Chen, W. et al. (Eds.) (2017). Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education

Effect Analysis of Students' Learning Styles on Learning Experience with Lecture Videos Played at Different Playback Speeds

Toru NAGAHAMA[a*] & Yusuke MORITA[b]
[a]*Graduate School of Human Sciences, Waseda University, Japan*
[b]*Faculty of Human Sciences, Waseda University, Japan*
*tnagahama@aoni.waseda.jp

Abstract: The goal of this study was to clarify effects of students' learning styles on their learning experience with lecture videos played at different playback speeds. We focused on the interactions between students' learning styles and video playback speed. In our experiment, participants' learning styles were categorized by Felder's Index of Learning Styles and 35 verbal students and 40 visual students learned about the network infrastructure with lecture videos played at original speed, 1.5× speed, and 2.0× speed. The comprehension test results indicated that the video playback speeds and the students' learning styles did not influence the comprehension test scores. The subject evaluation results indicated that there were significant interactions for their learning experience. Consequently, the possibility that students' learning experience could differ to their learning styles when they learn with hi-speed lecture videos was discussed.

Keywords: lecture video, online learning, high-speed video, variable-speed functionality

1. Introduction

As the popularity of MOOC (Massive Open Online Course) continues to grow all over the world, many studies have examined the importance of lecture videos. Guo, Kim, and Rubin (2014) studied lecture videos on MOOC by analyzing a dataset containing some 7 million instances of students watching lecture video. Guo et al. (2014) suggested that the number of course participants paying attention to a lecture video begins to decrease significantly when the video duration were longer than 6 minutes and instructor's speaking rate was fairly slow. Nagahama and Morita (2017) studied the efficacy of using variable-speed playback functionality to watch lecture videos at high speeds and indicated that video playback speed: original speed; 1.5× speed; 2.0× speed did not influence the learning outcomes. Nagahama and Morita (2017) also suggested that watching lecture videos would highly increase cognitive loads.On the other hand, Felder's index of learning styles (F-ILS: Felder and Henriques, 1995) has been used for researches which examine the relationship between learner characteristics and learning experience (Morita, Koen, Ma, Wu, & Johendran, 2005; Oyama, Murakami, Taguchi, & Matsushita, 2010). The goal of this study was to clarify effects of students' learning styles on their learning experience with lecture videos played at different playback speeds.

2. Methods

In our experiment, 35 verbal learners and 40 visual learners (all Japanese), whose learning styles were categorized by F-ILS, learned about the network infrastructure of a high school information science department with lecture videos. First, before watching the lecture videos, we gave a comprehension test (the pre-video test) to assess their pre-existing knowledge of the theme in the lecture video. Next, we divided 75 participants into three groups; (a) 1.0 group, who watched the lecture video at original speed; (b) 1.5 group, who watched the lecture video at 1.5× speed; (c) 2.0 group, who watched the lecture video at 2.0× speed. Next, each group of participants watched the lecture video. Next, after watching the

lecture video, the participants were given a post-video test. Finally, all participants were shown condensed versions of lecture video (lecture video digests) and were asked to complete a sheet of questions.

The lecture videos, the comprehension test, and the sheet of questions were the same as the ones that Nagahama and Morita (2017) used in their experiment. The comprehension test consisted of 20 problems, including 11 playback problems and 9 application problems. The questions consisted of two questions concerning comprehension, tow questions concerning speaking style, two questions concerning level of interest, three questions concerning concentration, three questions concerning ease of listening, three questions concerning ease of watching, four questions concerning whether students liked the speed and duration of the video, and five questions concerning whether students liked the video. The subjective opinions of the participants were surveyed using a five-point Likert scale.

3. Results

3.1 Comprehension Test

We determined the comprehension score and conducted a two-way ANOVA using the students' learning styles as the first factor (F-ILS factor) and the video playback speeds as the second factor (speed factor).

For the playback problems, the ANOVA result indicated no significant interaction, $F(2, 69) = 0.65$, $p > .05$. An analysis of main effects indicated no significant difference for the playback speed factor, $F(2, 69) = 0.53$, $p > .05$, and for the F-ILS factor, $F(1, 69) = 0.82$, $p > .05$. For the application problems, the ANOVA result indicated no significant interaction, $F(2, 69) = 0.59$, $p > .05$. An analysis of main effects indicated no significant difference for the playback speed factor, $F(2, 69) = 0.42$, $p > .05$, and for the F-ILS factor, $F(1, 69) = 0.58$, $p > .05$.

3.2 Subjective Evaluations

We computed the mean scores for each question and conducted a two-way mixed ANOVA using the students' learning styles as the first factor (F-ILS factor) and the video playback speeds as the second factor (speed factor). Significant interactions were found in four out of 24 questions. We focused on these four interactions in this paper. Table 2 shows the mean scores with the ANOVA results.

Table 2: The mean scores with the ANOVA results.

	Verbal			Visual			F-value		
	1.0×	1.5×	2.0×	1.0×	1.5×	2.0×	F-ILS	Speed	Interaction
Q4.	3.7 (1.27)	4.3 (0.89)	2.9 (1.26)	3.8 (1.01)	3.9 (0.88)	2.1 (1.22)	3.98 *	57.56 **	3.55 *
Q11.	1.9 (1.21)	2.1 (0.96)	3.7 (1.12)	1.8 (1.08)	2.4 (1.17)	4.3 (0.97)	2.35 *ns*	100.39 **	2.40 +
Q15.	4.3 (0.80)	4.2 (0.61)	3.5 (1.20)	4.2 (0.60)	4.0 (0.89)	3.9 (0.92)	0.01 *ns*	14.35 **	5.26 **
Q23.	2.4 (1.03)	2.5 (0.98)	2.4 (0.94)	2.8 (1.12)	2.8 (1.15)	3.0 (1.18)	3.39 +	1.35 *ns*	3.42 *

**: $p < .01$, *: $p < .05$, +: $p < .10$

For question 4 (The instructor's speaking style was easy to listen.) there was a significant interaction between the F-ILS factor and the speed factor, $F(2, 146) = 3.55$, $p < .05$. An analysis of simple main effects indicated significant differences for the F-ILS factor and the speed factor. For the F-ILS factor, the Bonferroni test indicated that verbal learners gave significantly higher scores to 1.5× speed than original speed, $p < .10$, and original speed than 2.0× speed, $p < .05$. On the other hand, visual learners gave significantly higher scores to original speed and 1.5× speed than 2.0× speed, $p < .05$. For

the speed factor, the Bonferroni test indicated that verbal learners' scores for 1.5× speed and 2.0× speed were significantly higher than visual learners', $p < .05$.

For question 11 (I found it difficult to understand the instructor's voice.), there was a significant interaction between the F-ILS factor and the speed factor, $F(2, 146) = 2.40$, $p < .10$. An analysis of simple main effects indicated significant differences for the F-ILS factor and the speed factor. For the F-ILS factor, the Bonferroni test indicated that verbal learners gave significantly higher scores to 2.0× speed than original speed and 1.5× speed, $p < .05$. On the other hand, visual learners gave significantly higher scores to 2.0× speed than 1.5× speed, $p < .05$, and 1.5× speed than original speed, $p < .05$. For the speed factor, the Bonferroni test indicated that visual learners' scores for 2.0× speed were significantly higher than visual learners', $p < .05$.

For question 15 (The images displayed were pleasant to view.), there was a significant interaction between the F-ILS factor, $F(2, 146) = 5.26$, $p < .05$. An analysis of simple main effects indicated significant differences for the F-ILS factor and the speed factor. For the F-ILS factor, the Bonferroni test indicated that verbal learners gave significantly higher scores to original speed and 1.5× speed than 2.0× speed, $p < .05$. On the other hand, visual learners gave significantly higher scores to original speed than 1.5× speed, $p < .10$.

For question 23 (The slides contained many figures and tables.), there was a significant interaction between the F-ILS factor and the speed factor, $F(2, 146) = 3.42$, $p < .05$. An analysis of simple main effects indicated significant differences for the F-ILS factor and the speed factor. For the F-ILS factor, the Bonferroni test indicated that visual learners gave significantly higher scores to 2.0× speed than original speed, $p < .10$. For the speed factor, the Bonferroni test indicated that visual learners' scores for 2.0× speed were significantly higher than visual learners', $p < .05$.

4. Discussion & Conclusion

The goal of this study was to clarify effects of students' learning styles on their learning experience with lecture videos played at different playback speeds. We focused on the interaction between students' learning styles and video playback speed. In our experiment, participants' learning styles were categorized by F-ILS and 35 verbal students and 40 visual students learned about the network infrastructure with lecture videos played at original speed, 1.5× speed, and 2.0× speed.

The comprehension test results indicated that the video playback speeds and the students' learning styles did not influence the comprehension test scores. The subject evaluation results indicated that there were significant interactions for their learning experience. Especially, visual learners felt much cognitive load when they watched video at 2.0× speed while verbal learners not.

These findings suggested that the possibility that students' learning experience could differ from their learning styles when they learned something with hi-speed lecture videos. The present data offered further corroboration of the findings of Nagahama and Morita (2017). However, the results are therefore limited to Japanese students, and they need to be replicated with other populations.

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