

USING COGNITIVE MAPPING TECHNIQUES TO TEACH ENGLISH AT UNIVERSITY

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Abstract – In an increasingly globalised and technology-driven world, cognitive tools have proven extremely successful in learning. As far as English language learning is concerned, cognitive mapping techniques can facilitate comprehension, encourage critical thinking and help learners to retain information. This work is aimed at showing how cognitive mapping techniques can be applied to English language teaching at university by focusing on the potential benefits of using several cognitive maps to teach both English grammar or general English (GE) and English for Specific Purposes (ESP). These maps can be seen as potentially successful ways of representing complex and/or dense information and, as such, they are recognised as valuable educational and visualisation tools, which assist students in organising, sharing and representing knowledge. The aim of this work is to evaluate whether the use of cognitive maps can help to improve the quality of English language teaching at University. This paper provides a case study of an English course taught to Italian university students of dentistry in their first year and highly significant differences were found and evaluated between the control group and the experimental group. This experimental study represents part of a larger, ongoing research project on the validity and feasibility of using cognitive mapping techniques as a means of enhancing students’ English language learning and information retention and recall.

Keywords: Cognitive maps; English grammar; ESP; English language learning; University language teaching.

1. Introduction

Thanks to new discoveries in the field of neuroscience, cognitive neuroscience, psychology, cognitive psychology and their related branches, language teaching may positively benefit from new and challenging methodologies that aim to enhance learning. The potential of using brain-based research to inform teaching practices is invaluable for a more complete understanding of students’ needs and to help them to improve their learning skills and strategies. Research in neuroscience has led to an increased understanding of the neural mechanisms underlying both cognition and behaviour, whereas cognitive neuroscience has contributed to the growing interest in the relevance of neuroscience to the field of education in a variety of ways by introducing different theories and methodologies which are implemented in the teaching field. An interesting claim, for instance, coming from the above-mentioned fields, is that making connections between new material and older known information helps learners to better retain it. Furthermore, the more connections a learner makes to the new material, the better the information is retained. Results and findings in neurological research and cognitive psychology are increasingly being brought into didactics.

In an increasingly multilingual world, it is quite complex and challenging to engage students in their learning, especially at university and it is fundamental to find new ways and approaches or methodologies to capture their attention. Among the most useful instructional tools, in this respect, one can mention cognitive mapping techniques. Such maps are powerful visual-mapping strategies that can be used to organise, communicate

and retain knowledge. They can help learners to lay out complex ideas and cognitive processes and recognize patterns and relationships, thus enhancing learning and memory. Cognitive map is an umbrella term for all visual representations of mental models and this term includes mind maps, knowledge maps and concept maps, among others. The term *cognitive map* will be used throughout the text to include different types of mapping.

2. Cognitive mapping

In the field of psychology, the term “cognitive map” was developed by Tolman in 1948 to refer to an individual’s internal mental representation of the concepts and relations among concepts. Cognitive maps are, therefore, described as “internally represented schemas or mental models for particular problem-solving domains that are learned and encoded as a result of an individual’s interaction with their environment” (Swan 1997, p. 188).

They allow us to present complex information in a visually clear and comprehensible way and, as such, they can be potentially successful teaching tools to store and retain information, which can more easily be recalled at a later stage (Lamb *et al.* 2014). The presentation of information in a visual format is undoubtedly perceived as being more attractive than the presentation of the same information through the text alone (Dunlap, Lowenthal 2016; Lidwell *et al.* 2010; Vande *et al.* 2010). Visual information can be presented in various ways including conceptual maps, mind maps and infographics, among others, which provide a visual and comprehensible representation of information using a combination of text and graphics (Smiciklas 2012; Sudakov *et al.* 2016). One of the main benefits of using cognitive maps in the field of education lies in their powerful potential to deliver “the maximum amount of content in the least amount of space while still being precise and clear; because they are visual presentations as opposed to oral or text presentations, they can quickly tell a story, show relationships, and reveal structure” (Dunlap, Lowenthal 2016, p. 42).

Cognitive maps can be powerful learning tools to reduce the working memory load in line with the *Cognitive Load Theory* developed by John Sweller in 1988. “Cognitive load” refers to the total amount of information that working memory can hold at one time. This means that working memory has a limited capacity and, as such, it should not be overloaded with instructional activities that do not directly contribute to learning. The use of visual elements along with text plays an important role in reducing the cognitive load, thus enhancing learning and information retention and recall.

Although cognitive mapping has been extensively researched, the use of cognitive maps for teaching languages, and more precisely languages for specific purposes (LSP) has had little empirical investigation. In the last few decades, cognitive map research in the published literature has mainly focused on the use of these maps in the sciences as effective tools for knowledge organisation, clarification and retention (La Vecchia, Pedroni 2007; Nesbit, Adesope 2006; Rice *et al.* 1998).

Cognitive mapping is a notion grounded in Ausubel’s *Assimilation Theory of Learning* developed in the early 1960s. According to this theory, there is a hierarchical organisation of knowledge and new information can be subsumed or incorporated into the existing hierarchy already present in the learner. According to Ausubel, learners’ prior knowledge increases the retention of new knowledge, thus implying that if they lack this kind of knowledge, they find it hard to make connections with the new material and, as a result, they are likely to forget it as it is meaningless to them. Therefore, Ausubel introduced the notion of ‘advance organisers’ that are pedagogical tools aimed

at facilitating learning and the retention of new, unfamiliar material. These advance organisers have a double function as they initially activate those concepts already present in the learner's cognitive structure and blend them with the organiser in order to make the new material more familiar and meaningful to the learner and, then, they act as anchors aimed at integrating and retaining the information.

Ausubel's work has influenced many different studies in education and one of the most important contributions in this respect was the development of concept maps by Novak *et al.* (1983) during their research aimed at following and understanding changes in junior high school science students' knowledge. According to their study, the correct use of these graphic organisers enables learners to better organise their thoughts.

Many studies have been devoted to different uses of cognitive maps in order to determine their potential advantages and benefits within the field of education. Nesbit and Adesope (2006) explored how the use of these maps was associated with increased knowledge retention and they claimed that "[a]cross educational levels, subject areas, and settings, it was found that studying concept or knowledge maps is somewhat more effective for retaining knowledge than studying text passages, lists, and outlines" (Nesbit, Adesope 2006, p. 434). Other scholars explored the benefits of using cognitive maps as a form of instructional diagrams to enhance learning of low-ability students, especially those with low verbal activity (Holliday *et al.* 1977; Moyer *et al.* 1984; Stensvold, Wilson 1990). Several studies showed that students' creation of concept maps representing their understanding is associated with improved learning and critical thinking (Bramwell-Lalor, Rainford 2014; Lee *et al.* 2013; Novak *et al.* 1983; Wu *et al.* 2012). Furthermore, many other studies showed how student participation in cognitive mapping activities is associated with improved writing (Anderson-Inman, Horney 1996; Brodney *et al.* 1999; Cliburn 1990; Dowd *et al.* 2015; Gouli *et al.* 2003; Hart 1990; Hyerle 1995; Reynolds, Osman-Jouchoux 1997). Although most of these works were conducted in the scientific fields of education, there is also an important research study that explored cognitive maps as productive interventions to improve critical thinking when reading and learning a second language (Khodadady, Ghanizadeh 2011).

Since cognitive maps have been mainly used and explored in the educational field of science, this work supports the hypothesis that they could also be used and fully exploited in the field of language teaching both to increase motivation and active participation and as good pedagogical tools for information retention and recall.

3. Methodology

In this paper I report on an experimental study on the use of cognitive maps to teach both English grammar and ESP that was conducted at the Italian university of Ferrara by involving 30 first-year students of dentistry in the second semester of the 2019-2020 academic year. Students were divided into two main groups, namely the control group (C group) and the experimental group (E group).

English for dentistry is a 96-hour course that runs twice a week and each lecture lasts three academic hours. The course is aimed at improving those language skills needed to communicate effectively in workplace settings. The focus is on the consolidation of reading, writing, speaking and listening skills in professional communication to allow students to understand the gist as well as the lexico-grammatical and syntactic features of a number of texts belonging to the field of dentistry. Through lectures and class exercises in English, the course provides students with a balanced knowledge of oral and written

comprehension. The course was divided into two main parts: 48 hours were devoted to general English with a special focus on grammar whereas the remaining 48 hours were dedicated to English for dentistry.

Students were divided into two groups: 15 students were placed in the control group (C group) and the remaining 15 in the experimental group (E group). The C group attended a more traditional course consisting of English grammar at B2 level and specialised English for dentistry through two textbooks whereas the E group was offered a different course consisting of the same programme with the same textbooks but they were provided with additional cognitive maps for both general English and ESP. Learners in both groups shared some common elements, that is: 1) same professor, 2) same textbooks, 3) same syllabus, 4) same number of lecture and seminar hours, 5) same lecture formats (PPT) and 6) same level of proficiency.¹

The aim of this experimental study is to assess whether the inclusion of cognitive maps, as an extra input, can prove successful in increasing motivation, participation and learning, thus allowing to improve English language teaching at university.

Evaluation of the course was based on the following criteria:

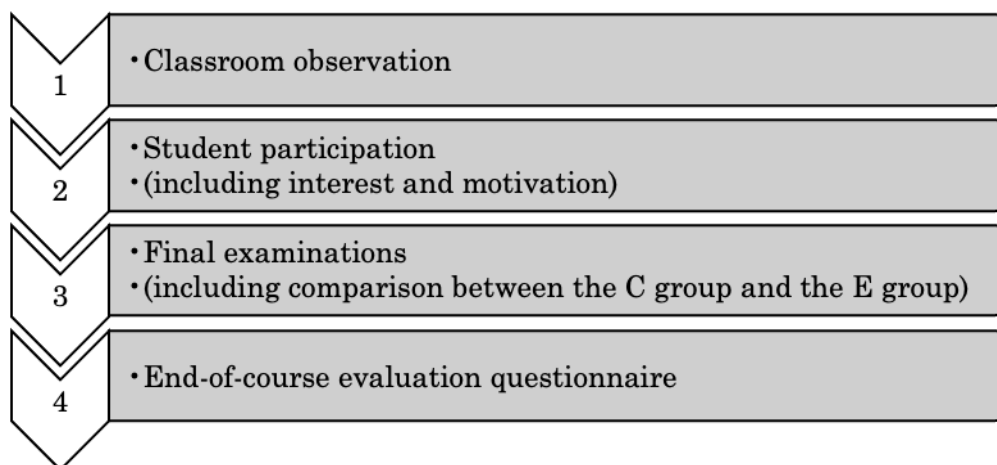


Figure 1
Course evaluation criteria.

The textbooks chosen for this course were:

- 1) *English Grammar in Use*, 4th edition, Raymond Murphy, Cambridge University Press.
- 2) *Smile! The English You Need as a Dental Professional*, Georgia Lauzi and Natalie Buchan Tomarchio, Franco Lucisano Editore.

The cognitive maps used for the grammar lessons were taken from *Cognitive English Grammar* by Vanessa Leonardi (2012) whereas the cognitive maps used for the specialised English part were taken from the teacher's online resources provided along with the *Smile* textbook mentioned above.

¹ In their first semester, further to a compulsory placement English test, students were asked to take a preparation course (corso di potenziamento B1) at the University Language Centre (CLA) to reach and align to the proficiency level required to follow the official English for dentistry course running in the second semester, that is B1.

3.1. Practical Application: English Grammar Cognitive Maps

Teaching grammar has always been a controversial issue as some people consider it essential to foreign language teaching whereas others view it as an impediment. Several different methods and approaches can be used to teach grammar, which is considered particularly challenging and difficult for both native and non-native speakers worldwide and, throughout the years, many different methodologies have been implemented. Memorisation-based techniques, which heavily relied upon repetition slowly gave way to more creative methods. Deductive and inductive approaches are the most commonly used and applied methods in foreign language teaching and they both have advantages and disadvantages. Deductive approaches to language teaching involve teaching rules and any other specific information about the language first and then students are asked to apply these rules when they use language through different exercises. This approach is directly opposite to the inductive method where students are not taught rules at the beginning of the class but they are encouraged to discover (or induce) them directly from either their use of language or through the exercises provided. Nevertheless, determining the advantages and disadvantages of these methods or other teaching approaches falls beyond the scope of this work.

This experimental study is based on the deductive method of teaching grammar aimed at providing instruction before practice. Students in both groups were given in-depth explanations of specific grammatical concepts and then they were asked to practise what they were taught in the theoretical lessons through a series of exercises. When showing the key to the exercises, students in both groups were asked to justify their answers and were encouraged to retrieve the grammatical rule(s) along with exceptions (if there were any) and, then, the professor drew their attention back to the theoretical part. Students in the E group, however, were also provided with some additional cognitive maps and several differences were found between the C group and the E group. First of all, participation was lower in the C group where students did not show a particular interest in either the topics taught in the theoretical part or in the exercises provided to practise grammar. No questions were asked during the grammar explanations and it was difficult to have them provide their answer to the exercises. The E group, however, was characterised by increasing motivation and active participation and regular interaction with the professor occurred as students attempted to work out the answer on the basis of their previous knowledge on the topic, thus generating interesting discussions both with the professor as well as with their peers. Both in the theoretical part as well as in the practical part of the grammar course, students in the E group showed more interest in the topics and a more active learning process was noted thanks to the inclusion of cognitive maps as an extra input.

Secondly, lack of participation eventually led to lack of motivation and students in the C group began leaving the classes earlier at times, especially during the practical lessons with the justification that they could work on the exercises alone. This was an indication that students in the C group did not consider the practical lessons important to extend their knowledge and understanding of the grammar points covered in the theoretical part. Conversely, nobody in the E group left the practical lessons earlier as they were interested in practising the grammar rules and they knew that they had the chance of taking the lead, especially in the cognitive mapping activities planned in each lesson.

In the E group, each theoretical lesson was always introduced by a cognitive map aimed at familiarizing and summarizing the main issues and rules that were then covered in the theoretical lesson. The following maps are used as illustrative examples:



Present Tenses

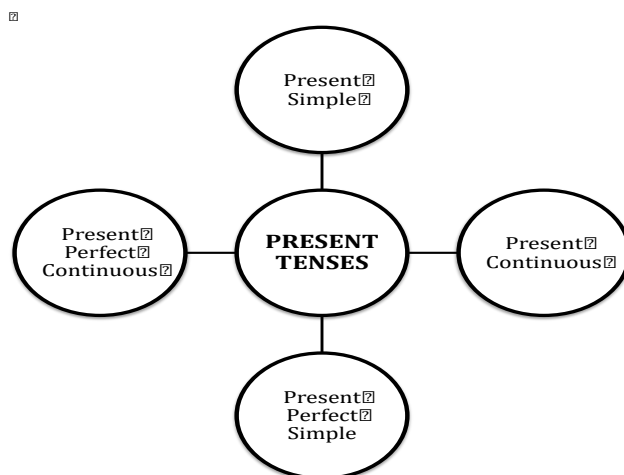


Figure 2
Present Tenses (adapted from Leonardi 2012, p. 109).

This map is fundamental to show students from the beginning that there are four main tenses in English that can be used to refer to present time situations. The reason behind this choice lies in the fact that most grammar books include the present perfect simple and the present perfect continuous in the section on past tenses. Although these two tenses can be used to express a past situation, they are also used to refer to present situations and, more precisely, they are used when people are concerned with the present effects of something that started in the past but it is still continuing in the present. This map was extremely useful to make them understand how some structures in English are translated into Italian by using a different tense, as shown below:

- *Mark has been living in Ferrara for twenty years*

This sentence tends to be often associated in Italian with a past tense. The problem lies in the fact that this construction refers to a present situation indicating that Mark started living in Ferrara twenty years ago and he is still living there. In the Italian translation, indeed, the present simple is used for this construction. These constructions were better recognised by students in the E group during the final examination and, especially, in the sentence translation exercises. It was interesting to note that if these constructions appeared in a gap-filling or multiple-choice exercise, most students in the C group were able to recognise them and write or choose the correct answer whereas in the sentence translation exercises from Italian into English or English into Italian they made more mistakes as compared to the E group. Both class exercises as well as final examination sessions revealed that most students in the C group showed a tendency to associate the present perfect simple and the present perfect continuous mainly with past references as the connection with the present time was not introduced at the beginning in their course textbook but only in unit 11 and only a brief section was devoted to this issue. Although the professor's explanation of this rule was provided in both groups, its understanding and retention had a different impact on students in these two groups. Thanks to the cognitive maps used in the E group, as also acknowledged in the evaluation questionnaire, this issue was immediately recalled by most of the students in this group during both class exercises and final examinations, thus showing better understanding and retention of the rule from the beginning until the end of the course.

Another cognitive map which proved very useful for students was the one used to introduce the future forms, as shown in figure 3 below:

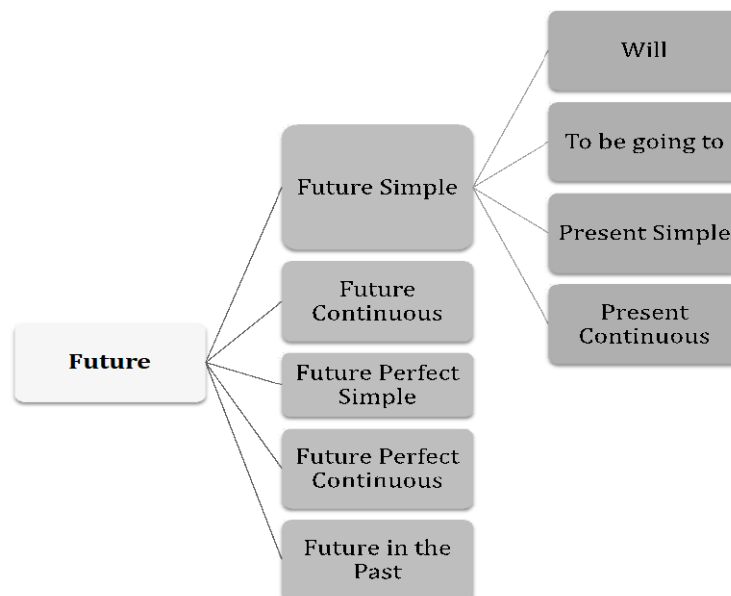


Figure 3
Future forms (adapted from Leonardi 2012, p. 129).

It may be complex for foreign students to understand the future in English as there are different forms that can be used in this respect. Furthermore, things could get considerably worse when learners are taught that two or more structures with similar meanings can be used on some specific occasions. Learners often find it challenging and confusing to have to choose an appropriate form from a variety of them and, in general, they find it harder to choose the correct form than construct it.

Italian students, in particular, may find it difficult to understand that there exist several different forms to express the future in English because in Italian there are only two forms, namely the future simple and the future perfect simple. It is therefore fundamental to show them a cognitive map that summarises in a concise way all the different forms used in English to express the future. By looking at the map, students in the E group were immediately informed that there are four different ways to express the future simple whereas in Italian there is only one tense. Then, before starting to teach the rules along with examples, students were once again reminded about the four different forms to express future simple and in order to focus their attention on this rule, another cognitive map was provided, as shown below:

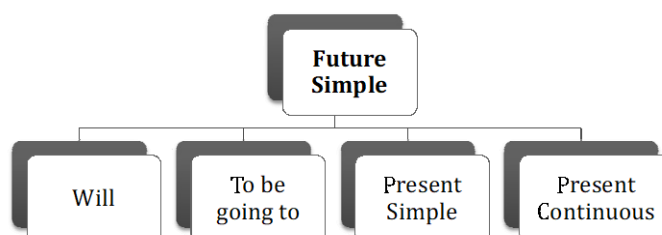


Figure 4
Future simple (adapted from Leonardi 2012, p. 130).

After showing these initial cognitive maps, the lesson proceeded through a reference to the grammar textbook used in class in order to look at the rules in more detail and let students work on a few exercises provided in it. At the end of the lesson, as a means of revision, other cognitive maps were provided in order to focus on the main differences between these forms, as shown below:

Will or to be going to?

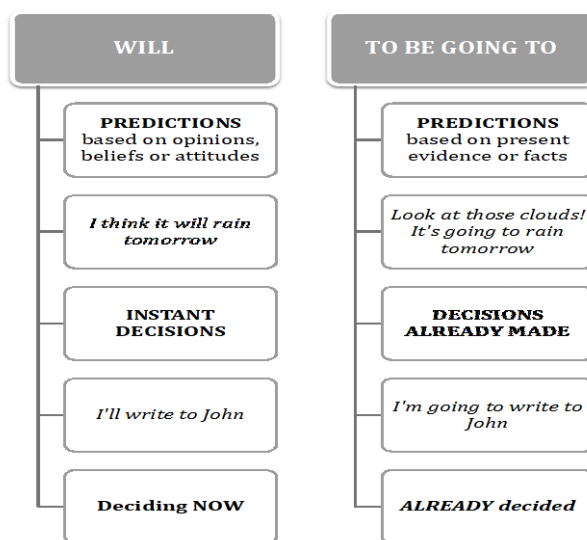


Figure 5
Comparison of structures (adapted from Leonardi 2012, p. 133).

Present simple or continuous?

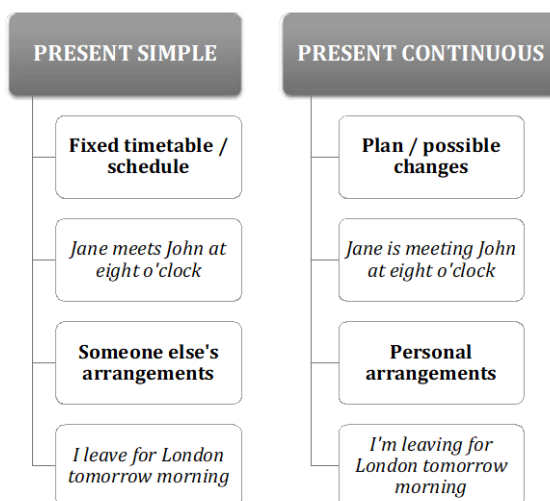


Figure 6
Comparison of structures (adapted from Leonardi 2012, p. 134).

These maps helped students in the E group to better understand how to use these different forms and tenses to express the future simple in English correctly by comparing some of the most confusing forms in this respect. The cognitive maps, which were shown at the beginning and at the end of the lessons, were provided for all the rules included in the grammar course. In the first lessons, students were provided with fully complete maps whereas as the course progressed, they were given either partially finished maps or empty

maps to complete themselves. The reason behind this choice was to test their knowledge both at the beginning (prior knowledge) and at the end of the lessons (new knowledge) as a means of revision and consolidation. These maps were also integrated with examples created by learners themselves and supervised by the professor aimed at increasing both motivation and participation in class.

One of the most significant differences found between the C group and the E group in this first part of the course, that is the grammar part, was that the more difficult the grammar topics taught, the greater lack of interest and motivation was found in the C group. Furthermore, the final test grades obtained by students in the C group were comparatively lower as compared to students in the E group.

3.2. Practical Application: Specialised English Cognitive Maps

In the second part of the course, students were introduced to English for dentistry where new scientific terms and concepts required a significant cognitive effort on their behalf to integrate new information with their existing knowledge. Instead of focusing on grammar and language structures, ESP focuses more on language in context where English is integrated into a subject matter area important to students. There are several significant differences between ESP and GE both in terms of the typology of students as well as in the typology of instruction aims. First of all, in GE all four language skills, namely speaking, listening, writing and reading, are given equal importance whereas in ESP the choice of which language skill is most suitable for learners is usually determined by the needs analysis which is considered the cornerstone of ESP as it can help to develop and further improve teaching materials and activities as well as assessment tests (Brown 1995). The purpose for learning English is, indeed, different. In ESP courses, students need to learn English in order to carry out specific job-related functions. This means that much more emphasis is laid upon language functions rather than grammar, thus integrating English in their specific subject area of interest. Therefore, students can have the opportunity to combine both the subject matter and language teaching, thus showing and applying their previous general English knowledge.

Nevertheless, as far as this experimental study is concerned, moving from GE to ESP was hard for students in both groups as the latter required a different knowledge of the language domain and was aimed at building practical language skills specific to their future profession or field (dentistry). Students, indeed, had to study new terminology and concepts which need to be acquired even in their native language. In other words, the challenging tasks of teaching English for dentistry were 1) to show differences in language use between general and specialised English, 2) to introduce new vocabulary along with definitions and in some cases translations and 3) to discuss new topics related to the language domain of dentistry. Several students in both groups highlighted the difficulties found in following this part of the course claiming that ESP was too difficult and too different from GE. In particular, these students claimed that they experienced problems in understanding specialised English because of their lack of knowledge in the Italian specialised domain.

The exercises used in class with both groups were all aimed at teaching reading comprehension and vocabulary acquisition through a wide variety of exercises including vocabulary matching, gap filling exercises and reading comprehension exercises. Translation activities were also used to get the students involved in the exercises. The only difference was that the students in the E group were provided in this case as well with additional cognitive maps in different formats and for different purposes.

When comparing the two groups, the C group showed a higher lack of interest and motivation in reading specialised texts and practising difficult vocabulary. There was low participation and almost no interaction between the professor and the students who did not feel either interested or comfortable in discussing the topics introduced and taught in the ESP lessons. In their comments written in the final questionnaire about the material used in the classroom, most students in this group complained about the difficulty in reading and understanding the text and stated that they would have preferred to have the professor translate the whole texts as a means of understanding the content in a better way.

In the E group, cognitive maps were used in the ESP lessons to perform several different functions. Students were provided with a cognitive map at the beginning of each ESP lesson aimed at introducing both new information and vocabulary to be covered in the lesson in order to enhance comprehension and a cognitive map at the end as a summary of the issues covered to allow comprehension and information recall and retention. Cognitive maps were aimed at helping students to visualise information about specific topics. Some cognitive maps were used to analyse or determine the essential features of specific materials related to dentistry. Others were used as brainstorming activities to stimulate critical thinking about the topics, developing new ideas and forming opinions with an attempt to increase participation on behalf of students. Some maps were specifically designed and/or used to allow students to compare and contrast several different issues in order to focus on similarities and differences on a wide range of topics included in the programme. Other maps were aimed at evaluating and assessing the advantages and disadvantages of using specific materials and/or techniques in dentistry. Finally, some cognitive maps were used in class to form hypotheses on specific issues and, in this particular case, students were provided with completely empty maps to be filled in with their own hypotheses.

In the first lessons, the texts were shorter and easier and they introduced students to issues related to anatomy for dentistry, which is one of the courses taught in Italian in the first semester. This previous knowledge in Italian allowed them to handle the specialised texts in English more easily and follow the lessons on the same topics previously covered in Italian. The cognitive maps were, therefore, initially provided to the students in the E group at the end of the lessons as a kind of summary activity whereas at a later stage, as the texts became longer and more complex and no previous knowledge was involved, cognitive maps served as introductory tools or advance organisers, in line with Ausubel's theory and principles, to facilitate comprehension and to make learning more meaningful for them.

The first ESP lesson, for instance, dealt with the classification and functions of human teeth. The text was short and students had already studied this topic in Italian for the anatomy for dentistry course held in their first semester. This meant that they had enough knowledge to understand the topic. Students in both groups showed a good level of information retention and recall, although the challenging task for them was to learn the equivalent terms in English. Therefore, several different activities were conducted in class through the textbook adopted for the course, such as matching terms and definitions, gap filling exercises and open questions. At the end of the lesson, the students in the E group were provided with the following cognitive map aimed at revising the text in terms of both information as well as vocabulary:

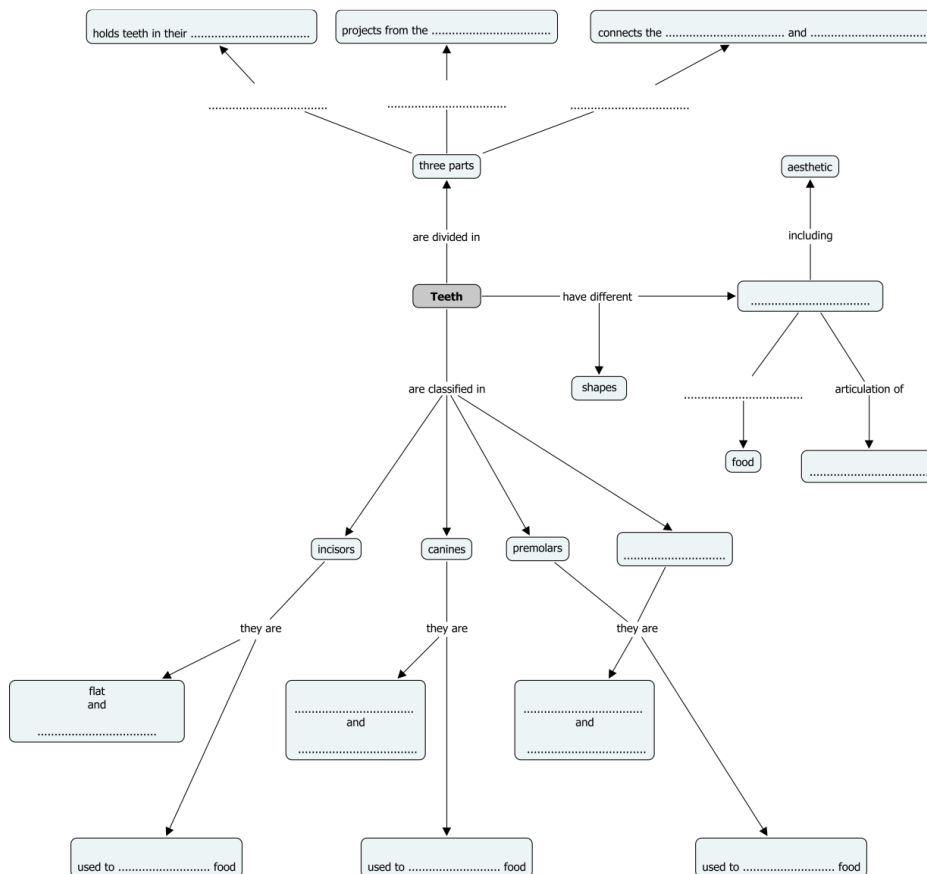


Figure 7
Cognitive map of the classification and functions of human teeth adapted from *Smile* (teacher’s online resources).

When students in the E group were shown the cognitive map above, they were asked to fill in the missing information on the basis of both their prior or past knowledge (anatomy course held in their first semester) and the ESP text provided in the lesson.

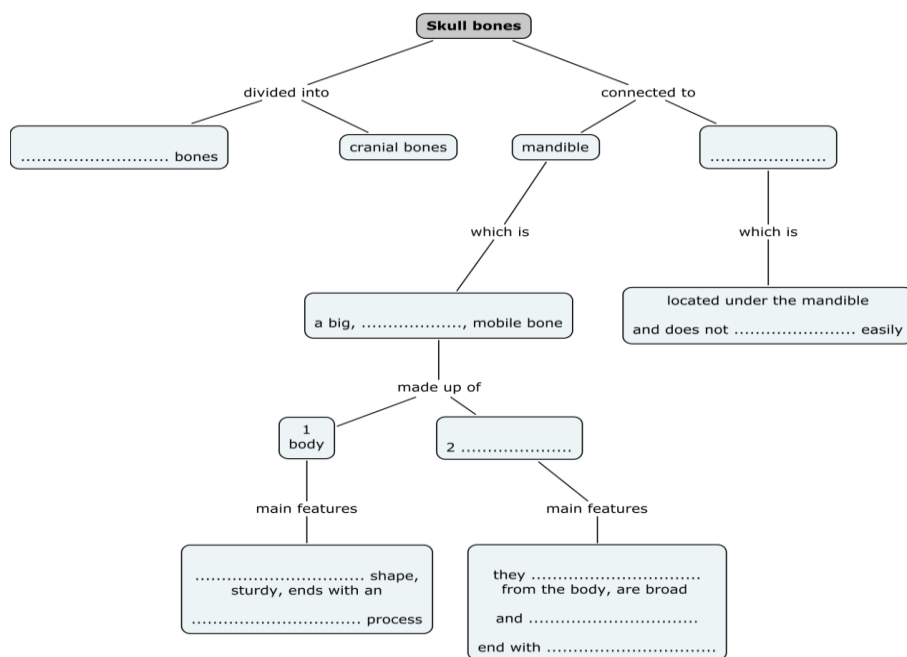


Figure 8
Cognitive map of skull bones adapted from *Smile* (teacher’s online resources).

The cognitive map above was provided in the 7th lesson of the course after reading the text dealing with the skull bones. The aim was to see whether students could fill it in easily, as they already had some previous background information on the topic in Italian, before working on reading and vocabulary exercises. It was interesting to note that it did not take too long for them to complete the map. They were all satisfied about it, as they could more easily organise the text information that eventually helped them to complete the following exercises planned for the lesson. On average, it was noted that students in the E group took less time to complete the exercises as compared to students in the C group. Through the map, indeed, they could more easily understand the type of information required and they could more easily find it in the written text whereas students in the C group took more time to find the references in the text.

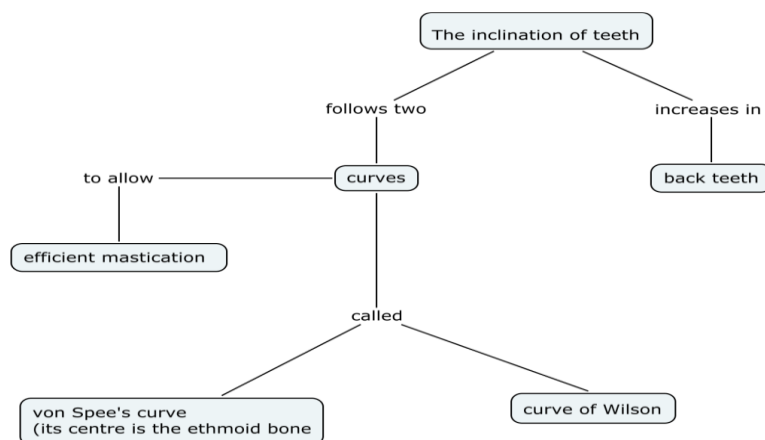


Figure 9
Cognitive map of the inclination of teeth adapted from *Smile* (teacher’s online resources).

As the course progressed, the content information became more challenging and, at times, confusing because students were not acquainted with this kind of concepts and it was necessary to provide them with some initial pre-reading activities aimed at introducing the topic and some basic terms eventually covered in the lesson. Students in the E group were also provided with a short but completely filled in cognitive map aimed at introducing the topic at the very beginning of the lesson before reading the text. This strategy allowed better reading comprehension and significant differences were, indeed, noted in the way students in both groups handled the reading comprehension exercises. Less time for completion and fewer mistakes were noted in the E group as compared to the C group. Furthermore, at the end of the lesson, students in the E group were also asked to write a summary out of this cognitive map and they were surprised to see how easy it was to summarise the text by using this map rather than retrieving information from the reading passage.

Towards the end of the course, the texts were longer and more complex and some of them included a long list of specialised and technical vocabulary which needed to be learnt and remembered. This is why, in these cases, the professor opted for providing students with more detailed and completely filled in cognitive maps to be shown at the beginning of the lessons so that students could more easily visualise these terms, such as in the cognitive map shown below:

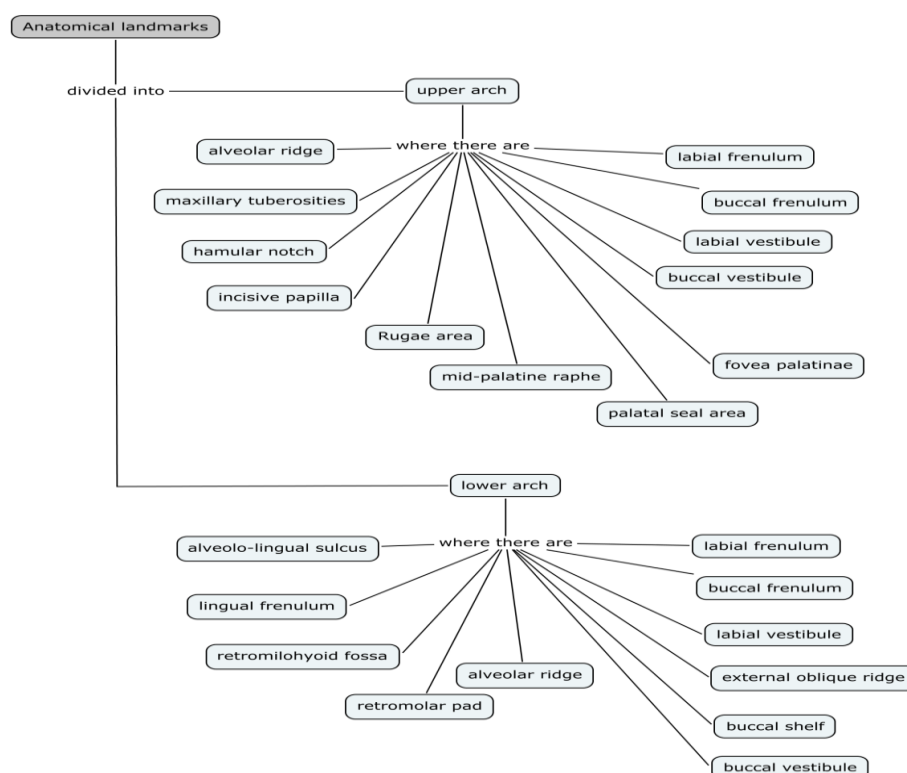


Figure 10
Cognitive map of anatomical landmarks adapted from Smile (teacher's online resources).

Highly detailed cognitive maps, such as the one above, were used from lesson 10 to lesson 16 (final lesson of the ESP course). They were shown and read aloud by the professor and served the purpose of clearly organising the text information before reading so that students could more easily locate the important terms and information within the text. As a

result, students in the E group found it easier to understand the text and it took less time for them to carry out the comprehension exercises as compared to the C group. At the end of each lesson, as usual, students were then required to write a summary out of the cognitive map shown at the beginning. These summaries proved to be beneficial tools for revision for the oral and written examinations. It is worth mentioning that students in the C group were also asked to write a final summary at the end of all the ESP lessons, although their writing style and performance greatly differed from the summaries written by students in the E group. The former, indeed, showed a tendency to copy down expressions and, at times, entire sentences directly from the reading passage instead of using their own words to paraphrase the text. This trend confirmed the studies mentioned at the beginning of this paper according to which student participation in cognitive mapping activities is associated with improved writing. Furthermore, it always took longer for students in the C group to finish their summaries as compared to students in the E group.

It is worth noting that the way these cognitive maps were designed and provided was carefully planned before the course took place. At the beginning, as students were not sure about how to create a cognitive map, they were given some cognitive maps written and prepared by their professor. The aim was to use them as a springboard to generate discussion in class in order to test past and new knowledge. As the time passed, students felt more comfortable about creating their own cognitive maps and, therefore, in the middle of the course, some activities were carefully designed as team work in which students were divided into three groups of five students each and they were asked to create a cognitive map on a given topic based on the reading passage in their textbook. At times, they were asked to complete some partially finished cognitive maps where some of the concepts were deliberately removed. On other occasions, however, especially towards the end of the course, they were asked either to fill in a completely empty cognitive map or to create a new one by themselves. Having students collaborate on developing cognitive maps was also very effective as it increased both motivation as well as active participation in class, thus shifting the focus from teacher-centred to a more student-centred lesson. Students were obviously guided through the creation of the cognitive map and they were asked to follow a series of instructions:

- 1) Selection of key terms: students were asked to scan the text and highlight keywords. They were told to keep the map as simple as possible, especially at the beginning, by selecting a list of 8 to 10 terms;
- 2) Concept sharing: Students shared their highlighted concepts with the other students in their group in order to generate a group discussion;
- 3) Creation of the map: Once they had decided which concepts had to be represented, they were asked to create their cognitive map;
- 4) Class presentation and discussion: Each group was asked to present their own version of the cognitive map along with an explanation for their choices;
- 5) Final product: on the basis of the three different maps created by the groups, a whole-class map was created where all the most important issues and concepts were merged into a single map.

Scanning the various maps created by the students in each group had the advantage of providing the professor with an idea of what students were thinking and what they judged to be important, thus helping the professor to better realise how to improve their understanding and which needs and weaknesses needed to be considered to develop meaningful teaching.

When students were asked to fill in the completely empty maps created by the

professor, which means that they had a ready-to-use template and they only needed to fill in the missing terms or concepts, some students opted for a customisation of these maps through several different ways, such as using different colour ink pens to insert the missing terms, adding translations and/or definitions close to some specific terms or concepts and inserting additional concepts taken from the reading passages.

To sum up, the experimental group achieved better results as compared to the control group in terms of grammar knowledge, specialised vocabulary acquisition and, especially, information retention and recall. All the cognitive mapping activities allowed a continuous shift from teacher-centred to student-centred lessons and the teaching was much more interactive, thus resulting in increasing motivation and active participation on behalf of students.

4. Final learner questionnaires and examinations

At the end of the course and before the final examinations took place, students in both groups were asked to fill in a questionnaire aimed at evaluating the course in terms of teaching material, teaching methodology, the professor's skills and availability as well as several other aspects concerning teaching tools and infrastructures among others.

Positive comments were collected in the E group as compared to the C group which indicated a general satisfaction with the English course (96%). The use of cognitive maps was positively evaluated and they were regarded as useful instructional tools (98%). Their usefulness lay in both the revision (90%) and consolidation (91%) of past grammar knowledge as well as in the acquisition of new grammar points (98%), which were better understood, memorised and retained at the end of the course. Positive comments were also expressed regarding the use of cognitive maps for the specialised English lessons where students found it easier to summarise the content of the articles read in class (100%) and to remember and retain specialised vocabulary (98%). Cognitive maps contributed to increased motivation and more active participation in class (91%) as compared to the C group where students did not show much interest or motivation (39%), thus avoiding any interaction or active participation (64%).

To sum up, students' evaluation of the programme and its material showed that the cognitive maps were identified as being very useful and interesting instructional tools, which allowed a better understanding of both content and grammar as well as a powerful way to recall information and examples quickly when revising and sitting the examinations.

At the end of the academic year, students in both groups took both an oral as well as a written examination in order to assess their learning and determine whether they were able to retrieve older information and lexis learnt at the beginning of the year. The tests were exactly the same for both groups. The data collected from these tests in both groups were compared and analysed to see which teaching method had been more productive. Significant differences were noted between the C group and the E group. The latter obtained higher grades as compared to the former both in the oral as well as in the written examinations and it was remarkable to see how it took less time for students in the E group to recall and retrieve both vocabulary and content information during the oral examinations. Students in the C group had to be encouraged or helped in recalling some specific vocabulary or information about the topics and in some cases, it was necessary to clearly open the book and show them the text or unit the exam questions were referring to. This was a clear indication of the fact that their memory could not perform as efficiently

as in the case of the students in the E group. The exercises included in the written examinations had the same format as the ones used in class to ensure the reliability of the test. More mistakes were found in the written tests administered in the C group and, at times, not all the questions included in the written texts were answered leaving some exercises unfinished.

5. Concluding Remarks

It has now been 70 years since Tolman first introduced the notion of the cognitive map and the growing number of publications dedicated to this issue undoubtedly shows how their use in many different fields of education is increasing, especially in the scientific fields. The use of cognitive maps in education is aimed at helping learners to develop meaningful learning, critical thinking and problem-solving skills. As acknowledged in this study, meaningful learning is achieved when learners are able to make associations between new and previous knowledge, thus developing more integrated cognitive knowledge structures and this can be done by using cognitive mapping techniques.

This study explored, through an empirical analysis, what can be the potential benefits of using cognitive maps to teach English at university. This experimental study showed that using cognitive maps to either introduce new information or recall and revise past knowledge helps students to retain this kind of information for longer as compared to traditional study habits, such as repetition and re-reading.

The use of cognitive maps in the E group revealed several benefits in the way it improved student motivation, participation, engagement, achievement and memory and it also increased lesson interactivity, thus leading to general learning improvement and satisfaction. Furthermore, significant differences were also observed in information recall and retention both during lectures and during examinations, thus enabling students in the E group to achieve higher scores in their final assessment. Cognitive maps allowed students to identify connections and gain a much deeper comprehension than traditional teaching based on reading and writing activities, especially in the field of ESP. Findings also indicated that the cognitive load of students in the E group was eased by the use of cognitive maps, which allowed them to focus on crucial information and relationships within the written text and less effort was made to decode it. Cognitive maps, indeed, are a form of visual thinking and, as this experimental study proved, students were better able to remember visual representations. This study also revealed that having students collaborate on developing cognitive maps was also very effective.

To sum up, this experimental study showed that there are several benefits of using cognitive maps to teach English, both general as well as specialised English, as they can help to see relationships of ideas and concepts along with examples. Cognitive maps helped students in the E group to clarify and structure their ideas in an accurate way both from a grammar as well as from a content perspective. Cognitive maps proved to be beneficial aids in developing higher-level thinking skills involved in the creation of maps, analysis of the information and evaluation of the topic(s). These maps allowed students to both synthesise and integrate information through additional explanations, definitions, examples and even translations into Italian. Furthermore, cognitive maps made use of dual coding, that is, the students in the E group learned the material both from the text labels found on the cognitive map as well as the visual structure of the map itself.

The findings of this experimental study, as well as the limitations it suffers from,

suggest new directions for further research in this area. First of all, the assessment of one course in only one academic year does not allow to draw definitive conclusions about the benefits and efficacy of using these maps for teaching English at university level. There is also a need to conduct more analyses on larger samples and throughout several different years in order to draw more objective conclusions. Secondly, it could be interesting to carry out a larger comparison with students of the same course in different universities in Italy and, even, internationally, in order to obtain more objective results. Thirdly, more studies should be performed to focus on both the advantages as well as disadvantages of using cognitive maps to teach both general English and specialised English. Fourthly, despite the teacher's efforts and encouragement to carry out several activities in the C group, students showed a general lack of interest in the class exercises. Perhaps, as a deductive method was chosen, it is felt that an inductive approach could have been much more suitable and successful to obtain greater motivation and class participation in the C group. On the whole, however, this study found that there were no disadvantages in using cognitive maps and, conversely, there are many potential benefits involved in their use to teach English at university. This study also supports the idea that cognitive maps should be fully and continually integrated into language learning as a valuable aid in understanding learners' difficulties and to work out better teaching strategies to help them in their learning process. It is hoped that the examples and suggestions provided in this work will stimulate more and more research interests in this field.

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