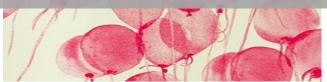Máster en Formación del Profesorado de Secundaria 2013-2014

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Modality of Input and Vocabulary Acquisition of English for Specific Purposes

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Abstract

This study examined the effect of input modality (audio, captions and image) on short-term and long-term recall of vocabulary of English for Specific Purposes. It also examined learners' attention to input. 33 English for Specific Purposes students participated in the project, 17 from the Mechanical Product Programming Course (group 1) and 16 from the Mechanical Product Design Program course (group 2). Students watched three videos of English for Specific Purposes: one with captions and image (CI), another one with audio and image (AI) and the last one with audio, captions and image (ACI). All participants completed written immediate post-tests after watching each video and a delayed post-test, which included all the vocabulary from the three immediate post-tests, one week after the last session. Students also answered a final survey.

Results indicated that audio helps recall of vocabulary in ESP, since the best scores in the delayed post-test were in the AI and ACI videos, the video without audio also obtained the worst results in the delayed post-test. Results from the final survey showed that visual images were more helpful for students than captions or audio and students stated that they were paying more attention to captions than to audio while watching the videos. Even if they perceived that they were paying more attention to captions than to audio, results confirmed that audio helped more in the acquisition of ESP vocabulary.

1. Introduction

The use of multimedia material in foreign language classrooms has become more and more common and this increased use has attracted researchers' interest towards the effect for acquisition of different modalities of input and in different combinations. Brinton (2001) stated that multimedia allowed students to have more authentic input and to be exposed to the target culture. The author also affirmed that multimedia was motivating for learners and that it encompassed different learning styles. Plass and Jones (2005) investigated different modalities of input and showed that the combination of images, audio and print made input more comprehensible. Their study supported Paivio's (1971, 1990, 2007) Dual Coding Theory, which stated that both verbal (audio) and nonverbal (visuals) representations are processed together.

Vocabulary plays an important role in second and foreign language acquisition and its importance is even higher in English for Specific Purposes (ESP). Videos are used more

and more as a source of real input in this field because of their benefits regarding vocabulary acquisition and comprehension as students receive more than a type of input modality at the same time, which makes them more motivating. However, research on their usefulness for the acquisition of vocabulary in ESP remains scarce. This project tries to fill this gap in research by analyzing how different combinations of audio, visual images and captions affect the acquisition of specific vocabulary and learners' attention to input.

2. Literature Review

2.1. *Visual and aural input in multimedia materials*

One of the areas of research that has informed this project is the use of captions in videos to learn a foreign language. In the 1980s, when captions were first used in foreign language classrooms captioning was used as a way to reduce anxiety, to raise learners' attention, to give students confirmation of what they were hearing and to increase their motivation (Burger, 1989; Froehlich, 1988; Grimmer, 1992; Vanderplank, 1988). Initial investigations on the topic compared the benefits of videos with captions and without captions in foreign language classrooms. The results of those studies showed that students performed better on vocabulary and comprehension tests when they watched captioned videos than when they watched the same videos without captions (Winke, Gass & Sydorenko, 2010).

Bird and Williams (2002) studied how bimodal (visual and aural) presentation of new words affected the acquisition of those words. In their research, advanced learners of English were shown a number of words in three different ways: in a text at the same time that they were listening to it, in a text without listening to it and in an oral text without reading it. They confirmed that bimodal presentation benefits the learning of new words and, furthermore, they proved that the auditory and the visual cognitive systems are interconnected, supporting Paivio's (1986, 1991, 2007) Dual Coding Theory that had stated that although verbal and non-verbal input is processed by different systems, those systems interact with each other. Thus, if both systems are activated the result is a better recall of the input presented.

Several researchers have concluded that captions facilitate listening comprehension in foreign languages (Baltova, 1999; Garza, 1991; Guillory, 1998; Markham, 1993, 2001).

However, Sydorenko (2010) claimed that their effect on vocabulary acquisition cannot be generalized because research on the topic has not always concluded the same.

As far as audiovisual materials are concerned, researchers have found out that visual aids help significantly comprehension in foreign language classrooms. Hazan et al. (2005, as quoted in Gonzales-Flores et al.) studied the abilities of English language learners from Japan, Spain, Korea and England to detect phonetic information when attached to auditory, visual or audiovisual cues in communication and concluded that audiovisual cues helped students the most.

Gonzales-Flores et al. (2012) also proved that audiovisual materials improved language comprehension and vocabulary acquisition. Nevertheless, those authors made a clear emphasis on the importance of a proper use of audiovisual materials and teachers have been warned against misusing them.

There are three ways of getting input trough videos: aural, visual and text. Written words or texts can appear on a screen in three forms: a) with subtitles in L1 and audio in L2, b) with subtitles in L2 and audio in L1, and c) with both subtitles and sound in the same language, called captions (Sydorenko, 2010). In the current research project, captions have been used because its use is advised in second and foreign language classrooms and subtitles are recommended with very difficult materials (Danan, 2004).

When watching a video, something that needs to be taken into account is the individual strategies of learners. Danan (2004) compared the limitations and benefits of multimedia materials and of the strategies used by students. She concluded that students need to be taught strategies in order for captions to be significantly useful in listening comprehension. In some European countries, watching subtitled or captioned videos is more usual than in our context, Spain, and so it should be taken into account in that our participants, Spanish students, are probably not used to watching audiovisual materials with subtitles or captions and that they have neither been taught relevant strategies.

2.2 English for Specific Purposes

Previous research on the topic has suggested that students were more likely to understand concepts related to their field of knowledge if specialist language and terminology were accurately incorporated into their vocabulary (Woodward-Kron, 2008). Moreover, Laufer (1989, 1992) concluded that learners who were able to recognize more than 95 % of the words in a text were able to reach a high level of comprehension of that text. Thus, learners who master specific vocabulary in their discipline are more capable of understanding textbooks, papers and lectures on their academic specialty (Rusanganwa, 2012).

Hyland and Tse (2007) also supported the value of specific vocabulary and stated that learners needed to have specialized discourse competencies that would let them participate as group members in a classroom and succeed in their studies. The importance of acquiring specific vocabulary in specialized areas of knowledge was the main reason to carry out the current research that tries to investigate how different combinations of input affect the acquisition of specific vocabulary related to their field. This is an area that has received no attention and if students are to be helped to acquire such vocabulary, it would be useful to know the most effective way of presenting multimedia material with this aim.

2.3 Learners' attention to input modality

The last line of research that informed this study is learners' attention to input modality. Previous research on this topic has shown that vocabulary learning increased when a video was presented with both audio and captions. However, teachers concern is that learners may not attend to the audio when they have the possibility of reading captions (Borras & Lafayette, 1994). The reason for this is that their attention is divided among three types of stimuli: visual images, print and audio. Thus, they have to attend selectively (Robinson, 2003; Wickens, 2007) or paying attention to the three modalities may lead to a cognitive overload.

And thus, redundant material, as the redundancy principle of the cognitive load theory assumes, slows down information processing and learning (Sweller, 2005). This was confirmed by Mayer, Heiser and Lonn (2001) who carried out a study with native speakers of English and concluded that captions were distracting when watching a video with audio due to the fact that they gave the same information. Consequently, according to the cognitive load theory, a video without captions should be easier to process than a video

with captions. However, the same seems not to be true when it comes to second or foreign language learners. Several studies have proved that the inclusion of three types of stimuli (audio, captions and image) displays better vocabulary acquisition results (Guillory, 1998; Markham, 1993, 2001).

The current study tries to find out whether this applies when the video is related to ESP and, thus, it will analyze if students pay more attention to any of the input modalities. This project also tries to find out if there is any effect of audio, visual images and captions in different combinations on the acquisition of specific vocabulary. As to the way to test the effectiveness of these modalities for vocabulary acquisition, according to Nation (2001) tests on vocabulary acquisition have been classified as tests focusing on recognition of form, on recall of form and on recall of meaning (L2 to L1 translation). In this project, the tests used have focused on recall of meaning.

3. Research Questions

This project aimed at illustrating the following research questions:

- ✓ Does input modality affect the acquisition of vocabulary for specific purposes?
- ✓ What input modality do learners attend to when watching videos: captions, image or audio?

4. Method

The goal of this research project is to find out if the overall learning of specific vocabulary is affected by the input modality and if students pay more attention to any of the three input modalities (captions, image and sound). It is a partial replication of a former study carried out by Sydorenko (2010). In her research, Sydorenko examined the effect of input modality (video, audio and captions) on (a) the learning of written and aural word forms, (b) overall vocabulary gains, (c) attention to input, and (d) vocabulary learning strategies of beginning L2 learners. Pedagogical implications of the study were that captioned video tended "to aid recognition of written word forms and the learning of word meaning, while non-captioned video tended to improve listening comprehension as it facilitated recognition of aural word forms" (Sydorenko, 2010, p. 50).

The research was carried out in Salesianos School in Pamplona. The school is semi-private and managed by the Salesianos religious community, but it also receives public funds. The school offers Secondary Compulsory Education, Bachillerato and Vocational Training, but it has always placed special emphasis on facilitating social inclusion and working incorporations through its Vocational Training Programs.

4.1 Participants

The participants who took part in the study were 33 English as a Foreign Language learners from two Vocational Training Programs learning ESP. 17 students were studying the Mechanical Product Programming Course (group 1) and 16 the Mechanical Product Design Program (group 2).

The age range of the participants was from 18 to 50, though the majority was between 18 and 26. Their mother tongue was Spanish, except for two of them who were Basque-Spanish bilinguals. 24 of them had done their previous studies in Spanish, five of them in Basque and four of them in both languages. Eight of the subjects had also studied French as a Foreign Language.

Before entering the Vocational Training Program in Salesianos, 19 of them had studied Bachillerato, 11 of them had done a Vocational Training Program of a lower level, and 3 of them had university degrees.

Regarding their English proficiency level, 29 students had started learning English at school, three of them at high school and one of them after secondary education. Their level of English ranged from an A1 to a B2 according to the *Common European Framework of Reference for Languages*. Students were also asked how long they had been without studying English; 19 of them had not studied English for a year, three of them for two years, two of them for three years and nine of them for longer than three years.

4.2 Instruments for data collection

Five instruments were used in this project. The first instrument was an initial survey to collect students' background data. This survey had ten questions and enquired about their age, about their proficiency of English, about the time they had been without studying English, about whether they spoke another foreign language and about their previous studies.

The second was a vocabulary pre-test (see APPENDIX 1) with thirty three words or expressions from the three videos which were going to be used. The pre-test contained eleven words from each of the video tutorials. Words in the pre-test were presented in the same order in which they would appear on the video. The pupils had to translate the meaning of the words or expressions or explain them in their own words. This test's goal was to collect the words or expressions unknown to all the students in order to prepare a post-test for each video with those unknown words.

The third instrument was a vocabulary post-test for each of the videos watched (see APPENDIX 2). These tests had been created with the unknown words extracted from the pre-test, and contained five words each. Words were presented in the same order in which they appeared on the videos.

The fourth instrument was a final survey, which contained six questions aimed at enquiring how students had attended to input while watching the videos.

The final instrument (see APPENDIX 3) used to collect data was a delayed post-test which contained the words from the three post-tests. Words in the delayed post-test were divided in three groups (five for each video) and they were presented in the same order as they had been presented in the immediate post-tests. This was a surprise test so that students could not prepare for it and thus, delayed recall could be measured.

4.3   Procedure

The study was carried out in four sessions during the months of March and April 2014.

Session 1:

In the first session, students were given the initial survey to get information about their academic background. Students were also given the specific vocabulary pre-test with words or expressions from the three videos. This pre-test aimed at checking for unknown vocabulary to create the three post-tests (one for each video).

Session 2:

In this session, the procedure was different for each group. The Mechanical Product Design group (group 2) watched first a video of a milling machine (AI) and completed the corresponding post-test. Then, they watched a lathe tutorial video (CI) and completed the post-test of that video.

The Mechanical Product Programming group (group 1) watched first the video of the lathe (CI) and completed the post-test. And second, they watched the tutorial of the milling machine (AI) and completed the corresponding post-test.

The students watched the videos in different order so that any possible effect of the position in which the video was watched could be ruled out.

Session 3:

Students of both groups watched the video of the grinding machine tutorial, which had audio, captions and image (ACI) and completed the corresponding post-test. After that, they answered the final survey that aimed at answering the second research question: What input modality do learners attend to when watching videos: captions, image or audio?

Session 4:

On the last session, students did a delayed post-test that they had not been told about so that they could not prepare for it. The goal of this delayed post-test was to know how many of the words they could still recall one week later.

5. Results

5.1. *Does input modality affect the acquisition of vocabulary for specific purposes?*

Results from the three immediate post-tests and from the delayed post-test have been compiled in order to analyze them and answer the first research question (see Fig. 1).
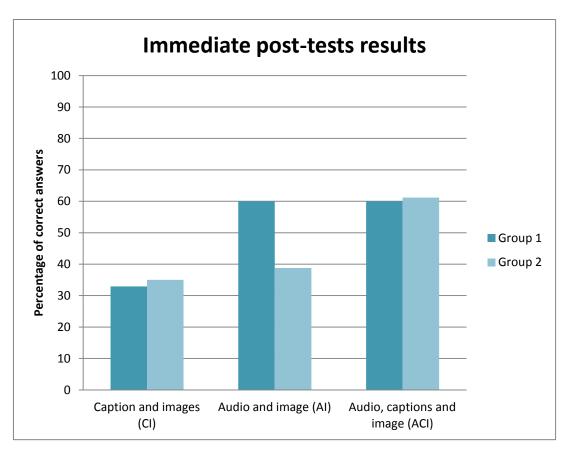
Immediate post-tests results

Fig. 1. Immediate post-test results

Group 1 performed equally in the milling machine video (AI) post test and in the grinding machine (ACI) immediate posttest. They translated correctly 60% of the words or expressions in both post-tests. However, the percentage of correct translations in the lathe video (CI) post-test was significantly lower, only 32.9% of the words or expressions translated were correct.

Group 2 performed the best in the grinding machine video (ACI) post-test; they translated correctly 61.2% of the words or expressions. They performed slightly better in the milling machine video (AI) post test than in the lathe video (CI) post test; 38.8 and 35 were the percentages of correct translations respectively.

Group 1 did the post-test of the AI video better than the post-test of the CI video. Group 2 also performed better on the AI video post-test than on the CI video post-test. Consequently, as both groups performed better on the test of the video with audio than on the test of the video with captions, we must conclude that videos including audio and images are better for immediate recall of vocabulary than videos with captions and images.

Group 1 maintained the results from the second video they watched to the third video, so immediate recall of vocabulary was maintained with a video incorporating captions, audio and images. However, group 2 slightly outperformed group 1 in the ACI post-test (61.2% and 60% respectively) and their results improved from the second video post-test (AI) to the third video post-test (35% and 61.2%).

According to our results, the type of input did not affect to the same extent both groups' results. For group 1, both AI and ACI were better than the first kind of input (CI) and their results in the post-tests of both kinds of input were the same. However, for group 2 the best input was clearly ACI as there was a big improvement (22.4%) from the AI video to the ACI video. This difference between the results of both groups allows us to conclude first that although the best kind of input seems to be ACI for both groups, AI is equally beneficial for group 1. The fact that AI is not equally good for both groups may be attributed to the different learning styles of students and the only conclusion that can be reached is that input modality does not seem to affect equally the results in the short-term and it does not affect all students in the same way. However, further research is needed to confirm this trend.

Although previous research has postulated that the use of captions facilitates vocabulary acquisition, this study does not confirm that the same happens with ESP vocabulary acquisition. In fact, when using captions only with images and with no sound both groups showed the worst results. Apparently, the use of captions is only effective when combined with sounds and images in our population.

The delayed post-test (see Fig. 2) was done a week after the students watched the last video and its goal was to know how many of the words or expressions learners recalled from each of the videos. The results showed that group 1 recalled 37.65% of the words or expression from the CI video, 56.47% from the AI and 42.35% from the ACI video. Group 2 recalled 33.75% of the words or expressions from the CI video, 38.75% from the AI and 37.50% from the ACI video.
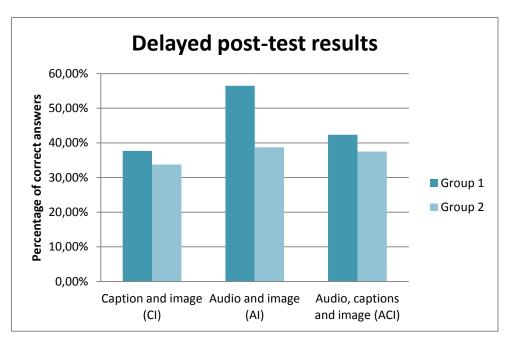
Fig. 2. Delayed post-test results

Independently of how they had performed in the immediate post-tests, the delayed post-tests results showed that the worst performance was in the CI video followed by the ACI video and the AI video, which was the video from which students recalled the most words in this post-test.

In group 1, there was a big difference (14.12%) between the results from the AI video and the ACI video and the difference was even greater (18.82%) between the scores from the CI video to the AI video. In group 2, the difference between their performance in the ACI video and the AI video was smaller (1.25%) than between both of these videos and the CI (5%) video.

These results confirmed partially previous research stating that bimodal presentation (visual and aural) benefits the learning of new words, students performed better in the ACI video than in the CI video (42.35% and 37.5% versus 37.65% and 33.75%). However, our results did not confirm previous research stating that ACI input is better than AI (Winke, Gass & Sydorenko, 2010). In fact, in this research, the AI allowed students to recall slightly more words (56.47% and 38.75) than the ACI video (42.35% and 37.5%).

Consequently, the answer to the first question is that input modality does not affect the acquisition of vocabulary in the same way for all students. Individual learning styles and strategies may be factors that need to be taken into account.

Pedagogical implications of the study are that even if previous research has shown that videos with captions, image and audio facilitate acquisition of vocabulary, and the same seems to happen in ESP even if in one of the groups AI is equally beneficial, recall is not maintained in time. After a week, recall of vocabulary taught using videos with captions, image and audio has decreased and videos with audio obtain better recall scores than the video without audio. In the long term, audio and image seems to be the best kind of input for vocabulary acquisition in ESP. This supports previous research with native speakers stating that captions may be distracting (Mayer, Hiser & Lonn, 2001) and it might indicate that the kind of vocabulary is a factor which should be taken into account.

5.2 What input modality do learners attend to when watching videos: captions, image or audio?

With regard to the second research question, results have been taken from the final survey that students completed after watching the three videos.

In group 1, 70.58% of students answered that they found watching videos in English helpful to learn specific vocabulary, 17.64% did not find them helpful and 11.76% did not answer that question. In group 2, fewer students (68.75%) found helpful watching videos in English to learn specific vocabulary, and more students (25%) did not find it helpful, 6.25% did not answer the question.

A high percentage of students (70.58% in group 1 and 68.75 in group 2) found watching audiovisual material helpful to learn ESP vocabulary. This is in line with the immediate and the delayed post-tests where results showed that using audiovisual materials was beneficial for students. However, there is a difference in the number of students who found watching videos helpful in both groups (more students in group 1 than in group 2) and this difference in the perception of helpfulness was corroborated by the results in the immediate and delayed post-tests, as group 1 performed better than group 2.

The final survey also enquired about what input modality students perceived they have paid more attention to. Results have been compiled in total and group by group (see Table 1).

The mean showed that students perceived that they had been paying more attention to visual images (3.70) than to sound (3.67) or captions (3.64). However, there was a difference in the perceptions of both groups. While the means in group 1 indicated that students perceived that they had been paying more attention to the sound (4.06) than to captions (3.82) or visual images (3.53), the students in group 2 perceived that they had been paying more attention to visual images (3.88) than to captions (3.44) or sound (3.25).

Table 1. Means of the survey

	Group 1	Group 2	Both groups
When watching the videos, I was listening to the sound	4.06	3.25	3.67
When watching the videos, I was reading the captions	3.82	3.44	3.64
When watching the videos, I was paying attention to the visual images	3.53	3.88	3.70

These perceptions of students were not completely in line with the results in the immediate post-tests. The perceptions of students from group 1 coincided with their results in the immediate post-tests. They expressed that audio had been more helpful than captions and they also had a better performance in the AI (60%) video post-test than in the CI (32.9) video post-test. Group 2 expressed that they had been paying more attention to captions than to sound, but they got better scores on the AI (38.8%) video post-test than on the CI (35%) video post-test, which indicates that audio helped them more than captions.

The delayed post-tests results showed the same, both groups performed better in the AI video delayed post-test (56.47% and 38.75%) than in the CI (37.65% and 38.75%) video delayed post-test. As it had happened in the immediate post-test, group 1 students' perception coincided with the delayed post-test results, they obtained better scores on the video with audio and they also found more helpful listening to the audio than reading the captions. However, group 2 perception did not coincide with the delayed post-test results either. They reported having captions as more helpful but they obtained better scores on the video with audio than on the video with captions. This misperception may be attributed to the fact that people usually feel more anxious about listening than about reading.

Another question of the final survey asked students what input modality they thought had been more helpful to understand the videos. Table 2 shows the results that were compiled.

Concerning this question about what input modality students perceived that had been more helpful, means indicated that the most helpful for both groups were visual images (4.15), followed by captions (3.54) and audio (2.75). In group 1, ratings were in the same order, the most helpful were visual images (4.05) followed by captions (3.58) and audio (2.64). In group 2 means showed that the most helpful were also visual images (4.25) followed by captions (3.5) and audio (2.87).

Table 2. Means of the survey.

	Group 1	Group 2	Both groups
The captions helped me to understand the videos	3.58	3.5	3.54
The audio helped me to understand the videos	2.64	2.87	2.75
The visual images helped me to understand the videos	4.05	4.25	4.15

Although ratings varied a little from one group to the other, results about what input modality was more helpful for students coincided in both groups. Students agreed that visual images were the most helpful, followed by captions and audio.

These results coincided partially with the above chart results. Group 1 perceived that they were paying more attention to sound but they found visual images more helpful, while group 2 perceived that they had been paying more attention to visual images than to captions or sound and they also found them more helpful.

Students of both groups found more helpful having captions than listening to the audio. Nevertheless, they performed much better on the AI video than on the CI video, both on the immediate post-tests (60% and 38.8% versus 32.9% and 35%) and on the delayed post-test (42.35% and 37.5% versus 37.65% and 33.75%).

Students of both groups were asked about the most difficult things when watching the videos and the majority of them affirmed that the most difficult thing was paying attention to the images while they were reading the captions. Many of them also remarked that it was hard for them to understand the audio because the speakers speed was too high. Finally, some of them said that they had not been able to read the captions because they were too fast.

The last question of the survey enquired about what would have helped students understand the videos better. The vast majority of students suggested that they would have understood much better if the speakers had talked at a slower pace. Some of the students also affirmed that having the subtitles in Spanish or watching the video more than once would have helped them very much.

The conclusion that can be reached is that visual images are clearly helpful for students. Apart from that, even if they perceived that captions were helpful they also knew that it is hard to read them at the same time that they watch the images. Thus, listening to the sound provided better results on vocabulary acquisition than reading the captions due to the difficulty of paying attention to three different input sources at the same time.

6. Conclusion

This study confirmed previous research stating that audiovisual materials are motivating for foreign language learners. A high percentage of learners, 70.58% of the students in group 1 and 68.75% in group 2, found watching videos helpful for ESP vocabulary learning. This may be explained by Paivio's Dual Coding Theory (1986, 1991, and 2007) that claims that auditory and visual systems are interconnected. Thus, the possibility of learning increases when both systems are activated.

Researchers have postulated that visual aids help significantly comprehension in foreign language classrooms (Hazan et al., 2005, as quoted in Gonzales-Flores et al. 2012). Gonzales-Flores et al. (2012) also proved that audiovisual materials improved language comprehension and vocabulary acquisition. This study has clearly confirmed these previous investigations, since our study results confirmed that visual images were the most helpful for vocabulary recall compared to captions and audio.

Even if captioning was considered as a facilitating tool for language comprehension and vocabulary acquisition when it was first used, it must be noted that as Sydorenko (2010) claimed, captions' effect on vocabulary acquisition cannot be generalized because research on the topic has not always concluded the same. In fact, in our study, the video including only captions and images obtained the worst scores both on the immediate and on the delayed post-tests. Even though both AI and ACI input showed good results in the immediate post-tests-ACI post-test scores were the best only in group 2 immediate post-test (61.2%), while AI and ACI obtained the same score in the immediate post-tests in group 1- apparently the effect is not sustained in time. For long-term vocabulary acquisition AI seems to provide the best kind of input, as AI video post-tests results were the best in the delayed post-test for both groups.

It must be noted that CI video was clearly the least beneficial. It should be pointed out that, as it has been explained above, there were differences in the results from one group to the other and there were also differences in the scores inside each group. Thus, further research should analyze the effect of individual learning styles and strategies on vocabulary acquisition using different modalities of input.

The Cognitive overload theory may have also affected results, since students' attention may have been divided among different types of stimuli. Thus, their selective attention may have led to a cognitive overload (Robinson, 2003; Wickens, 2007). Mayer, Heiser and Lonn (2001) concluded in their study that captions were distracting when watching a video with audio due to the fact that they give the same information. This study was carried out with native speakers and researches stated that the same did not seem to be true with foreign language learners. However, this study has shown that captions may also be distracting for ESP learners, although results must be further confirmed to be generalizable. Consequently, further research is needed to continue investigating how ESP learners process captioned videos.

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APPENDIXES

APPENDIX 1 – SPECIFIC VOCABULARY PRE-TEST

Do you know the meaning of these words or expressions?
Translate them or try to define them in your own words.

Lathe

Steel tools

Turning operation

Cutting edge

Steel shank

Cemented carbide

To be unclampled

Outer edge

Headstock

Blade

Sharp tool

Milling machine

Rotating cutter

Axis of movement

Manually operated

Drilling operation

Vertical machining center

Spindle

Milling head

Linear motion guides

Lead screw

Ball screw

Grinding machine

Flat surface

Grinding wheel

Handle

Spinning

Training wheels

Iron block

Handbill

Magnetic chuck

Wire

Outlet

APPENDIX 2 – SPECIFIC VOCABULARY POST-TESTS[1]

Do you know the meaning of these words or expressions?
Translate them or try to define them in your own words.

MILLING MACHINE

Rotating cutter

Spindle

Linear motion guides

Lead screw

Ball screw

LATHE

Turning operation

Steel shank

To be unclamped

Cemented carbide

Outer edge

GRINDING MACHINE

Flat surface

Spinning

Training wheels

Handbill

Magnetic chuck

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[1] Lathe and milling machine post-tests were presented on the second session in different order for each group and grinding machine post-test was presented on the third session.

APPENDIX 3 – SPECIFIC VOCABULARY DELAYED POST-TEST

Do you know the meaning of these words or expressions?
Translate them or try to define them in your own words.

Rotating cutter

Spindle

Linear motion guides

Lead screw

Ball screw

Turning operation

Steel shank

To be unclamped

Cemented carbide

Outer edge

Flat surface

Spinning

Training wheels

Handbill

Magnetic chuck