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On-demand lectures with humor and questions using avatars

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Abstract: On-demand lectures are becoming increasingly popular due to COVID-19. Meanwhile, the numbers of students (viewers) who cannot concentrate on on-demand lectures are also increasingly. One reason for this is boredom. Humor and questions are added to the lecture scenario in order to resist boredom during viewing on-demand lecture videos. Thus, a method was proposed to generate humor with "Boke (jokes)," "Tsukkomi (corrections)," and questions for important words in lecture scenarios and create lecture videos for demonstration by two avatars. Furthermore, to verify the validity of the proposed method, two experiments were conducted with 304 and 562 participants. The results of the experiments suggest that including humor and questions in on-demand lectures, demonstrated by two avatars, had the effect of inhibiting boredom.

Keywords: Humor, Questions, Lecture scenario, Avatar

1. Introduction

In recent years, the need for on-demand lectures has increased due to COVID-19, and on-demand videos have also been utilized in flip-style lectures after COVID-19. However, the need to devise a way to prepare for lectures has arisen because some students find it difficult to concentrate on lectures attended from home. According to Osugi (2021), on-demand lectures can guarantee knowledge gain; however, it is difficult to implement independent, interactive, and in-depth learning, and it remains difficult to change the way a person perceives things and thinks. Furthermore, Matsushima (2020) pointed out that on-demand lectures require significant time for teachers to prepare, which indicates that the burden on the faculty may increase in preparing for on-demand lectures.

In a previous study on substitute lectures by robots (Hiyori et al., 2018), a system in which a robot gave lectures at a university on behalf of lecturers was proposed. However, there are still some problems faced by lectures given by robots, such as mechanical nature and boredom. Meanwhile, according to Watanabe et al.(2020), it has been suggested that an avatar of the learner's own liking may be able to generate interest in the content and motivate the learner to take the next class.

In addition, a previous research (Yamashiro et al. 2020) on incorporating humor into educational settings has shown that adding toilet humor to Kanji drills can change students' grades and concentration. According to Yamashiro et al., students who used question books that incorporated humor showed an increased percentage of correct answers compared to students who used traditional question books. In addition, when concentration was measured by fixed-point camera imaging, it was found that students who used humor-infused materials concentrated on the paper from an earlier stage. Furthermore, Suzuki et al. (2021) proposed a comic script composition method for presentation talks. In this previous study, the authors found that incorporating a comic dialogue-like script structure into a presentation improved audience awareness, empathy, and familiarity. Furthermore, the effect of questions on viewers in lecture videos has been a focus of research. In one previous study (Yashio, & Araki, 2019), the insertion of questions for the viewer in a lecture scenario was proposed to generate lecture videos that do not bore the viewer.

Previous studies suggest humor and interaction during viewing on-demand lectures may be effective to resist boredom. However, adding humor or questions as interaction to the

regular lecture scripts increase the burden on faculty in preparing for on-demand lectures. This paper proposes a method to generate humor and questions for important words in lecture scenarios and create lecture videos for demonstration by two avatars to improve the problem of “boredom with on-demand lectures.” A lecture scenario with humor is generated by adding “Boke (jokes)” and “Tsukkomi (corrections)” about important words to the lecture scenario. The lecture scenarios follow a conversational format in which two avatars proceed with humor to soften the strict atmosphere. In addition, questions regarding important words are added to the scenarios for more active learning. The avatar asks students questions, giving them time to think, thus creating an active learning environment that makes the lecture less boring.

2. Method

We propose a humor method consisting of “Boke,” “Tsukkomi,” and questions regarding important words in the lecture scenarios that are input by a lecturer as a user. Two avatars representing teacher and student characters (“teacher avatar” and “student avatar”) demonstrate these scenarios so that students do not get bored with the lecture videos. The teacher avatar reads the lecture scenario aloud. The student avatar makes a joke as a “Boke,” and immediately after the “Boke,” the teacher avatar makes a correction of the joke as a “Tsukkomi.” In addition, the student avatar asks the student (viewer) questions regarding important words in the lecture scenario. Furthermore, the student avatar makes “Aizuchi (reaction)” along with the teacher avatar's talk to make their dialogue more natural.

The lecture avatars are placed at both ends of the lecture video screen, as shown in Figure 1. Vroid Studio was used to generate the two avatars, with the teacher on the right side) and student on the left side (see Figure 1). In addition, the lecture scenario is read aloud using Coe Font by avatars with an avatar lip-sync (the avatar's mouth moving in time with the voice) using 3tene. In addition, Open Broadcaster Software (OBS) was used to overlay a lecture slide and avatars to create a single lecture video, and subtitles were added using Adobe Premiere Pro (Figure1) because the text reading using synthetic voice Coe Font, may be difficult to hear the text.

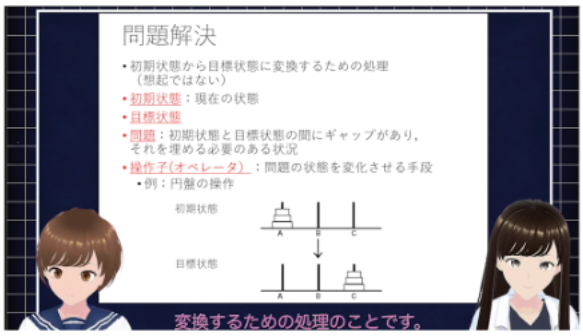

Figure 1. Lecture video by two avatars

2.1 Generation of “Aizuchi (reaction)”

Templates (“Ho-ho,” “So-Nanda,” “Naruhodo,” and “Hee” (Japanese “Aizuchi” expressing an agreement like “I agree”) were created, and one of them was randomly selected to make each “Aizuchi.” According to the previous research (Kamiya et al., 2010), after auxiliary verbs (“Desu,” “Masu,” etc.) there is a 27.5% probability that “Aizuchi” is given in a dialogue. Thus, assuming that the part of speech at the end of a sentence in a lecture scenario is almost always an auxiliary verb, an “Aizuchi” was inserted after the end of the sentence in the lecture avatar's talk at 27.5% probability.

2.2 Generation of “Humor”

The proposed method aims to make the lecture scenario humorous based on the Japanese comedy style “Manzai,” in which two comedians have a humorous conversation. In “Manzai,” one speaker says a “Boke (joke)” and the other speaker corrects the joke by “Tsukkomi.” Thus, a “Boke (joke)” and “Tsukkomi” were generated for the important words in the lecture scenarios.

2.2.1 Generation of “Boke”

In a previous study on the automatic generation of comic dialogue, Manzai (Yoshida, & Hagiwara, 2012) proposed three types of “Boke (joke)”: “Kotoba-Asobi-Boke (word game),” “Kajo Boke (excessive joke),” and “Mujun Boke (conflicting joke).” In this study, we adopted “Kotoba-Asobi-Boke (word game),” which can easily be applied to important words in a lecture.

In “Kotoba-Asobi-Boke (word game),” the Japanese target word is romanized and one consonant is replaced with another, as shown in Figure 2. The generated “Boke” must be a real word that is commonly heard in daily life, or else the meaning of the “Boke” will be unknown. Therefore, a textbook vocabulary corpus (Kyokasho Corpus Goihyo) was used. The textbook corpus contains words used in elementary, junior high, and high school textbooks, and each word is written in Japanese in Kanji and Romaji alongside its frequency of use. The consonants of the target word are randomly converted and compared with the words in the textbook corpus, and those that match the reading of the word in the textbook corpus with the highest frequency of use are output as “ Boke.” Words such as “death” that do not easily lead to laughter were removed from the “Boke” candidates. Words that consist of multiple morphemes (e.g., “Shusoku teki shikoh (thinking of convergence)”) are split into their individual morphemes by MeCab(Kudo et al., 2004), one morpheme (e.g., “Shusoku (convergence)”) other than a suffix (e.g., “teki (of)”) becomes the target, and the consonant of the target morpheme is changed randomly to create the “Boke (e.g., “Shutoku teki shikoh (thinking of learning).”

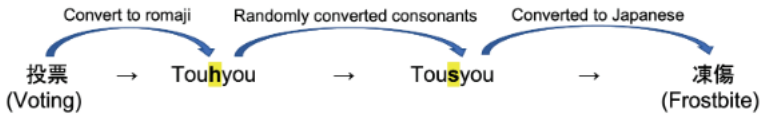

Figure 2. Generation method of “Boke”

2.2.2 Generation of “Tsukkomi”

As a “Tsukkomi” against the generated “Boke,” we adopted the “Setsumei Tsukkomi (explanation correction)” used by Yoshida and Hagiwara (2012). The “Setsumei Tsukkomi” provides negations and explanations for the “Boke.” To generate explanations for “Boke,” the meaning of the concept word used as the “Boke” is searched in the Japanese WordNet. Japanese WordNet is a Japanese dictionary in which the relationships between concepts and definitions of words corresponding to concepts are registered. For words that consist of multiple morphemes, only words that are generated as a “Boke” for target morphemes are searched. For example, when “Shutoku (learning)” is generated as a “Boke” for “Shusoku (convergence)” in “Shusoku teki shikoh (thinking of convergence),” “Shutoku (learning)” is searched for in the Japanese WordNet to generate an explanation.

“Setsumei Tsukkomi” consisting of negations and explanations is generated by randomly combining three types of negations (“Why are you (boke)?”, “No (boke),” and “(not saying anything)”) and three types of explanations (“(boke) is (explanation),” “That is (explanation),” and “That is (explanation), isn't it?”) (e.g. “No Shutoku (learning). Shutoku (learning) is acquisition of knowledge or ability.”). These are based on the canned sentences in Yoshida et al.'s [8] and were modified as “Tsukkomi” appropriate for the teacher character because the avatar playing the role of a teacher performs the “Tsukkomi.”

2.3 Question Generation

The questions are generated based on a previous study (Yashio, & Araki, 2019). Yoshio and Araki extracted questions have nouns that similar to the important words in the lecture from the Corpus of Japanese classroom Lecture speech Contents (CJLC) (Tsuchiya et al., 2008) and generated questions by replacing the nouns in the questions with the important words in the lectures (Figure 3). Instead of CJLC, this study used the Nagoya University Conversation Corpus (Fujimura et al., 2012) and Corpus of Japanese Teacher Speech (Nihongo Kyoshi Hatsuwa Corpus), which is a corpus of transcribed conversations, mainly by graduate students, that could be used to generate more comprehensible questions for students. The Corpus of Japanese Teacher Speech contains questions actually asked in lectures, and thus, it is more realistic as questions that appear in lectures. Questions that have similar nouns to the important words in the lecture were selected in these two corpora and replaced the nouns that appear in the questions with the important words that appear in the lecture. For example, for the important word “Shutoku teki shikoh”, a question”Shutoku teki shikoh suru koto arimasuka? (Do you ever do thinking of convergence?) “ was generated.

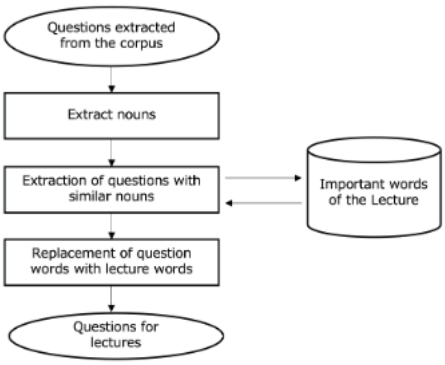

Figure 3. Generation method of question

3. Evaluation Experiments

Two experiments were conducted to validate the proposed method.

3.1 Experiment1

The purpose of the evaluation experiment was to verify the effect of humor consisting of “Boke” and “Tsukkomi” for “comprehensibility” and “boredom resistance.”

3.1.1 Method

A total of 304 people, who were paid cloud workers recruited by Lancers, participated in the experiment as a web-based survey (Males=187, Females=111, No Answer=6, Average age=42.29, SD of age=9.26). Three types of lecture videos were used: (1) a lecture video in which a teacher avatar reads a lecture scenario without a student avatar (Teacher), (2) a lecture video in which a teacher avatar reads a lecture scenario and a student avatar only gives an “Aizuchi” (Teacher+Student), and (3) a lecture video in which a teacher avatar reads a lecture scenario and “Tsukkomi,” and a student avatar gives an “Aizuchi” and “Boke” (Teacher+Student with Humor). In this study, the subjects were not shown the original lectures because it is difficult to generally compare between lectures given by avatars and by the actual teachers. Three types of existing scenarios and slides (Lectures 1, 2, and 3) that were actually used in a cognitive science lecture related to creativity at Future University Hakodate were used. At the end of the questionnaire, asked to rate their learning experience of cognitive science on a seven-point scale. The mean of the learning experience of cognitive science was 1.36, and the standard deviation was 0.89. The lecturer, who generated the scenarios and

slides and was one of the authors, selected two important words for each scenario. To avoid an order effect, the participants were divided into three groups (Group 1: 93, Group 2: 105, and Group 3: 106), and they watched the videos in the order of Lectures 1, 2, and 3 under different conditions depending on the group (Table 1). The length of each lecture video is 1:26 to 1:53 and viewers had time to answer questions after each video.

Table 1. Video watching conditions (Experiment1)

Lecture Type	Group 1	Group 2	Group 3
Lecture 1	Teacher	Teacher+Student	Teacher+Student with Humor
Lecture 2	Teacher+Student	Teacher+Student with Humor	Teacher
Lecture 3	Teacher+Student with Humor	Teacher	Teacher+Student

Immediately after watching each video, they were asked to rate how easy they found the videos to understand (comprehensibility) and how resistant to boredom they were (boredom resistance) on a 7-point scale using GoogleForm. After watching all videos, the participants were asked to respond to four-choice confirmation questions regarding the two important words in each video. One of the important words was a target word for “Boke” under the Teacher+Student with Humor condition.

3.1.2 Results

Using R, a two-way ANOVA (group × condition) was conducted to assess comprehensibility. An interaction was observed at the 1% level ($F(4,602)=41.5$, $p<.01$), and multiple comparisons using Holm's method revealed significant differences (Figure 4(a)). The results show significantly lower average ratings for the videos last viewed, regardless of condition (5%). Similarly, two-way ANOVA was conducted for boredom resistance. An interaction was observed at 1% ($F(4,602)=9.92$, $p<.01$), and multiple comparisons using the Holm method revealed significant differences (Figure 4(b)). The average rating was higher for the first video viewed than for the last in the Teacher condition and the average rating was significantly lower for the last video viewed than the others in Teacher+Student condition (5%). However, there is no simple main effect was observed in the Teacher+Student with Humor condition.

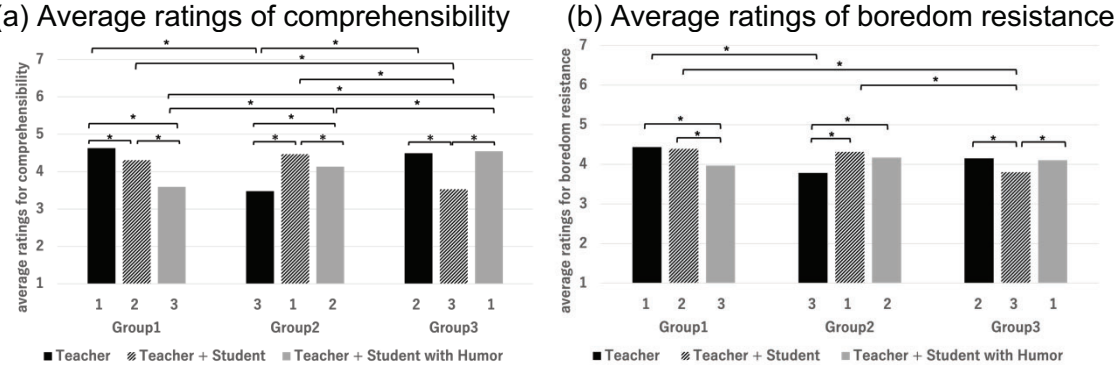

Figure 4. Average ratings of (a) comprehensibility and (b) boredom resistance
（** p<.01, * p<.05・The numbers below the bars indicate the order of viewing）

To compare correct response rates for questions about the important word with “Boke” and about the other word without “Boke,” a McNemar test was conducted using the results of the confirmation test under Teacher+Student with Humor condition. The number of

participants for the results of the questions are shown in Table2. The rates of correct responses to questions regarding important words with and without “Boke” were 68.1% and 61.2%, respectively, which were significantly different at the 1.0% level ($\chi^2(1)=7.23$, p<. 01).

Table 2. Results of confirmation test regarding important words with and without “Boke” under the Teacher+Student with Humor condition

		With “Boke”	
		Correct	Incorrect
Without “Boke”	Correct	166	20
	Incorrect	41	77

3.1.3 Discussion

The comprehensibility results show higher average ratings for the videos viewed in earlier order, regardless of condition.

Similarly, the boredom resistance results indicate the effect of viewing order. The average rating was higher for the first video viewed in each group regardless of the condition, and the rating was significantly lower for the last video viewed in each group, regardless of the condition. Meanwhile, simple main effects were observed among groups in the Teacher and Teacher+Student conditions, but not in the Teacher+Student with Humor condition. These results suggest that the inclusion of humor in a lecture video makes it difficult to be influenced by the viewing order and may make the participants concentrate on the lecture until the end.

The results of the confirmation test under Teacher+Student with Humor condition show that the rate of correct responses for the important words with “Boke” was significantly higher than without “Boke.” The inclusion of “Boke” for the important words may have an effect on the recognition of the words.

3.2 Experiment2

The purpose of the evaluation experiment was to verify the effect of questions for “comprehensibility” and “boredom resistance.”

3.2.1 Method

A total of 641 people, who were paid cloud workers recruited by Lancers, participated in the experiment as a web-based survey, of which 79 participants also attended Experient 1 and the remaining 562 participants were valid (Male=308, Female=253, No Answer=1, Average Age=42.25, Age SD=10.72). The survey was conducted from 17:52 Oct. 21 2022 to 14:58 Oct. 23 2022. Same as Experiment 1, the target lecture was a cognitive science course on creativity. The mean of the learning experience of cognitive science was 1.39, and the standard deviation was 0.95. Four types of lecture videos were used: (1) a teacher avatar reads a lecture scenario without a student avatar (Teacher), (2) a teacher avatar reads a lecture scenario and a student avatar asks a question about an important word and gives an “Aizuchi” (Teacher+Student with Q), (3) a teacher avatar reads a lecture scenario and a student avatar asks two questions about important words and gives an “Aizuchi” (Teacher+Student with 2Qs), and (4) a teacher avatar reads a lecture scenario and “Tsukkomi,” and a student avatar gives an “Aizuchi,” “Boke,” and question (Teacher+Student with Q+Humor). Three types of existing scenarios and slides were used (Lectures 1, 2, and 3), as in Experiment 1. Same as experiment1, the subjects were not shown the original lectures.

To avoid order effect, the participants were divided into six groups (Group 4: 95, Group 5: 97, Group 6: 93, Group 7: 96, Group 8: 89, and Group 9: 92)., and they watched the videos in the order of Lecture 1, 2, and 3 under different conditions depending on the group (Table 3). It is assumed that questions are selected by the lecturer (user); thus, each

question used in Experiment 2 was selected from 10 generated candidate questions according to the results of a pilot experiment in which seven undergraduate and graduate students were asked to rate the questions on a 5-point scale. As in Experiment1, the length of each videos were 1:28 to 1:54, and viewers had time to answer the questions after each video.

Table 3. Video watching conditions (Experiment2)

Lecture Type	Group 4	Group 5	Group 6
Lecture 1	Teacher	Teacher	Teacher+Student with Q
Lecture 2	Teacher+Student with Q	Teacher+Student with 2Qs	Teacher+Student with Q+Humor
Lecture 3	Teacher+Student with Q+Humor	Teacher+Student with Q+Humor	Teacher

Lecture Type	Group 7	Group 8	Group 9
Lecture 1	Teacher+Student with 2Qs	Teacher+Student with Q+Humor	Teacher+Student with Q+Humor
Lecture 2	Teacher+Student with Q+Humor	Teacher	Teacher
Lecture 3	Teacher	Teacher+Student with Q	Teacher+Student with 2Qs

"Q" is one question added to the scenario and "2Qs" is two questions added.

3.2.2 Results

Using statistical software R, a two-way ANOVA (group × condition) was conducted for comprehensibility using groups with the Teacher+Student + Q condition (Groups 4, 6, and 8). An interaction was observed at the 1% level ($F(4,548)=12.3$, $p<.01$), and multiple comparisons using Holm's method revealed significant differences (Figure 5(a)). In addition, two-way ANOVA was performed using groups under the Teacher+Student + 2Qs condition (Groups 5, 7, and 9). An interaction was observed at the 5% level ($F(4,564)=25.1$, $p<.01$), and multiple comparisons revealed significant differences (Figure 5(b)). Both of the results show show significantly lower average ratings for the videos last viewed in Teacher condition (5%).

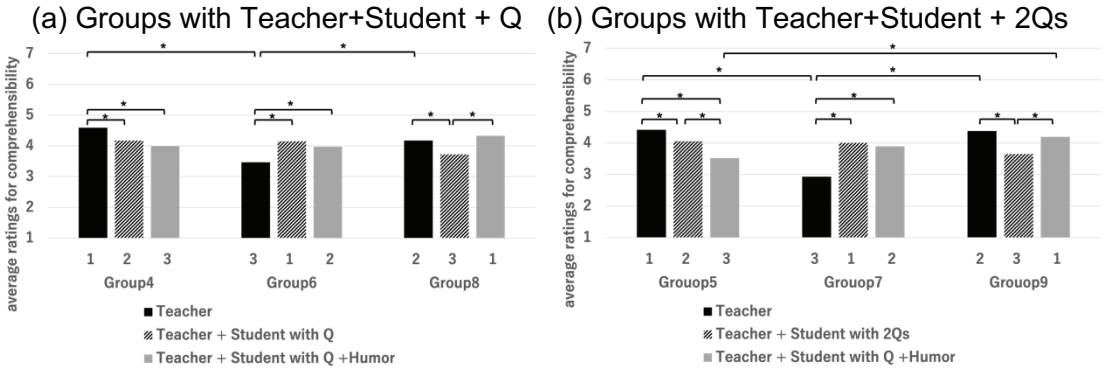

Figure 5. Average ratings of comprehensibility of (a) groups with Teacher+Student + Q condition and (b) groups with Teacher+Student + 2Qs
(** p<.01, * p<.05, The numbers below the bars indicate the order of viewing)

Two-way ANOVA (group × condition) was conducted for boredom resistance using groups with the Teacher+Student + Q condition (Group 4, 6, and 8). An interaction was observed at the 1% level ($F(4,548)=5.88$, $p<.01$), and multiple comparisons using Holm's

method revealed significant differences at the 5% level (Figure 6(a)). In addition, two-way ANOVA was performed using groups under the Teacher+Student + Qs condition (Group 5, 7, and 9). An interaction was observed at the 1% level (F(4,564)=25.1, p<.01), and multiple comparisons revealed significant differences (Figure 6(b)). Both of the results show show significantly lower average ratings for the videos last viewed in Teacher condition (5%).

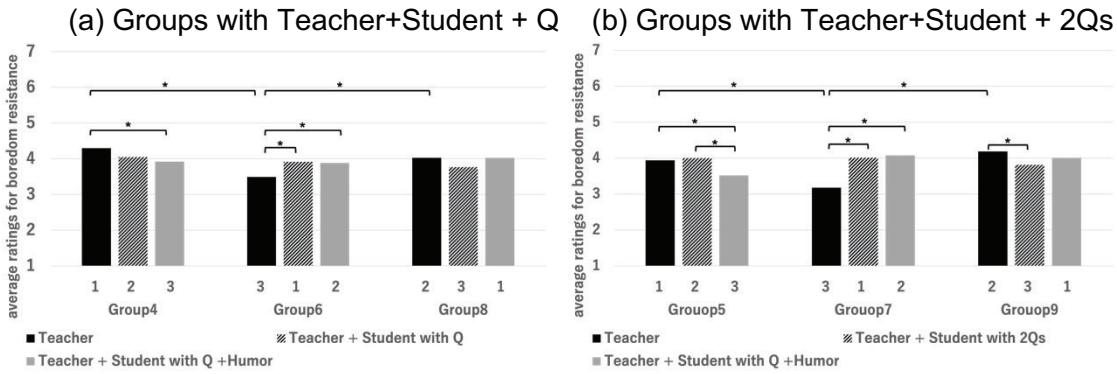

Figure 6. Average ratings of boredom resonance of (a) groups with Teacher+Student + Q condition and (b) groups with Teacher+Student + 2Qs
（** p<.01, * p<.05, The numbers below the bars indicate the order of viewing）

To compare correct response rates for questions about the important words with and without a question, McNemar's test was conducted using the results of the confirmation test under the Teacher+Student with Q condition (Groups 4, 6, and 8). The number of participants for the results of the questions is shown in Table 4. The rates of correct responses to the questions about important words with and without question were 64.6 and 52.% respectively, which were significantly different at the 1.0% level ($\chi^2(1)=16.33$, p<. 01).

Table 4. Results of confirmation test about important words with and without a question under Teacher+Student with Q condition

		With question	
		Correct	Incorrect
Without question	Correct	129	20
	Incorrect	55	81

To compare correct response rates for questions about the important words with a question and with a ''Boke," a χ^2test was conducted using results of the confirmation test under the Teacher+Student with Humor condition (Groups 1, 2, and 3) and Teacher+Student with Q condition (Groups 4, 6, and 8). No significant differences were observed at the 5. 0% level.

Furthermore, to compare correct response rates for questions about the important words with a question and with a ''Boke" in the same video, McNemar's test was conducted using results of the confirmation test under the Teacher+Student with Q+Humor condition. The number of participants for the results of the questions is shown in Table 5. The rates of correct responses to the questions about important words with a question and with a ''Boke" were 54.4 and 60.0%, respectively. There was a significant difference at the 1.0% level ($\chi^2(1)=7.45$, p<. 01).

To compare effects of questions and ''Boke" when the other question was included in the same lecture video, a X^2test was conducted using results of the confirmation test under the Teacher+Student with Q+Humor condition and Teacher+Student with 2Qs condition (Groups 5, 7, and 9). The rates of correct responses to the questions about important words with a question and with a ''Boke" were 60.6 and 67.9%, respectively (Table 6), and there is significant trend between them ($\chi^2(1) =2.84$, p<. 1).

Table 5. Results of confirmation test for important words with a question and with a ‘’Boke” in the same lecture video under Teacher+Student with Q+Humor condition

		With “Boke”	
		Correct	Incorrect
With question	Correct	257	49
	Incorrect	80	176

Table 6. Results of confirmation test for important words with a question and with a ‘’Boke” when the other question was included in the same lecture video under Teacher+Student with Q+Humor condition and Teacher+Student with 2Qs condition

	Answer	
	Correct	Incorrect
Question	168	109
“Boke”	188	89

3.2.3 Discussion

The comprehensibility results show higher average ratings for the videos viewed first and lower average ratings for those viewed last in the viewing order, regardless of the condition. A simple main effect between groups in each condition was observed under the Teacher and Teacher+Student with Q+Humor conditions but not under the Teacher+Student with Q or Teacher+Student with 2Qs conditions.

Similarly, the results for boredom resistance indicate an influence of viewing order. However, the results of Group 8 (Teacher+Student with Q+Humor, Teacher, and Teacher+Student with Q, in that order) do not show an order effect. Furthermore, a simple main effect between groups in each condition was observed under the Teacher condition but not under the other conditions.

This suggests that the inclusion of a question text directed to the participants regarding important words in the lecture video scenario may make it difficult to be influenced by the order in which they watch the video and may allow the participants to concentrate on the lecture until the end.

The results of the confirmation test for the important words with and without a question show that the rate of correct responses for the important words with questions was significantly higher than without questions. The inclusion of questions for the important words may affect word recognition.

Furthermore, the results of comparison between correct response rates for questions about the important words with a question and with a "Boke” in the same video show that the rate of correct responses for the important words with question was significantly higher than with "Boke.” This suggests that the inclusion of questions for the important words may have more of an effect for the recognition of words than the inclusion of a "Boke.” However, the results of comparison between effects of questions and "Boke” when the other question was included in the same lecture video show that a "Boke” is more effective than a question.

4. Conclusion

This paper proposed a method to generate humor consisting of "Boke,” "Tsukkomi,” and questions for important words in lecture scenarios, demonstrated by two avatars, to improve the problem of “boredom with on-demand lectures.” Two experiments were conducted to verify the validity of the proposed method. It was found that the addition of either a “Boke” or question made the participants less bored and also showed that the inclusion of a "Boke” and question for important words may have an effect on the recognition of words. However, since the content of the videos used in the experiments was only cognitive science, it is necessary to examine whether the proposed method is also effective for learning other content, e.g., mathematics. Furthermore, since the lecture video in this experiment lasted for

shorter than two minutes, it is unclear whether it will be an on-demand lecture that can be practically. It is necessary to conduct experiments using lecture videos that are similar in length to the on-demand lectures that are actually used. In addition, the evaluation of boredom resistance was subjective, and an objective evaluation is not yet possible. It is necessary to verify the use of physiological indices, such as the number of blinks. In addition, because including many sets of "Boke" and "Tsukkomi" increases the time of the lecture video and is considered impractical, we did not set a double humor condition in which two sets of "Boke" and "Tsukkomi" were included in the experiments. Hence, it is necessary to conduct additional experiments with a double humor condition to compare between effects of question and "Boke" when another "Boke" is included in the same lecture video.

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