Incidental Learning of L2 Collocations in an Academic Lecture: A Multimedia Theory Perspective

Maha Alkhalaf[1]

[1] Department of English Language and Translation, College of Arabic Language and Social Studies, Qassim University (QU), Buraydah, Qassim, 52571, Saudi Arabia

Correspondence: Maha Alkhalaf, Assistant Professor of Applied Linguistics, Department of English Language and Translation, College of Arabic Language and Social Studies, Qassim University (QU), Buraydah, Saudi Arabia. E-mail: ma.alkhalaf@qu.edu.sa

Received: April 13, 2023 Accepted: June 15, 2023 Online Published: June 26, 2023

doi:10.5430/wjel.v13n6p480 URL: https://doi.org/10.5430/wjel.v13n6p480

Abstract

This study aimed to examine how L1 Arabic learners incidentally acquire L2 English collocations through various input modes in academic lectures. A quasi-experimental design was employed, involving 87 Arabic learners studying L2 English at a Saudi university. The participants were randomly divided into six groups (5 intervention groups and one control group). An objective type multiple-choice question test was conducted in three phases: a pre-test, immediate post-test, and delayed post-test, to assess the participants' learning. Each experimental group received a specific input mode during the lecture, encountering a total of 17 English collocations. The input modes included listening, reading, reading while listening, viewing, and viewing with captions. The data were analyzed using SPSS version 25.0, employing ANOVA tests to compare mean scores across different test types (pre-test, immediate post-test, and delayed post-test) and the five input modes. The results revealed significant improvements in form-recognition learning from reading, viewing, and viewing with captions. These findings contribute further evidence supporting the effectiveness of academic lectures and multimedia theory in facilitating the incidental acquisition of L2 collocations.

Keywords: incidental L2 learning of collocations; multimedia theory; audiovisual input; academic lecture; higher education; learning

1. Introduction

Collocations are the natural two-word combination which is closely related to each other and their co-occurrence is not only by chance (Gablasova et al., 2017). Knowledge of vocabulary and specifically collections knowledge is one of the vital components of second language (L2) proficiency. However, L2 learners have minimum knowledge of the collocations and their use (Nguyen & Webb, 2017; Vu et al., 2023). Hence, L2 learners are required to build a large lexicon of vocabulary and collocations to achieve effective communication in the L2. In order to reach such lexical milestones essential for successful L2 production and proficiency of verbal and non-verbal texts, L2 learners are instructed not to underestimate the value of incidental learning, through supplementing deliberate learning of collocations with incidental learning (Jin & Webb, 2020; Rodgers & Webb, 2020a). Knowledge of collocations can be learned through implementing explicit teaching activities, however, neither L2 learners can learn all L2 collocations through deliberate learning nor teachers can explicitly teach all L2 collocations (Puimège & Peters, 2020). In such cases, the importance of incidental learning should never be ignored as it plays an important and key role in deepening the L2 learners' knowledge regarding collocations and their use (Vu et al., 2023).

Incidental learning of vocabulary and collocations occurs when encountering L2 input through various modes including listening, reading, reading-while-listening and viewing. Research shows that using multimedia or multi modes during the learning activity can enhance the output gained from incidental learning. As the use of multiple mediums or modes engages the learners while using multiple senses which in turn increases their capacity to process information more efficiently (Mayer, 2014). Which paid much focus on presenting the same information or knowledge through multiple forums, for instance, listening while reading, reading with captions, and listening while writing (Montero Perez, 2020).

Research investigating incidental learning has mainly concerned with non-academic sources of L2 input such as songs (Pavia et al., 2019), graded readers (Pellicer-Sánchez, 2017; Webb & Chang, 2022), Story-telling videos (Teng, 2019), Listening to the teacher (Jin & Webb, 2020) and TV programs (Puimège & Peters, 2020; Teng, 2019). More recently, only two studies have explored academic lectures as a potential source of input for incidental L2 learning of collocations (Dang et al., 2022b).

Furthermore, in the post-COVID era, there has been a flow in the availability of online and open-access academic materials provided by prestigious universities. These resources, including academic lectures, are easily accessible and offered in various formats such as audio and videos with or without subtitles. Recognizing this trend, educators can leverage academic lectures as a valuable source of meaning-focused input to enhance the incidental learning of L2 collocations for L2 learners. These in-class lectures can be accessed through various modes, including listening, reading, reading while listening, and viewing with or without captions. However, an important research question remains unanswered: which of these input modes is most effective in facilitating the incidental learning of L2

English collocations among Arabic learners through academic lectures? Existing literature has provided limited evidence on this aspect, underscoring the need for further exploration (Dang et al., 2022b; Vu et al., 2023).

The existing body of research offers conflicting hypotheses regarding the effectiveness of various input modes in incidental vocabulary and collocation learning. Webb and Chang (2022) found no significant difference in the incidental learning of collocations between reading and listening modes in graded readers, suggesting similar learning gains. In contrast, Vidal (2011) reported that incidental vocabulary learning in academic lectures through reading resulted in higher learning gains compared to the listening mode. These contrasting findings necessitate further investigation. However, studies focusing on incidental vocabulary and collocation learning consistently indicate that mixed input modes yield better results. Research has shown that TV viewing with subtitles is more beneficial for L2 learners compared to viewing without subtitles. It is reasonable to expect a similar pattern with academic lectures as L2 input. However, there is a dearth of research exploring and comparing different input modes in academic lectures and their impact on learning outcomes. Only one recent study (Dang et al., 2022b) has investigated this specific area, focusing on L1 Chinese learners' acquisition of L2 English collocations through academic lectures using various receptive modes. Therefore, further research is warranted to deepen our understanding of this domain.

The current study addresses this gap in the literature where no sufficient research has been conducted. Although there is research evidence regarding using two to three modes of input for collocation learning but these different modes were used separately without having the aim of comparing the gains across the maximum modes of input while using academic lecture as a source. Hence, neither is there existing maximum research evidence regarding using the academic lecture as a source for incidental collocation learning nor the different input modes are compared to find out which of the input modes can be used together to make the L2 Arabic learners' collocation learning more efficient. Hence, the main objective of this study is to examine and compare the efficacy of various input modes in the incidental acquisition of L2 English collocations among L1 Arabic learners using academic lectures. The findings of this study have significant implications for L2 educators and learners, shedding light on the potential of lectures as a valuable resource for incidental learning of L2 collocations.

2. Incidental Learning of Vocabulary and Collocations

The current study views collocations in terms of frequency of occurrence rather than semantic relationship or level of compositionality. That is, collocations can be defined as "two-word combinations whose frequency of occurrence is statistically higher than by chance" (Dang et al., 2022, p. 730). A frequency-based approach to investigating collocations ensures effective selections of lexical items, as it directs the learner's attention to collocations that they encounter the most in their daily language use (Nation, 2016). Explicit teaching of collocations is indeed possible but can be challenging for both teachers and learners alike (Boers & Demecheleer, 2001). And, this is the reason identifying sources of incidental learning of collocations is equally essential.

Incidental vocabulary learning occurs when L2 learners are engaged with meaning-focused activities; that is, they are focused on making sense of the input at hand, such as reading books and watching TV (Ellis, 1997; Szudarski, 2012). This means that learners are not focused on the form or deliberately trying to learn a set of vocabulary items. Hence, incidental learning is opposite to planned learning experiences that are provided with certain goals or objectives. Incidental learning involves unplanned and unintentional learning (Webb & Chang, 2022). Research on incidental learning of collocations through reading as an input mode seems to be, at best, inconclusive. Szudarski's (2012) and another study (Szudarski & Carter, 2016) findings appear to be contradicting to those of (Pellicer-Sánchez, 2017), with the former suggesting no significant learning gains from reading stories and the latter suggesting significant incidental learning through reading. Research on incidental learning through auditory and audiovisual input is more informative.

Studies in this field are few and far between. According to earlier research (Dang et al., 2022a, 2022b; Smidt & Hegelheimer, 2010; Vidal, 2003; Yang & Sun, 2013), learning gains vary depending on the type of input mode. It was discovered after a thorough assessment of the literature that only two research had looked at academic lectures as a source of input. In order to better understand the possible benefits of academic lectures as a source of incidental collocation learning for L1 Arabic learners of L2 English, the current study looks into this further. The current study also contrasts the amount of learning that occurs when only one input style is used, such as listening only or reading only, with that of a mixed input mode that includes reading and listening as well as viewing and viewing with captions.

3. The Multimedia Learning Theory

There seems to be a growing interest among second language acquisition (therefore, SLA) researchers in the multimedia learning theory (Mayer, 2014) to explain empirical SLA data. The theory states that presenting information to learners through two modalities results in deeper learning which is known as multimedia learning; that is, L2 learners can achieve greater gains when input is presented in both text and graphics. The key assumption held in the multimedia theory is that there are two channels for learning: visual and auditory. Such an assumption is based on the dual coding theory of Paivio (1990).

The presentation mode approach and the sensory-modality method are two different perspectives that focus on the format of the stimulus and can be used to understand these two channels. The redundancy principle and the split-attention concept are two crucial tenets of the multimedia learning paradigm. The first principle states that in order to avoid hindering the learning process, learners should be presented with non-redundant and simple information. That means duplicating information processed through *the same channel* would interfere with learning and would not facilitate it (Kalyuga & Kalyuga, 2008; Mayer, 2014). This is because human working memory is limited and processing redundant information would place a heavy load on the human cognitive system as reinforced by the cognitive load theory

(Sweller et al., 1998).

Several other SLA theories are also relevant to the current study. According to Krashen's (1985) input hypothesis L2 learners need to encounter comprehensible input that is slightly higher than the learner's current level of competence for the learning to happen. Academic lectures can be considered as comprehensible input for L2 English learners who are enrolled in universities where English is used as the medium of instruction. Note that a large number of academic lectures from prestigious universities are open-access and can serve as a potential source of comprehensible input for L2 learning of vocabulary. Schmidt (1990) suggests that L2 learners need to notice items in the input in order to learn them. In addition, VanPatten's (2007) processing theory recommends that L2 learners experience limited processing capacities when presented with multiple L2 inputs. The theory also states that L2 learners would attend to some linguistic structures less than others based on complexity and due to processing constraints while listening and reading. The current paper investigates which mode of input (if any) hinders L2 learning of vocabulary and which mode of input or combination of modes provide the best conditions for the incidental learning of new L2 collocations.

3.1 The Present Study

Academic lectures present a great potential for incidental L2 vocabulary learning. It would be interesting to investigate incidental learning of L2 English collocation by L1 Arabic learners through different input modes in the context of academic lectures. In fact, incidental L2 collocation learning through academic lectures is empirically under-researched and, as a result, little is known about the effectiveness of academic lectures as sources of incidental learning of collocations in different learning contexts. Keeping in view the gap in the literature and the scope of the current study, the following hypotheses were made.

H1: Using academic lectures, the Arabic learners' incidental L2 collocation learning is improved through listening mode.

H2: Using academic lectures, the Arabic learners' incidental L2 collocation learning is improved through reading mode.

H3: Using academic lectures, the Arabic learners' incidental L2 collocation learning is improved through reading while listening mode.

H4: Using academic lectures, the Arabic learners' incidental L2 collocation learning is improved through viewing mode.

H5: Using academic lectures, the Arabic learners' incidental L2 collocation learning is improved through viewing with captions mode.

Hence, in light of the above-mentioned hypothesis, it was hypothesized that,

H6: The Arabic learners' incidental learning of L2 English collocations is improved through academic lectures while using various input modes.

Throughout the study, there was adherence to ethical standards. The data gathered in this research were not sensitive in nature, and the procedures followed to collect and analyze data did not involve any issues of confidentiality and deception.

3.2 Research Questions

Following two research questions guided this study:

1. To what extent are L1 Arabic learners of L2 English able to incidentally learn L2 English collocations using academic lectures through five interventions?
2. Is there a significant difference between collocation learning scores across six input modes?

4. Methodology

4.1 Participants

There were 87 graduate female[1] students majoring in English language and translation studies. Participants had to sign a consent to approve that they agree to take part. At the time of testing, they all were enrolled in an English language and translation program at one of the public sector Universities in Saudi Arabia. Each group of participants were randomly allocated to one of the six groups: the control group, the listening group, the reading group, the reading-while-listening group, the viewing group, and the viewing with captions group. Due to uneven sample size, one group had slightly fewer participants than other groups. The number of participants along with percentages in each group are presented in Table 1.

Table 1. Group-wise Distribution of Participants

Group	Frequency	Percentage
Control	15	17.2%
Listening	15	17.2%
Reading	14	16.1%
Reading while Listening	15	17.2%
Viewing	13	14.9%
Viewing with captions	15	17.2%
Total	87	100.0%

4.2 Procedure of the Study

[1] This is a convenience sample as universities are gender-segregated in Saudi Arabia.

5986885965969688585 8/8The procedure of study before initiating the experiment, along with the control group, the participants of the study were divided into five experimental groups based on the various receptive modes: listening, reading, writing, viewing, reading while listening, and viewing with captions. To control for English language proficiency, the Vocabulary Levels Test by Webb et al. (2017) was administered to all participants two weeks prior to starting the trial. The materials were presented as a video, an audio or a written transcript (according to the assigned experimental group) of an open-access lecture entitled "Fundamental Issues in Linguistics" given by Naom Chomsky at the Massachusetts Institute of Technology. 20 collocations that appeared in the lecture were selected to be the target collocations under investigation. The 20 collocations used in the study were (a) combinations of two content words that were mentioned in the lecture, and (b) were unlikely to be known by the participants as judged by their instructor (the researcher themselves).

4.3 Research Instrument

As a pre-and post-test, a pen-and-paper-based multiple-choice test was administered to all participants from different conditions (i.e. input modes) to test their L2 English knowledge of target collocations. The control group was also given the same pre-test to measure their knowledge of collocations. All participants listened to the audial forms and read the written forms of all administered test options. This procedure was undertaken to minimize test bias towards a certain input mode and to increase the reliability of results. Participants were presented with three choices of paired words and had to choose the correct collocation from two distractors. Participants were also presented with an "I don't know" option, in case they did not know the correct collocation. One of the pre-test items is shown following

Q1 a. grant funding b. giant funding c. white funding d. I don't know

While reading the above test item, participants heard the following:

a. [pause for one second] Grant funding [pause for two seconds]

b. [pause for one second] Giant funding [pause for two seconds]

c. [pause for one second] White funding [pause for two seconds]

Illustrations and examples of how to complete the test were presented in both Arabic and English to eliminate any confusion. The same test was administered to all six group participants as a pre-test, an immediate post-test and a delayed post-test. However, the order in which test items appeared varied from one test to another to control for testing effects. A few tested collocation was known to around 75% of participants as indicated by a pilot study. These collocations were eliminated from the analysis, resulting in a total of 17 collocations available for statistical analysis.

4.4 Process of Experiment

The experiment was conducted over six weeks. Participants were unaware of the real purpose of this study to avoid any biases or external validity threads in the study. After the first week, the participants were informed that the focus of the current study is just to do experimental testing regarding L2 English comprehension of the given academic material. After which the pre-test was conducted. Till the fourth week, the experimental groups received treatment according to their allocated group where different input modes were presented i.e. listening, reading, viewing, reading while listening, and viewing with captions. The control group was not given any intervention and they were taught through conventional mode without any interference. After the intervention, all participants completed the immediate post-test in the fifth week of the experiment. Then all participants completed the delated post-test again on the last week of the experience.

4.5 Scoring and Analyses

The scoring of the task was determined by assessing the agreement between participants' responses and the expected answers. Correct answers were assigned a score of one, while incorrect answers or blank responses received a score of zero. The obtained scores were then subjected to statistical analysis based on the mode of input, which included listening, reading, reading while listening, viewing, and viewing with captions. Raw data were manually entered into an Excel spreadsheet and analyzed using SPSS software. ANOVA test was employed to compare mean scores across different groups and investigate the significant improvement in test scores by comparing pre-test and post-test scores within each group. Additionally, the ANOVA test was utilized to compare mean scores across different modes of input, addressing the research question related to the effect of input modes on test performance.

5. Results

Initially, a vocabulary test was conducted for all group participants to measure their prior comprehension level. A one-way ANOVA (Analysis of Variance) test was used to determine the significant differences in vocabulary tests across six groups. Results yielded that there was an insignificant difference across the six groups in the average scores of the test, $F(5, 81) = 2.49$, $p = 0.038$. These results indicated that all participants had similar knowledge of L2 English vocabulary (particularly, the most common 3,000 words in English). The statistical analyses indicated no significant differences between the scores of the pre-tests administered to all experimental groups and the control group, indicating that all participants had almost similar levels of competencies and knowledge before the treatment.

An ANOVA result indicated that there was a statistically significant difference in the post-test scores across all six groups, $F(5, 81) = 17.14$, $p<.001$. This indicates that there is a significant difference in the post-test scores across groups. Overall, the descriptive statistics show variations in scores among the different groups, and the ANOVA confirms that there is a significant difference in post-test scores among the groups. Further post hoc tests or pairwise comparisons would be needed to determine the specific group differences.

The post hoc analysis was performed using the LSD (Least Significant Difference) method to compare the mean differences in students'

post-test scores between different groups. Based on the results, it was concluded that the control group had significantly lower post-test scores compared to the Listening, Viewing, and Viewing with captions groups. This indicates that these three intervention groups have significantly higher post-test scores. It was also concluded that the Listening group had significantly higher scores compared to the control, Reading, Reading while Listening and Viewing groups. These findings indicate significant differences in scores between several pairs of groups, suggesting variations in post-test proficiency among the different groups. It is also suggested that the interventions have a significant effect as post-test scores for experiment groups are significantly higher as compared to the non-intervention group (control). The results highlight the impact of different input modes on students' post-test scores, with certain modes resulting in significantly higher scores compared to others.

Furthermore, the significant difference between the pretest and posttest was determined by performing a dependent *t*-test for each group separately. The pretest and post-learning gains were evident in all intervention groups, as all mean scores significantly increased from the pre-test to the immediate post-test in all input modes. Table 2 provides the results of the learning gain scores for each group, including the control group and the intervention groups with different input modes. The learning gains were calculated by subtracting the pre-test scores from the post-test scores. In all intervention groups, there were significant increases in mean scores from the pre-test to the immediate post-test, indicating learning gains. The control group also showed a slight increase in mean scores but without statistical significance.

The statistical analysis using dependent t-tests showed that there was a significant difference ($p < .001$) between the pre-test and post-test scores for all participants, suggesting that the treatment had a significant effect on learning gains. Looking at the mean difference scores, the largest improvement was observed in the "Reading while Listening" group, with a mean difference of 9.57. The "Viewing" and "Viewing with captions" groups also had substantial mean differences of 5.38 and 7.28, respectively. The "Listening" and "Reading" groups had smaller mean differences of 5.67 and 3.79, respectively. The significance level (Sig) column indicates the p-value associated with the statistical test. Values less than 0.05 ($p < 0.05$) are considered statistically significant, indicating that there was a significant difference between the pre-test and post-test scores in the corresponding group. Figure 1 visually displays the mean values of the pre-test and post-test for all six groups. Overall, the results suggest that all intervention groups showed learning gains, but the groups using the reading while listening, viewing, and viewing with captions input modes had larger and statistically significant improvements in their post-test scores compared to the control group.

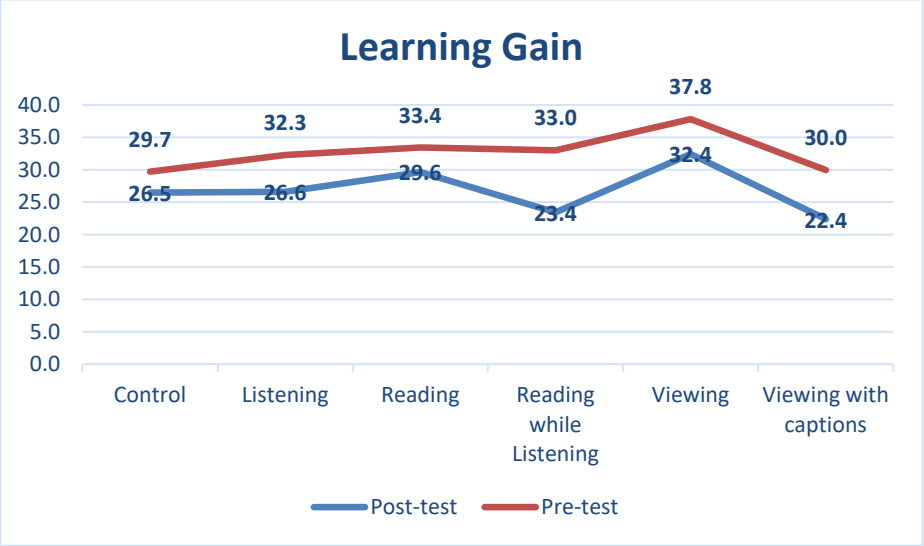

Figure 1. Mean scores of pre-test and post-test for all six groups.

Table 2. Learning gain scores for all groups

Group	N	Pre-test		Post-test		Mean Difference	t	Sig	95% CI	
		M	SD	M	SD				Lower	Upper
Control	15	26.47	11.16	29.70	8.78	3.23	1.22	0.24	-2.43	8.90
Listening	15	26.60	8.76	32.27	6.41	5.67	2.81	0.01	1.33	2.81
Reading	14	29.64	8.41	33.43	7.74	3.79	2.31	0.04	0.25	7.32
Reading while Listening	15	23.43	10.49	33.00	9.02	9.57	3.33	0.01	3.40	15.73
Viewing	13	32.42	7.96	37.81	7.71	5.38	2.61	0.02	0.90	9.87
Viewing with captions	15	22.37	11.58	29.97	10.08	7.28	4.04	0.00	3.57	11.63

The findings of the study indicated that the experimental groups, which received the reading, viewing, and viewing with captions

interventions, achieved significantly higher scores in the immediate post-test compared to the control group (p = .02, p = .03, p = .08, respectively). However, there were no statistically significant differences between the experimental groups and the control group in the listening and reading-while-listening interventions during the immediate post-test. Moreover, there were no statistically significant differences found in any of the delayed post-tests between the experimental groups and the control group. The results also showed that learning took place from the pre-test to the immediate post-test, as there was a statistically significant difference (p < .001) between the immediate post-test and the delayed post-test (p<.001).

Regarding the results of the immediate post-test, there were no statistically significant differences between the control group's performance and the performance of the listening group and the reading-while-listening group (all p > .05). When comparing these three modes, no statistically significant difference was found in the immediate post-test scores. These findings suggest that the listening and reading-while-listening modes did not result in the incidental learning of collocations in L1 Arabic learners of L2 English. In contrast, the reading, viewing, and viewing with captions modes demonstrated the incidental learning of collocations, as evidenced by the higher scores of the experimental groups in the immediate post-test compared to the control group. These three modes of input (reading, viewing, and viewing with captions) exhibited similar learning potential, as no significant difference was found between them. Regarding the delayed post-test, there were no statistically significant differences between the control group and the experimental groups in all modes, suggesting that the learning gains may not have been maintained and could have been lost over time.

6. Discussions and Conclusion

The results of the study provide valuable insights into the effects of different input modes on the incidental learning of L2 English collocations by L1 Arabic learners. The initial analysis of participants' vocabulary test scores revealed no significant differences among the six experimental groups, indicating that all participants had a similar level of knowledge of L2 English vocabulary prior to the intervention. This finding suggests that the groups were comparable and that any subsequent differences in learning gains can be attributed to the specific input modes received. The ANOVA results for the post-test scores showed a significant difference among the six groups, indicating that the intervention had an impact on participants' learning outcomes. Further investigation through post-hoc analysis using the LSD method revealed specific group differences in post-test scores. As expected, the non-intervention group (control) had significantly lower scores compared to the intervention groups, indicating that these intervention groups achieved higher post-test scores. Additionally, the Listening group had significantly higher scores compared to the control, Reading, Reading while Listening and Viewing groups. The Viewing with captions group also had significantly higher scores compared to the control, Reading, and Reading while Listening groups. These findings suggest that the intervention groups, particularly those using the Listening, Viewing, and Viewing with captions input modes, demonstrated significantly greater proficiency in L2 English collocations compared to the control group.

The analysis of pre-test and post-test scores within each group further confirmed the effectiveness of the intervention. All intervention groups showed significant increases in mean scores from the pre-test to the immediate post-test, indicating learning gains. In contrast, the control group showed only a slight increase in mean scores without statistical significance. This indicates that the specific input modes used in the intervention groups contributed to a measurable improvement in participants' knowledge of L2 English collocations. The findings of the current study revealed that the learning gains were evident in all five experimental groups as well as the control group. This could be attributed not only to the treatment but also to the exposure all participants (including the control group) had on the pre-test. Testing effects are not uncommon in the field of incidental vocabulary learning as found in previous studies (Dang et al., 2022b; Jin & Webb, 2020; Webb et al., 2017). Including a control group in the study is essential for the reliable interpretation of the results from the current dataset.

The current study further found that the mean score for the number of collocations learned at the form-recognition level from the immediate post-test through reading is 7.43 out of 17 test items, which showed that participants' knowledge of tested collocations improved by a high 43.70 percent. Participants learned a mean of 7.21 out of 17 collocations through viewing, which showed that participants' knowledge of tested collocations increased by a high 42.41 percent. Incidental learning through viewing with captions led participants to learn a mean of 7.64 out of 17 collocations, indicating knowledge improvement by a high 44.94 percent. Furthermore, there were no statistically significant differences among the latter three modes of input. Similar findings were found in Dang et al. (2021) and Dang et al. (2022) where viewing academic lectures was found to lead to significant incidental learning of collocations. Comparing results from the current study to those of Teng (2019), contrasting findings might be found as the latter study suggested that viewing with captions resulted in greater incidental learning of collocations than viewing with no captions. It is important to note that Teng's study differs from the current study that it tested children learning through viewing storytelling videos. Results from the current study also differ from these of Webb and Chang (2020) which suggested that reading while listening to graded readers led to greater gains than reading only or listening only. These conflicting findings might be attributed to the difference in treatment settings; Teng (2019) and Webb and Chang (2020) examined non-academic contexts, whereas the current study examined complex academic contexts. In such contexts, students are wired to rely heavily on their reading skills to gain knowledge. The findings of the current study are similar to those of Dang et al. (2022) where written and visual input was found to be the most effective mode to improve incidental collocational learning through academic lectures. Following are further details of it.

6.1 Listening Mode of Input

The findings from the current study suggested that the listening input does not lead to any advancement in incidentally learning L2 collocation in the context of academic lectures, as indicated by the current findings that the listening group and the control group scored

similarly in the assigned test. Vidal's (2011) study presents contrasting findings suggesting that listening to academic lectures led to learning gains through listening as a mode of input. Such contrasting results might be attributed to differences in methodological design. Vidal used a much shorter academic lecture (15 minutes) and modified and simplified the input for participants. These findings suggest that academic listening poses a challenge to the L2 learner as L2 learners have to face various challenges including the complexity of the topic, hesitation to speak, false starts, disconnected speech, irregular pauses as well as stress and intonation. All this adds to the cognitive load of decoding the meaning as well as learning new vocabulary and collocations (Field, 2011; Flowerdew, 1995; Goh, 2000). These features might even be more problematic for the participants in the current study because of the fact that they come from an educational context where the focus is heavily placed on improving literacy more than improving communication, that is the learners are more exposed to written input than listening input as the education system in Saudi Arabia is mostly based on written assessment. According to the noticing hypothesis of Schmidt (1990), L2 learners have to notice new unfamiliar linguistic structures in the input for the learning to occur. And, according to the input processing theory proposed by VanPatten (2007), L2 learners can notice new and unfamiliar linguistic forms only if they have enough attentional resources while processing any given input (written or listening). Thus, academic listening as well as L2 listening seem to pose a challenge for the participants of the current study and seem to cause a processing burden on the cognitive system. L2 learners in the current study might have been engaged more with the content of the lecture rather than learning new linguistic forms. This seems to be a logical explanation of the findings that the current participants did not learn new vocabulary through listening to an academic lecture.

6.2 Reading Mode of Input

The current study suggests that the reading mode of input in the context of academic lectures is a great learning resource for the incidental learning of L2 collocations. As seen in the discussion of the results, the reading group scored significantly higher than the control group which only shows the significant contribution reading input has on learning new collocations. This is also supported by earlier studies on the effect of reading on vocabulary learning such as Pellicer-Sánchez's (2017) on reading stories and Web and Chang's (2020) on graded readers. This might be because reading allows L2 learners to pause, visit and revisit what they find challenging in the input. This would allow for repeated perceptual processing that matches participants' individual needs (Flowerdew, 1995). This would allow learners to have more attentional resources in processing reading input than listening input and would make new unfamiliar vocabulary more salient and therefore easier to be learned.

The findings from the current study suggest that combining different input modes to support the learning of collocations from academic L2 listening results in different outcomes. While results from listening only and reading while listening did not seem to contribute to the learning of L2 collocation, viewing input combined with listening input seem to boost the incidental learning of L2 collocations as seen in the viewing group and viewing with captions group.

6.3 Use of Multimedia Theory

Referring to the multimedia theory, findings from the current study lends support to the theory, suggesting that combining visual input with listening input (i.e., audiovisual) result in significantly greater learning outcomes. According to this theory, processing information in two channels leads to greater learning gains than processing information in one channel. In the case of incidental learning through academic lectures, it seems that conceptualizing the two channels (for processing multimedia input) from the perspective of the presentation-mode approach better interprets the current findings than conceptualizing the two channels through the sensory-modality approach. This is because the presentation-mode approach categorises the listening input and the written input as verbal input, which is processed by the same channel (verbal). Whereas the viewing input is processed in a different channel (non-verbal). This study found that processing new vocabulary through two different channels (i.e., verbal and non-verbal/ auditory and visual) resulted in significantly greater learning outcomes than processing new vocabulary through the same channel (verbal/ listening and reading).

Findings from the current study lend support to the redundancy principle and the split-attention principle as well. First, processing new vocabulary in two different input modes through one single channel would result in repeated processing (i.e., redundancy) and would cause divided attention. This would hinder the process of learning new vocabulary and create a heavy cognitive load on learners' working memory. This is supported by the reading-while-listening group not scoring significantly higher than the control group. Second, processing new vocabulary through different input modes and through two different channels would not overburden the cognitive load on the learners' working memory and would facilitate the learning of new vocabulary. This is reflected in the viewing and viewing with captions groups achieving significantly higher than the control group, that is, combining verbal (auditory/listening) and non-verbal (visual/viewing) did lead to substantial learning gains.

The present study, however, contrasts earlier SLA studies investigating incidental L2 learning of vocabulary (e.g., Pllicer-Sánchez et al., 2020; Peters, 2019), which did not lend support to the redundancy and split-attention principles. The contrast in the findings might be attributed to the non-academic input that was used in the latter studies, while unmodified academic input was used in the current study and that of Dang et al., (2022). Processing information from academic lectures presents a high level of complexity; the learner has to decode the meaning of complex and abstract information in real-time, and in a second language. Thus, when learners are presented with input in written and listening modes, information was processed through the same verbal channel, which means that learners have to split their attention between written and listening input while trying to maintain decoding the meanings presented in the lecture. In contrast, when information was processed through two different channels (listening and viewing/ verbal and non-verbal), participants' ability to process information was not burdened, which enhanced the learning of vocabulary from the academic lecture through viewing and viewing with captions.

Meaningful learning gains were witnessed as a direct result of the treatment from the current study. Learners' knowledge of the target collocations was 43.70% greater after the reading treatment, 42.41% higher after the viewing treatment and 44.94% higher after the viewing with captions treatment.

The learning gains from the current study seem to be meaningful, especially because the study only measured L2 incidental learning of collocations at the recognition level. Learning gains might have surpassed the level of recognition to knowledge of collocation at deeper levels such as meaning and usage, but this could not be measured because of the design of the experimental test. Jin and Webb (2020) suggest that learning gains can be obtained through meaning-focused input where learners have the chance to learn different aspects of target collocations. Coxhead (2017) asserts that learners might be able to expand their knowledge of even familiar vocabulary by learning how these items are interpreted and used in different contexts through exposure to academic input. It should be noted that the treatment of the current study is exposing learners to only one academic lecture. Given the incremental nature of incidental language learning, it is safe to assume that consistent exposure to academic lectures would lead to greater learning outcomes. This is supported by previous studies (Dang et al., 2022a; Jin & Webb, 2020; Pavia et al., 2019; Rodgers & Webb, 2020b; Teng, 2019; Webb & Chang, 2014), which suggest that exposure to multiple texts led to better learning outcomes than exposure to a one-time text.

Overall, the findings highlight the impact of different input modes on the incidental learning of L2 English collocations by L1 Arabic learners. The results suggest that interventions utilizing reading, listening, and multimodal input modes, such as viewing with captions, can significantly enhance learners' proficiency in L2 collocations. These findings have important implications for language teachers and curriculum designers, as they emphasize the value of incorporating diverse input modes, particularly in the form of academic lectures, to facilitate the incidental learning of L2 collocations.

6.4 Limitations and Implications

The study has several limitations. First, the selection of participants was decided based on convenience. Second, although knowledge of L2 vocabulary is incremental, the current study only measured participants' knowledge of collocation at the form-recognition level and from encountering only one lecture. Third, findings from the current study would have been more reliable, if the listening proficiency levels of participants had been measured to have insights into how such variables might affect the results of the tests. It would also be interesting to measure different levels of vocabulary knowledge such as meaning recognition and meaning recall. It could also be useful to explore the effect of the level of L2 proficiency on the incidental learning of collocations. Future research should consider incorporating other levels of vocabulary knowledge, such as meaning recognition and recall, to provide a more comprehensive understanding of the incidental learning process. Additionally, investigating the influence of participants' listening proficiency levels on the results would provide valuable insights into how these variables may affect collocational learning outcomes.

5.5 Conclusion

Being one of the few studies to examine the potential benefits of academic lectures for L1 Arabic learners who unintentionally pick up L2 collocations through a variety of input methods, including listening, reading, listening while reading, viewing, and viewing with captions, the current study shows how academic lectures can be used to increase L2 learners' vocabulary knowledge. It provides information on the various impacts that different input modes have on learning gains when academic lectures are considered, and it suggests that reading, viewing, and viewing with captions contributed the most to the learning outcomes when compared to other input modes, such as listening, reading, and listening while reading. The current study additionally analyzed the results in the context of the multimedia theory, offering evidence in favour of the split-attention and redundancy principles while also, incidentally, teaching L2 English collocations in various ways. It emphasized and accepted the value of combining different input methods to help Arabic language learners learn L2 collocations more quickly, easily, and effectively. In conclusion, this study offers insightful information on how diverse input modes affect L1 Arabic learners' accidental acquisition of L2 English collocations. The results show that reading, listening, and multimodal input interventions significantly increase learners' learning gains. These findings have significant ramifications for language instruction and curriculum development as well as for our understanding of efficient language learning techniques.

Declarations

Ethical Approval The author obtained approval to conduct the study from the Deanship of Scientific Research, Qassim University.

Competing interests The author declares that they have no competing interests.

Authors' contribution not applicable.

Funding not applicable.

Availability of data and materials Data are available upon reasonable request from the author.

Acknowledgements The researcher would like to thank the Deanship of Scientific Research, Qassim University for funding the publication of this project.

References

Boers, F., & Demecheleer, M. (2001). Measuring the impact of cross-cultural differences on learners' comprehension of imageable idioms. *ELT Journal*, *55*(3), 255-262. https://doi.org/10.1093/elt/55.3.255

Coxhead, A. (2017). *Vocabulary and English for Specific Purposes Research: Quantitative and Qualitative Perspectives* (1st ed.). Routledge. https://doi.org/https://doi.org/10.4324/9781315146478

Dang, T. N. Y., Lu, C., & Webb, S. (2022a). Incidental learning of single words and collocations through viewing an academic lecture. *Studies in Second Language Acquisition*, *44*(3), 708-736. https://doi.org/10.1017/S0272263121000474

Dang, T. N. Y., Lu, C., & Webb, S. (2022b). Incidental Learning of Collocations in an Academic Lecture Through Different Input Modes. *Language Learning*, *72*(3), 728-764. https://doi.org/10.1111/LANG.12499

Ellis, R. (1997). SLA research and language teaching. In *International Journal of Applied Linguistics* (Vol. 9, Issue January 1997). Oxford University Press. http://eric.ed.gov/ERICWebPortal/recordDetail?accno=ED421866

Field, J. (2011). Into the mind of the academic listener. *Journal of English for Academic Purposes*, *10*(2), 102-112. https://doi.org/10.1016/J.JEAP.2011.04.002

Flowerdew, J. (1995). *Academic Listening: Research Perspectives (Cambridge Applied Linguistics)* (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781139524612

Gablasova, D., Brezina, V., & McEnery, T. (2017). Collocations in Corpus-Based Language Learning Research: Identifying, Comparing, and Interpreting the Evidence. *Language Learning*, *67*(S1), 155-179. https://doi.org/10.1111/LANG.12225

Goh, C. C. M. (2000). A cognitive perspective on language learners' listening comprehension problems. *System*, *28*(1), 55-75. https://doi.org/10.1016/S0346-251X(99)00060-3

Jin, Z., & Webb, S. (2020). Incidental Vocabulary Learning Through Listening to Teacher Talk. *The Modern Language Journal*, *104*(3), 550-566. https://doi.org/10.1111/MODL.12661

Kalyuga, M., & Kalyuga, S. (2008). Metaphor awareness in teaching vocabulary. *Language Learning Journal*, *36*(2), 249–257. https://doi.org/10.1080/09571730802390767

Krashen, S. (1985). *The input hypothesis: Issues and implications*. Longman.

Mayer, R. E. (2014). The Cambridge Handbook of Multimedia Learning. In *The Cambridge Handbook of Multimedia Learning, Second Edition*. Cambridge University Press. https://doi.org/10.1017/CBO9781139547369

Montero Perez, M. (2020). Multimodal input in SLA research. *Studies in Second Language Acquisition*, *42*(3), 653-663. https://doi.org/10.1017/S0272263120000145

Nation, I. S. P. (2016). Making and Using Word Lists for Language Learning and Testing. In *Making and Using Word Lists for Language Learning and Testing*. John Benjamins Publishing Company. https://doi.org/10.1075/Z.208

Nguyen, T. M. H., & Webb, S. (2017). Examining second language receptive knowledge of collocation and factors that affect learning. *Language Teaching Research*, *21*(3), 298–320. https://doi.org/10.1177/1362168816639619

Paivio, A. (1990). Mental Representations: A dual coding approach. In *Mental Representations: A Dual Coding Approach*. Oxford University Press. https://doi.org/10.1093/ACPROF:OSO/9780195066661.001.0001

Pavia, N., Webb, S., & Faez, F. (2019). Incidental vocabulary learning through listening to songs. *Studies in Second Language Acquisition*, *41*(4), 745–768. https://doi.org/10.1017/S0272263119000020

Pellicer-Sánchez, A. (2017). Learning L2 collocations incidentally from reading. *Language Teaching Research*, *21*(3), 381-402. https://doi.org/10.1177/1362168815618428

Puimège, E., & Peters, E. (2020). Learning Formulaic Sequences Through Viewing L2 Television and Factors That Affect Learning. *Studies in Second Language Acquisition*, *42*(3), 525-549. https://doi.org/10.1017/S027226311900055X

Rodgers, M. P. H., & Webb, S. (2020a). Incidental vocabulary learning through viewing television: *ITL - International Journal of Applied Linguistics*, *171*(2), 191-220. https://doi.org/10.1075/ITL.18034.ROD

Schmidt, R. W. (1990). The Role of Consciousness in Second Language Learning1. *Applied Linguistics*, *11*(2), 129-158. https://doi.org/10.1093/APPLIN/11.2.129

Smidt, E., & Hegelheimer, V. (2010). Effects of Online Academic Lectures on ESL Listening Comprehension, Incidental Vocabulary Acquisition, and Strategy Use. *Computer Assisted Language Learning*, *17*(5), 517-556. https://doi.org/10.1080/0958822042000319692

Sweller, J., Van Merrienboer, J. J. G., & Paas, F. G. W. C. (1998). Cognitive Architecture and Instructional Design. *Educational Psychology Review*, *10*(3), 251-296. https://doi.org/10.1023/A:1022193728205

Szudarski, P. (2012). Effects of meaning-and form-focused instruction on the acquisition of verb-noun collocations in L2 English. *Journal*

of Second Language Teaching & Research, 1(2), 3-37. https://pops.uclan.ac.uk/index.php/jsltr/article/view/32

Szudarski, P., & Carter, R. (2016). The role of input flood and input enhancement in EFL learners' acquisition of collocations. *International Journal of Applied Linguistics*, *26*(2), 245-265. https://doi.org/10.1111/IJAL.12092

Teng, M. (2019). The effects of video caption types and advance organizers on incidental L2 collocation learning. *Computers and Education*, *142*(C). https://doi.org/10.1016/j.compedu.2019.103655

VanPatten, B. (2007). Input Processing in Adult Second Language Acquisition. In *Theories in second language acquisition: An introduction.* (pp. 115–135). Lawrence Erlbaum Associates Publishers. https://doi.org/10.4324/9781410615299

Vidal, K. (2003). Academic Listening: A Source of Vocabulary Acquisition? *Applied Linguistics*, *24*(1), 56-89. https://doi.org/10.1093/APPLIN/24.1.56

Vu, D. Van, Noreillie, A. S., & Peters, E. (2023). Incidental collocation learning from reading-while-listening and captioned TV viewing and predictors of learning gains. *Language Teaching Research*. https://doi.org/10.1177/13621688221151048

Webb, S., & Chang, A. C. S. (2014). Second language vocabulary learning through extensive reading with audio support: How do frequency and distribution of occurrence affect learning? *Language Teaching Research*, *19*(6), 667-686. https://doi.org/10.1177/1362168814559800

Webb, S., & Chang, A. C. S. (2022). How Does the Mode of Input Affect the Incidental Learning of Collocations? *Studies in Second Language Acquisition*, *44*(1), 35-56. https://doi.org/10.1017/S0272263120000297

Webb, S., Sasao, Y., & Ballance, O. (2017). The updated Vocabulary Levels Test: Developing and validating two new forms of the VLT. *ITL - International Journal of Applied Linguistics*, *168*(1), 33-69. https://doi.org/10.1075/ITL.168.1.02WEB

Yang, H. C., & Sun, Y. C. (2013). It is more than knowledge seeking: examining the effects of OpenCourseWare lectures on vocabulary acquisition in English as a foreign language (EFL) context. *Computer Assisted Language Learning*, *26*(1), 1-20. https://doi.org/10.1080/09588221.2011.624523

Appendix – A. Experiment Test

In this part, you will hear 20 questions. For each question, you will hear four options. Circle the one correct answer. The correct answer is the two words that may often appear together in English. If you do not know or are not sure about the correct answer, choose the 'I After each question, you will have 5 seconds to circle and check your answer before you listen to the next question.

You will hear the recording ONCE only. Here are four examples:

Q0	a. close friend	b. fine friend	c. long friend	d. I don't know
Q00	a. single hair	b. light hair	c. blonde hair	d. I don't know
Q000	a. high house	b. true house	c. big house	d. I don't know
Q0000	a. low morning	b. good morning	c. blue morning	d. I don't know

Now it' your turn!

Q2	a. grant funding	b. giant funding	c. white funding	d. I don't know
Q3	a. delicate variation	b. significant variation	c. tall variation	d. I don't know
Q4	a. common sciences	b. easy sciences	c. natural sciences	d. I don't know
Q5	a. say a notion	b. capture a notion	c. keep a notion	d. I don't know
Q6	a. Universal Grammar	b. United Grammar	c. Unified Grammar	d. I don't know
Q7	a. red example	b. soft example	c. concrete example	d. I don't know
Q8	a. at retrospect	b. in retrospect	c. into retrospect	d. I don't know
Q9	a. radically false	b. very false	c. too false	d. I don't know
Q10	a. empirical house	b. empirical size	c. empirical data	d. I don't know
Q11	a. serious problem	b. stretched problem	c. beautiful problem	d. I don't know
Q12	a. overweight example	b. concrete example	c. big example	d. I don't know
Q13	a. unknown inquiry	b. gentle inquiry	c. linguistic inquiry	d. I don't know
Q14	a. state of the art	b. art state	c. new state	d. I don't know
Q15	a. generative writing	b. generative skills	c. generative grammar	d. I don't know
Q16	a. experimental laptop	b. experimental work	c. experimental school	d. I don't know
Q17	a. coming clear	b. coming light	c. coming to light	d. I don't know
Q18	a. long revolution	b. scientific revolution	c. blue revolution	d. I don't know
Q19	a. received wisdom	b. kind wisdom	c. light wisdom	d. I don't know
Q20	a. fine number	b. infinite number	c. heavy number	d. I don't know
Q21	a. orchestrating explanation	b. drawing explanation	c. seeking explanation	d. I don't know