An Action Study on the Cognitive Behavioral Training Effect on Dozing during Classes[1]

授業中の居眠りへの認知行動訓練の効果に関する実践的研究

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Abstract

The purpose of this research was to examine whether the Cognitive Behavioral Training method improved sleeping habits of high-school students to prevent dozing and to facilitate concentration during classes. After the preliminary experiment (Study 1) with two girls, six girls participated in the control group and three girls in the experimental group in Study 2. In Study 1, the level of concentration during class was measured by EOG/wink-meter. At the beginning of the second week, the experimental group was introduced to sleep education, and for the following two or three weeks carried out the CBT method. As a result, the average bedtime in the first week of the CBT method was earlier than the baseline both in Study 1 and Study 2. Nevertheless, the control group in Study 2 did not show any positive change in bedtime between the first and the second baseline week. Although reliable results were not obtained as to the concentration during classes, the results did suggest the improvement in sleeping habits for some participants. Moreover, in the post-experiment interview one participant answered that the frequency of dozing during classes decreased during the CBT method. In the discussion, technical problem which should be solved before doing the next study was pointed out.

Many Japanese high-school students are suffering from sleepiness and dozing during classes that prevent them from concentrating, thus making learning more difficult. Bad sleeping habits, especially a short or insufficient sleeping time, may cause the sleepiness and dozing, besides the poor quality of teaching and learning. According to an international survey on sleep (OECD, 2009), the Japanese are the second shortest sleepers next to Korea among 18 OECD countries. The average sleep time of the Japanese is shorter than 8 hours, while it is longer than 8 hours in the other 16 countries. In Japan, this situation is especially serious among high-school students. Benesse's recent survey (BERDI, 2009) indicates that high-school students sleep less than 7 hours and their bedtime is around midnight on average. Fukuda (2007) argued that bad sleeping habits (short sleep time, late bedtime, the naps in the evening and in the early morning) cause bad feelings such as stress, annoyance, and sleepiness, dozing and poor concentration during classes.

This being the situation, my research question is what can high-school students do in order to prevent sleepiness and dozing during classes, and thus concentrate better? Sleep education might be a key to solving this problem. Furutani and Miyazaki (2016) report that sleep education improves the sleeping habits of elementary school pupils. Tanaka and Tamura (2016) report that the sleep education with self-help treatment improves sleeping habits and reduce bad feelings of junior high-school students. Nevertheless, such action studies have not been carried out for high-school students.

Okajima and Inoue (2013) write that the Cognitive Behavioral Training (CBT) method is effective not only in improving insomnia[2], but also in improving sleeping habits. The CBT method consisted of the sleep education including correcting the wrong meta-cognition of sleep and acquiring the necessary knowledge about sleep and an objective self-monitoring of sleeping habits, recording the bedtime and wake-up time. The purpose of this research was to examine whether the CBT method of sleep improvement is effective for high-school students in preventing dozing and facilitating concentration during classes.

If high-school students can improve their bad sleeping habits and feel better in the daytime, they can concentrate better during classes. This research tested this hypothesis. The measurement of the level of concentration has been a technical problem, but a new device solves it. Recently, a Japanese company has developed a light glass-type convenient device called JINS MEME ES, which measures the level of concentration in terms of

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[2] Insomnia is the difficulty of falling asleep or staying asleep.

electrooculography [3] (EOG) and blinks of the eye (Kanoh et al., 2015).   In the experimental study with the device, high-school students successfully improved their concentration after smelling a special fragrance and doing short physical exercises (JINS MEME, 2018).

In Study 1 of the present study, the participants measured their concentration when learning or being taught using the JINS MEME ES device during class hours and the concentration level was calculated in terms of percentage of cumulated concentrated time to the whole measurement time.

In Study 2, some participants recorded sleep by the activity-based sleep monitor called MTN-220 [4] all the day long once a week in order to calculate the sleep efficiency using the Sleep Sign Act ver 2.0 [5] software.

Picture 1   On the left, the device to measure the concentration level called JINS MEME ES [6]. On the right, the activity-based sleep monitor called MTN-220.

The experiments were carried out from April to June 2017 at Kobe University Secondary School.   When the experiments were finished, all the participants were the fourth grade (first grade high school) students of the school. Before the experiments, the protocol of this research was reviewed and approved by the Research Ethics Committee of the school. After the experiments were approved, Sugiyama recruited participants from her classmates. They were volunteers. The participants and their parents read and signed the consent form of the experiment. The control group of Study 2 also received the sleep education after the experiment was over.

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[3] Electrooculography is a technique for measuring the eye movement in terms of the electrical changes on the surface of the eye.

[4] See Matsuo et al. (2016)

[5] https://www.kicnet.co.jp/solutions/biosignal/sleep/sleepsignact/

[6] https://jins-meme.com/ja/products/es/

Study 1 (Preliminary Study)

Purpose

　　The purpose of Study 1 was to examine the effect of the CBT method as to see whether it improved sleeping habits and concentration during classes.

Methods

　　Two 16-year-old female high school students participated in Study 1. Once in a week, each participant measured their concentration level during classes in terms of the percentage of cumulative duration of concentrated period to the measurement time.

Table 1　List of self-help treatments effective for improving sleep
(Tanaka & Furutani, 2012)

a	Getting up in the every morning approximately decided time.
b	Getting up in the morning at less than in holydays at 2hours earlier or later than in weekdays.
c	Enjoy the club activities and hobby in the daytime.
d	Doesn't take the nap after go home.
e	Having dinner by 2 hours before go to bed.
f	Avoiding drinking caffeinated after dinner.
g	Being bathed to the tepid bath.
h	Going to bed only after becoming sleepy.
i	Going to bed by 0:00 a.m.
j	Refraining from having an irregular sleeping period.
k	Refraining from watching TV or do other stimulant activities in bedroom.
l	Don't watch TV and sit at PC for long hours.

Table 2　Self-help treatments which each participant
adopted as a weekly goal in the CBT

Study	Subj.	1st week	2nd week	3rd week
1	101	a,b	i,j,k	l
1	102	g	j	
2	221	b	k	h
2	222	j	c	f
2	224	a,i	c	e

In the beginning of the experiment, each participant received the sleep education, and for the following weeks they undertook the CBT method, setting a weekly goal of the sleep improvement while continuing the self-monitoring practice. Through the sleep education, the participants checked the list of self-help treatments effective for improving sleep for high school students (Tanaka and Furutani, 2012). Each participant set maximally three uncompleted self-help treatments as their weekly goal. The treatments adopted as weekly goal are shown in Table 1 and Table 2.

Results

The results are shown in Figure 1 to Figure 3. Figure 1 shows the average bedtime in the first week (baseline) and in the first week of self-help improvement of sleep by the CBT method (CBT1 of st1). Figure 2 shows the wake up time in the first week (baseline of st1) and in the first CBT week (CBT1 of st1). As shown in Figure 1, the average of bedtime was earlier in the CBT first week than in the baseline. However, the average wake up time did not change between the baseline and the CBT first week (Figure 2).
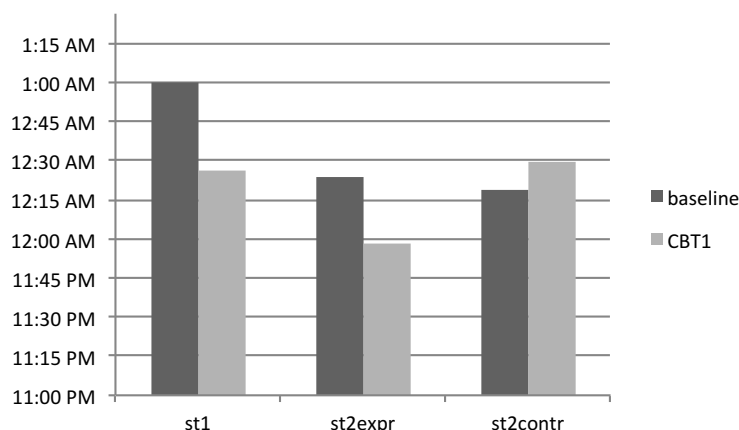

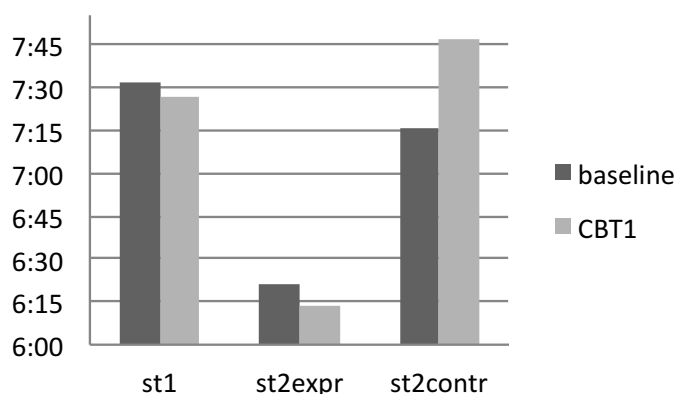
Figure 1   Bedtime
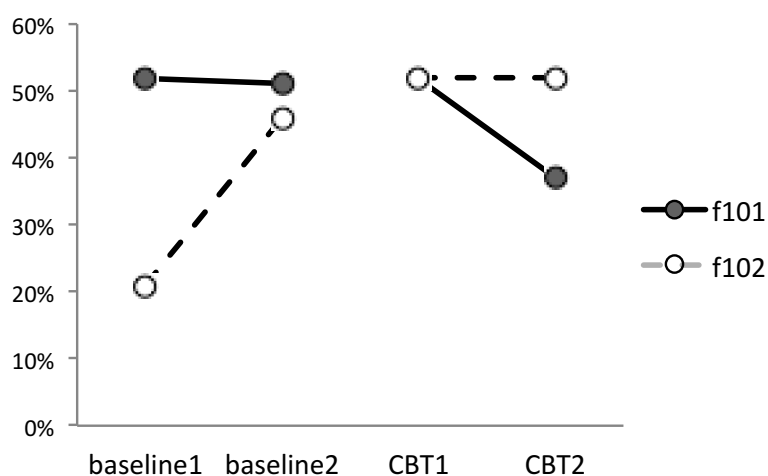

Figure 2   Wake-up time

Figure 3　Concentration level of each participant

　　Figure 3 shows changes in the level of concentration in the first baseline week (baseline1), the second baseline week (baseline2) and in the first CBT week (CBT1) and the second CBT week (CBT2).　If the sleep education and the CBT method are effective, the level of concentration is expected to increase in the CBT weeks, while not to change in the baseline weeks before the sleep education and the CBT method. As shown in Figure 3, the level of concentration was different between the participants. These results do not indicate any reliable effects of the CBT method upon concentration when learning or being taught.

Study 2 (Experimental design: experimental group vs. control group)
Purpose
　　The purpose of Study 2 was to examine the effects of the CBT method in the experimental design of two levels, the experimental group versus the control group. In order to measure the whole day activity and to calculate the sleep efficiency, some participants measured their heart rate using the activity-based sleep monitor all day long during the experimental period. Because the concentration during classes did not change clearly in Study 1, the measurement of the concentration was not done in Study 2.

Methods
　　9 high-school students (3 males and 6 females) participated in the control group and 6 high-school students (1 male and 5 females) participated in the experimental group.
　　The experiment continued for four weeks for both groups. From the first week to the last (forth) week, the participants from both groups recorded the bed-in time, the wake-up

time, their daytime feelings, and some of them measured their whole-day activity using the activity-based sleep monitor (MTN-220).   The experimental group also self-rated daytime feelings and feelings of the wake up time once a week.

At the beginning of the second week, only the experimental group received the sleep education, and for the following three weeks they undertook the CBT method, setting one weekly goal of the sleep improvement and continuing the self-monitoring. In the sleep education, the participants checked the list of self-help treatments and each participant set maximally two uncompleted self-help treatments as their weekly goal (Table 1).

Results

Figure 1 shows the average bedtime in the first baseline week and in the first CBT week in the experimental group.   Figure 2 shows the wake up time in the baseline and in the first CBT week in the experimental group. The results of the experimental group indicate the improvement in sleep. As shown in Figure 1, the average bedtime was earlier in the first CBT week than the baseline, while it was unchanged for two weeks in the control group. As shown in Figure 2, the average wake-up time did not change between the baseline and the first CBT week in the experimental group.

Self-rating scores of the degree of sleep (Figure 4) and the comfort at wake-up time (Figure 5) increased for two out of the three participants, which suggest the improvement of sleep. Table 3 shows the self-rated scores of the easiness in falling asleep, feelings at the wake-up time, the depth of sleep, and the quality of sleep in the baseline and in the first CBT week. The participant 222 did not measure these scores. If the sleep education and the CBT method are effective, these scores are expected to increase because of the improvement of the sleep habits. Table 3 indicates that all the indices show an increase except for the index "falling asleep" of the participant 224.

As shown in Figure 6, the tendencies of sleep efficiency are different among the three participants. Two out of the three participants showed a decrease from the first CBT week to the second CBT week, while the other participant did not show a significant change in comparison with the baseline. Therefore, any reliable tendency was not found as a result of the measurement of whole-day activity with the micro activity tracker.

After the experiment was over, the interview was conducted with each participant in the experimental group. One participant said that the dozing during classes was reduced by using the CBT method. Another participant said that afternoon naps became lesser in the CBT weeks than in the baseline. These statements suggest that the CBT method was effective for some participants.
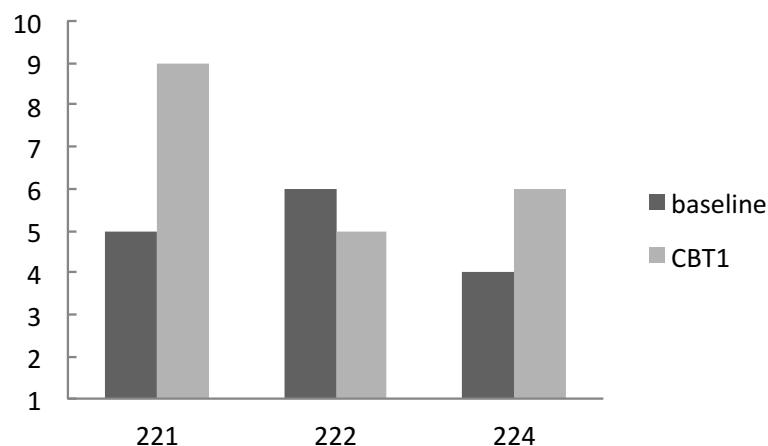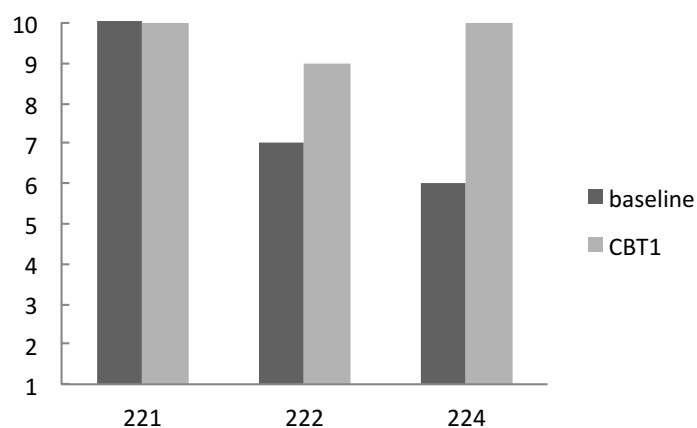
Figure 4　Sleep degree

Figure 5　Comfort degree at wake up time

Table 3　Self-rated indices of daily sleep quality*

Self-rated degree of falling asleep

participant	baseline	CBT1
221	81.4	80.7
224	85.7	85.0

Self-rated degree of feeling at wake up time

participant	baseline	CBT1
221	59.4	74.2
224	55.1	65.8

Self-rated degree of deep sleep

participant	baseline	CBT1
221	78.7	86.3
224	84.4	98.3

Self-rated score of sleep

participant	baseline	CBT1
221	65.1	70.8
224	70.1	84.2

* Perfect score is 100 points. The participant 222 did not measure these indices.
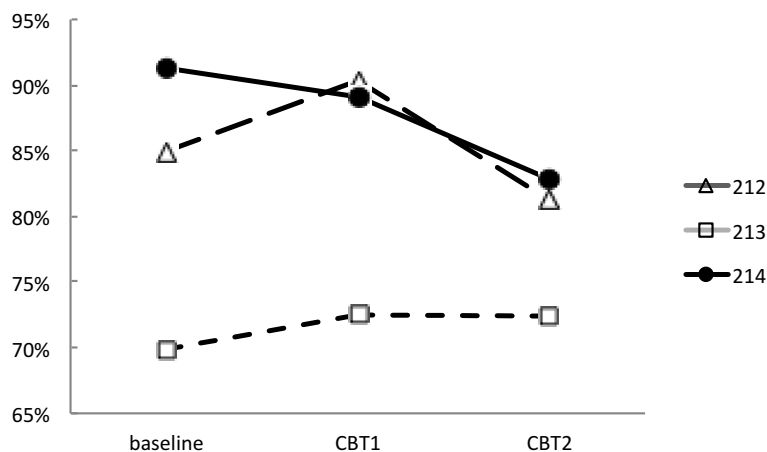
Figure 6   Sleep-efficiency (%) measured by the micro activity tracker

Discussion

The average bedtime became earlier in the first CBT week than in the baseline, and two out of the three participants reported a positive change in the self-rated indices of sleep and feelings. Therefore, it can be concluded that the CBT method has positive effects upon the improvement of sleeping habit. However, the measurement of concentration did not give any reliable results as to the improvement of concentration and dozing.

There still remain technical issues to be solved. For example, JINS MEME ES did not work several times, and the participants sometimes failed to set it when it worked. Unless such technical problems are solved, the next research cannot be done with this device to measure dozing and concentration.

In spite the fact that more than twenty students were expected to participate in this research, only eleven students could participate because of the school related activities such as examination and the sport meetings in the high school. In order to do the experiment with enough number of participants, it should have been carried out in the second term of the school year instead of the first term.

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