British Journal of Educational Technology *Vol 43 No 6 2012* E166–E170
doi:10.1111/j.1467-8535.2012.01320.x

Colloquium

Redundancy effect on retention of vocabulary words using multimedia presentation

Yavuz Samur

Address for correspondence: Mr Yavuz Samur, Learning Sciences and Technologies, Virginia Tech, 1333 Brighton Ct, Blacksburg, VA 24060, USA. Email: yavuzsamur@gmail.com

This study was designed to examine the effect of the redundancy principle in a multimedia presentation constructed for foreign language vocabulary learning on undergraduate students' retention. During the experiment, students received a multimedia presentation on Turkish vocabulary and answered questions on retention test. Some students received animation, concurrent narration and concurrent text (ANT group); other students received only animation and concurrent narration (AN group). According to the *redundancy principle*, adding redundant on-screen text to a multimedia explanation where it is already narrated, results in poorer learning (Kalyuga, Chandler & Sweller, 1999; Mayer, Heiser & Lonn, 2001). That is, when making a multimedia presentation with a narration and animation, the designers should not add on-screen text that duplicates words that are already spoken in the narration although students have more exposure to the multimedia presentation when it is delivered in three ways (animation, narration and text). The reason for removing on-screen text from the multimedia presentation is because of the cognitive theory of multimedia learning that is based on three assumptions: dual-channel (Clark & Paivio, 1991), limited capacity (Baddeley, 1992) and generative learning assumption (Mayer, 1996) or active processing.

On the other hand, the reason for adding on-screen text is based on the information delivery hypothesis, which states that students learn more when the same information is delivered by means of more paths rather than fewer paths (Mayer *et al*, 2001). That is, "adding on-screen text to a narrated animation will result in better performance on tests of learning that focus on remembering verbal explanation (ie, retention test)" (Mayer *et al*, 2001, p. 190). Therefore, the underlying hypothesis of this study is that when the students are exposed to the material in multiple ways through ANT, the learning and the retention will have better results in foreign language learning. Early research on vocabulary learning with text and pictures has consistently found that when the written vocabulary words are paired with pictures, there is a better retention of vocabulary words (Paivio, Clark & Lambert, 1988; Plass & Jones, 2005). Besides, presenting both on-screen text and narration at the same time is better than presenting just on-screen text or narration because students might choose the one that best fits their learning style (Mayer *et al*, 2001).

This small study is expected to contribute to the cognitive theory of multimedia learning literature in three ways. First, the study was realized in ecologically more valid environment than Mayer's experiments, because the experiment was done through authentic classroom experience. Unlike the experiments done in Mayer's cognitive laboratory, this study was done within regular classroom settings. Classroom research is an important way to establish external validity of findings when using multimedia. Second, the study was done in a different content area, foreign language learning. It was suggested by Plass and Jones (2005, p. 483) that an area for future research is "the integration of second-language acquisition theory and cognitive theories of multimedia learning." Third, the study was conducted with non-Turkish speaking students, which is also another contribution to the literature on multimedia learning. Besides, students'

ideas about the presentation were taken simply by asking how they feel about the presentation and what they think about their learning as an open-ended question because it is believed that their thoughts about the presentation and their learning process are also important to consider for the area. Therefore, the goal of this small study is to contribute to a growing body of research-based principles for the design of multimedia for foreign language learning.

Method

Participants

In this quasi-experimental design, 22 undergraduate students (19 female, 3 male) in a large public university located on the mid-Atlantic Coast were conveniently selected as participants. All participants in the study reported low levels of knowledge about Turkish, as indicated by low scores on the multiple-choice Turkish vocabulary pretest (3 or less out of 10). The participants were randomly assigned to either ANT group (11 students) or AN group (11 students). After treatment, participants answered the same test as a posttest for assessing their retention.

Design and variables

The study is a quasi-experimental design (see Table 1). The effect of independent variable (ANT) on students' retention (dependent variable) was analyzed in this study. Moreover, in the survey, the students' gender, age, how many and what type languages they could speak and their overall grade point avarage (GPA) were collected to note demographics and determine if those variables had any effect on students' retention scores. Notably, these demographics have not been analyzed with extant work examining multimedia presentation effects on foreign language learning. Finally, the students' views in both groups on their learning process and presentation were taken to analyze by asking an open-ended question: "How do you feel about the presentation and what do you think about your learning?" Students' answers were examined and the findings are given in the results section.

Instrument and material

A paper-and-pencil type multiple-choice test was the preferred type of data collection procedure for this study. There were 15 items in the pretest and 17 items in the posttest. The expert views were taken to develop the tests. The tests were pilot-tested by graduate and undergraduate students to improve questions, format and clarity before they were presented to the groups.

As for multimedia presentation, one presentation included ANT and the other one included AN without on-screen text. Both presentations were designed by the researcher after taking the expert views and showing the presentations to three students to check if there was any problem. Figure 1 shows selected frames from the animation along with concurrent narration (shown as text below each animation) and animation along with narration without text (Figure 2). In the 120-second multimedia presentation, after a general introduction to the presentation, 10 Turkish action verbs were presented with AN in the control group and with ANT in treatment group by using the PowerPoint software with overhead projector in the class.

Results and discussion

Table 2 presents the mean scores and standard deviations for each group on each of the two tests. Independent sample *t*-test and paired-sample *t*-test analysis were conducted to compare the retention test scores in ANT and AN conditions.

Table 1: Research design

Groups	*Before treatment*	*During treatment*	*After treatment*
Control	Pretest	Animation + narration	Posttest
Treatment	Pretest	Animation + narration + text	Posttest

Figure 1: Selected frames from the multimedia presentation of ANT group

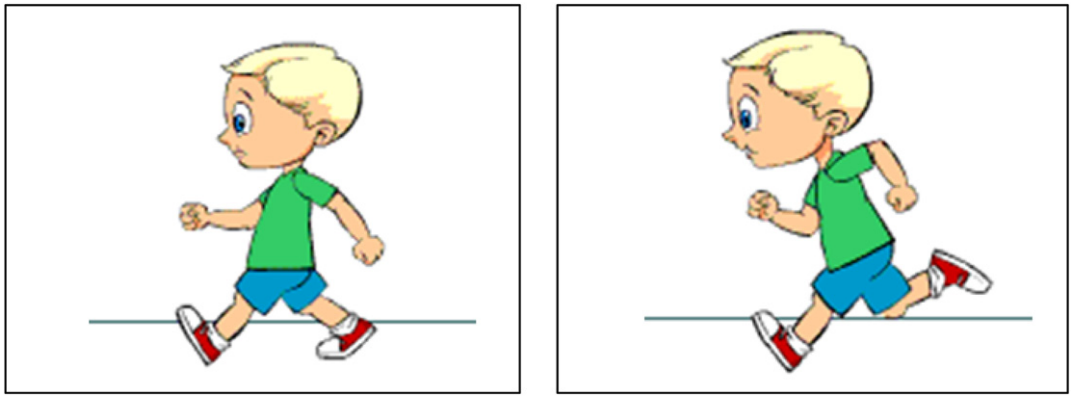

Figure 2: Selected frames from the multimedia presentation of AN group

Table 2: Independent samples test results for both groups

		F	*Sig.*	*t*	*df*	*Sig. (two-tailed)*
Pretest total scores	Equal variances assumed	0.642	.432	−0.122	20	.904
	Equal variances not assumed			−0.122	17.978	.904
Posttest total scores	Equal variances assumed	0.627	.438	−5.319	20	.000
	Equal variances not assumed			−5.319	17.333	.000

Although students were almost equal in terms of prior knowledge on Turkish vocabulary with a $t = -0.122$ ($df = 20$, $p > .05$) according to pretest scores (Table 2). When we look at the group statistics on Table 3, students who received the presentation with ANT remembered significantly more of the vocabulary words on the retention test ($M = 6.91$, $SD = 1.51$) than did students who received the presentation only with AN (no on-screen text) ($M = 4.00$, $SD = 1.00$). In order to see

Table 3: Group statistics for pretest and posttest

	Groups	*n*	*M*	*SD*
Pretest	AN	11	2.64	2.014
	ANT	11	2.73	1.421
Posttest	AN	11	4.00	1.000
	ANT	11	6.91	1.514

Table 4: Paired samples t*-test results for each group*

		M	*SD*	*Std. error mean*	*t*	*df*	*Sig. (two-tailed)*
AN	PreTotal—PostTotal	−1.364	2.292	0.691	−1.973	10	.077
ANT	PreTotal—PostTotal	−4.18182	2.35874	0.71119	−5.880	10	.000

if the difference is significant when it is compared with pretest retention test results for each group, paired-samples *t*-test was applied.

The results showed that (Table 4) while there is no significant difference between pretest and posttest scores of retention test in AN group, $t(10) = -1.97$, $p = .077$, there is a significant difference between pretest and posttest scores of retention test in ANT group, $t(10) = -5.88$, $p = .000$. In terms of the effect of gender, age, how many and what languages students can speak and their overall GPA, the results showed that there is no relation between the scores of retention with gender, overall GPA, age, the number of languages they speak and the languages they speak.

Overall, the results show that adding on-screen text to a multimedia presentation with animation and narration helped student learning new vocabulary in a previously unfamiliar foreign language. This result is concurrent with Borras and Lafayette's (1994) research; however, the findings are not consistent with redundancy effect and the split-attention hypothesis. Research on redundancy principle indicates that when same information presented in many different forms (narration and text at the same time), it hurts learning (Kalyuga *et al*, 1999; Mayer *et al*, 2001).

Mayer *et al* (2001) found that learning a scientific explanation from a narrated animation was hurt by the addition of on-screen text that contained the same words as in the narration. However, in this study, the content was foreign language learning and students did not have substantial knowledge on the target language. When students' responses to the open-ended question about their learning process and about the presentation were analyzed, the students who answered the question in AN group (9 out of 11) wrote negative sentences on their learning and the presentation such as "I was unable to learn any words" and "They all sounded same" and "It would have helped to see the written Turkish word instead of just hearing it." On the other hand, all of the ANT group students answered the question and 9 out of 11 students replied with positive sentences such as "It helps to have audio, visual, and text when learning new languages." Research on language learning with multimedia indicates that, especially for novice learners, using direct translations of vocabulary may be helpful for enhancing the input (Grace, 1998; Plass & Jones, 2005). Although on-screen text with corresponding narration was found redundant and detrimental for learning because of the increase in cognitive load (Kalyuga *et al*, 1999; Mayer *et al*, 2001), the reported research suggests that it may not always be valid for foreign language learning. On the contrary, according to this study, when students see the translation of the vocabulary in their native language, they remember significantly more words than students who do not (Grace, 1998). Therefore, in this study, students in the ANT group remembered more words than the AN group.

In conclusion, when presenting a multimedia instruction in language learning with narration and animated pictures, adding text to the presentation does improve learning. The main idea of the redundancy effect is to decrease the redundant information from the multimedia presentation to reduce students' cognitive load; however, if the topic is language learning, it was proved that narrated text is not redundant information for the language learners in this study.

Acknowledgments

I would like to thank Dr. Michael A. Evans for his valuable guidance and advice. He read the manuscript and provided critical comments while I was taking his course titled Multimedia Cognition (EDEP 6334, Spring 2011).

References

Baddeley, A. (1992). Working memory. *Science, 255*, 556–559.

Borras, I. & Lafayette, R. C. (1994). Effects of multimedia courseware subtitling on the speaking performance of college students of French. *The Modem Language Journal, 78*, 1, 61–75.

Clark, J. M. & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review, 3*, 149–210.

Grace, C. (1998). Retention of word meanings inferred from context and sentence-level translations: implications for the design of beginning-level CALL software. *The Modern Language Journal, 82*, 4, 533–544.

Kalyuga, S., Chandler, P. & Sweller, J. (1999). Managing split-attention and redundancy in multimedia instruction. *Applied Cognitive Psychology, 13*, 351–371.

Mayer, R. E. (1996). Learning strategies for making sense out of expository text: the SOI model for guiding three cognitive processes in knowledge construction. *Educational Psychology Review, 8*, 357–371.

Mayer, R. E., Heiser, J. & Lonn, S. (2001). Cognitive constraints on multimedia learning: when presenting more material results in less understanding. *Journal of Educational Psychology, 93*, 1, 187–198.

Paivio, A., Clark, J. M. & Lambert, W. E. (1988). Bilingual dual-coding theory and semantic repetition effects on recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 14*, 163–172.

Plass, J. L. & Jones, L. C. (2005). Multimedia learning in second language acquisition. In R. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 467–488). Cambridge: Cambridge University Press.