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The effect of college students' self-generated computerized mind mapping on their reading achievement

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ABSTRACT

This study explored the potential effect of college students' self-generated computerized mind maps on their reading comprehension. It also investigated the subjects' attitudes toward generating computerized mind maps for reading comprehension. The study was conducted in response to the inability of the foundation-level students, who were learning English as a second language, ESL, in the Community College of Qatar, to achieve the general and specific goals of learning reading. A quasi-experimental pre-posttest design was used. Convenience sampling was used to choose two ESL classes from a sum of five level three classes. The experimental group (n=14) was taught reading texts via students' self-generated computerized mind maps, and the control group (n=8) was taught by teacher-generated whiteboard maps. ANCOVA was used to analyze students' scores on the post test. The results revealed significant differences in favor of the experimental group. To identify the experimental group attitudes toward the intervention, a 40-item four-domain questionnaire was designed and administered. The analysis of means, modes and standard deviations revealed that the domains were ranked statistically from the most positive to the least positive opinions as follows: educational benefits, mental benefits, usability, and enjoyment.

Keywords**:** *computerized mind mapping; whiteboard mind mapping; Blended learning*; reading comprehension,

INTRODUCTION

Reading, as a receptive skill is very important in learning a foreign language. McGinnis and Smith, 1982 (cited in Rizqiya 2013, p. 31) defined reading, as "a purposeful process of identifying, interpreting, and evaluating ideas in terms of the mental content or the total awareness of the reader." Reading consists of two related processes: word recognition and comprehension. "Comprehension is the process of making sense of words, sentences and connected text."(Pang, Muaka, Bernhardt, & Kamill 2003, p.6). These levels can be summarized as *"*Reading the lines, reading between the lines and reading beyond the lines." (Gray cited in Shermila 1999, p. 27). The successful comprehension of a text is achieved by employing various reading skills, such as making inferences, understanding the organizational pattern of the text, identifying the main idea and sub-ideas, and figuring out the relationship among these ideas and the details given in the text (Donin, Graves, & Goyette 2004).

There are certain teaching techniques that help students to construct meaning in a reading text. One of these techniques that helps in acquiring reading skills is mind mapping. The learner transfers the text into a visual map to demonstrate the relationships among the text main ideas and its sub-ideas and to integrate the new information to his/her prior knowledge.

"Mind Maps*"* were developed by the British psychologist Tony Buzan in the late 60´s as a means of effective note-taking. According to Buzan, "A Mind Map" is an associative network of images and words which harnesses the full range of cortical skills: word, image, number, logic, rhythm,

colour and spatial awareness in a single, uniquely powerful technique*" (*Buzan, 1996, p.81). According to Buzan 2012 (cited in Dominik 2014, p.4*), "*The mind map is a graphical tool for holistic thinking which supports all of the brain functions - mainly our memory, creativity, learning and all additional thinking*." On the other hand, Eppler defined mind mapping operationally. Eppler stated,"A mind map is a multi-colored and image-centered, radial diagram that represents semantic or other connections between portions of learned material hierarchically." (Eppler 2006, p. 203). A mind map starts with a main topic written in the center and branches out to sub-topics (Eppler 2006).

Students begin a mind map by writing the main topic in a square in the middle of the paper. Then, nodes are drawn from this square carrying the main idea. From each idea, other nodes are drawn to write the sub-ideas from which examples or details are sent on other nodes. An important step in creating a mind map is to use colors as they help to differentiate the sub topics or sub-ideas. Using images, icons, tags and other visuals as video films in the case of computerized mind-mapping is useful as it helps to associate ideas in a more interesting way (Budd 2004, p.35).

Chang, Sung and Chen (2001) and King (2007a, p.87&94), pinpointed the fact that there are two ways to create mind maps. The first one is by hand, in which learners can use large pieces of paper, pens, pencils, markers, and pictures. Sometimes the maps can be created on a chalkboard or a whiteboard. The second one is via mind mapping software which facilitates the manipulation, colorization and restructuring of the mind map and its nodes and branches and make the process of creating mind maps faster and easier." (Dominik, 2014:5). "Additionally, through the use of mind mapping software, it is possible to avoid run off the edge of the paper**."** (Gomez and King 2014, p.78). In contrast, creating mind maps on paper can consume too much time, material and effort.

Mind mapping in learning and teaching

Mind mapping as used in the skill of reading is based on certain learning theories and approaches. These include, for example, the top-down approach in reading, radiant thinking, graphic organizers, schema theory, the educational significance of visual learning and communication, and constructivism. The top-down reading model encourages students to focus more on understanding the main ideas of a passage than understanding every word. Even if students do not understand each word, they are likely to grasp the meaning of a text as a whole (Nuttall 1996, cited in Brown 2001, p.299). Buzan suggested the notion of radiant thinking to rationalize mind mapping (Buzan and Buzan in Siriphanic & Laohawiriyano 2010; Al-Jarf 2009). To Buzan, information is structured in a way that reflects how the brain functions – in a radiant rather than linear manner. "In a mind map, a learner uses associations and connections that proceed or connect to a central point" Buzan 1993, p.57). Mind mapping stimulates cognitive mental skills of analysis, categorization and synthesis (Buzan 1993, p.57*)*. Kaufman (cited in Rizqiya and Bandun 2013, p. 37) argued that "the non-linear format of mind maps allows the text reader to view the entirety of his notes at a glance, then easily places new information in the appropriate branch or make connections between ideas."

Graphic organizers also explain why mind maps work well. "The way one learns bears a strong relationship to the way his/ her senses operate" and "a very high proportion of all sensory learning is visual*" (*Avegerinou and Ericson 1997, p. 287). This goes along with Fleming's model of learning styles, which is based on early neuro-linguistic programming models and recognizes three major learning styles labeled as visual learners, auditory learners and kinesthetic learners (King 2007a, p.8). In a computerized mind mapping, all three learning styles can be catered for as pictures, lines, colors, videos and sound effects can be added to the maps. The kinesthetic learners will inevitably like drawing branches and move them electronically in a very interesting flow of movements. Avegerinou and Ericson (1997, p. 287) relate graphic organizers and mind

mapping to sensory learning saying that “the way one learns bears a strong relationship to the way his/ her senses operate” and “a very high proportion of all sensory learning is visual.”

Schema theory, which refers to the way knowledge of concepts is organized and stored in memory in the form of categories or slots, is frequently used to explain and test the effectiveness of mind maps (Stanovich 1991; Silberstein 1994). Learners recall the existing knowledge and relate it to the text. Likewise, mind mapping reflects the principles of constructivism. Constructivists see learning as an active process in which the learner himself/herself uses sensory input and constructs meaning out of it.

There are many advantages to mind maps, such as creativity, quickness, easiness, adaptation, management, stimulation and outlining (Dominik 2014, p.11; Ingemann 2008).

- Creativity and stimulation**:** Maps enable students to create new ideas during brainstorming sessions. In addition, mind maps are good stimulators for the brain’s ability to associate ideas and evoke non-linear thinking especially because they use visual means as colors, images, fonts, etc. (Martinelli and Jones 1999).
- Adaptation and management: E-mind maps are easy to manage and to restructure as everything can be moved around freely.
- Retention and retrieval of information: Mind maps enhance the learner’s memory. In a study by Toi (2009), it was shown that mind mapping can help children to recall words more effectively than using lists, with improvements in memory of up to 32%.
- Enjoyment: Creating a mind map is a fun activity where learners can use colors, images and videos that make the whole task very interesting.
- Collaboration: A mind map is an excellent tool for collaborative groups. The group members can enjoy expressing their opinion in an open climate (Paykoc, Mengi, Kamay, Onkol, Ozgur, Pilli, and Yildirim 2004). In addition, mind maps can be used in different stages and for various purposes in the language classroom. They can be used in brainstorming ideas, taking notes, outlining, and analyzing a reading text into its main ideas and sub-ideas.

Unfortunately, mind maps can sometimes be difficult to interpret, especially when they contain much information. Budd (2003) pointed out that students may think creating mind mapping is time consuming as colors, images, symbols, videos might take much time.

Reading comprehension and mind-mapping are extremely interrelated. Researchers have been investigating the use of mind mapping to support students in dealing with study texts and stimulating their potential generative skills (Boyle and Weishaar 1997; Siddiqi 2007; Merchie and Keer 2012). In his generative model of the teaching reading comprehension, Wittrock (1991) states that it is important to change students' perception of their roles in learning from one of recording and memorizing information to one of generating understanding by relating concepts to their experiences and to their knowledge base. What Wittrock stresses is the importance of both the text and reader's learning characteristics in the reading process. In their research, Merchie and Keer (2012) found out that mind mapping was a specific generative strategy which helped learners to transform linear texts into graphical representation and understand the relationship between ideas and sub-ideas.

RELATED LITERATURE

Using experimental design, Boyle (1996) investigated the effects of using a paper and pencil cognitive mapping strategy on the literal and the inferential reading comprehension of narrative passages by 30 middle school students diagnosed either with a learning disability or a mild intellectual disability. The post-test scores revealed that the students who learned to use the cognitive mapping strategy increased both their literal and their inferential comprehension by a mean of 25% and 30% respectively when compared to pretests.

A year later, Boyle and Weishaar (1997) tested the effectiveness of cognitive mapping on the reading comprehension of 39 high school students with mild disabilities. The researchers compared the effects of three conditions in using maps: student-generated maps, teacher-generated, and no-mapping conditions. The finding showed that students performed better when creating their own maps than when using the templates supplied by the teacher.

Paykoc, Mengi, Kamay, Onkol, Ozgur, and Yildirim (2004) found that a speaking exercise involving mind mapping software provided a useful focus for pupils to organize their thoughts to present information clearly and attractively and facilitate communication.

Siddiqi (2007) investigated the effectiveness of using computer-assisted semantic mapping for teaching reading comprehension (at three levels: the literal level, the inferential level and the total achievement) to English as a foreign language students of the second year in a secondary school. The researcher used a quasi-experimental design. The subjects were 68 EFL students in the second year in the secondary school. Using experimental-control design where the experimental groups were taught via electronic semantic mapping, whereas the control groups were taught by the traditional reading strategy. The results indicated that there was a positive but not significant effect of using computer-assisted semantic mapping on the achievement of EFL students at the inferential level of reading comprehension.

Wong-Ang, Moi and Lian (2007) measured the effectiveness of the mind maps on learning vocabulary and reading on two primary classes 33 and 34 pupils of mixed ability and mixed gender. The researchers also surveyed the subjects' opinions about using mind maps, their retention of information, and their interest. The students' results on the posttest proved that mind maps were effective in enhancing students understanding. Teachers and students expressed positive attitudes towards using the maps in reading.

Likewise, Siriphanich and Laohawiriyano (2010) explored whether mind mapping techniques can improve 35 first year Thai ESL university students' reading comprehension. Their study also aimed to investigate the students' opinions about using mind mapping for reading purposes. They used one experimental group with the pre-posttest design, an attitude questionnaire and an interview. The results suggested that the students' reading comprehension achievement improved significantly on the post-test and most students expressed their enjoyment and satisfaction with their own reading comprehension ability.

Liu and Chen (2008) investigated the application of computer-assisted concept mapping for improving English reading comprehension of 94 freshmen with different proficiency levels who took an English course. Power-point concept mapping strategy was introduced to the learners in the class to improve their reading ability. Through the analysis of ANOVA, it was found that the effect of computer-based concept mapping reading strategy has more reading benefit on the high-level group than that on the low-level one.

Al-Jarf (2009) employed software mind mapping with an experimental group but not with the control group to assess its effect on students' writing achievement. The results showed that the

experimental group scored significantly higher than the control group. Using a survey afterwards, the experimental group subjects reported that the Mind Mapping tool encouraged creative thinking and they became faster at generating and organizing ideas for their writing.

Similarly, Liu (2011) explored the effect of different computerized concept mapping treatments (no-mapping, individual-mapping, and cooperative-mapping on the performance of pre-writing phase of students with different writing proficiencies. He also explored whether the quality of the concept maps constructed cooperatively exceeded the quality of the concept maps constructed individually. Ninety-four freshmen enrolled in an English course were divided into high-level, middle-level, and low-level learners according to their baseline writing scores. The results on a past test found that both computerized mapping treatments had equally positive effects on low-level and middle-level learners compared with the no-mapping treatment. However, high-level learners performed significantly better with the individual-mapping treatment than with the other two treatments.

Rizqiya (2013) explored the effect of computerized mind mapping on the reading comprehension of first graders of a senior high school in Bandung, Indonesia. Two class periods for the class were observed by the teacher and by an observer. The researcher also designed a questionnaire to investigate the learners' attitude toward implementing mind mapping. The data obtained after the treatment revealed that there the learners' reading comprehension was improved by 90.4% in the first meeting and 94.6% by the second meeting. The researcher attributed this achievement to the use of computerized mind mapping. The learners' responses in the questionnaire revealed that they enjoyed mind mapping although they were not familiar with it before.
Comez and King (2014) designed lessons in English as a second language classroom where they use mindmapping software to teach words in reading texts whose topics were geography and language art. They used NovaMind Software and Mindmapper software. They trained their students on creating mind maps by hand; and then they used the software to recreate them electronically. In exams, students were able to remember the words as pictures, videos and sounds were hyperlinked to the map. The researchers found out that using mind maps in teaching vocabulary items was effective and enjoyable to students.

Many studies have assessed students' attitudes toward applying mind mapping in classrooms. Cain (2001, 2002) surveyed the results of 14 students' satisfaction after using the mind map learning technique. Results showed that 10 agreed that the mind map learning technique was satisfactory and effective to the sample. Similarly, Holland, Holland and Davis (2003/2004) found out that mind mapping made students enthusiastic because it increased the students' sense of competence. It also enhanced their intrinsic motivation.

On a sample of 70 freshman students in the American University in Cairo, Ellozy and Mostafa (2010) conducted a case study on the implementation of E-mapping to develop critical reading skills. Results showed that E-mapping enhanced students' critical thinking and class participation. However, students found E-mapping a time consuming approach.

The above-mentioned literature review shows that mind mapping proved its effectiveness on various language skills in general and on their reading comprehension in particular. It also highlights the interchangeable influence of mind mapping and students' cognitive and psychological potentials.

PROBLEM OF THE STUDY

There was a widely-spread dissatisfaction among the instructors in the Community College of Qatar (CCQ) about the students' low achievement in reading courses and their lack of interest in participating in classroom reading activities. This, in turn, hindered achieving the vision and the educational reform for a knowledge economy of Qatar's Supreme Education Council under the auspices of Her Highness Sheikha Moza Bint Nasser Al-Thani , the First Lady in Qatar. This vision of the educational blueprint aims at shifting the focus from learning how to read to reading to learn, i.e. helping students to be autonomous and generative learners. On the other hand, to the best knowledge of the researcher, there was no Qatari research to investigate the effect of a generating-model of teaching reading on students reading achievement and on their interest. This study will hopefully contribute to fill that gap in research in Qatar and help CCQ instructors to engage students in reading activities that activate students' potentials to gain high achievement in reading.

PURPOSE OF THE STUDY

The study aimed to explore the effect of using computerized students' self-generated mind maps on college students' reading comprehension. It also aimed at investigating their attitudes towards generating these maps.

HYPOTHESIS OF THE STUDY

The study aimed to investigate the following null hypothesis:

> "There are statistically significant differences at (α =0.05) between the mean scores of the two level 3 experimental group and control group on the students' reading achievement due to the teaching strategies: student self-generated computerized mind mapping and teacher-generated chalkboard mind mapping."

SIGNIFICANCE OF THE STUDY

The study is significant in the following respects. First, the aims of the study go along with the new innovative trends in teaching reading, namely the use of computerized teaching strategies. Second, to the researcher's best knowledge, few studies have been conducted, in the Gulf in general and none in Qatar in particular, on the effect of computerized students' self- generated mind maps on students' reading achievement. In addition, the findings of this study will hopefully be beneficial to teachers and curriculum designers.

LIMITATIONS OF THE STUDY

The findings of this study will depend on the validity and reliability of the tests conducted by the researcher. The study will also be restricted to the population of the female level 3 English language foundation students. It will also be limited to a small sample size of level 3. Therefore, the results may not be generalized to the male students or to those in secondary schools or to the other levels.

METHODS AND PROCEDURES

Design of the study

The study followed a quasi-experimental design: pre–test- intervention- and post-test**.**

Sample of the study

The study was conducted in the second quarter of the academic year 2014/2015 in the English Language Center of the Community College of Qatar. The sample of the study consisted of the female students enrolling in two English as a second language level 3 foundation classes. The sample was conveniently chosen from the study population- the students enrolling in five morning CCQ Level 3 reading classes. According to the researcher investigation, the students were not taught reading via electronic mind-mapping in their previous levels. The convenience sampling was used as the researcher was scheduled to teach these two classes. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher. The two chosen classes were randomly assigned to an experimental group (n=14) that were taught reading texts via students-self-generated computerized mind maps; and a control group (n=8) that was taught the same texts via teacher-generated whiteboard maps. The treatment lasted for 8 weeks (40 class periods of an hour and thirty minutes each).

Instructional Material

The researcher used 13 reading texts in the Level three textbook, Real Reading 3. Several types of questions on the texts topics, main ideas, main points, details and examples were formed.

Instruments of the study

To achieve the purposes of the research, the researcher used the following instruments:

- A reading achievement pre-posttest was used to identify the participants' level in reading comprehension prior to the intervention and their expected progress after the intervention. (Appendix 1).
- A five-scale Likert questionnaire was used to survey the experimental group opinions of generating their own computerized mind maps. (Appendix 2)

The validity of the study instruments

To establish the validity of the research instruments, a jury of 8 specialists in teaching English as a foreign language were consulted for the appropriateness of the reading achievement test in terms of the number of the questions, the appropriateness of the reading texts, the general production of the test, the marks allotted for each question, pertinence of question category, the clarity of the questions and the suitability of the font by which the exam was typed. The instrument was modified in response to their comments. The same jury also assessed the appropriateness of the questionnaire items.

Procedures

1. A pilot study was conducted in the 1st quarter of the academic year 2014/2015 where the researcher established the validity and reliability of the pre-posttest.

2. The researcher got official permission from the dean and the department chair to conduct the research.

3. The pretest was administered to the two groups.

4. The experimental group was taught the reading texts via "Self-generating computerized mind mapping." The software Mind Mapper Arena 14 was installed in the classroom computer. Students were told about the research purpose. They were asked to download the software Mind Mapper 14 Arena in their PCs. They got training on how to create mind maps with the main idea in the center and branches and sub-branches used to lead to other ideas, details, and examples. They were trained on how pictures, videos, and sounds can be hyperlinked with Mind Mapper 14. They were encouraged to use different forms of mind maps. The students used the software very competently after two hours of training.

Classroom Presentation steps

A. **In the experimental group**: After introducing the vocabulary using intervals of silent reading and question-answer technique, students skim the target text for the main topic, scan the paragraphs for main ideas, sub-ideas, details and examples. Then, they worked in groups to generate their mind maps using a paper and colored pens. (Appendix 4). The groups decided on the shape of their own mind maps as far as the interrelationships between ideas and sub-ideas were correct. In the first lessons, maps were created in the classroom computer using the projector. Then, students were asked to create their mind maps on their PCs. A professional student, Rasha Ali, created some maps using the classroom set-up computer. Students' maps were displayed in class. Some examples of students' maps are shown below and in (Appendix 5).

B. **In the control group,** the traditional method was applied. The teacher and the students rotated in reading some parts aloud and paraphrasing the texts. Unlike the experimental group, students in the control group were not actively involved in groups. Instead, individual activities of answering written questions were used. The teacher sometimes drew one style of semantic maps using boxes on the whiteboard. E-mapping was never used in the class.

C. In the 8th week, the post test was administered. The scores of the pretest and posttest were statistically analyzed using ANCOVA.

D. The questionnaire was administered and analyzed using Cronbach alpha, modes, means and standard deviation.

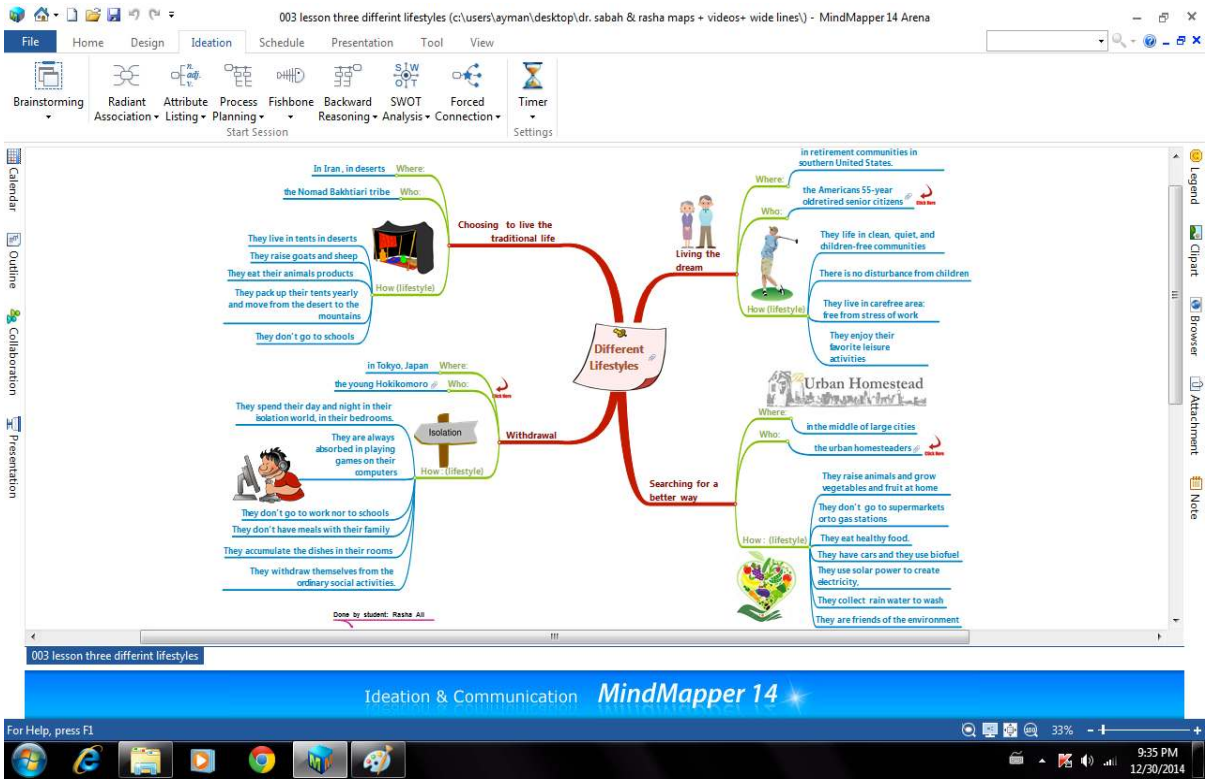

Figure 1: *MindMapper 14 – Different Lifestyles*

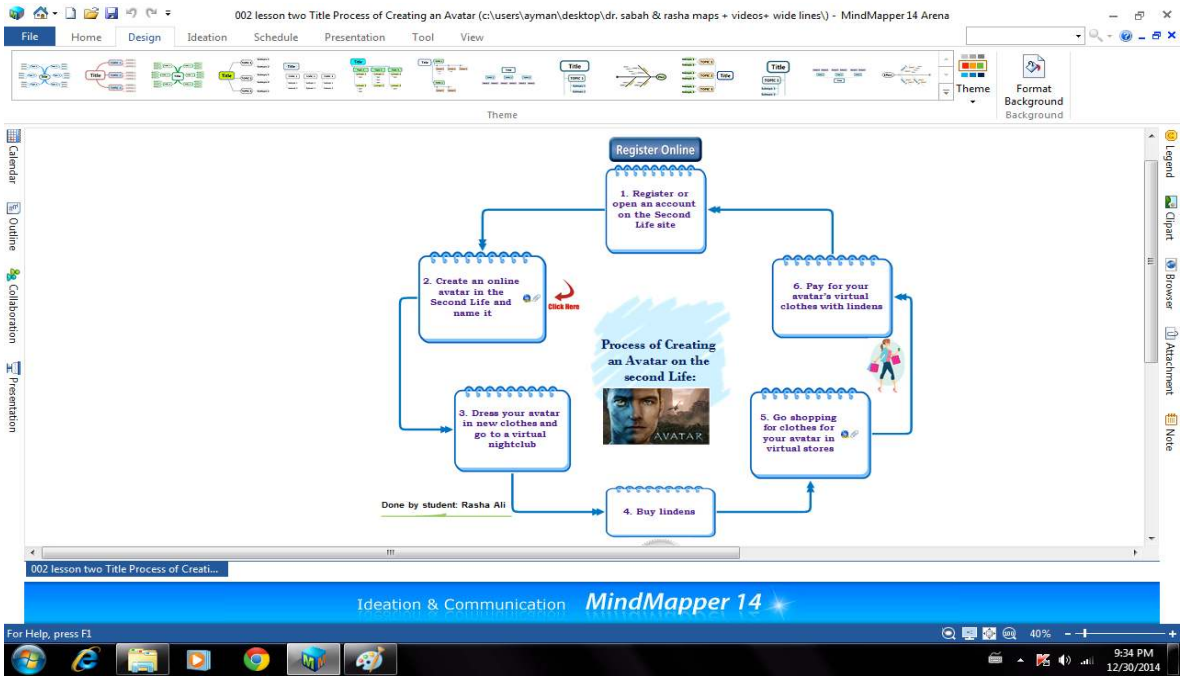

Figure 2: *MindMapper 14 – The Process of Creating an Avatar*

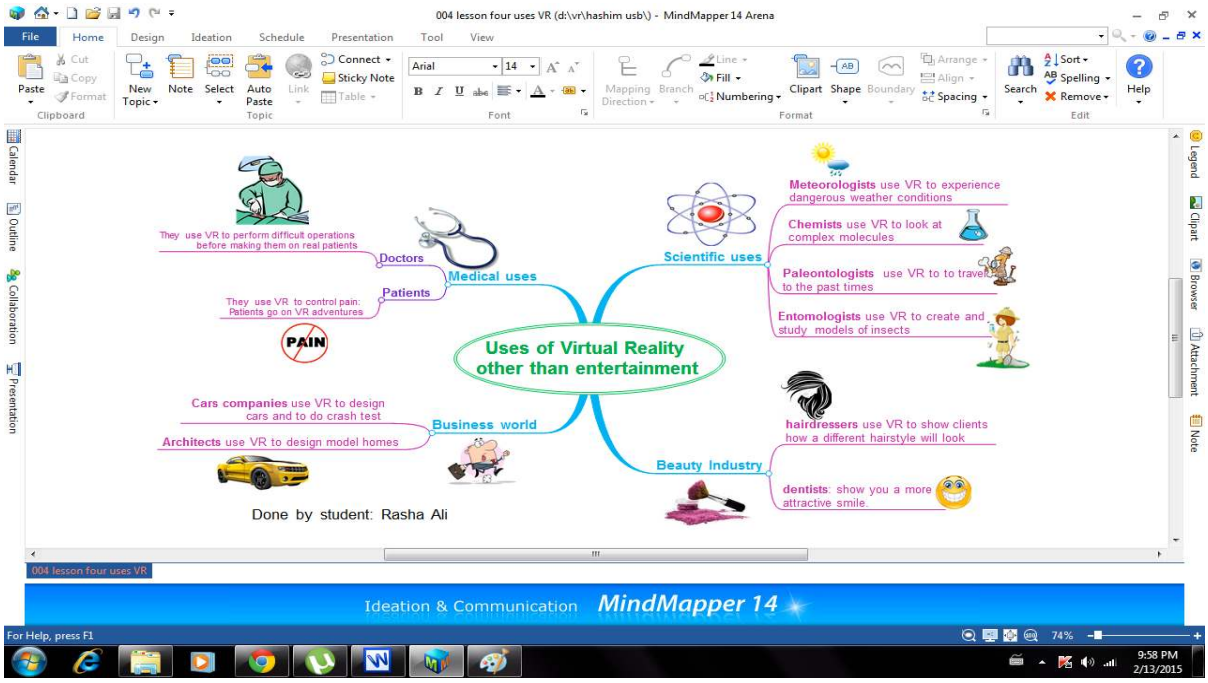

Figure 3: *MindMapper 14 – Virtual Reality*

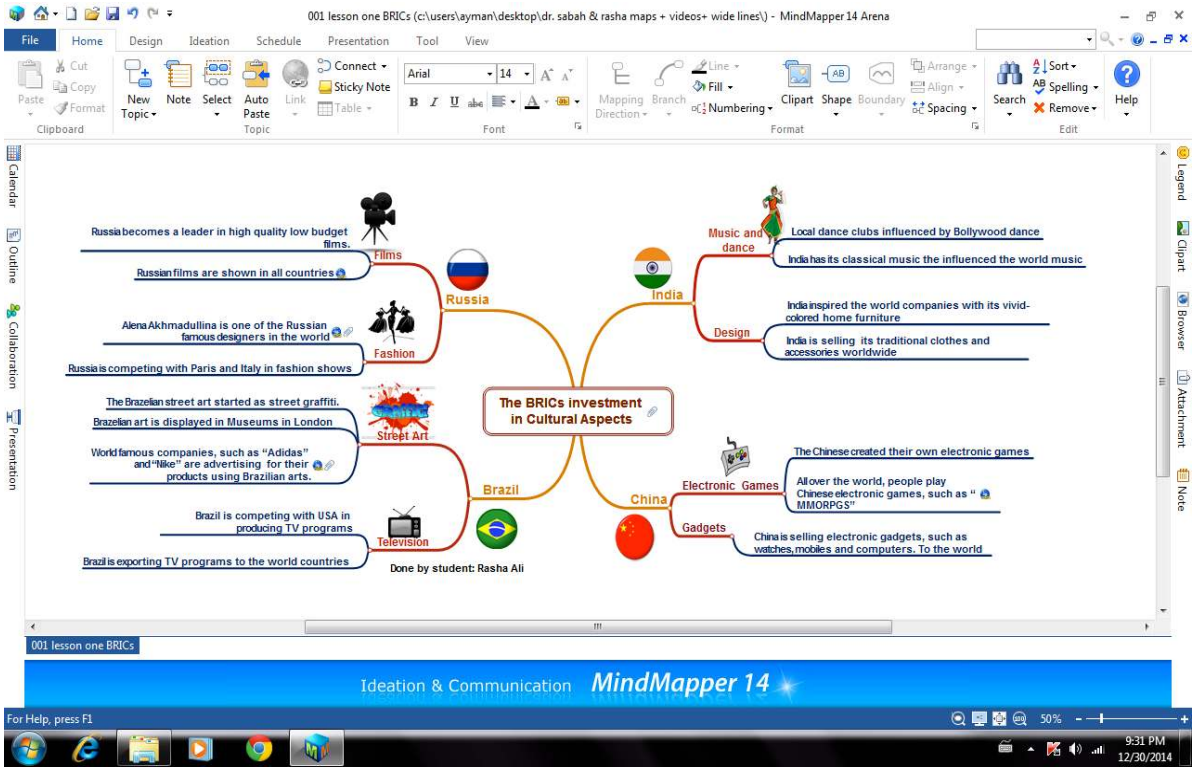

Figure 4: *MindMapper 14 – BRICs Investment in Cultural Aspects*

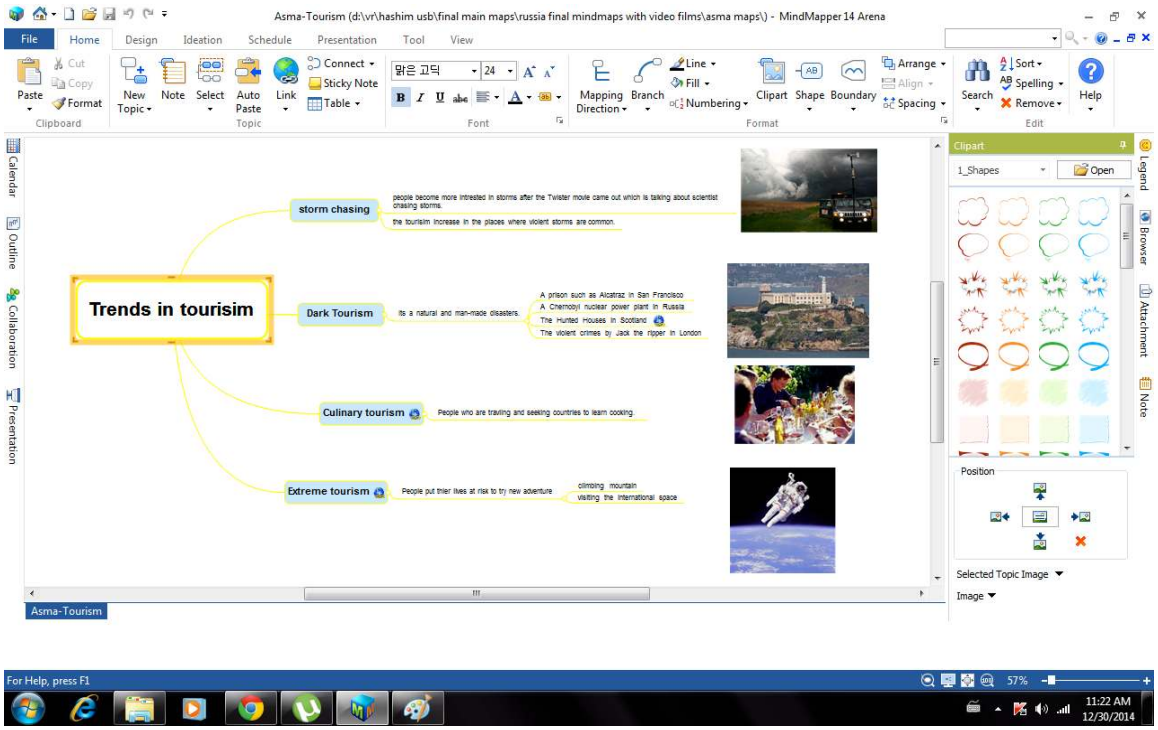

Figure 5: *MindMapper 14 – Trends in Tourism*

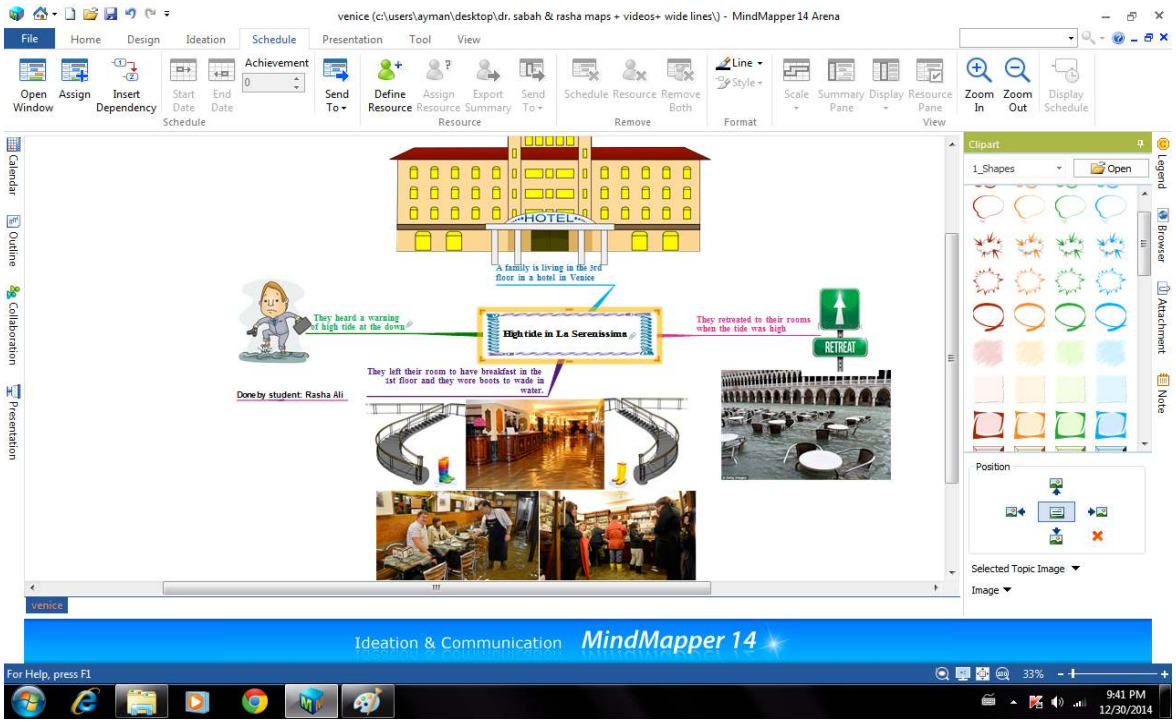

Figure 6: *MindMapper 14 – High Tide*

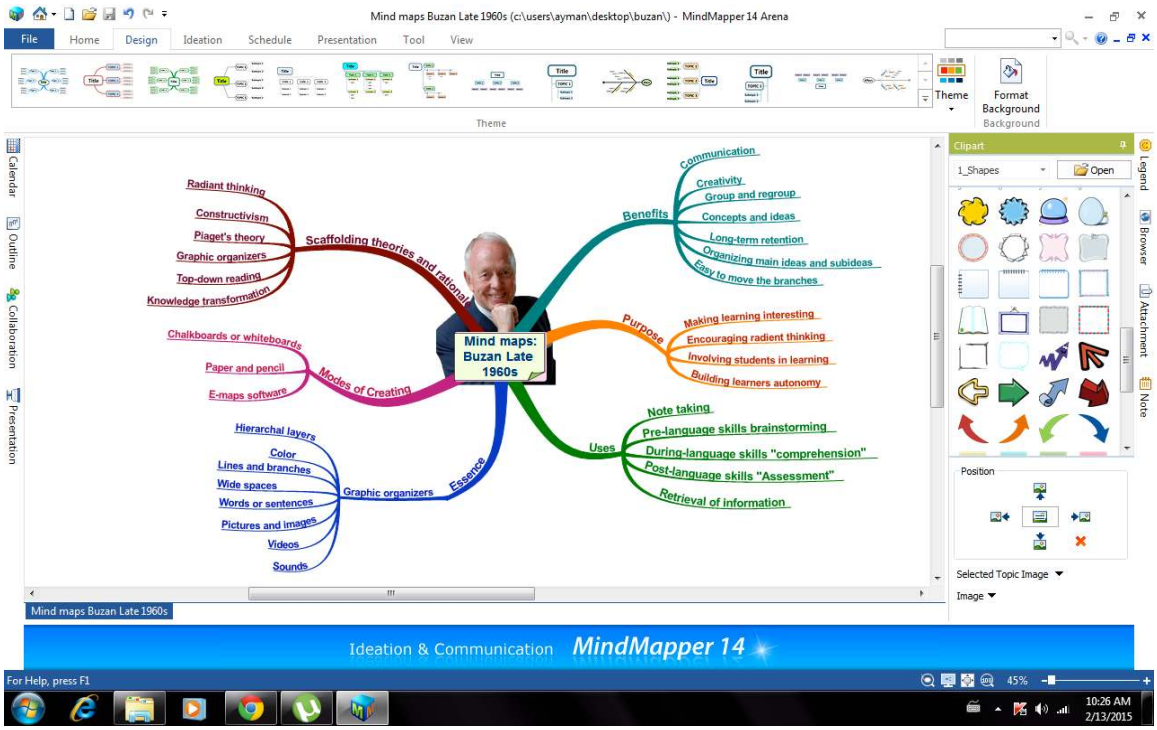

Figure 7: *MindMapper 14 – Mind Maps*

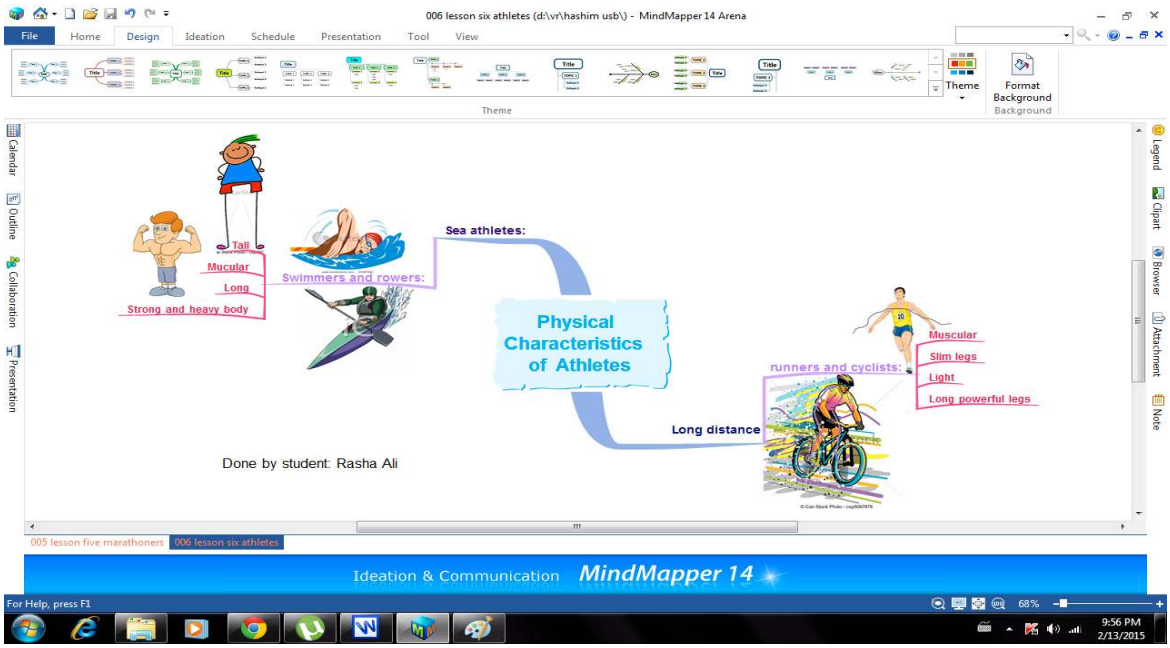

Figure 8: *MindMapper 14 - Athletes*

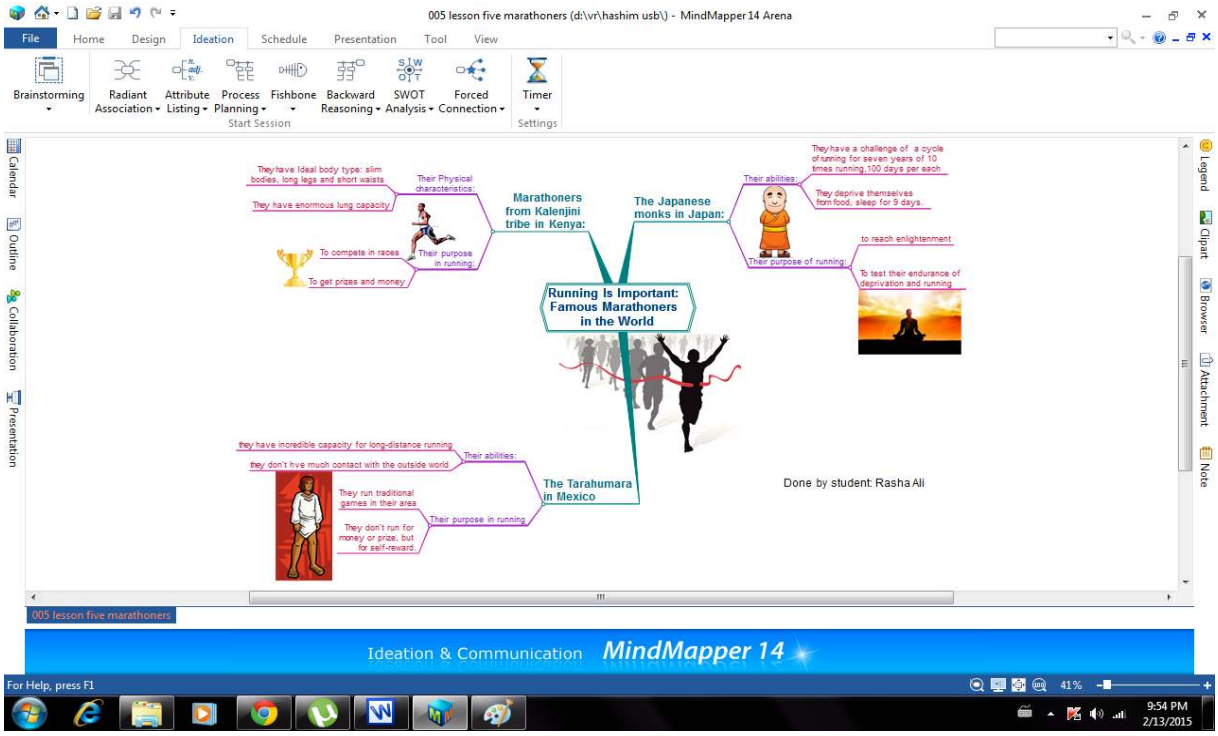

Figure 9: *MindMapper 14 - Marathons*

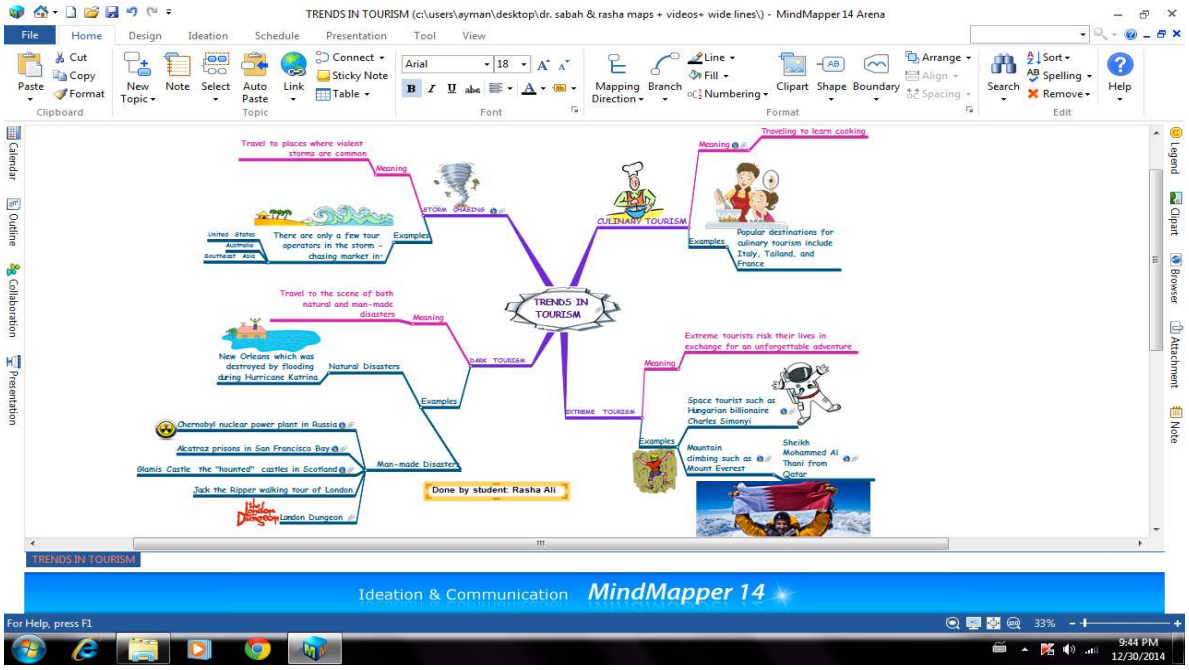

Figure 10: *MindMapper 14 - Trends in Tourism*

FINDINGS

Reliability

To test the reliability of the study instrument, the test-retest method was used, by applying the test twice in a period of two weeks with an exploratory sample other than the study sample. The reliability sample consisted of 23 students. Pearson correlation coefficient was calculated between the estimates of both occasions (0.87). This value was considered appropriate for the purposes of this study.

Equality between Groups

Pretest differences between experimental and control students were calculated using ANCOVA (see Table 1)

Table 1: *Means, Standard Deviations and t-test for pre-test according to experimental condition*

	GROUP	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
PRE	Experimental	14	73.64	12.762	.724	20	.477
	Control	8	70.00	8.089			

Table (1) shows there are no statistically significant differences at (α= 0.05) in the pre-test due to experimental condition. We conclude the two groups were equal.
Levene's Test for equality of variance was also conducted. The results were shown in the following table.

Table 2: *Levene's Test for Equality of Variance*

	Levene's Test for Equality of Variances	
	F	Sig.
PRE	.329	.573

Table (2) shows that F=.329, P=0.573 which indicates equal variances assumed.

To answer the question of the study, means, standard deviations and estimated marginal means were computed according to group variable as presented in tables 3 and 4.

***Table 3**: Means, standard deviations and estimated marginal means for responses on post test according to Method variable.*

Group	Mean	Std. Deviation	Estimated Marginal Means	N
Experimental	80.43	10.868	79.28	14
Control	70.13	10.999	72.14	8
Total	76.68	11.797	75.71	22

Table (3) shows a variance in the means of the post-test according to group, to find out whether there are statistical significant differences in these means, pretest score was used as a covariate. Also, one way ANCOVA was conducted which results in the findings shown in table 4.

***Table 4:** One way ANCOVA results of post related to their group of study (Experimental, Control).*

Source	Sum of Squares	df	Mean Square	F	Sig.
Pre test	1939.980	1	1939.980	83.332	.000
Method	253.024	1	253.024	10.869	.004
Error	442.324	19	23.280		
Corrected Total	2922.773	21			

Table (4) shows there are statistically significant differences at (α= 0.05) in the post test due to experimental condition in favor of experimental group.

Statistical Results of the questionnaire:

Type positive

Reliability of the questionnaire:

***Table 5**: The reliability of the questionnaire*

Domain	Cronbach alpha
Educational benefits	0.72
Benefits for the brain and nerves	(-)0.62
Usability in future tasks	0.85
Enjoyment	0.70
All items	0.87

Table (5) above shows that Cronbach alpha ranged between ((0.70-0.87)) which were considered sufficient for the sake of the study as all studies that studied attitudes reported that above 0.70 is good

Table 6: *Modes, Means and standard deviations of types of motivation ranked in descending order according to their means.*

Rank	#	Domain	Mode	Mean	SD
1	1	Educational benefits	5	4.51	.332
2	4	Enjoyment	4	4.27	.549
3	3	Usability in future tasks	4	4.06	.681
4	2	Benefits for the brain and nerves	3	3.29	.202
		Total	4	4.04	.365

Table (6) shows that the means ranged between (4.51-3.29), where the domain "Educational benefits" came in the first place was the highest mean (4.51), while the domain "Benefits for the brain and nerves" was ranked last with a mean (3.29), the mean for the all items was (4.04).

The mode means, and standard deviations of each domain items were calculated separately, which were shown in table (7) in the following page:

Table 7: *Modes, Means and standard deviations of Domain 1 items in descending order of the means.*

Rank	Item #	Item	Mode	Mean	Std. Deviation
1	13	Creating computerized mind maps improves my writing skills.	5	4.71	.469
1	21	Using computerized mind maps helped me to identify the main ideas and the sub-ideas in a more attractive way.	5	4.71	.469
1	34	Computerized Mind maps helped me to understand the relationship between main ideas, and details and examples.	5	4.71	.469
4	17	Creating computerized mind maps within a group work improves my vocabulary skills.	5	4.64	.497
4	12	Creating computerized mind maps improves my reading skills.	5	4.57	.514
6	14	Creating computerized mind maps within a group work improves my speaking skills.	5	4.57	.514
7	15	Creating mind maps within a group work improves my listening skills.	4	4.50	.519
7	30	Using the computerized mind maps increase my understanding of the reading text.	4	4.50	.519
9	5	Interacting with my colleagues in creating the computerized mind maps makes me more confident in speaking English	4	4.29	.825
10	32*	I feel using computerized mind maps as a reading technique is not useful at all.	5	4.29	1.069
11	19	Creating computerized mind maps in group work improve my communication skills.	4	4.14	.864

12		Educational benefits	5	4.51	.332

* Negative items (reverse coded: 5 = strongly disagree 4 = disagree 3 = neutral 2 = agree 1 = strongly agree).

Table (7) shows that means ranged between (4.14-4.71), where items (13,21,34), "Creating computerized mind maps improves my writing skills, " "Using computerized mind maps helped me to identify the main ideas and the sub-ideas in a more attractive way." and "Computerized Mind maps helped me to understand the relationship between main ideas, and details and examples" came in the first place with a mean of (4.71), while item (19), "Creating computerized mind maps in group work improve my communication skills" was ranked last with a mean (4.14). The mean for "Educational benefits" domain was (4.51).

***Table 8**: Modes, Means and standard deviations of Domain 2 items in descending order of the means.*

Rank	Item #	Item	Mode	Mean	Std. Deviation
1	35	The computerized Mind maps I created improved my retention of the information in the text.	5	4.86	.363
2	6	Using colors and pictures in the computerized mind map helps me remember the information better.	5	4.64	.497
3	31	Creating computerized mind maps enhances my motivation to learn reading.	5	4.36	1.082
4	28	Mind maps improve my mental abilities whether I create the computerized mind maps using computer software or using paper and pencil.	5	4.21	1.122
5	33	Creating a computerized mind map is a good exercise for my brain.	4	4.21	.893
6	7	Creating computerized mind maps ensures relaxed and stress-free atmosphere	4	4.07	.616
7	27*	I lost focus on the task during creating the computerized mind maps.	2	1.86	.864
7	36	Creating computerized mind maps makes me think of many ideas and then organizes my thoughts easily.	2	1.86	.864
9	40*	The different branches and lines drawn on the computerized mind maps distract me and make learning disorganized	1	1.64	.842
10	11*	Mind maps make the information too disorganized	1	1.21	.426
		Benefits for the brain and nerves	3	3.29	.202

* Negative items (reverse coded: 5 = strongly disagree 4 = disagree 3 = neutral 2 = agree 1 = strongly agree)

Table (8) shows that means were ranged between (1.21-4.86), where item (35), "The computerized Mind maps I created improved my retention of the information in the text." came in the first place with a mean of (4.86), while item (11), "Mind maps make the information too disorganized in my mind" was ranked last with a mean (1.21). The mean for "Benefits for the brain and nerves" was (3.29).

***Table 9**: Modes, Means and standard deviations of Domain 3 items in descending order of the means.*

Rank	Item #	Item	Mode	Mean	Std. Deviation
1	23*	It doesn't make me feel tired and bored to use colors and images in creating the computerized mind maps.	5	4.50	1.092
2	16*	Creating computerized mind maps is a waste of time	5	4.43	1.089
3	26*	It is troublesome and difficult to use computerized mind maps in reading comprehension	5	4.43	.852
4	38	I advise my colleagues in other classes and other levels to use computerized mind maps.	5	4.43	.938
5	4	I will use computerized mind mapping strategy in level 4 and in college level	5	4.29	1.069
6	10	I hope to learn all courses: reading, grammar and writing by creating the computerized mind maps.	4	4.07	1.072
7	20*	It makes no difference whether I use the mind maps or not.	5	3.93	1.328
7	25	I need good support and training prior to creating the computerized mind maps	4	3.93	.730
9	1	I will use the computerized mind mapping in my everyday plan outside the class	3	3.50	.760
10	3*	Creating a computerized mind map is a time-consuming task.	3	3.14	1.231
		Usability in future tasks	4	4.06	.681

* Negative items (reverse coded: 5 = strongly disagree 4 = disagree 3 = neutral 2 = agree 1 = strongly agree)

Table (9) shows that means were ranged between (3.14 - 4.50), where item (23), " It made me feel tired and bored to use colors and images in creating the computerized mind map" came in the first place with a mean of (4.50), while item (10), "Creating a computerized mind map is a time-consuming task" was ranked last with a mean (3.14). The mean for "Usability in future tasks" domain was (4.06).

***Table 10**: Modes, Means and standard deviations of Domain 4 items in descending order of the means.*

Rank	Item #	Item	Mode	Mean	Std. Deviation
	22	Using colors, images and video films while creating the computerized mind maps makes learning easy and interesting.	5	4.86	.363
	39	Inserting videos to illustrate ideas in the computerized mind maps was a good strategy to remember the information.	5	4.79	.579
	8*	Understanding a reading text is more difficult when we computerized create a mind map.	5	4.57	.514
	37	Editing my ideas in a computerized mind map is easy as it gives me more space than a paper and enables me drag ideas, enlarge lines and use pictures and videos hyperlinks easily.	5	4.36	1.082
	2	While creating the computerized mind maps, I felt the time pass very fast because I enjoyed creating the maps.	4	4.14	.864
	9*	I found creating electronic mind maps boring and difficult.	5	4.14	1.292
	18	During creating the computerized mind maps, I was absorbed in what I was doing.	4	4.14	1.027
	24*	If I were given the choice, I wouldn't create the computerized mind maps for reading comprehension	5	4.00	1.468
	29	I prefer individual work to group work to create computerized mind maps.	3	3.43	1.284
		Enjoyment	4	4.27	.549

* Negative items (reverse coded: 5 = strongly disagree 4 = disagree 3 = neutral 2 = agree 1 = strongly agree)

Table (10) shows that means were ranged between (3.43-4.86), where item (22), "Using colors, images and video films while creating the computerized mind maps make learning easier and more interesting" came in the first place with a mean of (4.86), while item (29), "I prefer individual work rather than group work to create computerized mind maps" was ranked last with a mean (3.43). The mean for "Enjoyment" domain was (4.27).

Frequencies and percentages of items of the questionnaire were statistically analyzed. They are shown in table 11.

***Table 11:** Frequencies and percentages of items of the questionnaire*

	1		2		3		4		5	
	Count	%	Count	%	Count	%	Count	%	Count	%
q1	0	.0	1	7.1	6	42.9	6	42.9	1	7.1
q2	0	.0	1	7.1	1	7.1	7	50.0	5	35.7
q3*	1	7.1	3	21.4	6	42.9	1	7.1	3	21.4
q4	1	7.1	0	.0	0	.0	6	42.9	7	50.0

	1		2		3		4		5	
	Count	%	Count	%	Count	%	Count	%	Count	%
q5	0	.0	1	7.1	0	.0	7	50.0	6	42.9
q6	0	.0	0	.0	0	.0	5	35.7	9	64.3
q7	0	.0	0	.0	2	14.3	9	64.3	3	21.4
q8*	0	.0	0	.0	0	.0	6	42.9	8	57.1
q9*	1	7.1	1	7.1	1	7.1	3	21.4	8	57.1
q10	1	7.1	0	.0	1	7.1	7	50.0	5	35.7
q11*	11	78.6	3	21.4	0	.0	0	.0	0	.0
q12	0	.0	0	.0	0	.0	6	42.9	8	57.1
q13	0	.0	0	.0	0	.0	4	28.6	10	71.4
q14	0	.0	0	.0	0	.0	6	42.9	8	57.1
q15	0	.0	0	.0	0	.0	7	50.0	7	50.0
q16*	1	7.1	0	.0	0	.0	4	28.6	9	64.3
q17	0	.0	0	.0	0	.0	5	35.7	9	64.3
q18	1	7.1	0	.0	0	.0	8	57.1	5	35.7
q19	0	.0	1	7.1	1	7.1	7	50.0	5	35.7
q20*	1	7.1	2	14.3	0	.0	5	35.7	6	42.9
q21	0	.0	0	.0	0	.0	4	28.6	10	71.4
q22	0	.0	0	.0	0	.0	2	14.3	12	85.7
q23*	0	.0	2	14.3	0	.0	1	7.1	11	78.6
q24*	2	14.3	0	.0	2	14.3	2	14.3	8	57.1
q25	0	.0	0	.0	4	28.6	7	50.0	3	21.4
q26*	0	.0	1	7.1	0	.0	5	35.7	8	57.1
q27*	5	35.7	7	50.0	1	7.1	1	7.1	0	.0
q28	0	.0	2	14.3	1	7.1	3	21.4	8	57.1
q29	1	7.1	2	14.3	5	35.7	2	14.3	4	28.6
q30	0	.0	0	.0	0	.0	7	50.0	7	50.0
q31	1	7.1	0	.0	0	.0	5	35.7	8	57.1
q32*	0	.0	2	14.3	0	.0	4	28.6	8	57.1
q33	0	.0	1	7.1	1	7.1	6	42.9	6	42.9
q34	0	.0	0	.0	0	.0	4	28.6	10	71.4
q35	0	.0	0	.0	0	.0	2	14.3	12	85.7
q36	5	35.7	7	50.0	1	7.1	1	7.1	0	.0
q37	1	7.1	0	.0	0	.0	5	35.7	8	57.1
q38	0	.0	1	7.1	1	7.1	3	21.4	9	64.3
q39	0	.0	0	.0	1	7.1	1	7.1	12	85.7
q40*	7	50.0	6	42.9	0	.0	1	7.1	0	.0

* Negative items (reverse coded: 5 = strongly disagree 4 = disagree 3 = neutral 2 = agree 1 = strongly agree)

“The mode, means, and standard deviations for each of the four domains items were calculated separately, and these can be seen on pages 10-14 above. By way of clarification: in the coding

process, negative statements have been reversed so that all statements in the survey are facing in the same (positive) direction. The number for each of the statements that have been reversed are identified by asterisks. My SPSS adviser said that this is standard practice in SPSS analysis.

IMPLICATIONS AND RECOMMENDATIONS

In light of the current study findings, the EFL teachers are recommended to vary their questions on the reading texts as to include questions which show the relations among ideas and sub ideas. It would be advisable that teachers implement computer-assisted mind mapping in different lesson stages. It is also highly recommended that researchers replicate the same experiment with other college levels, with a larger sample size as well as on male students so that the results could be widely generalized.

FINDINGS AND DISCUSSION

The results of this small study show that there are statistically significant differences at (α= 0.05) in the reading post-test due to group variable in favor of experimental group. This indicates that the treatment, namely the students' self-generated computerized mind mapping has affected their achievement in reading comprehension. This enhancement in the subjects' reading achievement is consistent with their attitudes in the survey as the items of the educational benefits of computerized mind mapping and the item of enjoyment scored the highest responses. These positive results and attitudes can be attributed to various factors. First, students expressed their enthusiasm about the computerized mind mapping as working within groups and drawing the maps by hand in the first phase of the treatment might have given the subjects more experience and deeper insight of how to create the computerized maps. Besides, the merits of computerized mind mapping that satisfy the neuro-linguistic needs of students of different learning styles (king 2007a) might have led to such positive results. Using colors and shapes facilitated the learners' understanding of the relationships among the ideas, the details and the examples of the texts. This might be a clear proof of what Antonacci (1991, p.174) argued, "A graphic arrangement shows the major ideas and relationships in text or among word meanings". The use of computerized mind mapping technique in an incremental manner, that is, through stages added more to the subjects' interest in the strategy. The teacher's asking questions to students made the process of creating the computerized maps easier. Gomez and King (2014, p.78) argued that the use of mind mapping software makes it possible for learners to "avoid run off the edge of the paper". In other words, e-mapping provides more space to learners to move freely by dragging branches, deleting ideas or replacing them with new ones so easily. Above all, the process of generating computerized mind maps was like an interactive game to students that was full of fun and enjoyment as they exchanged ideas and felt a sense of achievement to see their products created in very beautiful and informative images.

The results of the current study are consistent with a number of previous studies, such as those of Boyle and Weishaar 1997; Siddiqi 2007; Siriphanich and Laohawiryano 2010; Comez and King 2014 who found out that computerized mind maps enhanced learners' reading comprehension. The results of the attitude questionnaire implemented in the current study are also consistent with those of Holland, Holland and Davis (2003/2004), Mostafa (2010), and Rizqiya and Bandung (2013) as the subjects of all these studies expressed their positive attitudes toward creating their own computerized mind maps. What made this current study different from all previous studies is the finding which showed that using electronic mind mapping as a group technique was a good incentive to students' cooperation and use of their mental abilities for educational purposes.

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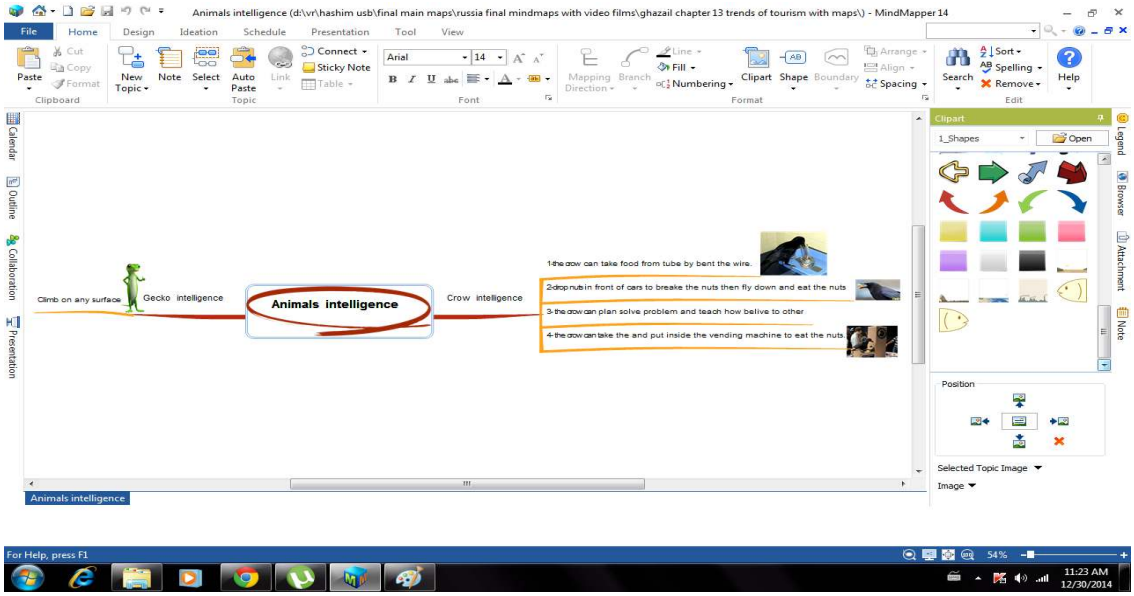
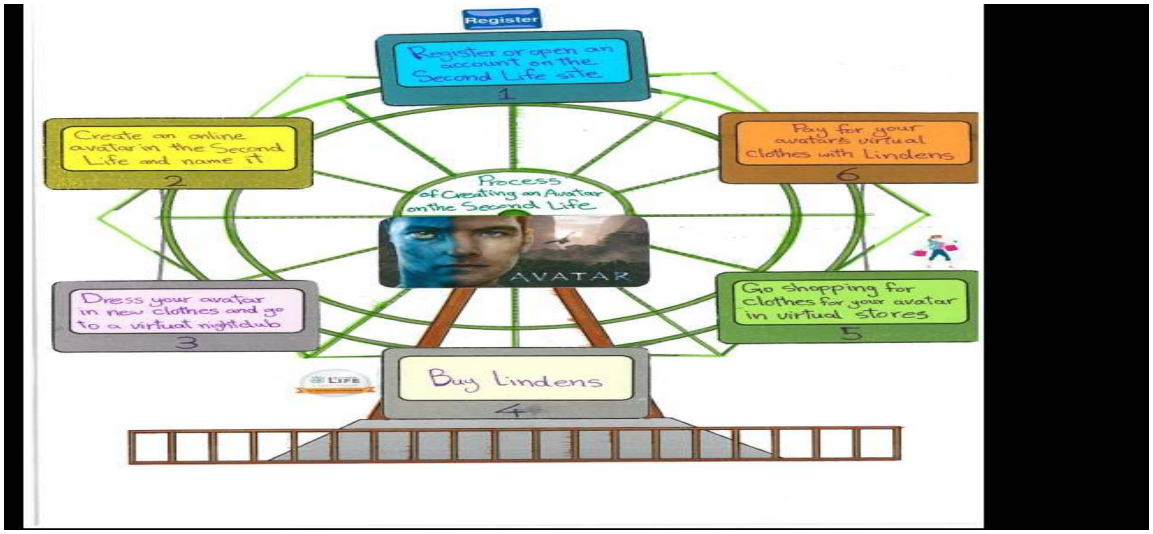
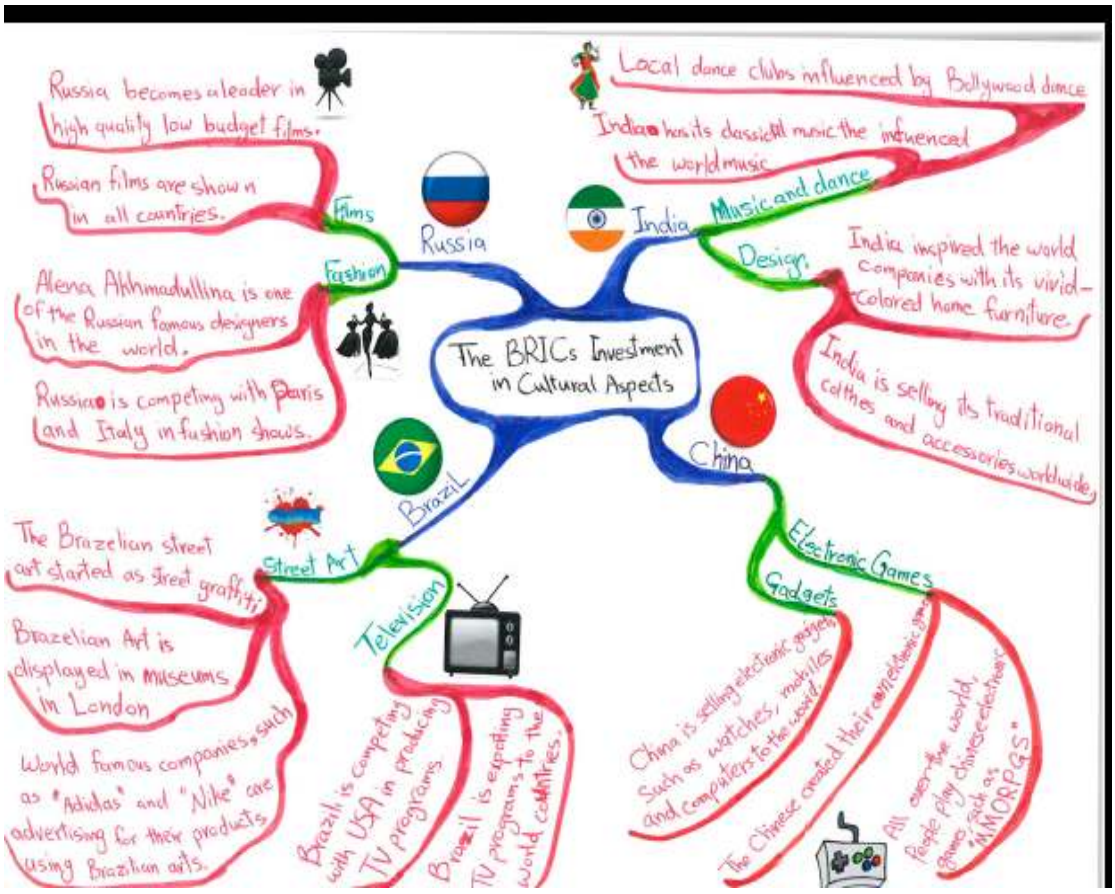
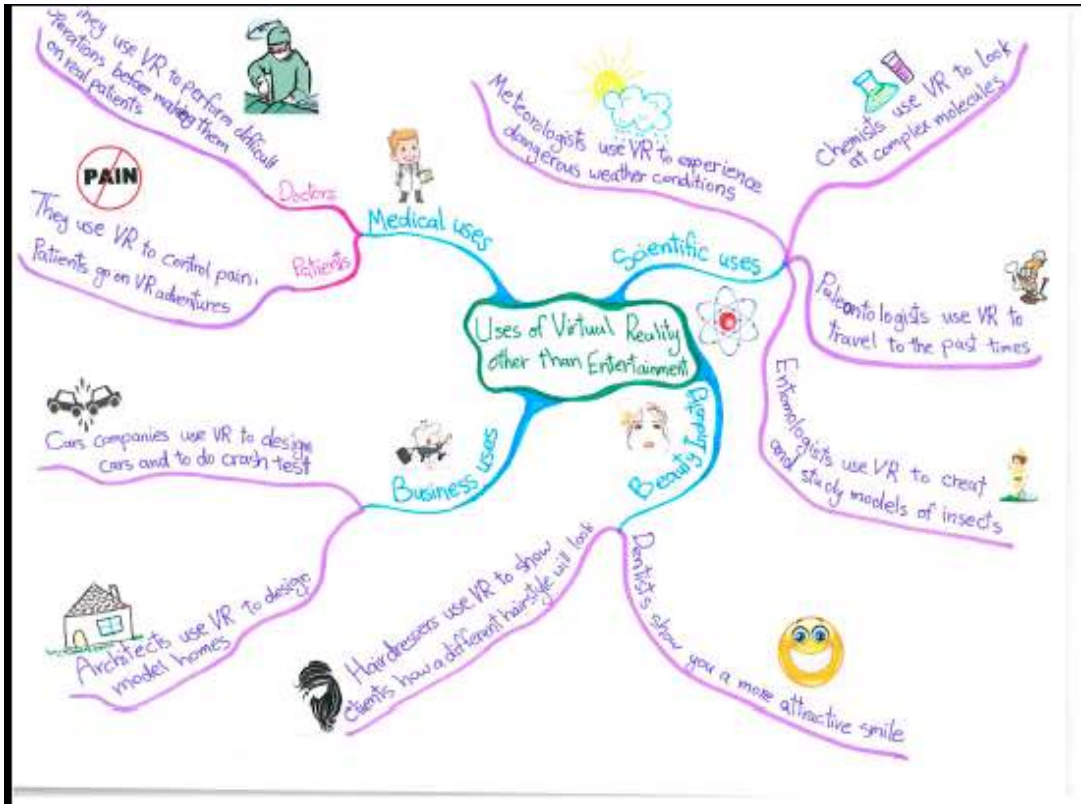
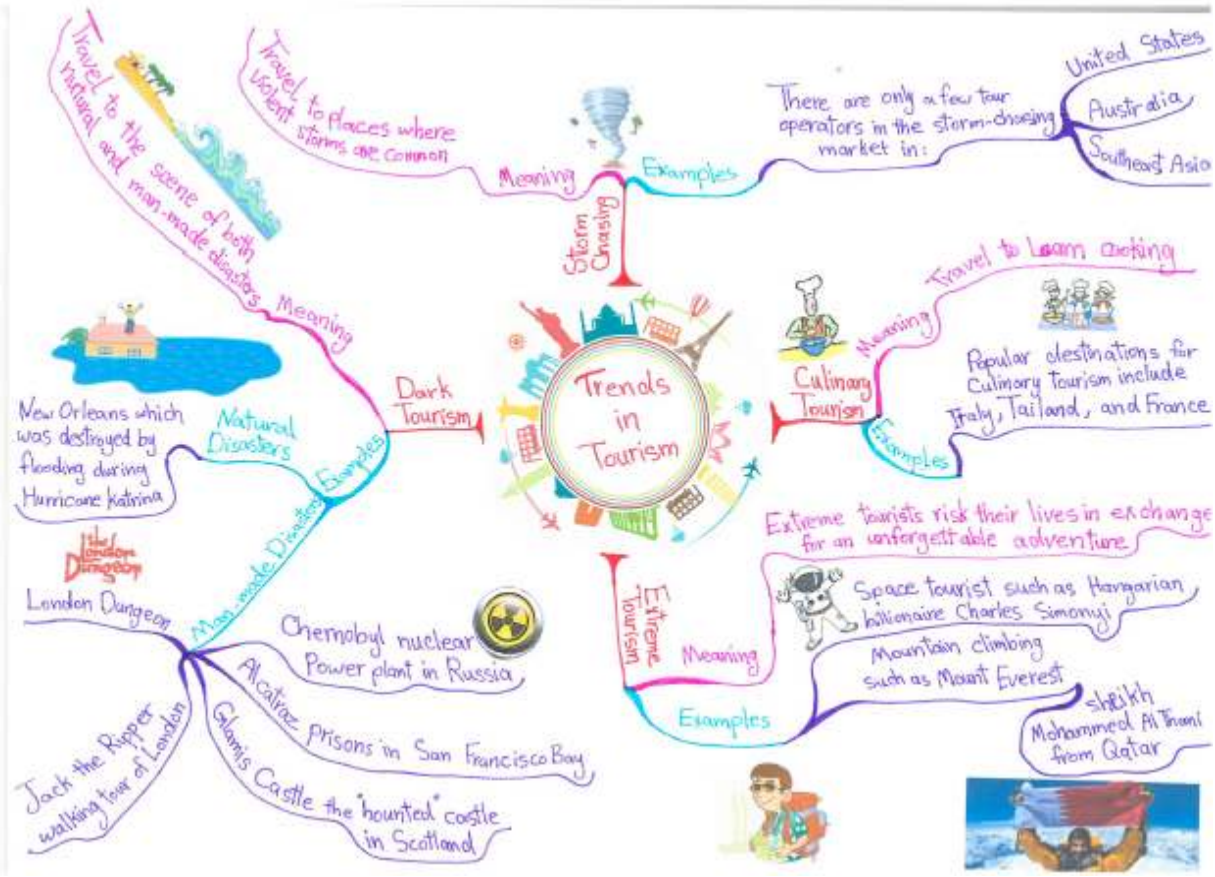
APPENDIX (1): Samples of the participants' manual and self-generated computerized mind maps

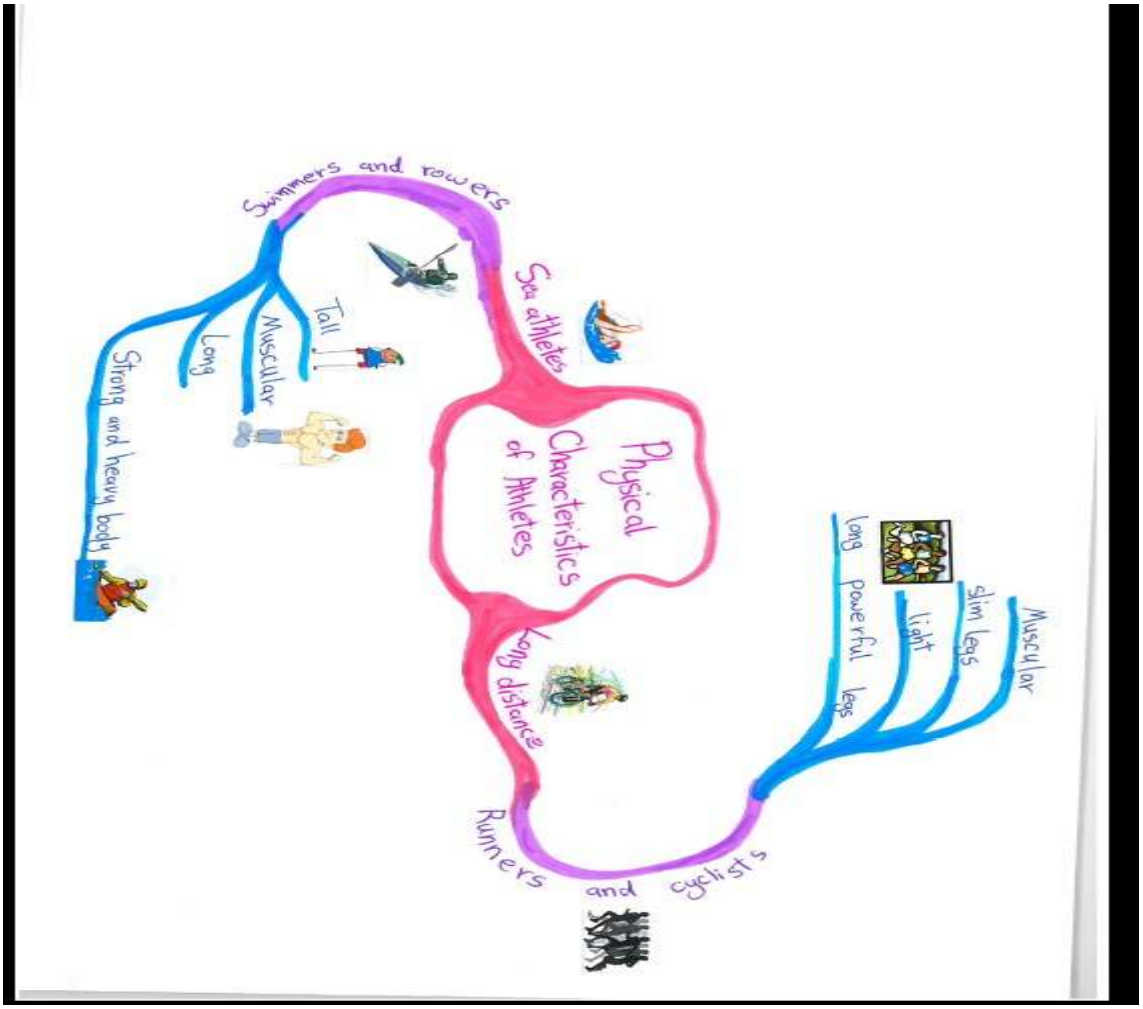


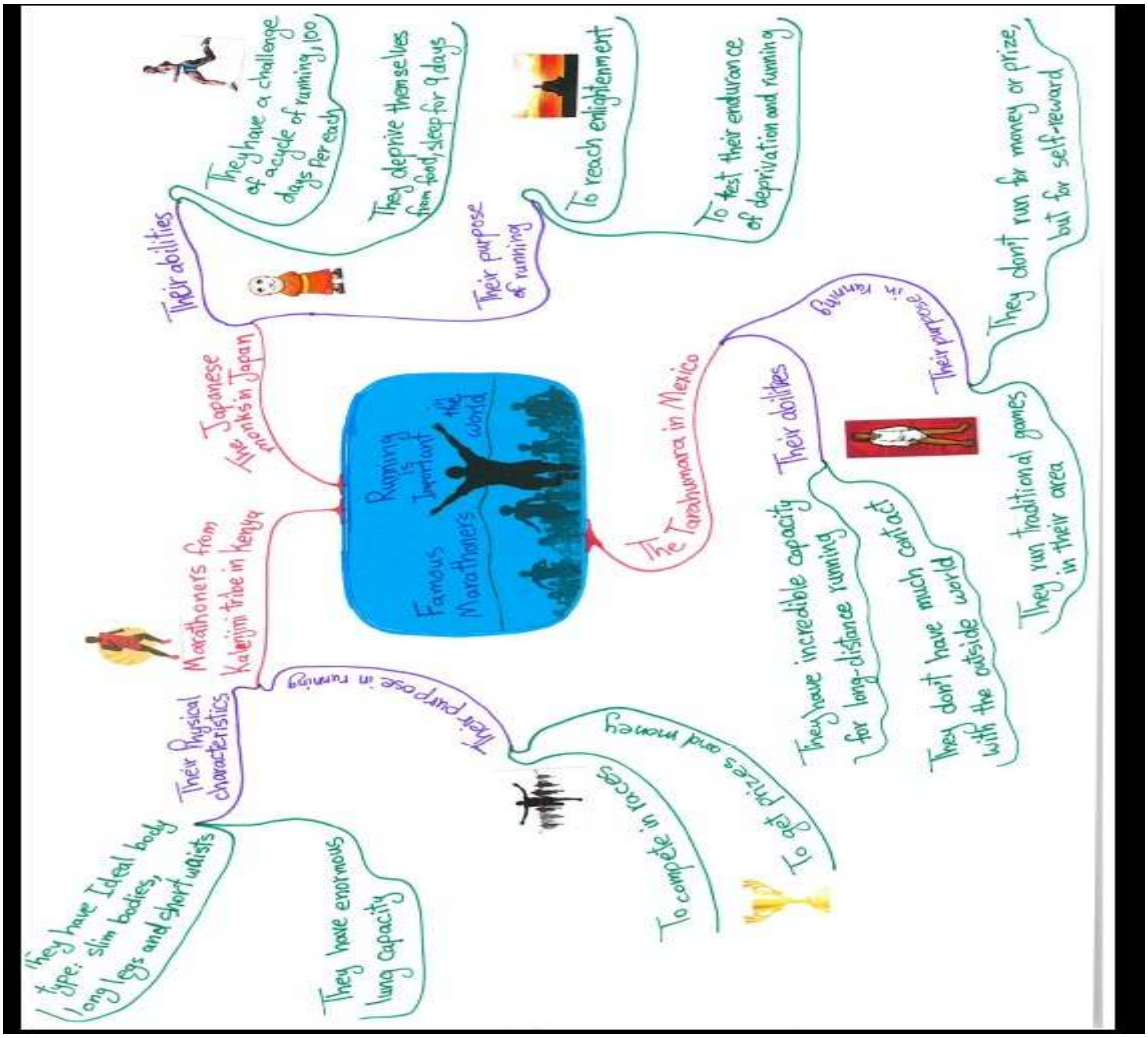


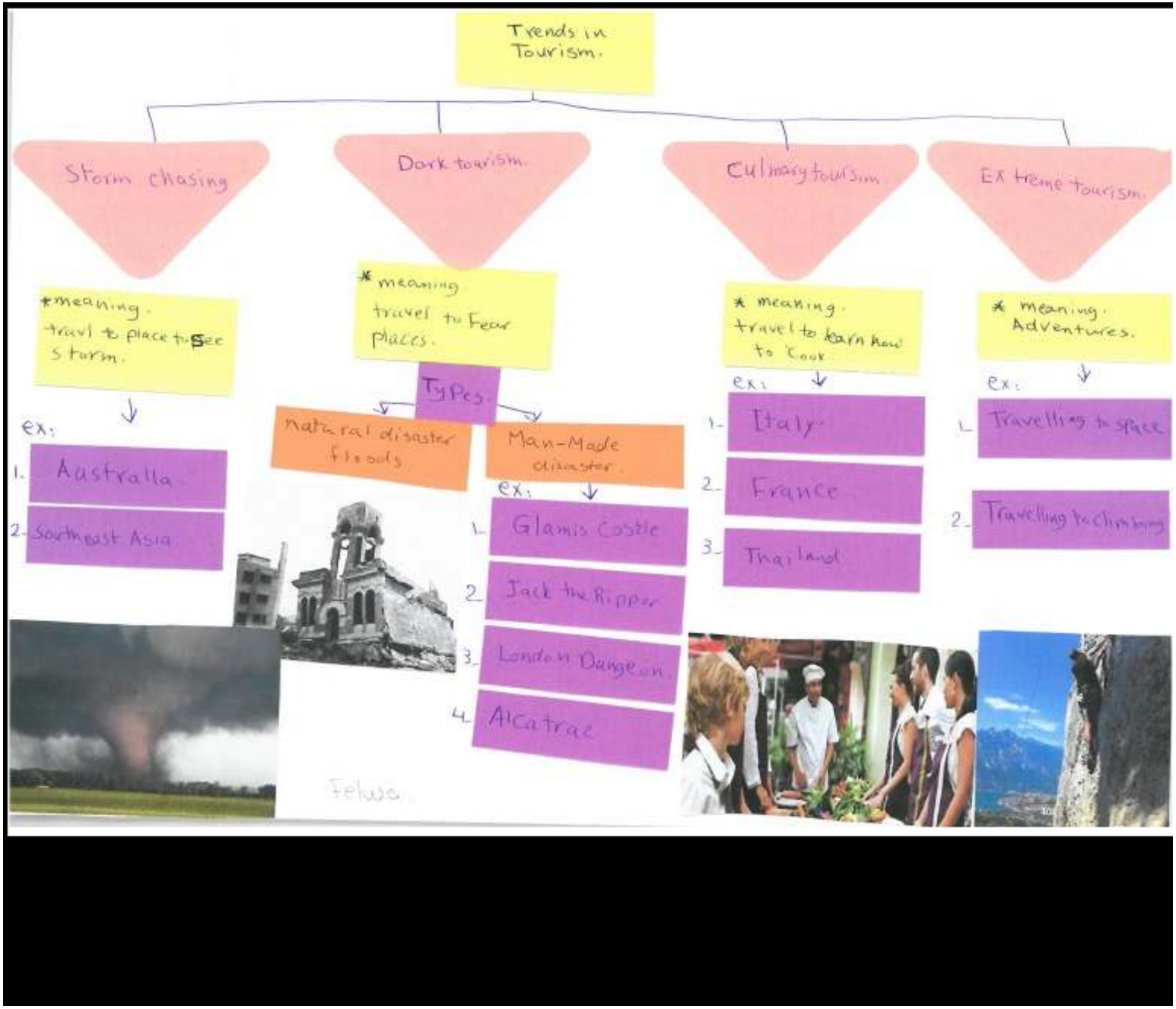

The BRICs Investment in Cultural Aspects
Russia
Films
Russia becomes a leader in high quality low budget films.
Russian films are shown in all countries.
Fashion
Alena Akhmadullina is one of the Russian famous designers in the world.
Russia is competing with Paris and Italy in fashion shows.
India
Music and dance
Local dance clubs influenced by Bollywood dance
India has its classical music the influenced the world music
Design
India inspired the world companies with its vivid-colored home furniture.
India is selling its traditional cothes and accesseries worldwide.
China
Electronic Games
Gadgets
China is selling electronic gajets such as watches, mobiles and computers to the world.
The Chinese created their own electronic games.
All over the world, people play chinese electronic games such as "MMORPGs."
Brazil
Street Art
The Brazelian street art started as street graffiti.
Brazelian Art is displayed in museums in London
World famous companies, such as "Adidas" and "Nike" are advertising for their products using Brazilian arts.
Television
Brazil is competing with USA in producing TV programs
Brazil is exporting TV programs to the world countries.

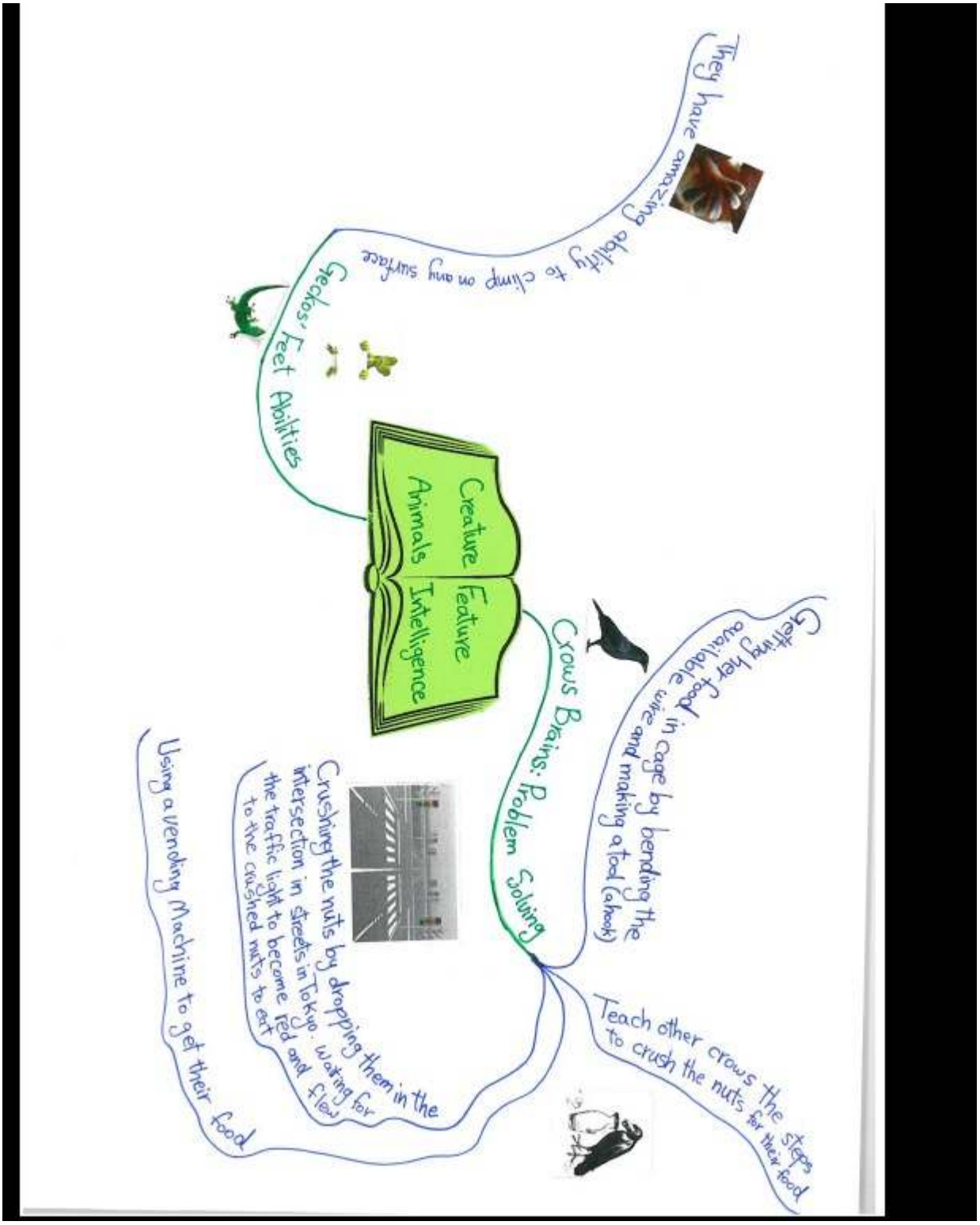

Uses of Virtual Reality other than Entertainment
Medical uses
Doctors
They use VR to perform difficult operations before making them on real patients
Patients
PAIN
They use VR to control pain. Patients go on VR adventures
Scientific uses
Meteorologists use VR to experience dangerous weather conditions
Chemists use VR to look at complex molecules
Paleontologists use VR to travel to the past times
Entomologists use VR to creat and study models of insects
Business uses
Cars companies use VR to design cars and to do crash test
Architects use VR to design model homes
Beauty Business
Hairdressers use VR to show clients how a different hairstyle will look
Dentists show you a more attractive smile


Trends in Tourism
Dark Tourism
Meaning
Travel to the scene of both natural and man-made disasters
Examples
Natural Disasters
New Orleans which was destroyed by flooding during Hurricane Katrina
Man-made Disasters
London Dungeon
Jack the Ripper walking tour of London
Chernobyl nuclear Power plant in Russia
Alcatraz Prisons in San Francisco Bay
Glamis Castle the "haunted" castle in Scotland
Storm Chasing
Meaning
Travel to places where violent storms are common
Examples
There are only a few tour operators in the storm-chasing market in:
United States
Australia
Southeast Asia
Culinary Tourism
Meaning
Travel to Learn cooking
Examples
Popular destinations for Culinary tourism include Italy, Tailand, and France
Extreme Tourism
Meaning
Extreme tourists risk their lives in exchange for an unforgettable adventure
Examples
Space tourist such as Hungarian billionaire Charles Simonyi
Mountain climbing such as Mount Everest
Sheikh Mohammed Al Thani from Qatar


Physical Characteristics of Athletes
Swimmers and rowers
Sea athletes
Tall
Muscular
Long
Strong and heavy body
Long distance
Runners and cyclists
Long powerful legs
Light
Slim legs
Muscular


Running is important in the world
Famous Marathoners
Japanese Monks in Japan
Their abilities
They have a challenge of cycle of running 100 days per each
They deprive themselves from food, sleep for 9 days
Their purpose of running
To reach enlightenment
The Tarahumara in Mexico
To test their endurance of deprivation and running
Their abilities
They have incredible capacity for long-distance running
They don't have much contact with the outside world
Their purpose in running
They don't run for money or prize, but for self-reward
They run traditional games in their area
Kalenjin tribe in Kenya
Their Physical characteristics
They have Ideal body type: slim bodies, long legs and short waists
They have enormous lung capacity
Their purpose in running
To compete in races
To get prizes and money


Trends in Tourism.
Storm chasing
Dark tourism.
Culinary tourism
EX treme tourism.
*meaning. travel to place to see storm.
ex:
1. Australia
2. Southeast Asia
* meaning travel to Fear places.
Types
natural disaster floods
Man-Made disaster.
ex:
1. Glamis Castle
2. Jack the Ripper
3. London Dungeon
4. Alcatraz
* meaning. travel to learn how to Cook
ex:
1. Italy
2. France
3. Thailand
* meaning. Adventures.
ex:
1. Travelling to space
2. Travelling to climbing


Creature Feature
Animals
Intelligence
Geckos' Feet Abilities
They have amazing ability to climb on any surface
Crows Brains: Problem Solving
Getting her food out of a wire cage by bending the wire and making a tool (a hook)
Teach other crows the steps to crush the nuts for their food
Crushing the nuts by dropping them in the intersection in streets in Tokyo. waiting for the traffic light to become red and flew to the crushed nuts to eat
Using a Vending Machine to get their food