcomes, which can also be used as standards to evaluate performance [4]. Goal-setting skills are essential for enhancing motivation, self-regulation and learning performance [5], [6]. Findings from previous studies have reported positive effects of goal setting on various learning outcomes. For example, Bursalı and Öz [7] explored the role of goal-setting in metacognitive awareness (i.e., regulating or planning the learning process) and a significant correlation was found. Morisano et al. [8] posited that the lack of skills to set clear goals may increase the probability of course dropout. Thus, they designed a goal-setting program to help struggling students improve academic achievement. Results showed that students who were able to complete the goal-setting tasks significantly improved in their academic performance.

While goal-setting skills are crucial to students' learning, there are certain challenges in setting effective goals. For instance, students may set ambitious and unrealistic goals [9]. In other words, there is an ontological disparity between actual capability and expected achievements. One way to address this concern is to set specific goals, instead of merely encouraging learners to do their best [10]. A framework proposed by Doran [11], namely SMART, was developed to support learners in writing meaningful objectives and goals. The SMART framework consists of five rules indicated by the spelling of "smart": Specific, Measurable, Assignable, Realistic, and Time-related. These Specific rules remind learners to think about their expectations or intentions of listing certain tasks. For instance, in the first lesson, teachers frequently ask their students "why do you take this course?" The Measurable rule requires learners to define the ways to evaluate the outcomes, such as the number of tasks that students aim to complete. The Assignable rule concerns who will be responsible for achieving the goals. The Realistic rule enables learners to ask themselves whether they can accomplish the goals they set. Finally, the Time-related rule specifies when the goals are expected to be achieved. In sum, the SMART framework helps learners clarify the learning procedures and expectations, which can potentially facilitate their goal-setting process.

A fully online mode of learning as a rapid response to school closure may also drive learners into an isolated learning environment. Online learners are likely to suffer from a lack of social interaction and sense of belonging to a learning community [12], as they complete learning tasks on their own. A common experience reported is their lack of opportunities to immediately interact with other participants in an online course [13]. One promising way to combat this feeling of isolation is to foster a sense of social presence [14]. Social

presence is defined as the extent to which participants conceptualize themselves as real persons socially and emotionally in an online learning environment [15]. According to Garrison et al. [15], social presence consists of three components: interpersonal communication, open communication, and cohesive communication. Interpersonal communication can be interpreted as the interaction that can create a welcoming climate and a sense of belonging to the group through expressing emotions. Open communication refers to interaction with others in a mutual and respectful way (e.g., giving responses to others, and expressing appreciation and agreement). Cohesive communication may be represented by the interaction that helps to create a collaborative culture through greeting participants, addressing them by name, and using inclusive pronouns (e.g., we).

This study involved the creation of a text-based chatbot as a virtual tutor to guide students in setting learning goals while communicating with them in a real-time manner. Chatbot, or conversational agent, is a program that can interact with users in natural language via text or voice. The use of chatbot as an instructional tool has been proven to promote student engagement and academic achievement. For example, Chang et al. [16] applied the use of a chatbot in a mobile learning environment to cultivate nursing students' obstetric vaccination knowledge. The result of their studies indicated that students in the chatbot group gained higher learning achievement than those in the control group who watched the teacher's lectures online.

The present study extends our previous work [17], which involved developing a goal-setting chatbot based on the same SMART framework but without considering social interaction in students' online learning. In this study, we incorporated the goal-setting chatbot into a fully online undergraduate course and emphasized the use of Social Presence indicators to engage students in the goal-setting process. We further investigated the effect of students' satisfaction with the chatbot on their goal-setting performance. The teacher's perception of using the goal-setting chatbot was also examined. The following are our research questions:

1) What is the effect of using chatbot on students' goal-setting process?

a) What is the effect of using the goal-setting chatbot on students' behavioral engagement?

b) What is the level of students' perceived social presence of the goal-setting chatbot?

c) What is the level of students' satisfaction with the goal-setting chatbot?

2) Is there any significant difference in students' learning goals between students who are highly satisfied with the chatbot and students who are lowly satisfied?

3) How does the course teacher perceive the use of the goal-setting chatbot?

II. DEVELOPMENT OF THE GOAL-SETTING CHATBOT

As mentioned earlier, this study investigated the effect of applying our previous chatbot design [17] to a new learning context. We applied the SMART framework [11] to underpin the goal-setting chatbot design. The chatbot guided students in clarifying their learning goals via six goal-setting questions (Table 1). The intended learning objectives drove the design of the SMART goal-setting questions. An example of this is that students in this course needed to work in groups of 5 or 6 to plan and conduct a lesson through micro-teaching, which was a "specific" goal the course teacher expected to achieve.

Therefore, one goal-setting question was "What would you say is the ideal size for group work in assignments/tasks like micro-teaching?" Based on the course teacher's experience, when students become teachers at school, they are usually working with 5 to 6 teachers teaching at the same level. However, students in the past cohorts of this course preferred working in smaller groups (e.g., with 2 to 3 students) or even preferred completing learning tasks individually. Different options of responses to students were provided accordingly (Figure 1).

TABLE I.   GOAL-SETTING QUESTIONS BASED ON "SMART" RULES

SMART rules	Chatbot guiding questions	Examples of choices given to students
Specific	What do you hope to get most out of the course?	Develop skills in teaching English speaking and listening.
	What would you say is the ideal size for group work in assignments/tasks like micro-teaching?	2-3
Measurable	May I know what overall grade you would hope to get in this course?	Grade A
Assignable	Do you foresee any difficulties you may have while pursuing your learning goal on this course?	I worry that I might not know how to apply the teaching strategies appropriately in my own classroom.
Realistic	Then could you tell me what you wish to gain most from this course?	Insightful conversations with the teacher and my classmates to help shape my career path.
Time-related	What would you say is a good time to get started with your planning for the group work?	Once possible.

Fig. 1. The chatbot guided students to set a "specific" learning goal.

Considering that the goal-setting chatbot was an individual online learning activity, we incorporated various indicators of Social Presence [15] into the chatbot conversation design (Table 2). Through this, we hoped that the goal-setting chatbot would interact with students in a more human-like manner. Interpersonal communication was strengthened by the use of *emojis* and *repetitious punctuations* to make the goal-setting chatbot livelier. Citing an example, the handshake emoji "🤝", was added to the following response: "I'm sure you'll learn so much through the professional dialogues with your classmates and the teacher 🤝 " in order to establish the connection between students and their classmates and with the teacher during their online learning process. Open communication was promoted with the help of *appreciation expressions*. When students set a high learning goal (e.g., I would like to get Grade A), the chatbot would respond with "Great!" or "That's superb!" to show its appreciation to them. Cohesive communication was achieved by the chatbot greeting students, addressing their names, and using inclusive pronouns (e.g., we).

Authorized licensed use limited to: The University of Hong Kong Libraries. Downloaded on January 06,2024 at 10:09:28 UTC from IEEE Xplore. Restrictions apply.

TABLE II.   SOCIAL PRESENCE INDICATORS IN CHATBOT RESPONSES

Categories	Indicators	Examples of response
Interpersonal communication	Using emojis	I'm sure you'll learn so much through the professional dialogues with your classmates and the teacher 🤝.
	Using repetitious punctuation	I see...; Hmm...
Open communication	Expressing appreciation	Great! It's always good to aim high!
Cohesive communication	Using greetings and vocatives	Greetings, {student's name}! {student's name}, I've got a few suggestions for you!
	Using inclusive pronouns	We're going to be discussing all these areas on the course.

III. METHOD

A. Participants and Context

Participants were a group of thirty-nine students enrolled in an undergraduate Education course in a large public university in Hong Kong. The entire course consisted of 12 online video-conference-supported sessions with a 2-hour duration for each session. The course teacher sent emails to students to invite them to participate in the goal-setting chatbot activity before the first session. The chatbot was embedded into the Learning Management System (LMS) where the teacher uploaded all course materials and engaged in asynchronous discussion with them. Students could easily access the goal-setting chatbot by clicking on the tab on the activity page on the LMS. Ethical approval to conduct the study was issued by the authors' university. All the participants signed consent forms to participate in the study.

B. Data Collection and Analysis

We used mixed-methods design in this study and included both quantitative and qualitative data collection and analysis [18].

1) Quantitative Data. To examine students' behavioral engagement, the conversational records between students and the goal-setting chatbot were collected. Behavioral engagement refers to students' involvement in a learning activity [19], such as whether they completed the learning task. We therefore analyzed chatbot-student utterance turns, session length, and goal completion rate as three objective measures of students' behavioral engagement. These measures have been used in previous studies [17]. One utterance turn is one time of back-and-forth exchange between a chatbot and a user [20]. The session length refers to the duration from the moment a user starts interacting with the chatbot to the moment the user ends the conversation [21]. Goal completion rate can be defined as the ratio of students who completed the learning task with the chatbot to the total number of students.

Students were invited to set learning goals for the online course with the chatbot before attending the first video-conferencing session. After the first session, students were invited to complete an online 5-point Likert-scale survey. The online survey included a social presence scale, goal-setting scale, satisfaction scale, and an open-ended question that gathered students' perception of the goal-setting chatbot. All items required ratings 1 (i.e., strongly disagree) to 5 (i.e.,

strongly agree). We received 34 students' responses to the online survey (87% response rate). Each scale is explained below.

To evaluate students' perceived social presence of the goal-setting chatbot, we used all 9 items from the social presence scale of the Community of Inquiry framework questionnaire [22]. An example of a social presence item was "I felt comfortable interacting with the goal-setting chatbot". The Cronbach's alpha was 0.912 for the social presence scale.

Students' goal-setting scores were reflected by their ratings of the goal-setting scale the Online Self-regulated Learning Questionnaire [23]. In this study, we used all 5 items from the goal-setting scale of the OSLQ questionnaire. Examples of the goal-setting items were "I set standards for my assignments in online courses" and "I set goals to help me manage studying time for my online courses". The higher ratings of the items represented the higher scores of students' goal setting. The Cronbach's alpha of the goal-setting scale was 0.903.

The satisfaction level was indicated by students' perceived usefulness and ease of use of the goal-setting chatbot. We employed the Technology Acceptance Model questionnaire [24] to measure students' perceived usefulness and ease of use. The usefulness scale consisted of 5 items. An example of the item was "The chatbot enhanced my effectiveness in setting my learning goals." The ease of use scale also included 5 items. This illustrates one of the items: "I found it easy to use the chatbot to communicate". The usefulness scale showed a high level of internal consistency with a Cronbach's alpha of 0.926. The Cronbach's alpha for the perceived ease of use scale was 0.825.

2) Qualitative Data. To further explore students' perception of the goal-setting chatbot, an open-ended question was included in the online survey: "In what ways do you think the chatbot engaged (or did not engage) you during the learning process?" The open-ended question helped the researchers obtain possible explanations of students' perceived satisfaction or dissatisfaction with the goal-setting chatbot.

We also interviewed the course teacher after the intervention to identify the teacher's perception of implementing a chatbot activity in an online class. A sample interview question was "To what extent do you think this chatbot helped facilitate students' goal setting and your online teaching?"

IV. RESULTS

A. Students' Behavioral Engagement

There were thirty-nine students who set their learning goals with the assistance of the goal-setting chatbot before attending the first lesson. The results of students' behavioral engagement with the chatbot activity are shown in Table 3. Students interacted with the chatbot within an average of about 19 turns ($M = 19.26$), with a standard deviation of 0.72. The duration of student-chatbot conversation averaged to approximately 5 minutes ($M = 4.93$, $SD = 4.22$). The conversation records revealed that over half of the students ($n = 27$) completed the goal-setting activity within 19 turns. Students who continued to talk with the chatbot expressed their appreciation using emojis (e.g., heart emoji "❤️", Figure 2) or social closures (e.g., "See you!", Figure 3). The goal completion rate was 100%.

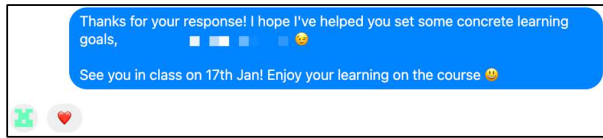|	N	Minimum	Maximum	Mean (SD)
Utterance turns	39	18.00	22.00	19.26 (0.72)
Session length	39	2.00	27.00	4.93 (4.22)

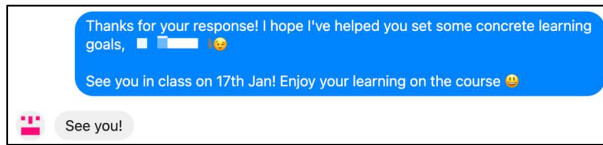Fig. 2. A student was observed expressing appreciation to the chatbot.

Fig. 3. Social closure was seen to be used by a student with the chatbot.

B. Students' Perceived Social Presence of the Chatbot

Descriptive statistics of students' responses to the online survey are shown in Table 4. The results indicated that students ($n = 34$) perceived a slightly high social presence ($M = 3.25, SD = .81$) after setting personal learning goals with the chatbot. Students considered conversation with the chatbot to be comfortable during the goal-setting process, as shown by item 4 of the social presence scale ($M = 3.56, SD = .79$). However, they hardly gained a sense of belonging in the online learning environment knowing that the chatbot was virtual in nature.

C. Students' Goal-setting Performance after Using the Chatbot

An average score of 3.67 on the goal-setting scale suggested that students had an overall positive goal-setting experience with the chatbot. By interacting with the chatbot, they could set standards for their learning responsibilities in this online learning environment ($M = 3.74, SD = .93$). They also reported that they could maintain high standards for online learning ($M = 3.97, SD = .80$). For example, they could complete online learning tasks with high quality.

D. Students' Satisfaction with the Chatbot

Students' satisfaction with the chatbot was measured by the perceived usefulness and ease of use of the goal-setting chatbot. The average mean of students' satisfaction was 3.54 with the standard deviation of 0.65. The use of the chatbot could help students comprehend the goal-setting process ($M = 3.41, SD = .86$), as the interface of the chatbot was easy to manage. They also indicated that the goal-setting chatbot was easy to communicate with ($M = 4.15, SD = .86$).

E. Effects of Students' Satisfaction with the Chatbot on Their Goal-setting Performance

Students in this study were grouped into a high satisfaction group (n = 10, top 25% students) and a low satisfaction group (n = 10, bottom 25% students), according to the ranking of their responses to the perceived usefulness and ease of use scales. Specifically, students in the high satisfaction group ($M = 4.24, SD = .21$) believed that using the chatbot could enhance the effectiveness of their goal-setting process and they perceived the goal-setting chatbot to be easy to use without much mental effort required whereas students in the low satisfaction group ($M = 2.72, SD = .27$) held a slightly negative perception of the usefulness and ease of use of the goal-setting chatbot. The average mean of the goal-setting scale in the high satisfaction group was 4.26 ($SD = .41$) while the low

satisfaction group had a lower average goal-setting score ($M = 3.02, SD = .84$).

Scales	Items	Mean (SD)
Social presence (n = 34)	1. Getting to know the goal-setting chatbot gave me a sense of belonging in this course.	2.85 (1.02)
	2. I was able to form distinct impressions of the goal-setting chatbot.	3.03 (.90)
	3. Online or web-based communication with the goal-setting chatbot is an excellent medium for social interaction.	3.03 (1.00)
	4. I felt comfortable conversing with the goal-setting chatbot.	3.56 (.79)
	5. I felt comfortable participating in the goal-setting activity.	3.44 (.89)
	6. I felt comfortable interacting with the goal-setting chatbot.	3.53 (.83)
	7. I felt comfortable disagreeing with the goal-setting chatbot's feedback to my learning goals, while still maintaining a sense of trust.	3.41 (.74)
	8. I felt that my learning goals were acknowledged by the goal-setting chatbot.	3.26 (.90)
	9. Online interaction with the goal-setting chatbot made me feel a sense of collaboration during my goal-setting process.	3.15 (.99)
Goal setting (n = 34)	1. I set standards for my tasks/responsibilities/assignments in this online course.	3.74 (.93)
	2. I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the semester).	3.47 (1.08)
	3. I keep a high standard for my learning in this online course.	3.97 (.80)
	4. I set goals to help me manage study time for this online course.	3.62 (.95)
	5. I don't compromise the quality of my work because it is online.	3.56 (1.13)
Usefulness (n = 34)	1. Using the chatbot enabled me to set my learning goals.	3.21 (.88)
	2. Using the chatbot made it easier to complete my goal-setting process.	3.26 (.93)
	3. My comprehension of the goal-setting process would be easy with the use of the chatbot.	3.41 (.86)
	4. The chatbot enhanced my effectiveness in setting my learning goals.	3.21 (.81)
	5. Overall, I found the chatbot useful in my learning.	3.24 (.85)
Ease of use (n = 34)	I found it easy to use the chatbot to communicate.	4.15 (.86)
	2. I didn't feel confused when I used the chatbot.	3.85 (1.05)
	3. The chatbot often behaved in expected ways.	3.59 (.89)
	4. I found it easy to recover from errors encountered while using the chatbot.	3.41 (.89)
	5. Overall, I found the chatbot easy to use.	4.15 (.74)

Next, we performed a Mann-Whitney test to check for any difference between the high satisfaction and low satisfaction groups in their goal-setting for the online course. We chose the Mann-Whitney test because the assumption of normality was violated for the high satisfaction group, $W(10) = 0.837, p = .041$, and the low satisfaction group had an outlier goal-setting score. The distributions of goal-setting scores for both groups were not similar. The result of the Mann-Whitney test (Table 5) showed a significant difference in students' goal-setting ratings between the high satisfaction group (*Mean Rank =*

14.55) and the low satisfaction group (*Mean Rank* = 6.45), *U* = 9.5, *z* = -3.088, *p* = .001.

TABLE V.   MANN-WHITNEY TEST ON STUDENTS' GOAL-SETTING BETWEEN THE HIGH AND LOW SATISFACTION GROUPS

Group	N	Mean Rank	Mann-Whitney U	*p*-value
High satisfaction	10	14.55	9.5	.001
Low satisfaction	10	6.45		

F. Students' Perception of the Goal-setting Chatbot

The open-ended question focused on students' perception of the engaging or disengaging factors during the goal-setting process, which may affect their level of satisfaction with the chatbot.

1) Engaging factors. Students found setting learning goals with the chatbot useful in two ways: helping them get ready for the online course (*n* =21) and simulating social interaction (*n* = 6).

a) Getting ready for the online course: Students reported that the goal-setting chatbot could convey the teacher's expectations clearly to them via its feedback, which gave them clear guidance on what learning goals they need to set and achieve on this course. For example:

"It is helpful in the sense that I am clear about what to expect on this course at the start of the semester and it guides me to become more disciplined." (Student D)

"This chatbot helped me evaluate my goals for the course and understand what I would like to learn and achieve, and helped me get ready for the semester ahead." (Student R)

The various options of each goal-setting question alerted students to their specific learning needs (e.g., learning difficulties) and helped them to reflect on their experience in online learning:

"The difficulties we may encounter throughout the course are listed by the chatbot, so I feel supported." (Student O)

b) Simulating social interaction: Social presence indicators were carefully incorporated into the chatbot's conversation design to make the goal-setting chatbot more vivid. Students treated the chatbot as a *"real person"* (Student G) that could *"acknowledge students' concerns"* (Student F), through which they felt being cared for by the teacher:

"The intention behind the chatbot is good, and the professor [course teacher] using it makes me feel cared for as a student." (Student O)

Students also highlighted that the use of emojis could foster an interesting communicative atmosphere. They expressed their preference for the emojis, saying that *"the emojis are cute"* (Student K).

2) Disengaging factors. Students' responses to the open-ended question revealed a major drawback of the current goal-setting chatbot design: *chatbot-driven conversation* (*n* = 8). In this chatbot activity, students were invited to answer goal-setting questions by choosing from pre-set options. Although these options provided students with various goal-setting directions, some students preferred *"having more space to offer their unique answers"* (Student M). Student T suggested that adding *"more open-ended questions"* could be one solution to allow them to flexibly express their own expectations.

We further analyzed the responses from students in the low satisfaction group to identify the possible reasons why they perceived the goal-setting chatbot to be less useful or not easy to use. Most of the students in the low satisfaction group mentioned that they had no idea why the teacher invited them to set learning goals. Hence they could not see the value of setting goals for the course and held a neutral attitude to the usefulness of the goal-setting chatbot.

G. Teacher's Perception of Using the Goal-setting Chatbot

We conducted an interview with the teacher who participated in the goal-setting chatbot design and implementation. The grounded approach was used to analyze the interview data, allowing for themes to be generated inductively. The results indicated three benefits of using the goal-setting chatbot before the first session: *facilitating rapport-building between students and the teacher, reflecting on previous teaching experiences* and *creating an interactive goal-setting process*.

1) Facilitating rapport-building between students and the teacher. The chatbot called their "Learning Buddy" was designed to simulate the goal-setting process in real time with a buddy and to create a warm and welcoming atmosphere, easing students more smoothly into a course. After all students completed the goal-setting chatbot activity, the teacher could receive a report showing their preferred learning goals on the online course. Through this, the teacher viewed this as an opportunity "to connect myself [herself] with the students earlier on", as this allowed her to know more about their expectations before class and take note of those who needed help and guidance. The learning report generated by the chatbot also enabled the teacher to respond to some general concerns as revealed by students' chosen options:

"This [report] was found to be very helpful in my discussion with the students in our first session when communicating the expected learning outcomes to them with heightened sensitivity to their learning styles and preferences."

2) Reflecting on previous teaching experiences. When developing the content of the goal-setting chatbot, the teacher mentioned that this offered her an opportunity to reflect critically on her previous teaching experience and review the reasons behind previous cohorts' misunderstanding of the course learning objectives set. Therefore, with the current cohort she was hoping that "students would better understand the learning objectives and the teacher's expectations before the very first session" through receiving the feedback from the goal-setting chatbot. For example, for students who indicated their preference to be working on their own, they would receive feedback from the chatbot explaining why they are expected to be working in larger groups of five to six so as to hone their teamwork, collaboration and communication skills:

"We [teachers] actually intentionally want them [students] to be working in larger groups, but then for some reasons this message doesn't really get to them effectively and they often prefer working on their own or in smaller teams. Once the group size gets a bit bigger, they might feel that they're not really benefiting as much. But we hope that they will develop a closer bonding among themselves as a learning community, learn to work as a team and learn from as well as with one another."

3) Creating an interactive goal-setting process. The teacher commented that using the goal-setting chatbot helped to engage students in sharing their expectations and preferences in a more specific and spontaneous way than

393

using a questionnaire. She recalled using other methods with the past cohorts (e.g., directly asking questions in class and sending out questionnaires), inviting students to introduce themselves and talk about their course expectations and learning goals. Comparing this to interaction with the chatbot in a conversational way, students were provided with more specific goal-setting questions and personalized feedback. The teacher expressed that the goal-setting chatbot felt more two-way and hence collaborative and dialogic in nature rather than just letting the students tell the teacher their expectations in written form through the self-introduction or questionnaire:

"I feel that they [the students] would enjoy taking part in the goal-setting chatbot activity much more than answering five multiple-choice questions from the teacher."

V. Discussion

With universities' widespread adoption of a fully online mode of teaching and learning during the pandemic, students have been faced with the challenges of a lack of self-regulation skills to monitor their learning and a feeling of loneliness. In this study, we aimed to develop a goal-setting chatbot to help students set effective learning goals in an interactive way to address these challenges prevalent in online learning. The SMART framework and the Social Presence framework were adopted as theoretical underpinnings guiding the chatbot conversational design. Our major findings and proposed practical implications of chatbot usage in online learning are presented below.

First, the results indicated that the use of chatbot was effective in engaging students in the online goal-setting process. The 100% completion rate suggested that all students finished the learning activity following the chatbot's guidance. Low completion rate has been reported to be a prime concern in online learning in higher education [25]. In this study, the goal-setting activity was a voluntary learning task and students could choose to stop setting goals anytime. However, all of them successfully completed the activity before the first session. This revealed the attraction of the use of the goal-setting chatbot in engaging students in setting goals in online learning.

Second, some students were observed continuing their conversation with the chatbot after setting learning goals. The chatbot-student conversation records of these students demonstrated that they interacted socially with the goal-setting chatbot. It was noted that some responded with emojis and closing lines (e.g., "See you!") to communicate their feelings to the chatbot. This finding revealed that students' behavioral engagement can be promoted by employing the Social Presence framework in the design of online learning. Our finding is consistent with the study of Sung and Mayer [26], who asserted that social presence in an online learning environment can be enhanced by instant responses received to show social respect and by addressing participants by name to amplify social identity.

Despite this, students' lowest rating in the social presence scale (item 1: $M = 2.85$, $SD = 1.02$) indicated that they could hardly feel a sense of belonging if they are only accompanied by the chatbot in an online learning environment. In view of this, we propose that teachers use chatbot as a supplemental activity in online learning rather than the sole instructional medium. As recommended by Pérez et al. [27], it is necessary for teachers to work more closely with chatbots in online learning. In future design, we may consider involving teachers more actively in the goal-setting activity to give students more in-depth feedback in response to their answers. As discussed, the major drawback of our current chatbot design is related to the lack of open-ended goal-setting questions. This can be addressed by closer teacher-chatbot collaboration. For instance, students may be given more space to express their own thoughts via the goal-setting chatbot instead of being confined by set options. If the chatbot cannot answer the students' inquiries or respond to their input, the teacher may follow up on these.

Third, the degree of students' satisfaction significantly affected their goal-setting scores. 10 students who perceived the goal-setting chatbot to be less helpful were found setting lower learning goals for the online course compared to 10 other students who were satisfied with the chatbot activity. The survey findings implied that students in the low satisfaction group were not clear about the purpose of setting learning goals. To address this issue, future online goal-setting design may take teaching presence into consideration. Teaching presence includes defining the curriculum and providing direct instruction (Garrison et al., 2000). To do so, before students set goals, the chatbot can directly explain the learning outcomes of the goal-setting activity to them.

Fourth, the interview with the teacher indicated several advantages of designing and using chatbots in online learning. The chatbot as a virtual tutor in this study strengthened the connection between students and the teacher, even before the online course started. Using the goal-setting chatbot allowed the teacher to know students' course expectations and learning goals sooner, thereby enabling her to make more informed decisions when planning lessons with specific learner needs in mind. Besides, the teacher participated in the chatbot development process and created all goal-setting questions and responses. During this process, she had the opportunity to reflect on her previous teaching experience and realize the need to help students understand the rationale for the expected learning outcomes which was facilitated by the chatbot. Teachers are thus encouraged to creatively explore more pedagogical uses of chatbot [28], [29].

VI. Limitations

We must acknowledge several limitations in this study. As there were only thirty-nine participants in the study, the small size may cause bias in data analysis. Future research involving students with different backgrounds is also needed to deepen our understanding of the effect of chatbots on their online learning experience. Added to this, students only interacted with the chatbot before the first session. Follow-up investigation was not conducted to find out whether the goal-setting chatbot had lasting effects on their online learning. This merits further exploration.

VII. Conclusion

We explored the use of a goal-setting chatbot designed to guide students in setting learning goals for a fully online course. Students' positive learning experience with the goal-setting chatbot was indicated by their behavioral engagement, perceived social presence, goal-setting performance and satisfaction. The course teacher also highlighted the pedagogic value of using chatbots in students' online learning and teachers' reflections. This suggests the potential effectiveness of using chatbots in facilitating learners' goal-setting process and online learning experience.

REFERENCES

[1] Albelbisi, N. A., & Yusop, F. D. (2019). Factors influencing learners' self–regulated learning skills in a massive open online course (MOOC) environment. *Turkish Online Journal of Distance Education*, *20*(3), 1-16.

[2] Schwarzenberg, P., Navon, J., & Pérez-Sanagustín, M. (2020). Models to provide guidance in flipped classes using online activity. *Journal of Computing in Higher Education*, *32*(2), 282-306.

[3] Handoko, E., Gronseth, S. L., McNeil, S. G., Bonk, C. J., & Robin, B. R. (2019). Goal Setting and MOOC Completion: A Study on the Role of Self-Regulated Learning in Student Performance in Massive Open Online Courses. *International Review of Research in Open and Distributed Learning, 20*(3), 39-58.

[4] Latham, G. P., & Locke, E. A. (1991). Self-regulation through goal setting. *Organizational behavior and human decision processes*, *50*(2), 212-247.

[5] Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance*. Englewood Clifs, NJ: Prentice Hall.

[6] Zimmerman, B. J., Bandura, A., & Martinezpons, M. (1992). Self-motivation for academic attainment - the role of self-efficacy beliefs and personal goal-setting. *American Educational Research Journal, 29*(3), 663-676. doi:10.2307/1163261

[7] Bursalı, N., & Öz, H. (2018). The role of goal setting in metacognitive awareness as a self-regulatory behavior in foreign language learning. *International Online Journal of Education and Teaching (IOJET), 5*(3). 662-671.http://iojet.org/index.php/IOJET/article/view/455/260

[8] Morisano, D., Hirsh, J. B., Peterson, J. B., Pihl, R. O., & Shore, B. M. (2010). Setting, elaborating, and reflecting on personal goals improves academic performance. *Journal of Applied Psychology, 95*(2), 255-264. doi:https://doi.org/10.1037/a0018478

[9] Shih, K. P., Chen, H. C., Chang, C. Y., & Kao, T. C. (2010). The development and implementation of scaffolding-based self-regulated learning system for e/m-learning. *Journal of Educational Technology & Society*, *13*(1), 80-93.

[10] Nebel, S., Schneider, S., Schledjewski, J., & Rey, G. D. (2017). Goal-Setting in Educational Video Games: Comparing Goal-Setting Theory and the Goal-Free Effect. *Simulation & Gaming, 48*(1), 98–130. https://doi.org/10.1177/1046878116680869

[11] Doran, G. T. (1981). There's a SMART way to write management's goals and objectives. *Management Review, 70*(11), 35–36.

[12] Purarjomandlangrudi, A., Chen, D., & Nguyen, A. (2016). Investigating the drivers of student interaction and engagement in online courses: A study of state-of-the-art. *Informatics in Education*, *15*(2), 269-286.

[13] Rabe-Hemp, C., Woollen, S., & Humiston, G. S. (2009). A comparative analysis of student engagement, learning and satisfaction in lecture hall and online learning settings. *The Quarterly Review of Distance Education*, *10*, 207–218.

[14] Whiteside, A., Dikkers, A., & Lewis, S. (2014). The power of social presence for learning. EDUCAUSE Review Online. Retrieved from https://er.educause.edu/articles/2014/5/the-power-of-social-presence-for-learning

[15] Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2), 87–105.

[16] Chang, C. Y., Hwang, G. J., & Gau, M. L. (2022). Promoting students' learning achievement and self-efficacy: A mobile chatbot approach for nursing training. *British Journal of Educational Technology*, *53*(1), 171-188.

[17] Hew, K. F., Huang, W., Du, J., & Jia, C. (2021, August). Using Chatbots in Flipped Learning Online Sessions: Perceived Usefulness and Ease of Use. In *International Conference on Blended Learning* (pp. 164-175). Springer, Cham.

[18] Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research*, *209*(240), 209-240.

[19] Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of educational research*, *74*(1), 59-109.

[20] Yao, M. (2016). 5 metrics every chatbot developer needs to track. VentureBeat, The Machine. https://venturebeat.com/2016/10/04/5-metrics-every-chatbot-developer-needs-to-track/

[21] Mead, J. (2019). What session length can tell you about your chatbot performance. Inf. Commun. https://inform-comms.com/session-length-chatbot-performance

[22] Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. P. (2008). Developing a community of inquiry instrument: Testing a measure of the community of inquiry framework using a multi-institutional sample. *The internet and higher education*, *11*(3-4), 133-136.

[23] Barnard, L., Lan, W. Y., To, Y. M., Paton, V. O., & Lai, S. L. (2009). Measuring self-regulation in online and blended learning environments. *The internet and higher education*, *12*(1), 1-6.

[24] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 318–339.

[25] Murphy, C. A., & Stewart, J. C. (2017). On-campus students taking online courses: Factors associated with unsuccessful course completion. *The Internet and Higher Education*, *34*, 1-9.

[26] Sung, E., & Mayer, R. E. (2012). Five facets of social presence in online distance education. *Computers in human behavior*, *28*(5), 1738-1747.

[27] Pérez, J. Q., Daradoumis, T., & Puig, J. M. M. (2020). Rediscovering the use of chatbots in education: A systematic literature review. *Computer Applications in Engineering Education*, *28*(6), 1549-1565.

[28] Hwang, G. J., & Chang, C. Y. (2021). A review of opportunities and challenges of chatbots in education. *Interactive Learning Environments*, 1-14.

[29] Kohnke, L. (2022). A pedagogical chatbot: A supplemental language learning tool. *RELC Journal*, 00336882211067054.