

The Perceptions of Users Regarding Multimedia Principles in Mobile-Based Japanese Language Learning

Mohd Sofi Mohammad Ayub

*University Putra Malaysia
klyearchery@gmail.com*

Othman Talib

*University Putra Malaysia
zahinothman@gmail.com*

Nyet Moi Siew

*Faculty of Psychology and Education, Universiti Malaysia Sabah
Jalan UMS, 88400 Kota Kinabalu, Sabah, MALAYSIA
snyetmoi@yahoo.com*

ABSTRACT

This study aimed to explore the perceptions of users regarding the use of seven multimedia principles in mobile-based Japanese language learning. Students and lecturers expounded their views on these seven multimedia principles: Generative Learning, Spatial Contiguity, Temporal Contiguity, Coherence, Modality, Redundancy and Personalization. A single group with intervening mobile-based Japanese language learning design was used to test each of the multimedia principles. The participants consisted of 62 undergraduates and three Multimedia lecturers. A mixed method approach was employed where questionnaires and interviews were used as data collection tools. The findings revealed that a majority of the respondents agreed that the multimedia principles were appropriate for application in mobile-based Japanese language learning, except for the Personalization and Redundancy principles. The respondents expressed the need for incorporating on-screen text and formal style text in a mobile learning environment. The findings of this study can facilitate instructors and developers to develop an optimal mobile-based learning experience for Japanese language learners.

KEYWORDS: Japanese language, Mobile-based learning, Principles of Multimedia.

INTRODUCTION

Mobile-based learning has increased in popularity among kids, teenagers and adults. Mobile-based learning is an education via the network using personal mobile devices, such as tablets and smartphones to obtain learning materials through mobile apps, social interactions and online educational hubs. It is flexible, allowing learners access to education anywhere and anytime. The development of mobile-based learning apps has increased drastically with the aid of advances in multimedia to fulfil the needs of targeted audiences or learners. Multimedia is the presentation of material using at least two of the elements of sound (audio), text, still graphics, and motion graphics (visual) (Mayer, 2002). The purpose of combining various types of media is to convey a message or information and to facilitate effective learning among learners. Consequently, more and more mobile apps developers are integrating multimedia into the learning apps to enrich the learning material. This has resulted in a progressive mobile apps development in order to fulfil the requirements of modern learning needs and to reach the high quality of multimedia material in mobile-based learning. However, to successfully deploy multimedia in mobile-based learning environments, an effective approach is required to address the multimedia issues jointly.

Previous research has unveiled the increasing complexity in the multimedia content (Rasiwasia, Costa Pereira, Coviello, Doyle, Lanckriet, Levy, & Vasconcelos, 2010) as well as some pertinent issues in designing effective multimedia-based instruction for education (Issa, Schuller, Santacaterina, Shapiro, Wang, Mayer, & DaRosa, 2011). Most of these researches have reported issues of mismatch between words and audio when the multimedia principles are applied in learning apps. In regards to these matters, great effort is required to gather users' perceptions in tandem with designing effective mobile-based learning material. This study attempts to investigate the perception of users regarding the use of multimedia principles in mobile-based learning.

The Concept and Importance of Multimedia Principles in Education

The seven principles of multimedia proposed by Mayer (2002) has been widely referred to in designing multimedia learning materials. The seven principles are Generative Learning Principle, Spatial Contiguity Principle, Temporal Contiguity Principle, Coherence Principle, Modality Principle, Redundancy Principle, and Personalization Principle. The first principle, Generative Principle, suggests that learners learn better with words and pictures than from words alone. This principle allows learners to visualize ideas and connect concepts with the help of pictures (Malik & Agarwal, 2012). It also cautions that learners are less likely to connect the words with other knowledge when words are used alone which usually lead to shallow learning. The second principle, the Spatial Contiguity Principle, suggests that learners learn better when the corresponding words and pictures are presented near to each other rather than far apart on the page or screen. This principle helps to attract learners' attention by visualizing the messages when an image is placed next to the words. However, learners will need to visualize the content using cognitive processing in order to understand the intended messages.

Next, the Temporal Contiguity Principle suggests that learners learn better when the corresponding portions of the narration and animation are presented at the same time. This principle allows learners to cope with the learning content by making mental connections simultaneously in their working memory. However, narration could be used during the presentation followed by an animation in successive presentation that allows the learner to have two separate exposures to the explanation rather than one. The fourth principle, the Coherence Principle, suggests that people learn better when extraneous words, pictures and sound are excluded from multimedia messages. A simple and concise slide presentation makes it easier for a learner to focus and read the content. Albeit, this principle is not applied to learners who learn subjects that require complex action in multimedia such as biology or medicine which demands extraneous information of a complex structure (Issa *et al.*, 2011)

Modality Principle, the fifth principle, suggests that people learn better from words and pictures when the words are spoken rather than printed. This principle allows the learner to easily convert information from oral information for further information processing (Mayer & Moreno, 2003). However, the learners' visual channel might become overloaded when both words and pictures are presented visually. The sixth principle, Redundancy Principle, suggests that people learn better from graphics and narrations than from graphics, narrations and on-screen text. This principle renders ease to the learners' visual sensory while watching for the main content while listening to the audio. However, people have separate channels for processing verbal and visual material that causes learners to select only a little amount of information to be processed at one time (Clark & Mayer, 2016). Lastly, the Personalization Principle suggests that people learn better from a multimedia lesson when words are transmitted through a conversational style compared to a formal style (Mayer, 2005, 2009). According to Moreno and Mayer (2000), using audio that represents a friendly mood and environment will increase the learners' interest. In this study, the conversational style was engaged to the learners by using "I" and "you" (e.g.: "Next, I would like you to click on your name") instead of a third person in the formal style (e.g.: "Next, click on the name at the top").

According to Clark and Mayer (2016), well-designed multimedia messages help to enhance the learner's ability to absorb and assimilate learning material. Thus, in order to design an effective multimedia instruction that promotes understanding among learners, it is crucial to be guided by relevant multimedia principles based on how learners learn.

Past research has reported the increasing sophistication in multimedia content that is not matched with the multimedia principles (Rasiwasia *et al.*, 2010), as well as issues in designing an effective multimedia instruction and applying multimedia design principles to enhance learning in medical education (Issa *et al.*, 2011). Meanwhile, in the mobile context of multimedia learning, many issues and challenges brought by the emerging technologies remain unanswered in learning foreign languages. For example, users' experiences have been identified as one key factor in designing mobile-based multimedia learning, but its provision in learning foreign languages has not been explored thoroughly. The area concerned with multimedia design which is to enable mobile-based learning in a foreign language and exploration of users' perception on mobile-based learning are explored thoroughly for the purpose of this research.

Purpose of Research

It is particularly important to address challenges in applying information and multimedia processing techniques for mobile-based learning in a foreign language. As yet, little is known on how multimedia principles are applied to mobile-based learning in foreign languages, and consensus among instructional

design researchers on how to design effective instructional messages across various media. In order to comprehend these issues, effective ways of applying appropriate multimedia principles in mobile-based learning are essential based on learners' views and requirements. Thus, the impact of multimedia principles to foreign language learners' cognitive processing demands exploration in constructing a meaningful mobile-based learning.

The Japanese language has long been regarded as one of the most difficult languages to learn (Miller, 1982). It is a challenge to learn Japanese due to the way the words are pronounced. and it involves three writing styles: *hiragana*, *katakana*, and *kanji*. *Kanji* words are the most difficult yet useful to learn because in *kanji* one letter has several meanings, pronunciations and different writing style. Non-native Japanese learners are only exposed to *hiragana*, *katakana*, and *kanji* through learning materials. It is particularly important to address the challenges encountered by non-native Japanese learners in applying the principles of multimedia in mobile-based learning. Therefore, this study attempts to investigate users' perceptions regarding the principles of multimedia in a mobile-based Japanese language learning context.

The objective of this study was therefore to explore the perceptions of Malaysian learners regarding Mayer's seven principles of multimedia when studying the Japanese language in a mobile-based learning environment. The learners in this study refers to university students and lecturers. The result of this study could serve as a guide for educators to look into how multimedia principles work on mobile-based learning which can assist students to generally learn a new foreign language. The findings of this study will provide general ideas for instructors and designers to select and implement any of Mayer's Multimedia Principles which are considered as effective in mobile-based learning.

Research Questions

The research questions guiding this study is as below:

What are the perceptions of university students and lecturers regarding Mayer's seven principles of multimedia in mobile-based Japanese language learning?

Methodology of Research

Research Participants

The participants consisted of university lecturers (n=3) and undergraduates (n=62), both from the Faculty of Creative Multimedia in a private Malaysian multimedia university. Purposive sampling was used in combination with non-random sampling in order to identify participants who have background or basic knowledge in the principles of multimedia. Selection of participants who possessed knowledge, ideas or experiences relevant to the research would best help the researcher achieve the research objectives (Creswell, 2003). The mean age of the students was 23 years. Of them, 36 were males and 26 were females. The students were generally Malaysians from a multi-racial group of Chinese, Malay and Indian. The lecturers were experts in multimedia, who have a vast of experiences in the teaching and developing multimedia. Participation in the research was voluntary and individual responses were strictly confidential. After the written permissions of the relevant authorities were obtained, the students and lecturers' written consent was obtained.

Research Instrument

A mixed method approach used qualitative and quantitative methods to address research objectives in this study. Research instruments comprised of questionnaires (quantitative data) and interviews (qualitative data). A seven-item questionnaire was developed and used to gain opinions from the students and lecturers. Each item represented each respective principle in the Seven Principles of Multimedia and was accompanied by a screenshot of apps. A sample of questionnaire items is shown in Figure 1.

I think that spoken words are needed when words are presented.

- 1) Strongly disagree
- 2) Disagree
- 3) Neither agree nor disagree
- 4) Agree
- 5) Strongly agree




Figure 1: A sample of questionnaire items

All responses were entered on a five-point Likert scale ranging from (1) Strongly Disagree, (2) Disagree, (3) Neither Agree or Disagree, (4) Agree to (5) Strongly Agree. Mean scores ≤ 3 refer to negative perceptions toward the use of multimedia principles in mobile-based Japanese language learning. The items in the questionnaire were reviewed by 25 students in a pilot study. The participants were asked to detect errors, give feedback and critique the items in the questionnaire. Based on their feedback, the questionnaire was improved.

Semi-structured interviews were conducted with Multimedia lecturers and students in order to gain a deeper insight about their view point regarding the use of the Seven Principles of Multimedia in mobile-based learning. Semi-structured interviews were conducted by referring to screenshots of apps for seven principles of multimedia. An example of interview questions is shown in Table 1. The interview questions were validated by two lecturers in the field of multimedia-learning during the pilot study. Interviews were audio taped and transcribed.

Table 1: An example of interview questions

Multimedia Principle	Interview Questions
<p>Multimedia Principle A suggested that people learn better from words and pictures rather than from words alone.</p> 	<p>1 (a): After you have gone through the lesson, by presenting the words and picture together, what do you think about it?</p> <p>1 (b): In your opinion, how Multimedia Principle A can help student learn Japanese language better?</p>

Research Design

A single group with intervening mobile-based Japanese language learning design was used to test each of the multimedia principles. The study utilized a ready-made free application available from iTunes named 'Learn Japanese Easily'. This app is available on <https://itunes.apple.com/us/app/learn-japanese-easily/id532810714?mt=8>. The purpose of using the selected apps was because it had sufficient multimedia elements to test the Seven Multimedia Principles in terms of words, pictures and audio. Besides, the app is attractive, rich in colour and designed in a simple and neat way that would not disorient the beginner learner. Learn Japanese Easily app also provides learners a relaxing and interactive way of learning Japanese language. Learners can interact with the software by connecting words with images to confirm their meaning.

The field study was administrated to two groups of undergraduates. The first group consisted of 22 students, while the second group consisted of 40 students. The participants, including the three lecturers were exposed to Learn Japanese Easily app using smart phones and tablets. In addition, participants went

through each tutorial within the application. A total of two hours were used to run the lessons for each participating group.

The administering of questionnaires was followed by showcasing three pictures of mobile apps’ screen shots for each item. The questionnaires were completed within 10-15 minutes. Follow-up semi-structured interviews were conducted with three lecturers, as well as 10 students who were randomly selected from each group.

Validity and Reliability of Questionnaire

Both the pilot and field study were conducted by the researcher over a duration of two weeks, with the assistance of the multimedia lecturers in order to ensure the accuracy of the principles used and to increase the reliability of the study. Quantitative data was analyzed using SPSS Version 22.

Cronbach’s alpha was used to assess the internal consistency of questionnaire. The Cronbach’s Alpha coefficient of internal consistency was computed to determine the degree to which the items on the same instrument, measure the same construct in order to produce a consistent result (Cohen, Manion, & Morrison, 2007). Chua (2006) stated that an alpha value within 0.65 and 0.95 was considered satisfactory. The alpha value of the questionnaire based upon the 25 undergraduates’ scores was 0.795. For an instrument with only seven items, the value showed a satisfactory indication of internal consistency. The Corrected Item-Total Correlation and Cronbach’s Alpha Coefficients After Each Item Was Deleted were also calculated (Table 2). All the Corrected Item-Total Correlation was less than that Cronbach’s Alpha Values if Item was Deleted. Consequently, this indicated that all the seven items contributed to the Seven Principles of Multimedia in the instrument.

Table 2. Corrected Item-Total Correlation and Cronbach’s Alpha if Item was Deleted

Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item was Deleted
1	.446	.592
2	.403	.598
3	.392	.600
4	.433	.596
5	.040	.686
6	.074	.687
7	.498	.572

Secondly, the internal consistency analysis was conducted to examine item-total correlations and inter-item correlations. The item-total correlations varied from 0.25 to 0.69 (Table 3). According to Büyüköztürk (2014), item-total correlations with 0.3 and above is considered acceptable. Overall, there was a significant, weak to moderate and positive correlation between items and total scores. On the other hand, the inter-item correlations varied from a weak 0.017 (between Item Five and Item Seven) to a moderate 0.43 (between Item Three and Item Four). According to Clark and Watson (1995), average inter-item correlations should fall somewhere between .15 and .50. Overall, there was a significant, weak to moderate and positive correlation between test items, except items 5 and 6. Thus, items 5 and 6 were revised in terms of wording as shown in Table 4. The initial items 5 and 6 were phrased as ‘I learn better if the spoken word is presented’ and ‘I think animation and the spoken words are sufficient in the app’, respectively.

Table 3. Correlation Coefficients between Items as well as Item and Total Scores

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	
Correlation	Item 1	1.000	.314*	.311*	.192	.38	.136	.368**
	Item 2	.314	1.000	.272*	.220	-.041	-.050	.295*
	Item 3	.311*	.272*	1.000	.431**	-.026	-.071	.318**
	Item 4	.192	.220	.431*	1.000	.092	.117	.324**
	Item 5	.038	-.041	-.026	.092	1.000	.108	.017
	Item 6	.136	-.050	-.071	.117	.108	1.000	.068
	Item 7	.368**	.295*	.318**	.324**	.017	.068	1.000
	Total	.583**	.594**	.604**	.595**	.249*	.327**	.651**
Sig. (2-tailed)	Item 1	-	.011	.012	.126	.762	.282	.003
	Item 2	.011	1.000	.029	.079	.743	.694	.017
	Item 3	.012	.029	1.000	.000	.834	.572	.010



Item 4	.126	.079	.000	1.000	.467	.351	.008
Item 5	.762	.743	.834	.467	1.000	.383	.894
Item 6	.282	.694	.572	.351	.393	1.000	.581
Item 7	.003	.017	.010	.008	.894	.591	1.000
Total	.000	.000	.000	.000	.045	.008	.000

*. Correlation is significant at the .05 level (2-tailed)

**. Correlation is significant at the .01 level (2-tailed)

Results of Research

Findings from the Quantitative Data (Questionnaire)

The results shown in Table 4 below are based on the perceptions of 62 students and 3 lecturers regarding the Seven Principles of Multimedia in mobile-based Japanese language learning: Generative Learning, Spatial Contiguity, Temporal Contiguity, Coherence, Modality, Redundancy and Personalization. For the purpose of discussion, Strongly Disagree (SD) and Disagree (D) are stated as “disagree”, Agree (A) and Strongly Agree (SA) as “agree”, while “Neither Agree or Disagree” is maintained.

Table 4. Summary of Percentage, Means and Standard Deviations of Questionnaire Responses

No	Item	Strongly agree	Agree	Neither Agree or Disagree	Disagree	Strongly disagree	M	SD
1	The pictures and words help me to learn faster about the content.	46	54	-	-	-	4.46	.50
2	The location of the pictures and words help me to learn the content better.	19	70	11	-	-	4.08	.61
3	By presenting words, pictures, and pronunciation at the same time, I understand the language faster.	37	52	11	-	-	4.26	.66
4	A simple presentation like ‘next’, ‘previous’, ‘repeat’ and ‘exit’ elements are necessary when learning the Japanese language in this apps.	43	57	-	-	-	4.43	.50
5	I think that spoken words are needed when words are presented.	50	49	1	-	-	4.60	.56
6	I think that on-screen text is needed with the narration in the apps.	43	48	9	-	-	4.34	.64
7	I think the formal style instead of conversational style, helps me to listen and to speak Japanese sentences better.	62	34	4	-	-	4.57	.59

The results show that all respondents agreed that, i) the pictures and words help them to learn faster about the content (Generative Learning Principle), and that ii) ‘next’, ‘previous’, ‘repeat’ and ‘exit’ elements are necessary when learning the Japanese language in this app (Coherence Principle). Almost all respondents (99% and 96% respectively) agreed that the spoken texts are needed when words are presented (Modality Principle), and the formal style helps them to listen and to utter Japanese sentences better (violation of Personalization Principle). A total of 91% agreed that on-screen text is needed for the narration in the apps (violation of Redundancy Principle). On the other hand, a total of 89% agreed that i) the location of the pictures and words help them to learn the content better (Spatial Contiguity Principle), and ii) the simultaneous presentation of words, pictures and pronunciation helps them to understand the language faster (Temporal Contiguity Principle). None of the respondents disagreed with the use of the Seven Principles of Multimedia in mobile-based Japanese language learning.

Findings from the Qualitative Data (Interviews)

The interview data were analyzed to ascertain whether the responses from the respondents matched the ideas put forward in the questionnaire. The abbreviations used for the analysis are: “S” represents Student, “L” represents Lecturer, “G1” represents Group 1, and “G2” represents Group 2. The findings on each principle is described as below.

The Redundancy Principle. According to the Redundancy Principle proposed by Mayer and Moreno (2003), learning is diminished if animation, narration and on-screen text are used together. However, the majority of respondents in this study found that this principle was inapplicable in mobile-based Japanese language learning. Both lecturers and students believed that on-screen text would allow students to learn better in terms of understanding by reading the delivered information in text especially in a foreign language. The respondents further insisted that listening alone would make it difficult for a beginner to catch up. Sample responses include:

“For the learning purpose, on-screen text allows students to understand the lesson better” (S10, G2; L01); “...in the context of foreign language just by listening is hard to catch up” (S2, G1); “...student tend to read, especially when they can’t catch up or understand spoken words of narration” (L02); “...even with all the design of motion form of pictures in and out, people still tend to read the subtitle without looking at the animation which perhaps will present the most information” (L03).

Besides, both lecturers and students agreed that this principle will come into play when the spoken words or audio are not working properly.

“..it is a good thing to have on screen text especially when the audio is not that clear, or having lost for catching up the spoken words” (L01); I might mishear from audio, so I really need screen text on this apps” (S22, G2).

This principle is mainly to allow young learners to reach the highest focus in learning. The findings of this study, however, did not support this principle as claimed by both lecturers and students. Thus, the Redundancy Principle was discovered to be inapplicable in mobile-based Japanese language learning.

The Principal of Personalization. The Personalization principle suggests that people learn better from a multimedia lesson when words are presented in a conversational style rather than formal style. The study found that two out of the three lecturers felt that this principle was inapplicable. The lecturers believed this principle should not be applied in mobile learning unless it could provide clear and ample instruction for learners to follow and learn. A majority of students felt that words presented in the formal style was sufficient for them to learn, as it would not complicate or distort the text. Below are some of their comments:

“This application is friendly enough, no need conversational words in learning” (S41, G1); “It is straight forward, easy for me to understand”. (S13, G1); “Formal is ok, simple and easy to catch up (S21, G1; S34, G2); “As long as navigation is allowed, formal is ok” (S32, G2).

Nonetheless, both lecturers and students in this study believed that this principle was applicable in video learning in creating a warm and friendly environment.

“Will be more friendly if conversation is inside the video” (S04, G1); “Conversation creates a warm environment in video learning” (S03, G2); “It gives better experience to users to connect with the lessons using video” (S22, G2).

This principle is mainly to assist students’ learning by creating and stimulating the learning environment, with the main objective of building a connection between the lesson and the learner. However, this study does not support this principle as claimed by students since they could accept a formal style of presenting words. Students preferred a straight forward and fast type of learning, which allowed them to easily read and not overload their cognitive processing. Thus, this principle was recognized as not applicable in mobile-based Japanese language learning.

Principle of Generative Learning Theory. This principle suggests that students learn better when they are presented with a combination of words and pictures rather than with words or pictures alone. From the perspectives of both students and lecturers, it was found that they strongly agreed with this principle. According to lecturers, they were able to memorize the *kanji* word for “apple” when they saw the picture of an apple. The pictures helped in visualizing and remembering the learning process much easier, while the text displayed pronunciations in English to encourage proper pronunciation. Besides, students also agreed that they needed to have a picture paired together with a word to learn better compared to using words alone. The combination of words and pictures allowed the students to detect the correct name of an animal when the picture of an animal was presented to him or her. Their responses included:

“The pictures of the objects helped me to remember the words” (S11, G1); *“...by presenting the words and picture together, it will help me to identify the Japanese words better”* (L02); *“...since I’m not familiar with the Japanese words or language, the words will help me to pronounce, while images will support in visualising the words”* (L03); *“By placing words and pictures together, it will allow students to identify the name of the animal”* (L01).

Participants also remarked that the pictures helped them visualise the words and their meanings. In their words:

“The Japanese words are hard to learn. Pictures help me to visualise the words” (S40, G2); *“Images does help visualize and memorize the words better”* (S11, G1); *“I can relate it with my memory after seeing the picture”* (S14, G1); *“I need pictures to display the definition”* (S27, G2); *“I need pictures because the hardest part in Japanese is words and its pronunciation”* (S34, G2); *“Picture helps to give a clearer view of the terms”* (S30, G2); *“Pictures show me the meaning of words”* (S11, G1).

This principle aided students in building links between pictures and words. However, if words alone were presented, the learner could only build a “verbal” mental representation, but hardly build a “visual” mental representation. This principle is mainly to assist students’ learning by understanding what the verbs are and by mentally visualizing the content when the words are presented as per agreed by lecturers. Therefore, when developing multimedia materials for language learning, both words and pictures should be included. Thus, this principle was found applicable in mobile-based Japanese language learning.

Principle of Spatial Contiguity. This principle suggests that students learn better when words and pictures are presented near to each other rather than being placed apart. Both the students and lecturers found this principle to be applicable. According to lecturers, this principle helped them to relate and link both elements together as a single item. They further added this will help them in remembering and memorizing the text much better. As for students, this principle helped them to locate the picture easily as they tended to have a habit of referring to the nearest picture. Students were eager to know the visual form of the texts they read. According to the students, looking at the nearest picture will help them to understand the written words much faster. Besides, students were easily attracted to an interesting or even just a simple picture that was presented near to the words. They will look at the picture first before the words. Sample responses include:

“When looking at the pictures and words that are near to each other, I’m able to relate the two items together as one” (L01); *“Since I’m not familiar with Japanese language, by presenting the images near to the words will help me to remember the text better”* (L03); *“Pictures and words are noticeable when they are near”* (S32, G2); *“When I read the text, I need to know the visual form of the words”* (S12, G2); *“When I read the words, I will immediately look at the nearest picture”* (S10, G1); *“I learn faster when pictures are placed near to the words”* (S11, G1).

From this study, it is also found that the pictures play an important role to attract student's attention to prevent boredom while the reading of texts. From there, students were capable to foresee and construct relationships between pictures and the text. This principle aims to relate the connection of verbs and visuals when placing pictures beside words as agreed by lecturers. Besides, learners can locate the picture easily as a visual aid in their learning. Therefore, when developing multimedia materials, words and pictures should be placed near to each other to allow learners to identify the connection between the pictures and words. Thus, this principle was found applicable in mobile-based Japanese language learning.

Principle of Temporal Contiguity. This principle suggests that students learn better when words and pictures are presented together rather than in succession. Both the students and lecturers found this principle to be applicable. Both lecturers and students agreed that this principle would help them to see the connection between the picture and words as a whole. From there, students were able to perceive the information faster while visualizing the images in their mind. From the mobile learning lesson, students were found to be able to identify the words easily by recalling the picture as a whole as they could view the single page from the mobile content. Feedback included:

“Engaging words and pictures at the same time make me understand better” (S24, G2); “From the single page, I get to know what I see” (L3); “It is easier to understand when I see the whole page” (S28, G2); “I can easily relate the pictures to words at the same time” (S12, G1); “I prefer to see the words and pictures appear as a whole” (S08, G1); “My brain is able to understand quickly when seeing the whole texts with pictures” (S12, G1); “It is better to show up together for our viewing and understanding” (S14, G1); “Help me to understand the content in instant” (S14, G1); “Single glance help me to link the words with the pictures” (L2).

This principle aims to relate the connection of verbs and the visual together as one. When developing multimedia material, the words and pictures should be presented as a whole instead of in succession. Thus, this principle was found applicable in mobile-based Japanese language learning.

Principle of Coherence. The principle of Coherence suggests that students learn better when extraneous words, pictures and sounds are excluded from the multimedia message rather than to include them. Both students and lecturers found this principle was applicable. Lecturers believed that eliminating extraneous multimedia element inside the multimedia presentation would make the learning process more focused with less distracting elements on the main content. In addition, they said that the added irrelevant images would only disrupt the concentration of students. They noted that:

“Eliminating extraneous multimedia element from the presentation will make the learning more focused” (L01); “...student has limited capability to absorb information and to focus on content information for a longer period. It will be best to avoid complicated content for learners” (L02); “...if adding an irrelevant images, concentration will be distracted” (L03).

Students also shared parallel views with the lecturers regarding this principle as they would love to learn from more straight-forward and simple content. According to the students, they would rather avoid heavy-visually loaded information. Besides, students do not like unorganized and chaotic multimedia presentation. The students agreed that a simple design with minimal elements would help in directing them to the point of content. Below are some of their comments:

“It is good to keep as simple as possible. Minimal elements help learner to learn straight to the point” (S02, G1); “Make the apps easier to use and straight forward” (S13, G2); “These simple function and elements are necessary to have inside the content for modern apps” (S05, G1); “It is good as it is not complicated” (S20, G1); “The picture is in the centre and organized. It is at the right position for us to view” (S13, G1).

Overall, the findings suggest that irrelevant words and pictures should be excluded when developing multimedia material. This principle aimed to reduce an overload of cognitive processing. Thus, this principle was found applicable in mobile-based Japanese language learning.

The Modality Principle. The principle of Modality suggests words to be presented as speech rather than on-screen text. This principle claims that student’s learning is enhanced when the speech narration is used inside the presentation. Both students and lecturers in the study found this principle applicable. Based on the collective experience in this study, participants were inclined to remember the names of the animals easily when they listened to verbal pronunciations at the same time. The lecturers asserted it was a good way to learn while listening to the verbal utterances from the audio at the same time. The spoken words help to navigate the learners to become better readers which contributes to better focus on the content. It also works as an alternative option for the vision when the visual input is overloaded. Related responses are:

“Our mind need the sense of hearing to remember faster” (S13, G1); “When the words are spoken, I can remember the names of the animal better” (L02); “.. it helps to direct me to the information of the slide by reading and listening at same time” (S02, G1); “Spoken words will help me in focusing the content of learning when I’m about to lose concentration of eye sight.” (S03, G1); “.. people tend to hear and see ... it is a good way to learn when hearing and watching on screen” (S13, G1).

Besides, the lecturers agreed that this principle should be applied in language learning, as it mainly aims on the production of correct pronunciation especially in the foreign language. Students expressed that sound enhances their learning in the context of learning a foreign language. In addition, they learned to have better enunciation and make correct pronunciations through the lesson. Since the students were novice learners, the verbally uttered words definitely helped them to learn better. They commented:

“..help students to get a proper and better pronunciation of the words than just reading it” (L01); “I need sound for learning foreign language” (S40, G2); “The audio helps me to pronounce the words correctly” (S01, G1); “It is a lot easier to pronounce the words when someone has said it correctly” (S14, G1); “Our brain can easily learn with visual and sound” (G32, G2); “It will make me focus on the learning” (S12, G1); “I might misread, so I need sound” (S38, G2); “A must because it shows us how to pronounce correctly” (S10, G1).

Spoken words also attract and create fun in a multimedia lesson to avoid a dull learning experience. Students learned better when verbal input was presented as speech rather than just as text alone.

“The Japanese pronunciation is weird but fun to hear” (S14, G1); “Audio make the lesson more enjoyable to learn” (S12, G1); “More fun when hearing the pronunciation of Japanese” (S15, G2); “Motivate me to catch up and speak together” (S15, G1); “Listening to sound is more fun” (S21, G2); “...so that user won’t get bored” (S10, G1); “Make the apps more interesting” (S16, G1); “It will grab my attention for sure” (S05, G1).

Based on the results, a meaningful learning experience can be achieved when learners are able to build connections between corresponding visual and verbal representations. In conclusion, it is necessary to incorporate spoken words to support learners’ acts of listening while they read texts to help them focus and understand the lesson better. This principle aims to support learning using sound as a learning aid. Thus, this principle was categorized as applicable in mobile-based Japanese language learning.

DISCUSSION AND CONCLUSION

The research stipulates that the Seven Principles of Multimedia are applicable in the context of mobile-based Japanese language learning based on the students’ perspectives in the questionnaire, except for the Personalization and Redundancy principles. The findings from the interviews similarly revealed that a majority of the students and lecturers disclosed that the Redundancy and Personalization principles were unsuitable for the mobile-based Japanese language learning.

The Redundancy Principle suggests that learners focus on a single processing system in selecting information so that they can attain maximum focus in learning. However, both lecturers and students stressed the need for on-screen text, other than animation and narration to be displayed in a mobile-learning environment. Particularly, beginner learners emphasized the need of the texts to display the

pronunciation and definition of *kanji* words upon seeing the picture and listening to the pronunciation in order to help them learn better. They found that listening to mobile audios are not enough because they may not be entirely clear. The findings were inconsistent with previous researches (Mayer, Heiser, & Lonn, 2001; Moreno & Mayer, 2002) that on-screen text can overload the visual channel by presenting too much information for visual working memory to process simultaneously.

Meanwhile, the personalization principle aims to assist students' learning by creating and stimulating the learning environment, which involves building connections between the lesson and the learner. Previous research on the personalization principle in multimedia learning (Kurt, 2011) found that conversational style used in the software motivated learners to study and feel as if they were talking to a human. Yet, the learning performance of this condition did not really reflect the users' needs in the mobile-based Japanese language learning environment. The participants felt that the content would be too packed and complex if the conversational style text was applied in the mobile. Students also preferred the straight forward formal style text in their lesson instead of reading a lot of friendly conversational texts in the mobile context. They agreed that a simple designed mobile environment will decrease the mental load for cognitive processing.

In summary, the research findings conclude that only five multimedia principles of Mayer (2002) were found applicable in mobile-based Japanese language learning. These multimedia principles were Generative Learning Principle, Spatial Contiguity Principle, Temporal Contiguity Principle, Coherence Principle, and Modality Principle.

RECOMMENDATION AND FUTURE RESEARCH

It is necessary to identify the multimedia principles which deserve to be included with proper instructional method before developing the mobile learning material. It is important to refer to experts such as Multimedia lecturers or instructors before proceeding with the implementation of the principles in the mobile learning material. Careful consideration of these principles enables instructors to form the basis of an implementation strategy for using mobile technology, which can offer the best manner for optimal learning. Adding screen texts during the narration does potentially improve students' learning, but its uses should be based on cognitive theory and intended language users.

This research shows that images and sounds possess great potential to improve human learning, especially when the goal is to promote deep understanding. However, in order to effectively use them, it is necessary in future research to investigate how people learn from pictorial and verbal media. The seven principles are based on a cognitive theory of multimedia learning and were tested by previous rigorous experimental studies. Yet, the seven principles should not be taken as rigid procedures to be followed in all situations. Instead, for future study, it is suggested that researchers employ a study which investigates how multimedia presentations should be designed to promote the cognitive processes, which involved meaningful learning. Finally, more scrutiny and research is required in the area of multimedia education so that its design and content reach the standards of educational procedure with add-on edutainment.

Despite the focus on multimedia principles used in a mobile-based learning environment for adult learners in this study, it can also be applied to all levels in education and carried-out within different age groups.

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