Examining the Merit of Social Robots in Supporting Students with Mood Problems

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Introduction

Can a social robot provide therapy to students to enhance their mental well-being? Considerable research has shown that internet-based versions of the commonly applied Cognitive Behavioral Therapy (iCBT) seem to be promising to alleviate mood problems and depression among adults and adolescents.[1] However, they still fall short in establishing meaningful therapeutic relationships despite recent versions embedding virtual avatars.[2,3] The level of adherence is rather low, that is, participants quit the program rather soon. This is partially due to the lack of guidance.[4] The absence of a therapist in *un*guided iCBT also lacks the therapeutic alliance, which was found to play an important role in CBT's overall efficacy.[3,5] We argue that the embodiment of a social robot may add to such therapeutic alliance and increase adherence among people seeking support for their mood issues.

Research on social robots in healthcare suggest that robots easily elicit feelings of connectedness.[6,7] Furthermore, instructions from an embodied robot were followed more closely than from a computer tablet with the same software and voice.[7] Therefore, we assume that a physically present social robot brings stronger feelings of connectedness, which over time may improve adherence, compared to a screen-based therapeutic intervention. Because this is a first study applying (i)CBT with social robots, we focus on milder mood problems among a student population.

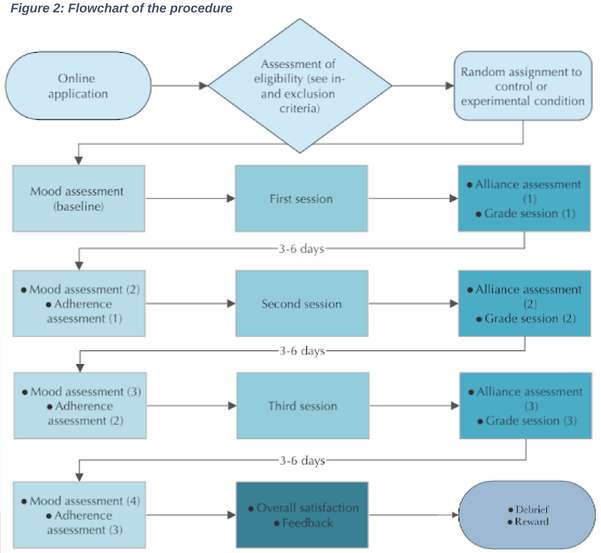
Aim & hypothesis

To investigate whether a social robot may act as 'guidance' in iCBT and improve therapeutic alliance and adherence as well as enhancing their mood?
We hypothesized that a social robot yields higher levels of therapeutic alliance, adherence and mood after the intervention than the same version of iCBT presented on screen with an avatar.

Figure 2: The NAO robot

Method

Figure 2: Flowchart of the procedure



Experimental Paradigm

We tested our hypothesis in a between-subjects experiment with repeated measures, three interventions. Participants (*N*=22, *M*age=20.9, *SD*age=2.4) were randomly assigned to either the experimental (robot intervention; see Fig. 1) or control condition (laptop, same intervention with an avatar).

Materials

The intervention was based on MoodPep (cf. Caring Universities[8]) from which three modules were selected, each 30 minutes, that targeted the CBT modules 'activity stimulation', 'replacing negative with positive thoughts', and 'setting personal goals', including exercises between sessions.

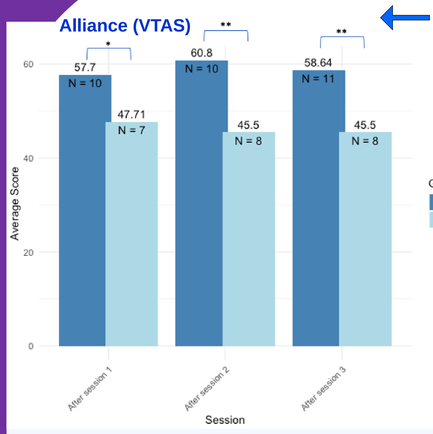
Measures

Alliance was measured afterwards with the VTAS.[9] Adherence was assessed through session measures and drop-out rates.[4,5] Prior to, during, and after the study, participants' mental health was assessed using the PHQ-9 questionnaire[10]. A 1-item satisfaction rating (1-5) followed each session and after the last session, participants completed the STTS-R[11] to measure overall satisfaction of the therapy. Measures are standardized and reliable.

Procedure

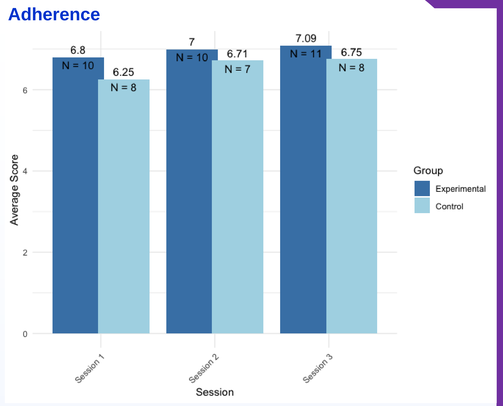
Participants were voluntarily recruited from campus through posters and flyers with a QR-code (reward €15), providing information and options to subscribe to 3 individual sessions in a private room at the University. See Figure 2.

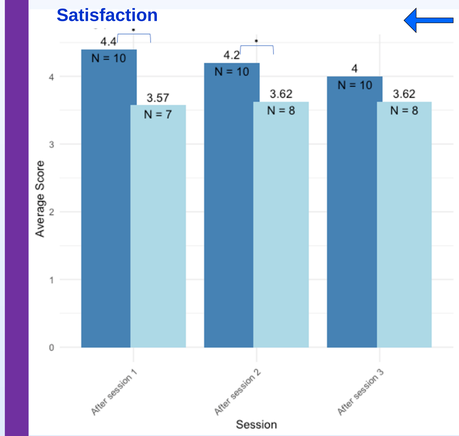
Results



Alliance (VTAS): Differences are significant with Welch Two Sample Tests, for each session (s1: $p = 0.030$, s2: $p = 0.008$, s3: $p = 0.009$), and overall ($p < 0.001$) with alliance with the robot significantly stronger than in the control condition.

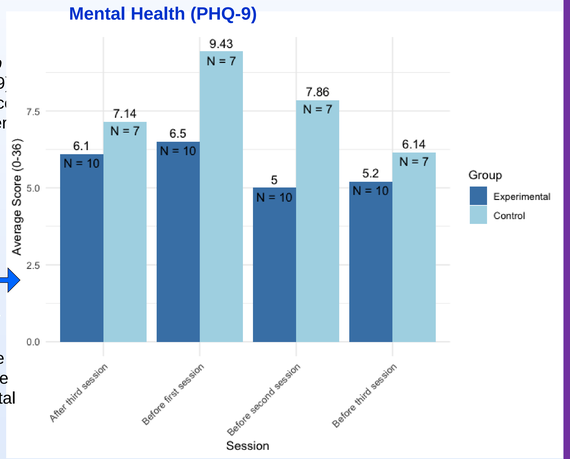
Adherence: no significant differences between sessions (s1: $p = 0.432$, s2: $p = 0.827$, s3: $p = 0.744$; overall $p = 0.470$).
Adherence assessed through number of completed sessions is significant ($p = 0.043$): experimental group completed 100%, whereas control group completed 87%.





Satisfaction: Differences are significant, for each session (s1: p 0.030, s2: $p = 0.008$, s3: $p = 0.009$ and overall ($p < 0.001$) with alliance with the robot significantly stronger than in the control condition.

Mental Health: No significant differences between sessions nor afterwards (all *p*s > 0.17, non-parametric paired Wilcoxon). Note that a decline of the average score indicates an improvement of mental health.



Discussion

Overall, a social robot providing a therapeutic mood-improvement intervention increased participants' therapeutic alliance, adherence and satisfaction compared to the same screen-based intervention, but did not improve students' mental well-being. This might be due to relatively mentally healthy participants. Furthermore, the study was insufficiently powered, that is, the sample size was too small to reach significance. Also, the baseline measurements indicated that on average and before the trial, the participants in the experimental group had fewer mental health problems. Nevertheless, the study highlights the potential of social robots in enhancing effectiveness of unguided iCBT. Our results merit further, larger-scale studies to determine the full extent of the benefits of robot-delivered iCBT. These studies could explore making robots more appropriately tailored in their interactions and investigate the impact of robot therapy on participants with various depression severity levels and mood issues (e.g., loneliness).

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