Cognitive and Psychological Dimensions of Colours in Mind Maps

A Case Study of Second Year Bachelor Students at the Teachers' Training School of Constantine

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Abstract

Mind Maps are brain-friendly creative visual tools for organizing, representing and processing information. An indispensable component in Mind Maps' design is colours. So, this study investigates the cognitive and psychological impact of colours on second year students at the Department of English at the Teachers' Training School in Constantine "Assia Djabar" inspecting their attitudes towards their efficiency and feasibility in the prewriting phase. On this ground, a post-attitude questionnaire was administered to a randomly chosen sample of 25 students. A quantitative method was used and the data analysis was purely descriptive. The results revealed that the participants demonstrated an inclination to use colours in their Mind Maps for enhancing their cognitive performance (memorability, attention and focus, and creativity and imagination) and improving their psychological state (motivation, interest, stress and anxiety). They also manifested their awareness about the central role of colours in their Mind Maps' designs.

Keywords : Mind Maps; Buzan's Mind Maps ; brain- friendly ; Cognitive effects ; Psychological impacts.

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INTRODUCTION

One of the revolutionized findings in neuroanatomical research and cognitive linguistics is that human brains work out with mental maps. These are highly developed systems for information processing- storing and retrieval which consists of a set of elements (signals and symbols) and operations (Menzal and Byrne, 2008 p: 229). The signals and symbols represent the defining features and the semantic properties of the experienced world. The cognitive operations on those signals and symbols enable the brain to cipher explicit mental portrayal (i.e. representation) and to generate appropriate physical and non-physical responses. Therefore, human cognitive, affective and motor behaviour come out of mental maps which help us perceive, make decisions and solve daily problems. Hence a cognitive tendency to use what is known as brain-friendly strategies , among which is Mind Mapping, in learning, in general, and learning foreign languages, in particular, becomes dominant driven by the belief that "we act in accordance with our own mental map of the world" (Shah, 2016 p: 22).

I. MIND MAPS: A BRAIN-FRIENDLY TECHNIQUE

Mind Maps reflect Buzan's convictions in the inner power of the human mind and his visualizations of the flexibility, creativity and limitlessness of human cognitive potential. For Buzan, the language of the brain (in this work 'brain' and 'mind' are used interchangeably) is different: it is neither the spoken nor is it the written language. It is a system of mapping of sensation, imagination and association built on four complementary elements. These are images, colours, key words and ideas (Buzan, 2006, p: 143) and these constitute the heart of original Mind Maps. It is well-known that addressing people with the language they know reinforces communication, and so does the Mind Map with the brain.

A Mind Map is "a powerful graphic technique that provides a universal key to unlock the potential of the brain" (Buzan cited in Sumamol, 2019 p: 15) as long as it necessitates the synergy of the different cortical regions of the human brain; that is why Mind Maps are both good storing and effective retrieval tools. As the "visual input accounts for 40% of the total sensory input to our brain" (Lee 2005, p: 290), modelling thought via Mind Maps enhances information processing at different levels. They prove to ease and fasten the mental accessibility to given information since they activate the needed hemispheric regions for a given thought (the right hemisphere for visual thinking i.e. imaginative and spatial thinking, and intuitive thinking; the left hemisphere for logical, analytical and orderly thinking). Simply, keys to mind gates are Mind Maps. Buzan (2013) explains that "Mind Maps are that phenomental data-retrieval and access system for the gigantic library that actually exists in your amazing brain" (Buzan, 2013, p: 13). Having such gigantic library in those very small cerebral regions entails the working of highly developed and critically interwoven cognitive systems which facilitates the access to this store and makes the task of 'finding a needle in a haystack' possible. Geniously distinguishable, a Mind Map is considered to be "a special type of spider diagram" (Ivan et al, 2016, 395). What makes it so special is the use of colours and images. Radiant thinking is another point of difference. It vehemently translates the cognitive tendency of the creator and seeks out the neurocognitive potential of the mapper. More importantly, using a mind map permits to deal with any problem (idea/task) in a non-linear manner because its design flexibly affords spaces to organise information via

methodical brunching that clarifies the connections of an idea to the centre. Mind mapping, therefore, investigates the complex relational framework of input (new/old) storing the results in the working memory (Carroll, 1993, p: 11). Highlighting such connections leads to "organize disparate thoughts into a coherent whole" (Harrison & Hobbs, 2010, p: 62) which, evidently, reinforces focus on relevant issues, and generates more and more ideas. In this way and via creating such associations, the cerebral work would smoothly be boosted and the integration of the new information into already existing schemata guarantees not only the safe short term store, but it also passes smoothly to the long term household for a simple reason that "patterns or templates that connect new sensory data to neuronal networks increase success at converting short-term or working memories into long-term memories" (Calvin & Bickerton, 2000 cited in Willis, 2007, p: 69). Using mind maps is basically, then, a kind of simulation of the work of mind/brain which internalize (i.e. store) or externalize (i.e. recall and retrieve) data in a highly systematic way. Decreasing the cognitive load of tasks, Buzan (2013) claims that "with a Mind Map, a long list of boring information can be turned into a colorful, memorable, highly organized diagram that works in line with your brain's natural way of doing things" (Buzan, 2013, p: 9).

Some of the good reasons to prioritize such a technique in different acts of learning is the fact that mind maps provide the brain with "a pre-structured framework for association" (Buzan & Buzan, 1993: p 129) that is both inclusive and generative. Giving that creative thinking "has to do with making and expressing of meaningful new connections (Isaksen et al , 2011, p: 36) and that imagination is "forming mental images of what is not actually present and combining them with previously unrelated ideas' (Cornelius & Casler, 1991 cited in Wootton & Horne, 2012, p: 132), Mind mapping promotes, subsequently, both creativity and imagination. Therefore, more than enhancing simple thoughts and ideas, Mind Maps boost logical and creative skills, thereby triggering the work of both sides of the human brain (Harrison & Hobbs, 2010). Working with the two hemispheres paves the way for more smart ideas and creative thought as long as "creativity flourishes best when you use both sides of your brain" (Harrison & Hobbs, 2010, p: 67). Consequently qualitative outcomes would be attained in less time.

I.1. Elements in Mind Maps' Design

Mind Maps' design is unique in that it "harnesses the full range of cortical skills: word, image, number, logic, rhythm, colour and spatial awareness in a single, uniquely powerful technique" (Buzan 1996 cited in Nast, 2012, p: 20). Consequently, a Mind Map is a systematic combination of linguistic and non-linguistic means. These are mainly words, symbols, pictures, and branches that are arranged in vivid, organized and generating templates stimulating radiant thinking. The centre, made prominent enough to attract attention, is the foremost idea/topic around which the minor derivational clues turn. Curvilinear branches and images open gates to new multi-level flows of thought to easily activate visual memory. Buzan's original Mind Map includes: **1) Key Words**: functionally, "Key Words are critical 'signposts' or 'joggers' to your multi-dimensional data sorter, your brain" (Buzan, 2006, p: 140). They are used to create mental images of the experienced world; they are rather the locomotives that drive one's flow of thought to its target. Since they are generative tools and motivating mental devices, Key Words set free the human mind and, expectedly, generate different thought. **2) Curvilinear Branches**: two main reasons

for avoiding straightforward lines and adopting curvilinear branches according to Chambers & Smith (2013): the visual variety and the use of space. Visually, curvilinear branches are more attractive, dynamic, resemble nature and more importantly they resemble the neurons network in human brain which afford a kind of flexible use. Psychologically, these branches fight boredom because a "Mind Map with straight lines is boring to your eyes! Your brain is far more attracted to the curved lines that you find in nature" (Buzan, 2001, p: 43). **3) Images and Symbols**: modern research on brain and human memory reveals that "human brains remember visual information much more clearly than verbal information" (Capital, 2016, p: 18) i.e. pictures and images easily pass to the long term store more probably than words do. The use of images and symbols is, then, strategic for generating new associations, thereby boosting productivity. At the information processing level, adding images and symbols to Key Words in Mind Maps necessitates a double encoding process, verbal and visual, which fortifies the overall encoding (Sweeny, 2011). **4) Radiant Thinking**: Mind mapping banks on radiant thinking which is basically non-linear. So, in Mind Map's design, "thoughts radiate outwards like the branches of a tree" (Buzan, Griffiths & Harrison, 2013 p: 20). Radiant thinking implies almost all the types of human thinking; it is a holistic, analytical, divergent, creative and critical thinking. Therefore, the very good medium for radiant thinking is the Mind Map, hence, "Mind Mapping is the external expression of Radiant Thinking" (Buzan, Griffiths & Harrison, 2013 p: 21). **5) Colours**: these non-linguistic means are added to Mind Maps for their effective cognitive, psychological and aesthetic roles.

II. COGNITIVE AND PSYCHOLOGICAL DIMENSIONS OF COLOURS IN MIND MAPS

Perceiving colours activates "a hormone that affects our moods, mental clarity, and energy levels" (Engelbrecht cited in Kornblatt, 2022, p: 31). So, colours can positively alter humans' psychological, cognitive and physical behaviour and, accordingly, be used as good learning tools for developing human resources. Beyond the aesthetic side of colours' use, their cognitive and psychological effect is prominent in almost all the fields, among which is foreign language learning.

II.1. Cognitive Dimensions of Colours in Mind Maps

With respect to learning styles and individual differences, using colours proves to be an influential factor for memorization. It is estimated that "colored images are five to ten percent more memorable than images without color" (Madigan, 2015, p: 74). The positive effect of colours is marked not only for simple memorization, but also for empowering human memory as a whole, Buzan defends the idea that "using colour alone can improve your memory by as much as 50 per cent" (Buzan, 1986, p: 40). Colours enjoy a wide range of support among researchers for their expediency. Bolarin (2015) comes to conclude that "color improves readership as much as 40 percent. Color accelerates learning from 55 to 78 percent. Color increases comprehension by 73 percent. Color ads are read up to 42 percent more than similar ads in black and white" (Bolarin, 2015, p: 32). Supporting evidence comes from different disciplines which assist the idea that using colours enhances brain's work because "the brain invokes independent analysers for color and shape" (Goldstein. 2010, p: 453). In addition, colours impressively increase the visual impact of the Mind Map and make its organization noticeable from the first sight. They empower, then, the attentional level since vivid (colored) notes and images afford an eye-relaxing

material unlike the "monotonous (single color) notes [which] are visually boring. As such they will be rejected and forgotten" (Buzan. T. & Buzan B. 1993, p: 49). Enhancing attention raises concentration which, in turn, reinforces the opportunities for deep processing and storing, this rule is well-defined in cognitive science: "the more attention on certain stimuli, the more chances to be transferred to a more permanent memory storage" (Ahram & Falcao, 2019, p: 129).

At another level, using colours enables not only to personalize the Mind Map but also to stimulate human visual intelligence (Ellis, 2013). More importantly, they can be used as a useful way to 'code' the content in the mind map. Encoding meaning via colours creates and sometimes 'imposes' associations between colours and concepts. Therefore, "colors are already laden with symbolism in our minds" (Brogaard & Marlow, 2015, p: 85). Yet, colour symbolism is not an agreed-upon issue, it is rather culturally bound. Warm colours, namely red, yellow and orange, denote a long list of meanings. They express both modest as well as strong emotions which are not always compatible. Cool colours, as the name signposts, call for tranquillity and calmness, vastness and even peace; that is why, using colours in Mind Maps helps in creating associations between similar ideas and differentiating themes from each other. In addition, grouping ideas into main and subordinate is a task that can be easily achieved via the use of colours. It is possible to code the content to highlight main topics and key details. Hence, the knowledge of how to use the colour wheel (complementary and contrasting colours) is undoubtedly required. The basic rule is far from being complex: main colours are for main ideas; derivational colours are for the details. In this way, colours can be used "as highly visible organizers" (Ellis, 2013, p: 158). So, the more you know about colour use, the better your Mind Map looks like.

Recently, neuroscience research proves that the use of colour stimulates the right and the left sides of the brain (Hardy, 2014). This allows the full engagement of the brain in the thinking process invoking all types of thinking and reasoning: logic, critical thinking, creativity, emotion and imagination. Significantly, using the two brains enhances thinking and cognitive abilities in general with remarkable effects on the individuals' psychological state.

II.2. Psychological Dimensions of Colours in Mind Maps

Colours can impact the affective state of individuals, so they can be used as emotional regulators (Cleland et al, 2015 p: 266). In Mind Maps' design, the choice of the right colour is a requirement for efficiency and practicality of the driving affective consequences. Colours' role as mood filter is conventionally recognizable in Psychology, yet not universally definitive the impact of each colours' category (warm vs. cool) on individuals for social and personal reasons. Although colour symbolism is culturally bound, individuals' preferences are decisive driven forces for enjoying and using some colours other than others. At the psychological level then, colours behave differently. It is estimated that warm (also hot) colours like red, orange, yellow afford more interest and excitement than cool colours like blue, green, cyan (Lieberman, 2006). Therefore, warm colours do increase human arousal which directly and systematically impacts human behaviour. Excitement, for example, may result in quick decisions. Potentially reducing stress and anxiety, hot colours put human mind into a state of relief. Meanwhile, cool colours work on also decreasing stress and anxiety provoking a sense of calmness and inner peace. This boosts creativity hiking up the neural activity in many ways since there is a correlation

between colors, cognition and motivation. Xia et al (2016) explain that "the type and difficulty of tasks both modulate the color effect via motivation and arousal, respectively" (Xia et al, 2016, p: 2); for example, compared to red, the blue colour can enhance performance on both difficult detail-oriented tasks and creative tasks whether they are simple or difficult (ibid, p: 1). As they enhance the visual impact of the Mind Map, colours attract attention, enhance motivation and raise interest consequently. Additionally, they evoke emotional reactions thereby changing the mood of human beings because a great deal of the human sensory impressions comes from their visual system. Colours act, consequently, as "boosters of senses" (Kornblatt, 2022). In foreign language learning, the affective factor has its weight on the one's qualitative achievement; therefore, colours do increase and contribute to the productivity of learners, their imagination and creativity.

However, it is advisable for the mapper to use colours thoughtfully and intentionally not to overwhelm the viewer on the one hand and to ensure that the colours used go cleverly with the content on the other hand. For these reasons and others, specialists (among whom is the Mind Map founder, Buzan), three colours, but not fewer, are a good starting number for visual memorability whereas the maximum is relative (Nast, 2012). On the whole, combining warm and cool colours can systematically make a fine equilibrium and a defined divergence and the strategic use of them energizes both body and mind.

III. RESEARCH METHOD

In what follows the setting, the population and the tools of research are introduced. .

III.1. Setting and Population

This study adopts an action research orientation, a research method that aims at crafting a motivating atmosphere in the classroom and creating a dynamic involvement of students for enhancing their language learning skills. The present study took place at the Department of English at teacher training school during the academic year 2022-2023. To avoid a biased date collection coming to unbiased conclusions, random sampling was adopted, a statistical method where each member of the sample has equally the same opportunity to be chosen. The total number of second year undergraduate students was twenty five (25). All the participants were females (100%). They were participating and voluntarily engaged in an experiment where they were directed to use Mind Mapping in the prewriting stage in their essays for more than eight weeks. To avoid the random use of colours and to use the intended type of Mind Maps (Buzan's model), students participated in three training workshops. In addition, the researcher created a Padlet, a virtual display board, in order to enable the participants to share their Mind Maps and exchange feedback on each work.

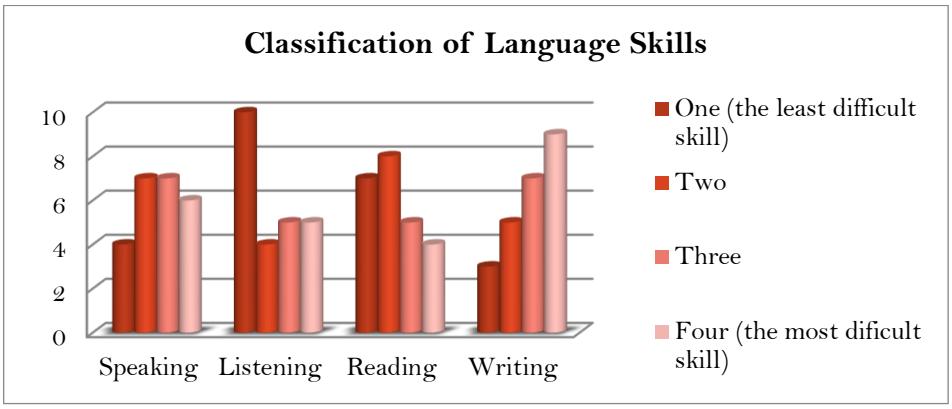
III.2. Tools of Research

After the treatment (experiment), a post-attitude questionnaire was administered to the students to investigate the effectiveness of using colours in their Mind Maps and to quantitatively gauge the change in their attitudes towards the use of colours. Analysis of the data was quantitatively descriptive.

IV. DATA ANALYSIS AND RESULTS

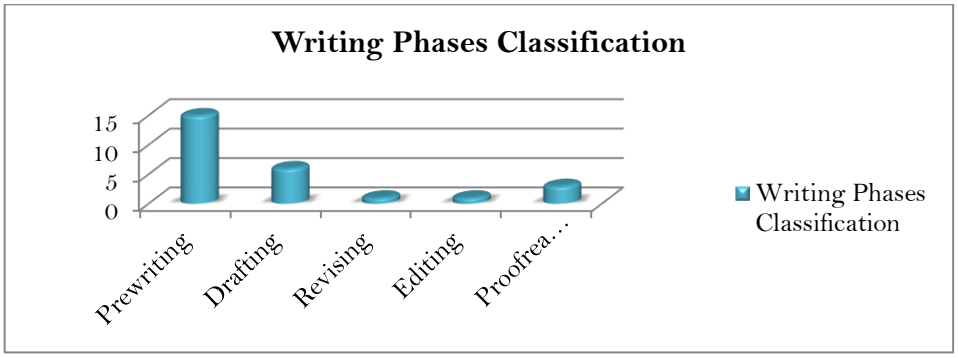
To refer to the questionnaire used to illicit the analysed data, please see the appendix at the end of this paper.

1. **Students' classifications of language skills according to an increasing scale of difficulty**



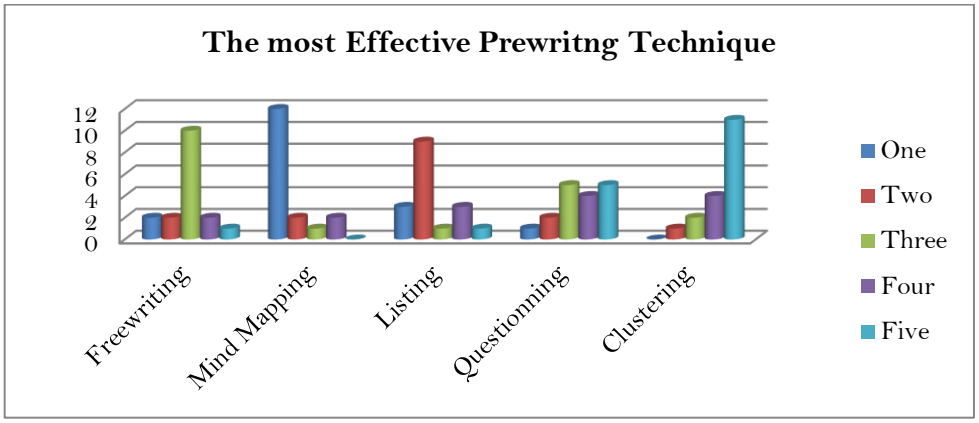
The total number of those who ranked the skills is 24; the twenty fifth respondent (4%) did not rank but opted for listening. Yet, listening did not impose much difficulty to many respondents (41.66%: the highest ranking in first position i.e. the least difficult skill) unlike writing which is considered as the most difficult language skill by 37.5% of the respondents (the highest raking in first position i.e. the most difficult skill).

2. **Student's opinions about the most difficult writing phase in the writing process**

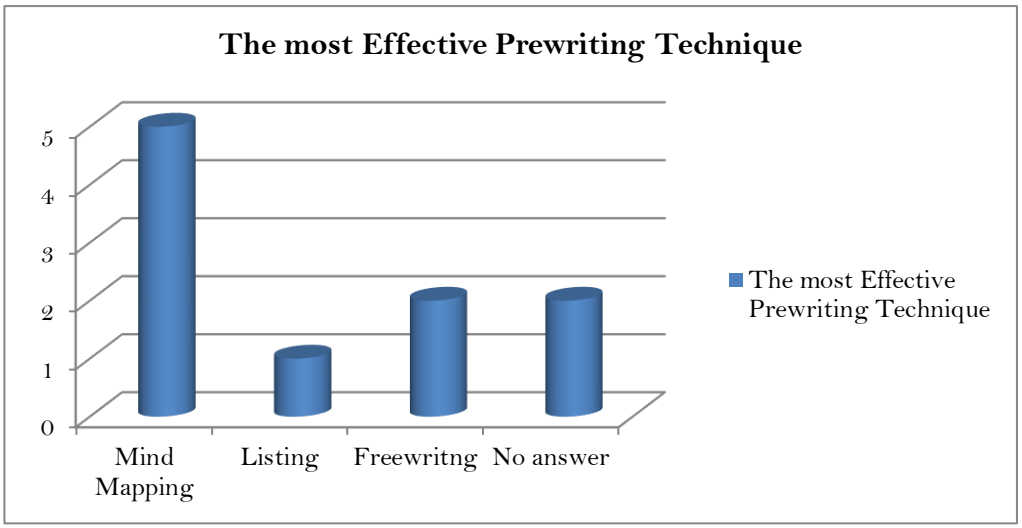


The respondents provided 26 answers because one respondent opted for two options (prewriting and proofreading). The prewriting phase was the most difficult phase in the whole writing process (57.69 % of the answers). 23.07% of the respondents' choices placed drafting in the second position in the scale of difficulty. 11.53% opted for proofreading while revising and editing got only 3.84% for each.

3. The most effective prewriting techniques from students' perspective

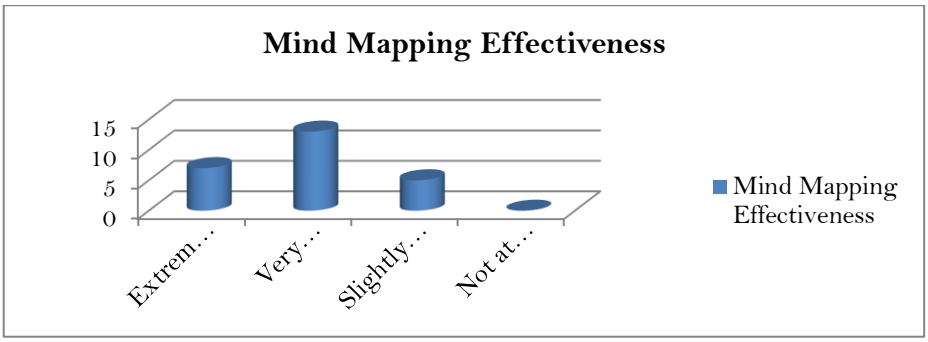


17 respondents understood the question and ranked the techniques. Regarding the highest percentage for each prewriting technique ranking, Mind mapping was considered the most effective prewriting technique by 70.58 % of the answers followed by listing (52.94%) in second position and freewriting in third position (58.82%). The respondents placed questioning equally in third and fifth positions (29.41%). The highest ranking for clustering placed it as the least effective technique (64.70%). However, two (8 % of the total number) respondents left this question unanswered; the remaining six (24%) did not provide a ranking but they opted for naming the most effective technique; sometimes they opted for more than one option (up to three options). So, the total number of the answers was 8. The results came as follows:



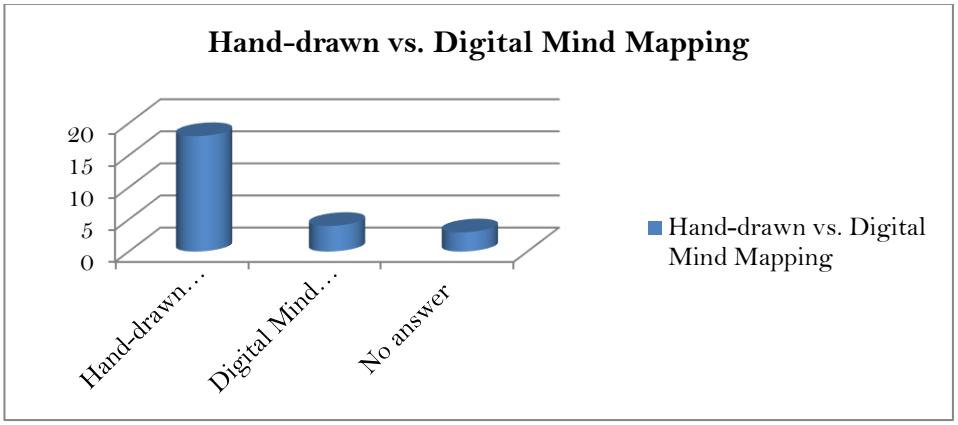
Mind Mapping was also the most effective prewriting technique according to 62.5% of the total number of the answers (8), preceded by freewriting (25%), and listing (12.5%) which came in third position.

4. **Students' attitudes towards the effectiveness of using Mind Mapping as a prewriting technique**



All the respondents did not doubt the effectiveness of Mind Mapping in the prewriting phase. So, Mind Mapping was extremely effective for 28%, effective for 52% and slightly effective for 20%. No one of the respondents considered Mind Mapping as ineffective.

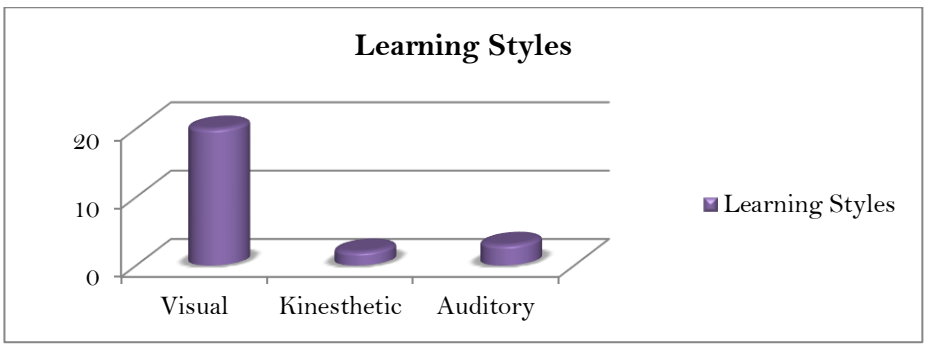
5. **Students' preferred type of Mind Mapping**



Hand-drawn Mind Mapping has been the preference of 72% of the respondents while 16% preferred digital software diagrams and 12% of the respondents left this question unanswered.

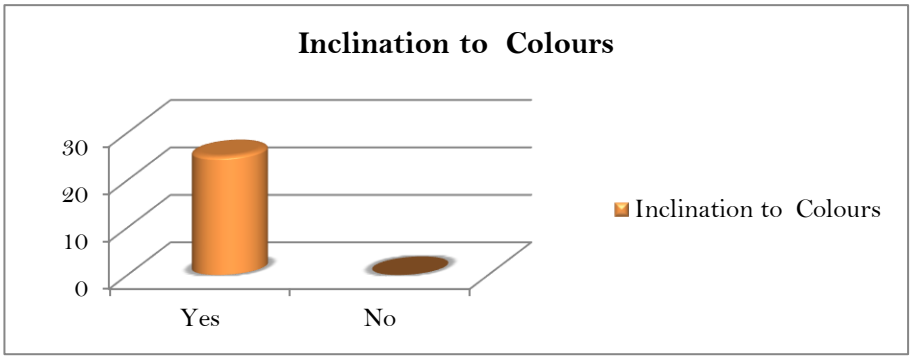
It was remarked that most of those who opted for "slightly effective "are those who opted for digital Mind Mapping.

6. **Students' learning style**



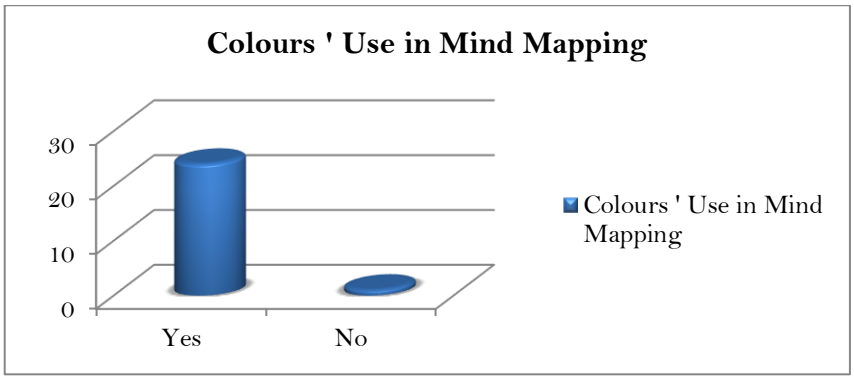
As colours are tidily related to the learning styles, being aware of students' styles is inevitable. Most of the respondents (80%) were visuals; 8% of the participants were kinaesthetic and only 12% of them were auditory.

7. Students' inclination to using colours in learning in general



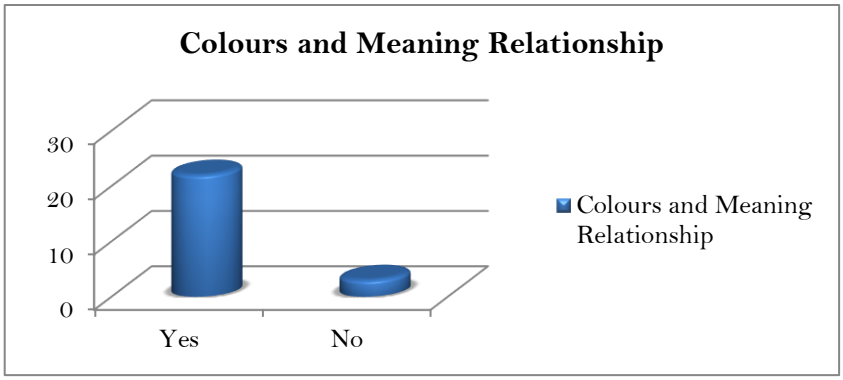
100% of the respondents did love colours even those with other than the visual style.

8. The use of colours in students' Mind Maps



As colours are one of the most important elements in any Mind Map, 96% of the mappers confirmed that they use them in their maps. Nonetheless, one respondent (4%) drew maps without colour.

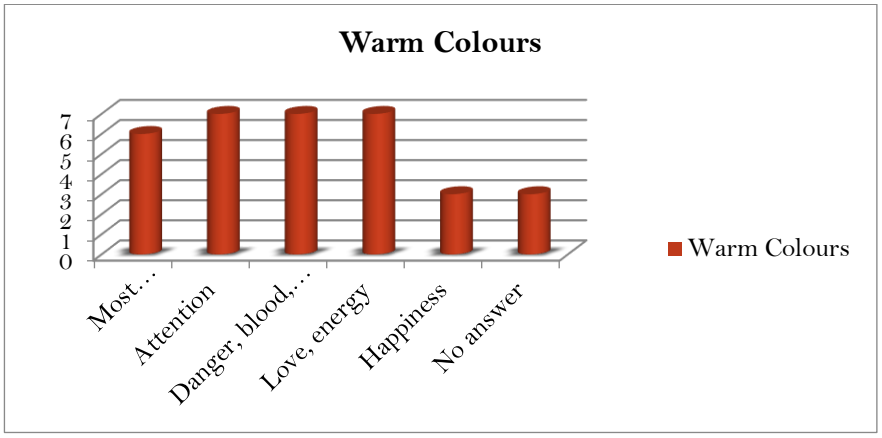
9. Students' recognition of the relationship between colours and meaning



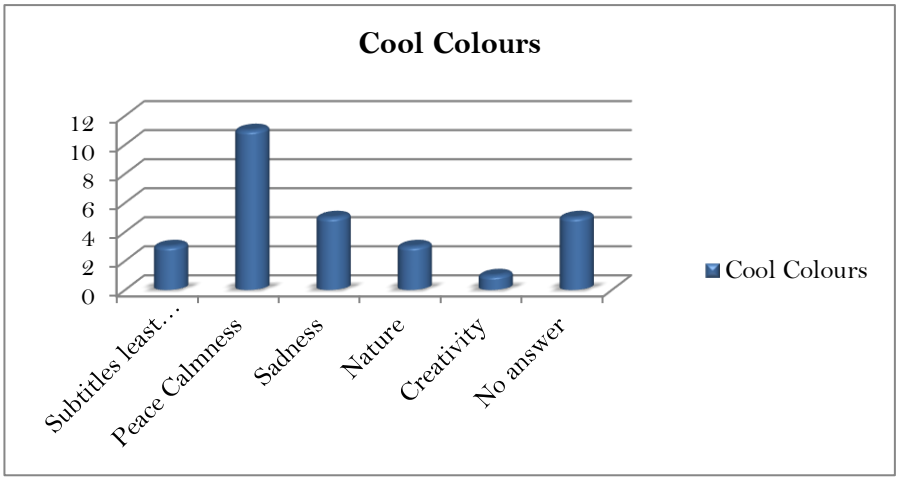
The majority of the respondents (88%) believed that colours do encode meaning. 12% believed that colours do not encode meaning and opted for "No". It

should be mentioned that auditory and kinaesthetic respondents believed that colours encode meaning while some visual learners were the ones who did not believe so.

Those who recognised the relationship were asked to name some of the meanings encoded by the warm colours (e.g. orange and red) and the cool colours (e.g. blue and green). The answers came as follows.



Thirty (30) answers were provided pointing to more than one meaning. 20% of the participants thought that warm colours can be used to signal the most important ideas/points. Similarly, these colours attracted the attention of 23.33% of the respondents. The two categories that include meanings of danger, blood and threat and those of love and energy respectively also received 23.33% each, whereas happiness got 10% of the answers. 12% of respondents avoided answering this question. For cool colours the results came as follows:

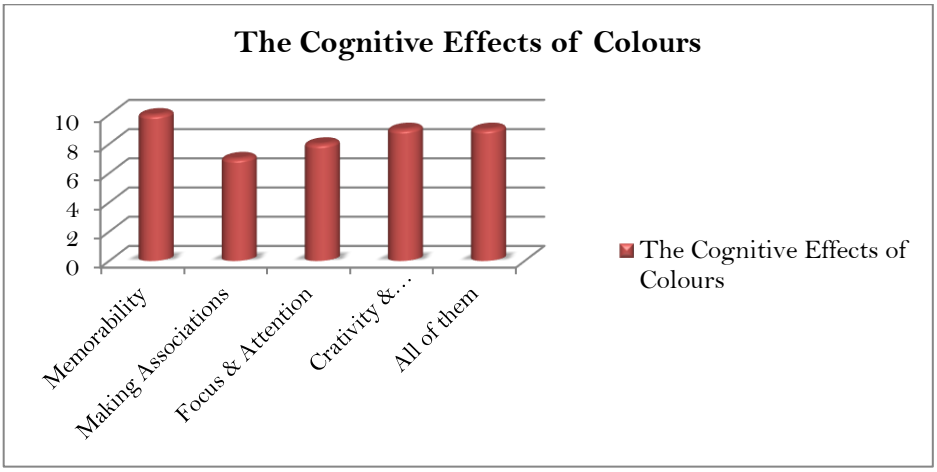


The total number of the answers was 23. Using cool colours for subtitles and the least important ideas was the tendency of 13.04% of the respondents. 47.82% used them to reflect peace and calmness and 21.73% to express sadness. 13.04% of the respondents thought that these colours invoke nature and 4.34% believed that cool colours can trigger creativity.

While five respondents (20%) did provide no answer to this question, one of the respondents (4%) mentioned other colours that do not belong to either class; those

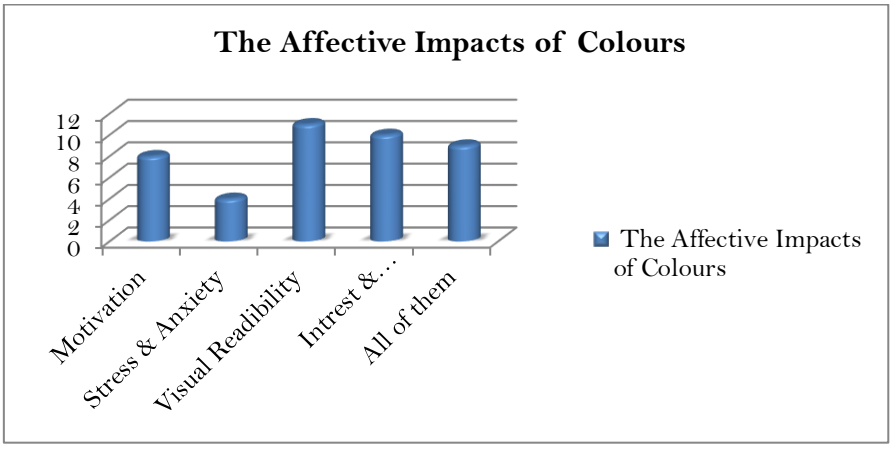
belong to what is known as 'neutral colours'. The colours of this class (e.g. beige, taupe, brown, grey, black, cream & white) are pale and often have underlying hues that change with different lighting. It should be mentioned that these colours are not on the colour wheel but they complement primary and secondary colours.

10. The cognitive effects of colours from students' perspectives



The total number of answers was 43. The results revealed that 23.25% of the respondents held that colours enhance memorability, 16.27% of the respondents were for the second option and they thought that colours facilitate recalling and making associations while 18.60% of the respondents believed that colours enhance the attentional abilities and focus. The fourth option related to creativity and imagination was chosen by 20.93% of the respondents. The same percentage (20.93%) opted for "all of them" admitting all the positive effect of Mind Mapping on mental work.

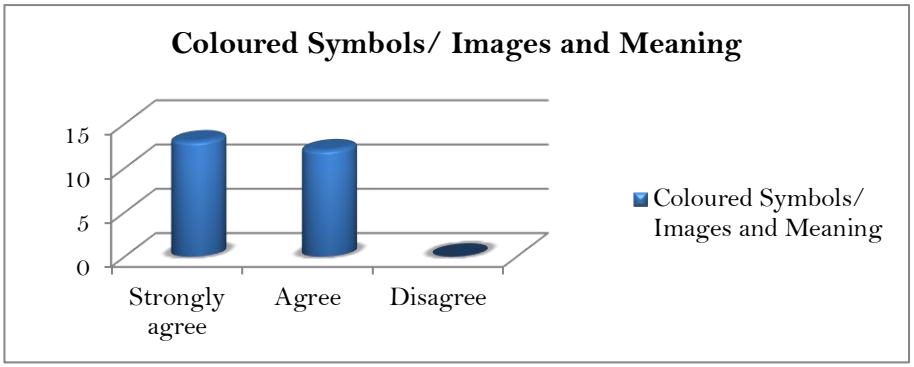
11. The affective impacts of colours on human memory and brain in using the Mind Maps from students' perspective



Forty two (42) was the number of the obtained answers to this question because some respondents chose more than one answer. All the respondents admitted the positive affective influence of colours in Mind Maps. 26.19 % of the responses were for the visual readability and attraction. 23.80% held that colours in Mind Maps attract attention and raise interest. 19.04 % went for option 'a' and admitted that

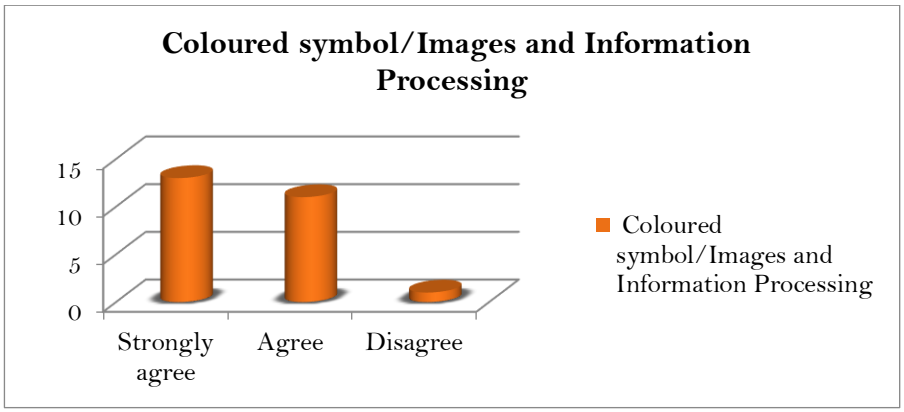
colours have to do with students' motivation. 21.42 % of the respondents were aware of all the positive affective side of colours, so they opted for 'all of them'. Only 9.52% of the respondents thought that colours could reduce students' stress and anxiety.

12. Students' attitudes towards using coloured symbols and images to express a strong meaning



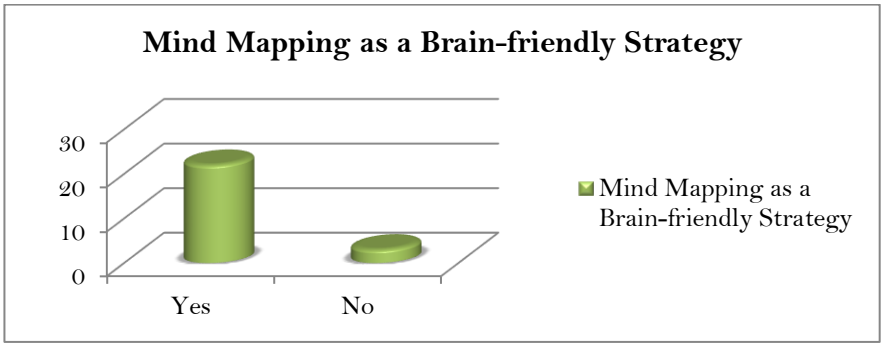
Images and Symbols are mediums for using colours; that is why this question emphasized the importance of the relational triangle between symbols and images, colours and strong meaning in Buzan's original model. The respondents were divided between "strongly agree" (52%) and "agree" (48%) that symbols and images are effective means to support meaning. No one (0%) disagreed about the strong relationship between the use of coloured symbols and images and meaning reinforcement.

13. Students' visualization of using coloured symbols and images as effective visual stimuli to speed up information processing



More than a half of the respondents (52%) strongly agreed and the rest (44%) did agree on that coloured symbols and images could be used as effective stimuli to speed up information processing. Only one respondent (4%) disagreed with this statement (or fact).

14. Students' conception of Mind Mapping as a brain-friendly strategy



A good percentage of the respondents (88%) knew that Mind Mapping is a brain-friendly strategy meanwhile 12 % of them answered that they did not know.

V. DISCUSSION

The research findings withstand the positive impact of colours in Mind Maps' design and reveal the wide support of using colours for their cognitive and affective dimensions among second year students at the Teachers' Training School of Constantine (ENSC). The cognitive potential and the psychological engagement of colours justified students' tendency to experience drawing coloured Mind Maps in the prewriting phase of their essays. They believed that colours did reinforce significantly the visual memorability and accelerate the work of the brain in both storing and retrieving as a whole. They thought that colours are compulsory in any Mind Map's design since they can be used not only as a graphic organizer, but also as a strong meaning encoder/decoder. Colours support creating more and more associations, and this would inevitably drive students' creativity and imagination. Releasing stress and increasing arousal, colours filter students' mood motivating and putting them in a relaxing psychological state. Being aware of their strategic and interpretational influence, students came to conclude that colours are one of the most important pillars in Mind Maps' design.

CONCLUSION

Conclusively, the cognitive potential of students as well as their affective involvement can be boosted up via the use of colours in Mind Maps. Therefore, mappers' use of colours should be intentional and systematic.

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APPENDIX

Students' Questionnaire: Cognitive and Psychological Dimensions of Colours in Mind Maps

This questionnaire is a part of a research work that investigates the cognitive and affective impact of colours on students using Mind Mapping in the prewriting stage. As an influential partner in the teaching/learning process, you are invited to resourcefully

contribute to answering the following questions ticking the right option, or providing full answers where necessary.

1. Which of the following language skills you find most difficult? Order them, please, in a scale of increasing difficulty.
   Speaking ☐ Listening ☐
   Reading ☐ Writing ☐
2. Which of the following writing phases is most difficult?
   Prewriting/planning ☐ Drafting ☐ Revising ☐
   Editing ☐ Proofreading ☐
3. Please, order the following prewriting techniques in term of effectiveness (from the most to the least effective one).
   Freewriting ☐ Mind mapping ☐ Listing ☐
   Questioning ☐ Clustering ☐
4. Do you think that using Mind Mapping as a prewriting technique is:
   a- Extremely effective? ☐
   b- Very effective? ☐
   c- Slightly effective? ☐
   d- Not at all effective? ☐
5. Which type of Mind Mapping do you prefer?
   a- Hand-drawn Mind Mapping ☐
   b- Digital Mind Mapping ☐
6. Which type of learners are you?
   Visual ☐ Kinaesthetic ☐ Auditory ☐
7. Do you like the use of colours in learning in general?
   Yes ☐ No ☐
8. Do you use colours in your Mind Maps?
   Yes ☐ No ☐
9. According to you, do colours encode (express) meaning?
   Yes ☐ No ☐

If yes, name some of the meanings encoded by the warm colours (e.g. orange and red) and the cool colours (e.g. blue and green).

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10. According to you, what are the cognitive effects of colours on human memory and brain in using the Mind Maps?
    a- Colours increase information memorability.
    b- Colours facilitate recall and making associations while writing.
    c- Colours enhance the attentional abilities and focus.
    d- Colours increase creativity and imagination.
    e- All of them
11. According to you, what are the affective (Psychological) impacts of colours on human memory and brain in using the Mind Maps?
    a- Colours increase students' motivation.
    b- Colours lessen students' stress and anxiety.
    c- Colours increase the visual readability of the Mind Map and hence its attraction.
    d- Colours attract attention and, consequently, raise interest.
    e- All of them
12. Coloured symbols and images are effective means to express a strong meaning.
    I strongly agree. ☐ I agree ☐ I disagree ☐
13. Coloured symbols and images are effective visual stimuli to speed up information processing.

I strongly agree. ☐ I agree. ☐ I disagree. ☐

14. Do you know that Mind Mapping is a brain-friendly strategy?

Yes ☐ No ☐

TO QUOTE THE AUTTHOR : .

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