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Method to Promote Social Facilitation of Learners by Presenting Writing Sounds

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Abstract: We propose a method to induce the presence of other learners using writing sounds without interfering with self-guided study. For learners who are more likely to progress when they feel the presence of others, it can be difficult to continue independent self-guided study alone at home. In addition, in certain environments, e.g., libraries and learning commons, where other learners are present, the presence of others may positively influence the continuation of learning. Thus, the proposed system attempts to induce the presence of others according to the learner's level of concentration, which is evaluated by the learner's leg movements. The proposed system was introduced experimentally to determine whether it can induce the presence of others in an environment with no other learners engaged in self-study activities.

Keywords: Learning support, social facilitation, self-study

1. Introduction

The ability to maintain motivation in autonomous learning is important in self-guided study. However, distractions frequently interrupt learning or prevent the learner from returning to study after taking a break. In addition, when working on tasks, e.g., preparing for exams or writing reports, some learners prefer to learn in a library or learning commons rather than at home. In other words, the presence of others may contribute to a learner's motivation to continue self-guided study. Thus, this paper proposes a method to induce the presence of others by presenting writing sounds according to the target learner's level of concentration.

A previous study proposed the "Enlight-Pen" device (Yoshihara, et al., 2003), which was designed to support learning by presenting information according to the learning status of others. The "Enlight-Pen" device supports the continuation of autonomous learning by illuminating LEDs embedded in a pen. However, flickering LED may interfere with the learner's concentration. Thus, in this study, we designed a system that plays a fluctuating writing sound to induce the presence of others. Writing sounds occur frequently during learning tasks; thus, we considered that such sounds could naturally communicate an environment in which others are learning.

In the proposed method, leg movements are measured (Aikawa et al., 2019) to estimate the target learner's level of concentration because a correlation has been demonstrated between leg movements and a learner's subjective fatigue.

2. Design

The proposed system comprises a single-board computer (Raspberry Pi Model 3 B+), a leg movement measurement module, a speaker (Creative Metallix), and a server PC. The leg movement measurement module was designed based on the findings of a previous study (Hamada et al., 2022). The leg movement measurement module comprises a passive infrared ray sensor (EKMC2609112K) and a single-board microcontroller (Arduino Nano Every). Figure 1 shows the installation position of the leg movement measurement module. The voltage values of the passive infrared sensor are acquired at 10 Hz and transmitted to the

server. The server determines whether the learner is concentrating or not based on the amount of leg movement. Then, the server sends the results to the Raspberry Pi, which in turn varies the volume of the writing sound according to the user's state, i.e., concentrating or not concentrating.

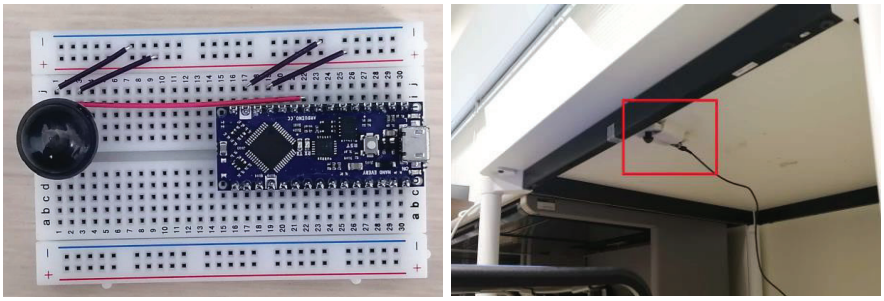

Figure 1. Leg movement measurement module (left) and installation position (right).

3. Experiment

An experiment was conducted to investigate the psychological influence and the effect on learning activities when using the proposed system during self-study. The experimental environment was set up assuming a self-study environment in which the proposed system was installed. This experiment was conducted with one group of participants using the system as the experimental group and a control group that did not use the proposed system. The subjects were science and engineering university students. Figure 2 shows the experimental environment and the flow of the experiment.

In this experiment, the participants took a test comprising 50 true or false questions before and after performing self-study. The content of the self-study was divided into three parts: Textbooks A, B, and C. Each part of the study was 30 minutes long and involved taking notes. At the end of the experiment, a questionnaire about the learning environment was administered. The questionnaire consisted of questions on a five-point scale and free comments regarding the experimental environment. In addition, a textbook related to a certification examination related to food advisors was used as the learning material.

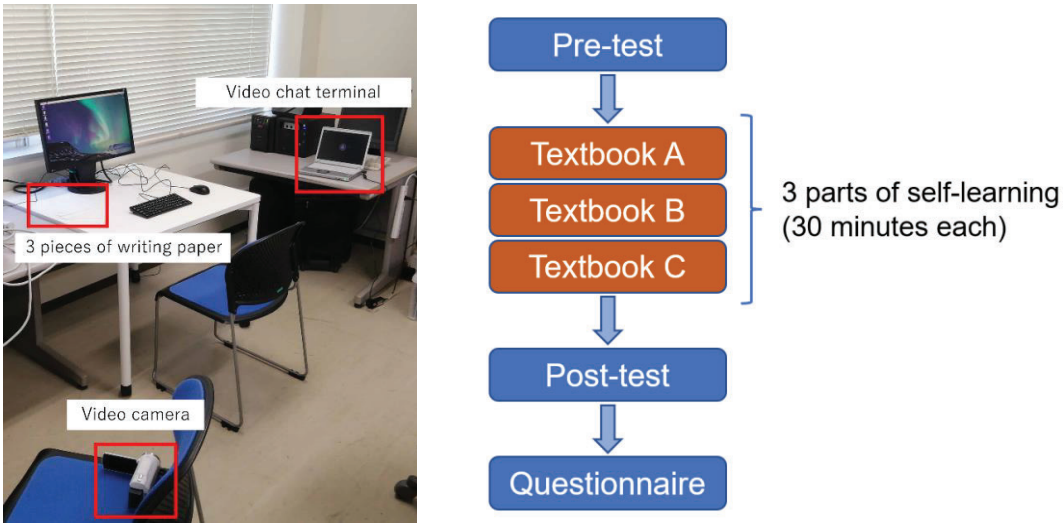

Figure 2. Experimental environment (left) and experiment flow (right).

4. Results

The results of the pre-tests and post-tests are shown in Table 1. The results of t-tests on the pre-test results for the experimental and control groups exhibited no significant differences.

Similarly, no significant differences were observed in the results of the post-test. Thus, the proposed system does not necessarily contribute to learning outcomes.

Table 1. Pre-test and post-test results.

	Experimental group		Control group	
	Avg.	S.D.	Avg.	S.D.
Pre-test	30.20	3.35	28.63	3.78
Post-test	42.40	4.16	38.38	4.69
Diff.	12.20	3.35	9.75	4.17

The mean value of the questionnaire for the experimental group, i.e., "The presentation of sound made me feel the activity of the person I was learning with," was 3.40. This result suggests that the proposed system may have induced a certain degree of the presence of others. In addition, the mean value of a question, i.e., "I could not concentrate due to the sound presentation," was 3.40. This result indicates that the presentation of sound may have interfered with the learner's level of concentration.

Comments from the experimental group's questionnaires stated that the presented sound was loud and very distracting, and the recorded writing sound was not similar to the sound of a pen being used during study. This suggests that the presented writing sounds were louder than the expected environmental sounds in a normal learning environment and that they did not adequately represent natural writing sounds.

5. Conclusion

In this study, we developed a system that presents recorded writing sounds according to the target learner's concentration. The proposed system was evaluated experimentally, and we found that the system was able to induce a certain degree of presence of others; however, it may have interfered with the learner's concentration. Thus, in the future, it will be necessary to consider an appropriate volume level that does not interfere with learning and to present sounds that accurately represent natural writing sounds. If the presentation of writing sounds can be improved to reduce the interference with the learner's concentration, we believe that it will be possible to induce the presence of others in a manner that does not interfere with concentration, which is expected to contribute positively to learning outcomes.

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