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Research Paper

Learners' Perceptions Towards Dual-Coding in Adaptive Hypermedia Environments: Listening Texts, Keywords and Visuals

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ABSTRACT

In this study, 56 participants' (N= 56) perceptions towards dual coding in design of audio-only listening texts (i.e. re-provision of the same audio-only listening texts in the form of audio-only listening texts + keywords or supplementary contextual visuals + keywords at non-initial phases of the while listening stage) in a hypermedia listening application for foreign language learning (FLL) were investigated. The study also investigated whether there were any differences between the participants' perceptions in terms of gender, age, job and FLL period. The study was both quantitative and qualitative in nature. The results of the study were analysed with SPSS (i.e. Mean, Std. Deviation, Independent Samples t Test, ANOVA, Pearson Correlation test, Chi-square). The results revealed that the language learners (LLs) were overwhelmingly in favour of the use of the dual coding in design of audio-only listening texts (i.e. re-provision of the same audio-only listening texts in the form of audio-only listening texts + keywords or supplementary contextual visuals + keywords at non-initial phases of while listening stage) in a hypermedia listening application for FLL. The majority of the LLs believed that not only did such a design benefit them in different ways, but it also contributed to the enhancement of their learning. The participants also felt that such a design could and should have been further improved. Moreover, the results revealed that there were significant differences between the participants' perceptions towards the re-provision of the same audio-only listening texts with keywords, and (supplementary contextual) visuals + keywords.

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INTRODUCTION

The outstanding differences between adaptive hypermedia environments (HEs) and conventional materials (CMs), and the positive aspects of the former are already documented very well in a wide range of pertinent studies (Abobaker & Hussein, 2012; Baturay et al., 2010; Cárdenas-Claros, 2021; Chou, 2012; Mosalanejad et al., 2012; Turel, 2011, 2015a, 2015b, 2016, 2018; Yu et al., 2010). In this research article, initially the positive aspects of HEs are briefly examined in terms of foreign language learning (FLL) hypotheses and theories.

It is the availability, combination and personalised simultaneous delivery of a wide range of digital elements on the same digital computer platform that make adaptable HEs more efficient (Turel, 2021a, 2021b; Herron et al., 2002; Ridgway, 2000). In other words, adaptable HEs provide multidimensional, multi-sensory learning environments in which personalised rich, efficient, instant, comprehensible, optimum and meaningful input and feedback can be presented on the same digital platform (Turel, 2021a, 2021b, 2018, 2016; Cárdenas-Claros, 2021, 2009;). In HEs, language learners' (LLs) attention can be attracted to adaptive and combined forms, and meaning in input. Such a pedagogically rich availability and an efficient design correspond with different pedagogical principles, instructional design models (e.g. Turel, 2021c), relevant hypothesis and theories such as the comprehensible input hypothesis and theory (Tschirner 2001, p.311; Schmidt, 1990, p.139), the dual-coding theory, the generative theory of multimedia (Ginther, 2002; Mayer, 1997), the noticing hypothesis (Nicholas et al. 2001, p.721; Schmidt 1990, p.141), and the redundancy hypothesis (Al-Seghayer, 2001; Sherwood et al., 1987).

Adaptive HEs give learners flexible control, ease of personalised use, and a navigational and tension-free learning environment particularly during self-study. This is a requirement of both person perception theory and social learning theory (Robinson, 1991, p.157). Adaptive HEs also provide the opportunity for the learners to produce immediate, multidimensional and multi-sensory output (Turel, 2018, 2015a; Türel, 2012), which is a requirement for comprehensible output. Enabling LLs to produce comprehensible output can promote noticing and contribute to FLL through 'hypothesis testing'. Such opportunities can serve as a metalinguistic function (i.e. the ability/opportunity to think about and analyse the produced forms and structures) (Shehadeh, 2002, p.608; Tschirmer, 2001, p.311), as well.

Such positive aspects of adaptive HEs motivate learners and are appreciated by them (Turel, 2018, 2010), are praised (Herron et al., 2002) and considered 'very helpful' (Tschirmer, 2001, pp.312-3). The mentioned positive aspects are also a requirement of the social-psychological theory and the socio-educational model, both of which focus on the role of attitudes and motivation in FLL (Gardner, 1985, p.158).

Optimum and personalised input in different forms (i.e. glossaries, feedback, audio-only listening texts + keywords, audio-only listening texts + visuals + key words, audio-only listening texts + captions and so on) grant interactivity. LLs can access such useful features in adaptive HEs without losing time. For example, unfamiliar syntax, lexis, listening texts and feedback can be explained or given through hyperlinks and/or optimum combinations (De Ridder, 2002). Such a provision meets both visual and acoustic needs of LLs. It can also help LLs to find out what and why they cannot understand, and overcome the complications (Turel, 2012).

Cultural differences featured in the listening texts can be presented in plain words and through simple interactive and adaptive samples, contextual visuals or video clips in the form of annotations, feedback or advance organisers (Turel, 2014a; Turel & McKenna, 2013). This is a requirement of the socio-cultural theory. This theory focuses on and emphasises the importance of culture in FLL (Platt & Brooks, 2002, p.369; Vygotsky, 1978).

The above mentioned positive aspects of adaptive HEs help LLs to develop effective strategies, contribute in terms of comprehension and retention of the listening texts (Türel, 2012; Moreno & Mayer, 2002; Mangiafico, 1996). Such positive functions make more real-world learning contexts and more authentic and interactive tasks available (Ashworth, 1996).

To be able to design listening input effectively and efficiently in adaptive HEs, we are required to bear in mind the requirements of a wide range of instructional design models (Turel 2021c; Gardner, 1985), theories and hypothesis such as dual-coding theory (Paivio, 2006, pp. 82-86), the generative theory of multimedia (Ginther, 2002; Mayer, 1997), the redundancy hypothesis (Al-Seghayer, 2001; Sherwood et al., 1987), the comprehensible input hypothesis and theory (Tschirmer 2001, p.311; Schmidt, 1990, p.139), working memory and the noticing hypothesis. It is argued that materials designers and developers must provide learners of any subject with the opportunities to have direct experience with things, as "things are essential, words only accidental; things are the body, words but the garment; things are the kernel, words the shell and husk. Both should be presented to the intellect at the same time, but particularly the things, since they are as much objects of understanding as is language" (Comenius, 1896 translation, p. 267; cited in Piaget, 1993).

So far studies (e.g. Cárdenas-Claros, 2021; Paivio, 2006, pp. 82-86; Ginther, 2002; Mayer, 1997; Al-Seghayer, 2001; Sherwood et al., 1987; Tschirmer 2001, p.311; Schmidt, 1990, p.139; Sherwood et al., 1987; Tschirmer 2001, p.311; Richardson, 2003; Purnell & Solman 1991; Chun & Plass, 1996, 1997; Lomicka, 1998) continue to favour dual coding and require us to design listening texts efficiently and effectively in adaptive HEs.

Thus, giving language learners the opportunity to re-listen to/re-view the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial listening in HEs can be more effective in promoting comprehension and recall of instructional texts (i.e. listening texts, pronunciation, lexis and syntax). Such a provision can enhance LLs' acquisition (Thompson & Paivio, 1994).

In this study, therefore, the target LLs were exposed to multiple forms of the same *audio-only listening texts* (i.e. *audio-only listening texts* at the first phase of listening, and *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial listening stages) as an aid to help them to comprehend and acquire the instructional texts.

Providing the same *audio-only listening texts* in different / multiple forms (i.e. *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords*) in adaptive HEs delivers LLs with the opportunity to repeat the same *audio-only listening texts* in different forms. Not only does repetitions in different forms makes learning process less boring and motivate learners (i.e. contributing to dynamism), but repetitions of the same *audio-only listening texts* in different forms result in better recollection (Tyler et al., 1979; Xue et al., 2010), as repetitions require more effort. Thus, the research questions of this study are:

1. What are the participants' general perceptions of re-listening to/re-viewing the same *audio-only listening texts* with *keywords* or (supplementary contextual) *visuals* + *keywords* at the non-initial phases of the while-listening stage in adaptive HEs for FLL?
2. Are there any differences between the participants' perceptions in terms of their personal characteristics (i.e. gender, age-group, third language, language learning period, level in English, level in listening, level in computing, feeling confident while learning English etc.) as well as between their perceptions towards dual coding (i.e. *audio-only listening texts* with *keywords* or supplementary contextual *visuals* + *keywords*) in design of the *audio-only listening texts* in adaptive HEs for FLL?

The aim of the study

This study aimed to find out how the participants of this study valued (a) the provision of *keywords* or (supplementary contextual) *visuals* + *keywords* with the same *audio-only listening texts* at the non-initial phases of the while-listening stage in adaptive HEs for FLL. The study also intended to find out (b) whether there were any differences between the participants' perceptions in terms of gender, age, job and FLL period as well as between their perceptions towards dual coding in design of *audio-only listening texts* in adaptive HEs for FLL. The nature of the study is emphasised below in 'the procedure' section.

METHODOLOGY

Research Design

Quantitative and qualitative researches were used (Tseng & Yeh, 2013; Masgoret & Gardner, 2003). The research questions required the use of questionnaires, and interviews in the form of open-ended questions (Tseng & Yeh, 2013; Nunan, 1993). For the participants' profiles questionnaire, Brett's data collecting procedures (1999) were used, although new items were added and the existing ones were further improved and tested. Data collecting questionnaires regarding the participants' perceptions of re-listening to/re-viewing the same *audio-only listening texts* with *keywords* or (supplementary contextual) visuals + *keywords* at the non-initial phases of the while listening stage in adaptive HEs for FLL were prepared and pilot tested by the author of this study. Their Cronbach's Alpha is below.

The participants' pre-exposure characteristics questionnaire consisted of 10 general items such as occupation, gender, age, other languages, English learning period etc. and 13 Likert scale items such as 'feeling' and 'how often' questions. The questionnaire about the provision of the same *audio-only listening texts* with *keywords* ($\alpha = .832$) included 11 Likert scale items from strongly disagree to strongly agree. The questionnaire about the provision of the same *audio-only listening texts* with (supplementary contextual) *visuals* + *keywords* ($\alpha = .904$) included 11 Likert scale items from strongly disagree to strongly agree. Cronbach's Alpha of both combined (22 Likert scale items from strongly disagree to strongly agree) is $\alpha = .927$. All items also featured multiple measures of similar attitudes so that inaccurate answers could be guarded against.

Fifty-six participants answered the questionnaires about the re-provision of the same *audio-only listening texts* with *keywords* or (supplementary contextual) visuals + *keywords* at the non-initial phases of the while-listening stage in adaptive HEs for FLL. This was immediately after using the hypermedia listening software. Majority of the participants (i.e. fifty-four participants, which is given in the 'findings' section below) answered the open-ended questions, while some gave long and detailed answers; the others preferred short answers, which is understandable. Answering the open-ended questions required more time and effort in comparison to ticking one or a few available options out of a group of options. Thus, it is believed that this was the reason why not all of the participants answered the open-ended questions. Both quantitative and qualitative data collection was anonymous. The collected data were not shared with anyone who knew the participants. Furthermore, the qualitative data were analysed by three different researchers to avoid subjective interpretation and were categorised according to categories that were extracted from the data itself and then applied.

The participants

The participants of this study were 56 non-native speakers (37.5% male, 58.9% female, 3.6% no-answer). Their level in listening was intermediate (i.e. pre-intermediate: 28.6%, intermediate: 53.6%, upper-intermediate: 17.9). All of the participants were undergraduate students. They were computer literate (i.e. Level 1- Basic User: 17.9, Level 2: 10.7, Level 3: 26.8, Level 4: 23.2, Level 5 – Proficient user: 5.4). They were learning English as a foreign language. Their age-range was: 20 and below age-group: 41.1%, 21-25 age-group: 53.6%, 26-30 age-group: 3.6%, and 31 and above age-group: 1.8%. Majority never used any FLL software before (No - never used: 82.1, Yes: 16.1, and no-answer: 1.8).

The hypermedia listening application

The hypermedia listening application was designed and developed by the author of this study. The listening application was the right level for the target LLs (i.e. intermediate). The listening application aimed to develop and practise the participants' listening skills and to improve their listening-development as a part of FLL. To succeed this target, a wide range of gradual tasks were provided to help the participants in practising and developing their acoustic and visual channels, receptive and productive skills. The target participants were instructed (a) at what stage of listening what kind of strategies they needed to follow and what they needed to do, (b) how they could improve and develop their listening and listening-skills, and (c) why they needed to study in the instructed ways. While improving their listening skills and development, the hypermedia listening application also aimed to help the participants to become familiar with the target culture, different accents, authentic language and its features such as intonation and stress, fillers, false starts, grammatical mistakes and so on. The hypermedia listening application was also expected to improve the target LLs' vocabulary and pronunciation, both of which are necessary and essential for listening development and improvement. The hypermedia listening application was professional, as it was designed and created according to educational findings in the fields of FLL, design of adaptive hypermedia learning environments, and computer assisted language learning (CALL). Furthermore, the listening application was designed in a way so that the research questions could be investigated.

The hypermedia listening application consists of three units (Table 1): (a) Smoking II: Introduction, (b) Smoking II: Do they smoke? and (c) Smoking II: Smoking in Public. Each unit consists of two sections. In the first section of each unit, the participants listen to the *audio-only listening texts* and answer the pertinent gradual questions (Figure 1). In the second section of each unit, the participants re-listen to/re-view the same *audio-only listening texts* with *keywords* (Figure 2) or (supplementary contextual) *visuals* + *keywords* (Figure 3) and answer the pertinent gradual questions.

Table 1. The listening texts accessed by the participants

The media types accessed by the participants		
Unit	**Length**	**Media Type** (in order of exposure)
Smoking II: Introduction	00:14 + 00:20	(Firstly) tasks + audio-only listening texts; (Secondly) tasks + the same audio-only listening texts + keywords or (supplementary contextual) visuals + keywords
Smoking II: Do they smoke?	00:23	(Firstly) tasks + audio-only listening texts; (Secondly) tasks + the same audio-only listening texts + keywords or (supplementary contextual) visuals + keywords
Smoking II: Smoking in Public	00:58 + 00:51 + 00:35	(Firstly) tasks + audio-only listening texts; (Secondly) tasks + the same audio-only listening texts + keywords or (supplementary contextual) visuals + keywords
The entire audio	03:21	

Figure 1. A sample of the first section of 'Smoking II: Do they smoke?' unit, at which the participants listen to *the audio-only listening texts* and answer the pertinent gradual questions/activities

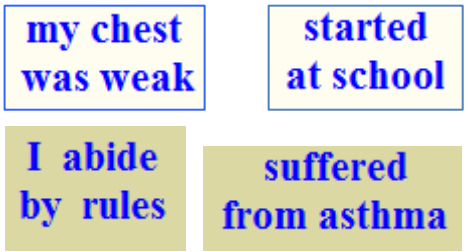

Figure 2. Samples of the second section of the first unit, at which the participants re-listen to/re-view the same *audio-only listening texts* with ***keywords*** and answer the pertinent gradual questions

Figures 3: A sample of the third section of the first unit, at which the participants re-listen to/re-view the same *audio-only listening text* with (*supplementary contextual*) ***visuals*** + ***keywords*** and answer the pertinent gradual questions

The procedure

The participants accessed the hypermedia listening application voluntarily in the same class at different times during the academic year. Since the lab had 30 PCs, a maximum of 30 participants could use the listening application at one time. The participants were introduced to the hypermedia listening application in the first five minutes of the first session. The participants were then requested to complete the participants' profiles questionnaire. After that, the participants were free to use the hypermedia listening application as they wished. The participants used the application as long as and in the way they wanted. After they had used the application, they answered the questionnaires (i.e. Likert scale items from strongly disagree to strongly agree, 1 to 5). The interviews were conducted after the participants had answered the questionnaires.

FINDINGS

The results were presented in two parts, corresponding to the two above mentioned research questions. The quantitative data were analysed with SPSS. The analysis of the qualitative data was conducted by examining the participants' responses gathered from the open-ended questions. It focussed on the shared themes among the responses. In the analysis and discussion of the qualitative data, ranges of themes emerging from the qualitative data were identified. These emerging data were consistent with the results of the quantitative data.

Re-listening to the same 'audio-only listening texts' with 'keywords' or (supplementary contextual) 'visuals' + 'keywords' at the non-initial phases of the while listening stage is useful

The analysed results indicate that the participants' general perceptions of re-listening to the same *audio-only listening texts* with *keywords* (Table 2) or (supplementary contextual) *visuals* + *keywords* (Table 3) *at the non-initial phases of the while-listening stage* are very positive (Tables 2 and 3 respectively). The participants believe that (1) *keywords* pertinent to the same *audio-only listening texts* should be provided (M = 4.55, Table 2). Providing *keywords* pertinent to the same *audio-only listening texts* helps them (2) focus on listening (M = 4.36), (3) understand better (M = 4.50), (4) learn new words (M = 4.29), (5) understand main words better (M = 4.34), (6) learn main words (M = 4.23), (7) understand difficult words (M = 4.27), (8) learn difficult words (M = 4.23), (9) learn private names (M = 4.14), (10) learn the target language (M = 4.34), and (11) be better prepared for the target / real-world (M = 3.82).

Table 2. Mean score for the participants' general perceptions of re-listening to/re-viewing the same '*audio-only listening texts'* with '*keywords'* at the non-initial phases of the while listening stage

Items	N	Mean	Std. Deviation
1. '*Keywords*' pertinent to the same '*audio-only listening texts*' should be provided (at the non-initial phases of the while listening stage)	56	4.55	.711
2. Providing 'keywords' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you focus on listening	56	4.36	1.017
3. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to understand better	56	4.50	.874
4. Providing 'keywords' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to learn new words	56	4.29	1.140

5. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to understand main words better	56	4.34	1.164
6. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to learn main words	56	4.23	1.236
7. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to understand difficult words	56	4.27	.924
8. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to learn difficult words	56	4.23	1.250
9. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to learn private names	56	4.14	1.394
10. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you to learn the target language	56	4.34	.900
11. Providing '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) prepares you better for the target- / real-world	56	3.82	1.363
1= Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree			

The participants believe that (1) (supplementary contextual) *visuals* + *keywords* pertinent to the same *audio-only listening texts* should be provided at the non-initial phases of the while listening stage (M = 4. 21, Table 3). Providing (supplementary contextual) *visuals* + *keywords* pertinent to the same *audio-only listening texts* helps them (2) focus on listening (M = 4.39), (3) understand better (M = 4.45), (4) learn new words (M = 4.61), (5) understand main words better (M = 4.45), (6) learn main words (M = 4.50), (7) understand difficult words (M = 4.21), (8) learn difficult words (M = 4.16), (9) learn private names (M = 4.04), (10) learn the target language (M = 4.20), and (11) be better prepared for the target / real-world (M = 4.14).

Table 3. Mean score for the participants' general perceptions of the re-listening to the same '*audio-only listening texts*' with (supplementary contextual) '*visuals'* + '*keywords'* at the non-initial phases of the while listening stage

Items	N	Mean	Std. Deviation
1. Supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' should be provided (at the non-initial phases of the while listening stage)	56	4.21	1.261
2. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you focus on listening	56	4.39	.908
3. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you understand better	56	4.45	.952
4. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you learn new words	56	4.61	.867
5. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you understand main words	56	4.45	.893
6. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you learn main words	56	4.50	.786
7. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you understand difficult words	56	4.21	.868
8. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you learn difficult words	56	4.16	.987

9. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you learn private names	56	4.04	1.206
10. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) helps you learn the target language	56	4.20	.961
11. Providing supplementary contextual '*visuals*' and '*keywords*' pertinent to the same '*audio-only listening texts*' (at the non-initial phases) prepares you better for the target-/real-world	56	4.14	1.271
1= Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree			

As for the analysis of the answers to the open-ended questions, most of the qualitative results supported the quantitative data. When the participants were asked: "What do you think of re-listening to the same *audio-only listening texts* with *keywords* or (supplementary contextual) *visuals + keywords* at non-initial phases of the while listening stage?" and "What are the advantages and / or disadvantages of re-listening to the same *audio-only listening texts* with *keywords* or (supplementary contextual) *visuals + keywords* at non-initial phases of the while listening stage in terms of understanding the listening texts and learning the target language?" the following reactions were revealed:

Providing the same *audio-only listening texts* with *keywords* or (supplementary contextual) *visuals + keywords* at the non-initial phases of the while listening stage has a positive effect, is more effective and more beneficial (54 times mentioned by different participants out of 56).

> *"Such a design [providing the same audio-only listening texts with visuals and keywords]* ***has a positive effect****, as visuals are more permanent" (Participant GR201)*
>
> *"Providing [the same audio-only] listening texts with visuals and keywords is* ***50% more effective*** *than only providing [audio-only] listening texts.* ***Visuals are more permanent****, but providing [the same audio-only] listening texts with visuals and keywords is* ***more beneficial****. (Participant GR202)*
>
> *"[Providing the same audio-only listening texts with] both visuals and keywords is* ***very good****. In this way, people can* ***understand difficult words better****"(Participant GR204)*
>
> *"Such a design [providing the same audio-only listening texts with visuals and keywords] is v****ery good and effective****. It is* ***really very good****. Re-listening [to the same audio-only listening texts] with visuals and keywords is* ***very efficient****" (Participant GR205)*
>
> *"[Providing the same audio-only listening texts with] visuals and keywords is* ***the right thing to do****.* ***Such a design is very important for listening****. (Participant GR206)*
>
> *"Such a design is* ***more permanent in terms of remembering the input****" (Participant GR207)*
>
> *"[Providing the same audio-only listening texts with visuals and keywords]* ***becomes more permanent****" (Participant GR2013)*
>
> *"[Such a design] is positive. ...* ***has no negative effect****" (Participant GR2014)*
>
> *"I have no idea.* ***I do not think that it has any negative effect****" (Participant GR2015)*
>
> *"[Providing the same audio-only listening texts with visuals and keywords]* ***is more effective****" (Participant GR2019)*
>
> *"I think it is* ***more useful****. When we miss the key words, we have difficulty in understanding the following segments. If one uses only the auditory function of their brain, they can understand the listening text, but if one also sees keywords and pertinent visuals, then they can fully understand the listening text. In my opinion, [such a design]* ***has very positive effects****" (Participant GR2021)*
>
> *"In my opinion, [such a design] can be* ***useful****, but makes learning easy. Therefore, I am in favour of [providing visuals + keywords with the audio-only listening texts at re-listening stage]" (Participant GR2029)*
>
> *"[Such a design]* ***has many positive effects****. [It]* ***makes understanding easy****" (Participant GR2030)*
>
> *"I think [such a design]* ***is good and positive****" (Participant GR2031)*
>
> *"Certainly [such a design]* ***has very positive effects****. If visuals and keywords are provided in this way, it becomes* ***entertaining*** *(Participant GR2034)*

Providing the same *audio-only listening texts* with (supplementary contextual) *visuals + keywords* at non-initial phases of the while listening stage is useful for understanding the *audio-only listening texts* (53 times mentioned)

*"**Visuals are always useful for understanding** [the audio-only listening texts]. **Visuals help understand better** and **visuals are more permanent** in comparison to audio-only" (Participant GR203)*

*"The assumption underlying this is that **such a design helps to understand the listening text better**" (Participant GR206)*

*"In my opinion, **such a design is very useful**. Definitely, **visuals and key words made the listening text more meaningful**. For example, when I listened to the audio-only version of the listening text, I could not understand what Lisa and Barbara's jobs were. However, **when I re-listened to the same listening text with visuals and keywords, then I understood better**. In my opinion, such a design is very positive" (Participant GR208)*

*"[Providing the same audio-only listening texts with visuals and keywords] **fills in the missing gaps**. [Such a design] **helps us understand** [listening texts] **faster**" (Participant GR209)*

*"[Providing the same audio-only listening texts with visuals and keywords] **is also useful for understanding**.*

*"[Such a design] **helps understand** [the listening texts] (Participant GR2014)*

*"Keywords should be provided. Definitely [Keywords] **enable us to understand** [the listening texts] **better**" (Participant GR2016)*

*"With visuals, [the listening texts] **became more understandable**. ...**Visuals made the listening texts understandable** as well as helped us learn" (Participant GR2018)*

*"[Providing the same audio-only listening texts with visuals and keywords] **helps us to understand quickly**" (Participant GR2020)*

*"With keywords, **I understood the speaker better**. **I grasped the topic of the listening text**. Listening to with keywords motivated me. In my opinion, [such a design] is very positive. [Such a design] **also enables us to understand private names**. Designing in this way helps us **understand what we listen to better**" (Participant GR2022)*

*"Keywords enable us **to understand most of the listening text** and answer the pertinent questions" (Participant GR2023)*

*"Providing both visuals and keywords affected us positively. The assumption underlying this is that by linking these keywords and visuals with the listening text, **we understood the listening texts more easily**" (Participant GR2024)*

*"Provision of the keywords **helps a lot**; **as a result, we do not have difficulty in understanding** [the listening texts]. [Such a design] motivates us" (Participant GR2025)*

*"Visuals certainly **help us understand the content** [of listening texts)" (Participant GR2026)*

*"Certain keywords **enable us to understand the listening text**" (Participant GR2027)*

*"When I listen to the listening texts, I have difficulty in understanding. However, when there is a clue, then that **helps me understand a bit**..." (Participant GR2032)*

*"In my opinion, visuals and keywords should be provided with the listening texts. I have realised in this experiment that **I understand better when visuals are provided with the listening texts**" (Participant GR2033)*

Providing the same *audio-only listening texts* with (supplementary contextual) *visuals + keywords* at non-initial phases of the while listening stage helps learn more effectively (24 times mentioned)

*"[Providing the same audio-only listening texts with] visuals and keywords are **more effective** in learning" (Participant GR203)*

*"[Providing the same audio-only listening texts with] visuals and keywords **is convenient for** our [language] development. Especially visuals and re-listening to the same listening texts in different formats are more permanent in terms of learning" (Participant GR207)*

"Visuals made the listening texts understandable as well as helped us learn" (Participant GR2018)

*"Providing the same audio-only listening texts with visuals and keywords **makes listeners better learners**" (Participant GR2023)*

*"[Providing the same audio-only listening texts with visuals and keywords**] increases the speed of learning and makes it easier for us to understand**" (Participant GR2023)*

*"Keywords should be provided at least once or twice so that we **can remember certain things**" (Participant GR2025)*

"Visuals ***make learning permanent*** *and* ***help the development of visual memory****. Certain keywords enable us to understand the listening text. Using both visuals and keywords* ***make comprehended input permanent****" (Participant GR2027)*

"[Such a design] ***affects in very positive ways****. It is very useful for understanding English [the listening texts] easily and better. It is helpful in terms of speaking, as well" (Participant GR2028)*

"... I even ***memorised most of the provided keywords****" (Participant GR2034)*

"Providing listening texts with keywords or visuals and keywords ***makes learning easy*** *and* ***helps us understand better and enables us to focus on carefully****. In short,* ***it contributes positively to our understanding and learning****" (Participant GR2036)*

*"****We can acquire new words through the provision of the keywords with the listening text****. At the same time,* ***it helps us in our daily conversations****" (Participant GR2037)*

"Yes, certainly! Keywords or visuals and keywords ***are useful in understanding*** *the listening texts and* ***learning*** *[the target language]…even if it is limited" (Participant GR2038)*

*"In my opinion, providing the listening texts with keywords and visuals h****elps us understand listening texts better as well as learn new words****. In this way, we figure out the meaning of unfamiliar words and* ***learning becomes more permanent****" (Participant GR2042)*

Providing the same *audio-only listening texts* with (supplementary contextual) *visuals + keywords* at non-initial phases of the while listening stage is useful for drawing attention to salient features of the listening texts (12 times mentioned)

"[Providing the same audio-only listening texts with visuals and keywords] enables me ***to pay attention to the*** *keywords that I could not realise before and understand better" (Participant GR2019)*

"Providing the same audio-only listening texts with visuals and keywords ***enables our brain to keep a new word in long term memory****" (Participant GR2023)*

"In my opinion, ***a listening text should feature in both visuals and keywords so that we can focus on content more****" (Participant GR2026)*

"... I even ***memorised most of the provided keywords****" (Participant GR2034)*

"… and ***enables us to focus on carefully****. In short, it contributes positively to our understanding and learning" (Participant GR2036)*

"… [Such a design] will ***help us focus on the features*** *[of the listening texts]* ***that we should have paid attention to****. As a result, we better benefit from such listening [such a design]" (Participant GR2046)*

"Provision of the keywords is useful. For example, it ***enables us to focus on what we need to****. …'****Seeing helps us remember****' " (Participant GR2049)*

Two participants (out of 56) comment that such a design enables them to overcome unfamiliar accents.

"Positive effects: At the first listening, as ***accents*** *were unfamiliar, it was difficult to understand. However, due to keywords or visuals and keywords, the second listening was much more easier I think. …" (Participant GR2040)*

"While listening to the audio-only versions of the listening texts, I could not understand due to unfamiliar words as well as their ***accents****. Visuals made the listening texts understandable as well as helped us learn. …" (Participant GR2018)*

Moreover, two participants (out of 56) indicate that such a design motivates them as well as helps them learn private names.

"With keywords, I understood the speaker better. I grasped the topic of the listening text. Listening to with keywords ***motivated*** *me. In my opinion, [such a design] is very positive. [Such a design] also enables us to* ***understand private names****. Designing in this way helps us understand what we listen to better" (Participant GR2022)*

"Provision of the keywords helps a lot, as a result, we do not have difficulty in understanding [the listening texts]. [Such a design] ***motivates*** *us" (Participant GR2025)*

However, there were some negative comments emerged from the qualitative data, all of which are below (2 times mentioned)

"Certainly! Keywords are very useful for understanding the listening texts, ***but visuals are not effective*** *…" (Participant GR2035)*

"In my opinion, keywords and visuals ***should not be provided because in real-life such things are not available****… Watching films or video is better because word become more permanent." (Participant GR2056)*

Differences between the participants' perceptions and their characteristics, and correlations between the participants' perceptions

In this study, the differences between the participants' characteristics (i.e. gender, age-group, third language, language learning period, level in English, level in listening, level in computing, feeling confident while learning English etc.) and their perceptions towards the provision of *keywords* or (supplementary contextual) *visuals* + *keywords* with the same *audio-only listening texts* at non-initial phases of the while listening stage were not found to be statistically significant.

In terms of the participants' general perceptions towards the provision of *keywords* and (supplementary contextual) *visuals* + *keywords* with the same *audio-only listening texts* at non-initial phases of the while listening stage, the correlations were statistically significant (Table 4). The participants seemed to have high positive general perceptions (Tables 4 & 5) towards the provision of *keywords* and (supplementary contextual) *visuals* + *keywords* with the same *audio-only listening texts* at non-initial phases of the while listening stage in HEs for FLL. The participants seem to prefer (a) mostly the provision of (supplementary contextual) *visuals* + *keywords* (see Figure 3 above) with the same *audio-only listening texts*, and (b) secondly most *keywords* (see Figure 2 above) with the same *audio-only listening texts* (see Table 5).

Table 4. Correlations between the participants' perceptions towards the provision of '*keywords',* and (supplementary contextual) '*visuals'* + 'k*eywords'* with the same *audio-only listening texts* at the non-initial phases of the while listening stage in HEs for FLL

		Keywords	**(Supplementary Contextual) Visuals + Keywords**
Keywords	R	1	0,815
	p		**0,001***

*Correlation is statistically significant; a: 0,05; Pearson Correlation test

Table 5. Overall means of the participants' perceptions towards the provision of '*keywords'*, and (supplementary contextual) '*visuals'* + 'k*eywords'* with the same *audio-only listening texts* at the non-initial phases of the while listening stage in HEs for FLL

	N	**Mean**	**SD**
Keywords	56	4,28	0,68
(Supplementary contextual) 'visuals' + 'keywords'	56	**4,31**	0,72

DISCUSSION AND IMPLICATIONS

Dual-coding in designing 'audio-only listening texts' in hypermedia environments for FLL

The above-mentioned results match the existing findings of similar studies (Turel, 2015b, 2014b, 2011; Hsu et al., 2013; Türel, 2010; Cárdenas-Claros, 2009; Paivio, 2006; Purnell & Solman, 1991; Chun, & Plass, 1997). The results of this study also contribute further to the existing body of knowledge in terms of the role of dual coding in designing *audio-only listening texts* in HEs for FLL.

In this study, *audio-only listening texts* were provided at the initial phases (of the while-listening stage). At the non-initial phases (of the while-listening stage), the same *audio-only listening texts* were provided in the form of *audio-only listening texts* + *keywords,* and *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords*. Only these were the focus of this study. At the final stages, *audio-only listening texts* + (full) *captions* were provided, which was not the focus of this study. In other words, more than one concurrent digital element on the same hypermedia environment, which aimed to teach one thing (thus, at least one available digital element was redundant), was provided. Such a design of *audio-only listening texts* in a hypermedia listening environment for FLL corresponds with the dual-coding theory, the generative theory of multimedia (Ginther, 2002; Mayer, 1997) and the redundancy hypothesis (Al-Seghayer, 2001; Sherwood et al., 1987), and also provides more paths of recall (Al-Seghayer, 2001; Paivio, 1986).

The results also psychologically match common sense; as such varied and enriched, but not overloaded combinations of the same *audio-only listening texts* in the same hypermedia listening application can avoid boredom and maintain motivation. "A more enriched learning experience occurs when LLs are presented with different styles of learning in both content and teaching style"' (Brickell, 1993, p.2), a challenge which is "often neglected" by instructional designers (McLoughlin, 1999, p.1). The results of the current study further matched the other findings in that the participants overwhelmingly appreciated the re-provision of the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial phases in the hypermedia listening application for FLL, as most learners are visual in their learning (Reid 1987, pp. 96-7).

The re-provision of the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial phases in the hypermedia listening application for FLL corresponds with the requirements of working memory, as it consists of separate processors for auditory and visual information (Kalyuga, 2000; Baddeley, 1992). Listening texts that can be processed using senses of both hearing and vision can expand limited working memory. The results also match the cognitive load theory (Kalyuga, 2000; Sweller, 1999), as such a provision of the listening texts decreases cognitive load because they consist of two different information sources (i.e. audio + keywords, audio +

visuals + keywords). Each of these different information sources requires the use of a separate learning processor (i.e. hearing, vision). These might be the reasons why the majority of the participants appreciated these particular designs of the *audio-only listening texts* in the specific hypermedia listening application for FLL.

The results of this study authenticate the related findings in the field of FLL (Turel, 2014b; Herron et al., 2002, p. 37; Ginther, 2002, pp. 133 - 67; Al-Seghaye,r 2001, p. 203; Brett, 1997, pp. 46-7; Secules et al., 1992, pp. 480-90; Rubin, 1994; Mueller, 1980, p. 340; Omagigo, 1979; Arnold & Brooks, 1976, pp. 713-16; Casambre, 1962, pp. 51-55). Illustrations/visuals generally facilitate intermediate learners' understanding, which is likely to result in FLL. The quantitative and qualitative data of this study clearly show that the majority of the participants are in favour of re-listening to/re-viewing the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial phases in HEs for FLL. The results of this study, therefore, match the comprehension input hypothesis (Türel, 2010, p. 1610). The results also match what was pointed out by Peter (1994, p. 90) as well as Brett (1997, p. 46-7) in that it is said that (a) relevant information around the video stage area can be very useful, and (b) the combination of different digital learning elements are found most beneficial by LLs, and visuals (i.e. pictures) secondly most.

The results are consistent with the social learning theory (Robinson, 1989, pp. 119-33; Carroll, 1977, p. 507), as repeated exposure to similar or parallel listening texts contributes to learning. In this study, the participants are in favour of re-listening to/re-viewing the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at non-initial phases of the while listening stage.

Re-provision of the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial phases can facilitate recognition, comprehension and learning (Jones & Plass, 2002, pp. 546-61; Al-Seghayer, 2001, pp. 202-32; Carroll, 1977, p. 509). The assumptions underlying these are that LLs recall better when they are assigned to combined-elements. The effects of visuals are much longer for pictorials (i.e. learners remember and learn better when one of the combined elements is visuals). This current quantitative and qualitative study fully supports these results, as well. Re-provision of the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial phases is more likely to lead to acquisition (Long 1983, p. 138, Carroll 1977, p. 500).

The participants of this study, as mentioned above, were computer literate. This, under normal conditions, is the case with most of today's students. Today's students are generally digitally fluent and competitive, and thus they enjoy working with such hypermedia listening applications. The hypermedia listening application made use of for this study responds to today's digitally fluent students' demands and learning style preferences (Türel, 2013; Duncan-Howell, 2012). This might be another reason why the participants overwhelmingly appreciated the re-provision of the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial phases.

Implications for the use of hypermedia environments and better design of 'audio-only listening texts' in such environments for intermediate language learners

Once more it has become clear that HEs are still not widely used at all in (some) educational institutions. HEs are also not integrated into most classrooms and FLL centres. In this study, for example, 82.1% of the participants indicated that they had never used any language software before. This finding matches other results (Türel, 2014, p. 179; Bax, 2003). To this end, the implication is this:

HEs need to, and have to, be made use of and integrated in all areas of education. This recommendation is a practical suggestion for the target educational institution as well as all Higher Education Institutions in Turkey. Many institutions, unfortunately, still do not have high-level structural factors and do not make efficient use of educational technology at different levels of education (Türel, 2013, p. 493). The target educational institution appears to be very slow in "taking the fullest advantage of the potential benefits that educational technology can offer at tertiary level" (Türel, 2013, p. 493). Many other researchers (e.g. Buchanan, 2013; Goktas, Yildirim, & Yildirim, 2009; Usluel & Seferoglu, 2004) put forward these suggestions, as well.

In terms of pedagogically effective and efficient design of *audio-only listening texts* in adaptive hypermedia listening applications for intermediate language learners, the implications are:

Comprehensible but slightly challenging *audio-only listening texts* + *tasks* should be provided at the initial listening phases (i.e. at the first phases of the while-listening stages). Target LLs should be required and encouraged to listen to the same *audio-only listening texts* a few times (when needed) and complete the provided gradual tasks.

The same comprehensible but slightly challenging *audio-only listening texts* should also be provided in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* accompanied with gradual tasks at the non-initial listening phases of the while-listening stages. The provided listening texts in their new dual-coded forms should be re-viewed by the target LLs, and they should complete the accompanying gradual tasks, as well.

Why should adaptive hypermedia developers take into heed the implications put forward above? Providing *audio-only listening texts* at the initial listening phases (i.e. the first phases of the while-listening stages) requires target LLs to put more effort into the listening process. In other words, "pedagogically, language learners should not be spoon-fed. Language learners, instead, should be

guided, directed and motivated to try to understand by their own initially" (Turel, 2015b, p.52). Such a provision "requires language learners to make more effort to process and understand the *audio-only listening texts* on their own (i.e. meaning-negotiation process)' (Turel, 2015b, p. 52). This implication is the requirement of the depth processing theory, which suggests that without enough effort (deep processing) input will not be remembered (Craik & Lockhart, 1972).

Similarly, re-providing the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial listening phases of the while-listening stages provides 'a more enriched learning experience', as discussed above in more detail.

Provision of *audio-only listening texts* at initial listening phases of the while-listening stages, and re-provision of the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at non-initial listening phases of the while-listening stages would have a positive enhancement of motivation, LLs' listening development and on preparation for the real world. Failing to take into account these practical recommendations, however, can lead to poor motivation, less comprehension and ineffective FLL. The assumption underlying this is that attitudes of language learners are always related to achievement (Masgoret & Gardner, 2003, pp. 123-63; Linebarger, 2001, pp. 288-298; Baltova, p. 2000; Chapelle & Jamieson, 1991, p. 43). Furthermore, learners' learning style preferences, instructional design models, a wide range of learning hypothesis (i.e. noticing hypothesis,) and theories (i.e. the comprehension input theory, the dual-coding theory, the attention theory), epistemology, senses of human beings, the concern in the field of hypermedia and relevant findings in the field of FLL, authenticity, the realities of the real-word and common sense require hypermedia developers to use varied combinations of *audio-only listening* texts at different phases of the while-listening stage so that effective and efficient adaptive hypermedia listening applications for FLL purposes can be designed and developed.

In sum, the implication of this study is that the same comprehensible but slightly challenging *audio-only listening texts* provided at initial listening phases of the while-listening stage should, and need to, be re-provided in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at the non-initial listening phases of the while-listening stages in hypermedia listening applications for intermediate language learners. The underlying assumptions for this implication are (a) the above argued reasons, and (b) the suggested design provides a repetitious exposure at different phases of the while-listening stages with different features of the same listening texts each time. This is, as discussed above, one of the invaluable factors in FLL. Such a recommended instructional design for HEs for listening development as a part of FLL can be a positive enhancement of better understanding of *audio-only listening texts* and efficient listening development as a whole.

Last, but not least, while the same *audio-only listening texts* is provided with additional *visuals* (i.e. *keywords*, or supplementary contextual *visuals* + *keywords*) at the non-initial listening phases of the while-listening stages for intermediate language learners, the requirements of the cognitive load theory (Kalyuga, 2000, p. 161; Sweller, 1999) and working memory should not be ignored by hypermedia developers. In short, we -hypermedia developers- need to be precise and keep the balance, as emphasised in a Kurdish proverb: "Plough deeply, neatly but do not hurt the oxen". Ignoring such important pedagogical design implications can decrease the effectiveness of multiple modalities in re-providing the same *audio-only listening texts* in different forms. Not only can such a failure cause cognitive overload or make misuse of working memory resources available for learning, but it can also hinder acquisition (Kalyuga, 2000, pp. 161-72).

Further research (i.e. experimental research) should investigate whether re-provision of the same *audio-only listening texts* in the form of *audio-only listening texts* + *keywords* or *audio-only listening texts* + (supplementary contextual) *visuals* + *keywords* at non-initial listening phases of the while-listening stages in hypermedia listening applications for intermediate language learners improves listening development and contributes to FLL or not.

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