

# Effectiveness of Mind Mapping as Digital Brainstorming Technique in Enhancing the Writing Skills of Indian Students

<sup>1</sup>Heethal Jaiprakash, <sup>2</sup>Sanil S Hishan, <sup>3</sup>Suresh Ramakrishnan

**Abstract--** Writing is an essential means of contact between individuals and society. This is an important part of contact. Developing a healthy mindset of future teachers would allow them to become internationally competent. The research focused on the utility of interactive brainstorming using visual modeling to improve students' writing success and attitudes. The thesis employed an experimental testing method before the evaluation after the evaluation. The participants included 25 students. The experimental process lasted eight days and samples were taken before and after the operation. The degree of significant differences was determined by the t-test based study. On the basis of the findings, it revealed that the technique for mapping the mind has a considerable effect on respondents' writing efficiency, although the writing attitude before and after implementation did not vary significantly. This indicates that students have developed a high degree of attitude towards learning. The research concluded that mind mapping is an important method for optimizing student writing efficiency.

**Key words--** Writing Performance, Writing Attitude, Mind Mapping.

---

## I. INTRODUCTION

Writing is considered one of the most valuable skills students require so they can convey who they are as a person and retain their thoughts and memories. In culture, writing skills are highly important as they are the very foundation on which relations, literature and art have began. In school settings, students study different grammar rules that they can follow in a structured setting, training them for their future as professionals. It is also the foundation for evaluating one's job, learning and intelligence, particularly in tertiary education. A individual would benefit from the opportunity to write for the remainder of his life.

Writing is both an essential, positive and complex mechanism and an integrative ability (Maharani, et al, 2018). For students, it is relevant, but they regarded it as a difficult task and they expressed a negative attitude towards it (Magulod, 2018). The explanation some students don't like writing is that they see it as a challenge, a terrifying work that they don't see as authors (Regehr, Glancy & Pitts, 2013). When you do not know how writing has a connection to your own life and how you may benefit from written language skills, you will be less likely to practice and appreciate it.

---

<sup>1</sup>Senior Lecturer, International Medical University, School of Medicine, Bukit Jalil, Kuala Lumpur, Malaysia

<sup>2</sup>Azman Hashim International Business School (AHIBS), University Technology Malaysia, Malaysia, hishanssanil@gmail.com

<sup>3</sup>Azman Hashim International Business School (AHIBS), University Technology Malaysia, Malaysia

English is an international language which plays a predominant role in all professions, industries, trade, education and humanities. The ability to use English in diverse contexts is an important quality for learners to attain global competence. English language skills enable a person to understand the varied people of the world. World school institutions are introducing action to train learners for global contact skills. Language education involves teachers to learn about the use of appropriate language teaching techniques to meet the needs of the global economy, stressing English as a language of the globe, particularly with the advent of education 4.0 (Magulod, 2018).

In the Indian context, issues emerge from using teaching techniques that build the potential of English learners in real-life contexts (Chen, et al, 2019; Hu, 2005; Wang, Smyth, & Cheng, 2017). It has been confirmed that Indian EFL students will not have English speaking facilities. In 2001, the Indian Ministry of Education initiated programs for the uniform English language teaching at all levels at schools to tackle these growing issues. The emphasis was on publishing, walking, reading and listening in English. The solution aims to increase the success of Indian learners in English.

Research suggests that their attitude to writing and fear of writing are one of the key problems that affect students' progress in school. (Abdel Latif, 2019; Limpo, 2018; Mahfoodh, 2017). Students suffer from poor language skills, fear of writing, lack of commitment, first-language dependency, and insufficient hierarchical structure (Fareed, Ashraf & Bilal, 2016). The preparation that students receive in the university has to be prepared for the various written activities that they will plan to do in their future work. Lessons are one of the most challenging challenges for a teacher in communications art in the 21st century. Understanding the writing process is important for students as it helps students to communicate their thoughts, tastes and emotions effectively, particularly for learners who speak English as a Foreign Language (ESL).

Writing is very important for teacher-education students, as potential teachers must have this skill. In addition to giving students the right knowledge and setting the correct precedent, writing is also their principal tool to turn them into their best image. We would not be an accurate and reliable tutor to both their students and the other members in the society without their skill in writing. The improvement of writing skills is an important factor to be discussed by educators, teachers and academics.

Lagarrigue et al (2017) Agree that if teachers were knowledgeable of the writing process, they will teach right strategies and improve students' written skills in the field of education. Writing is also an important resource for acquiring other effective and sensitive skills (Shao & Purpur, 2016). Teaching writing is a challenging task for most teachers and also a daunting and frustrating work for students to do (Saddler et al, 2017). The students' writing skills are still poor. The students made errors in spelling, orthographing and punctuations. It was difficult for them to "test" their own thoughts (Graham, Harris & Beard, 2019). Teachers will evolve their instructional strategies, techniques and activities that represent the interest of the students. The use of imaginative and immersive prewriting methods, such as mind mapping, was described as a way to enhance the attitude and success of students in writing. Brainstorming is a method-based pre-writing approach to learning. This allows students to explore and produce ideas before they compose a script.

Mind mapping is characterized as a learning method, whereby the student places superior concepts on paper and links inferior concepts as required. Mind mapping is a means to build insight and bring things out of the brain in a human spirit. The approach to chart the thoughts is creative and easily (Fu et al. 2019, Karim et al. 2019, Panggabean et al. 2019, Strobl et al. 2019). Effectiveness literature found to improve EFL student writing abilities and inspiration (Bruner, 2014; Hager, Kolar & Janke, 2016; Lin, 2019; Wette, 2017). This technique is considered useful for teachers, as the writing abilities of students have been seen to be enhanced.

Research on the usefulness of the automated mind mapping methodology in the written output of Indian students have not been further discussed on the basis of checked literature. Cultural research on the use of multiple writing techniques exists, but most are restricted to basic education. There is a lack of study into the usefulness of visual modeling as a tool for publishing. As a research void found, this study evaluated the efficacy of mind mapping as one of the teaching writing techniques for Indian students. The findings of the analysis will allow both teachers and students to assess their abilities in writing and develop their methods and techniques.

In this sense, one of the developing countries, such as India, acknowledged the essential role of English in the world. India has also introduced changes to meet the learners' needs for language acquisition in English language education programmes. As part of the report, the placement of English language skills amongst Indian learners calls for teachers to have a realistic understanding of sociocultural-sensitive pedagogy by implementing successful language teaching methods, given that Indian has already adopted an English-writing program, particularly in EFL writing.

## **II. OBJECTIVES OF THE STUDY**

This study explored the feasibility of mental modeling as an interactive brainstorming method to enhance the behavior and success of students. Most specifically, it aims at: (1) finding students' pre-and non-test scores in writing; (2) defining the post-test and post-test scores in writing using mind mapping as a visual brainstorming tool, (3) measuring students' variations in their pre-and post-test attitude and (4) measuring their disparity in their pre-tests and post-test results.

## **III. METHODOLOGY**

### **Research Design**

The research used one-group pre-test configuration to determine the efficacy of interactive brainstorming technologies in improving students' writing performance and attitudes. Before and after treatment administration the write efficiency and attitude of the experimental group is assessed. Based on the statistic, the study group was pre-tested to assess its written output and writing role before the experiment was performed. Posttest was also performed after the procedure or counseling was completed.

### **Respondents and Inclusion Criteria**

Research subjects were EFL graduates from one university in India for the first year. The study respondents were intentionally selected because the researchers find the value of good results and written attitude that will allow

them to effectively excel in their future jobs. We will not be able to qualify for a respectable job without their expertise in English, and will not be an effective and reliable mentor for the future generation. A total of 25 students were involved in the report. They are in one class. Sufficient detail was given on the aims and benefits of the research. Informal approval was used to ensure that the research was ethically accepted.

### **Research Instrument**

The study data are collected using testing tools, including attitude test writing and written composition of the students. A sample consists of 20 elements and is based on Donna Rafanello's questionnaire in his paper *Writing Well: It's All about Attitude*. The Likert scale of 5 points with 1 being the lowest and 5 being the highest. Researchers were tested for the reliability of the instrument. The second approach was the students' written results in a sample in which participants were asked to write what they learned about the subject "Trends in Learning." In determining the written systems of the students, the students were told first of the requirements by presenting them with some objective standards for their written performances.

### **Data Gathering Procedure**

The experimental procedures of this study lasted for 8 days. Upon the written permission of the researcher to the concerned authorities, the study started in April 16, 2019 to April 24, 2019. Figure 2 shows the paradigm of the study to gather the needed data.

#### **Phase 1: Pre-Treatment Phase**

A pre-attitudinal test and pre-writing test were conducted to the students. A pre-writing attitude questionnaire was administered to the group at the beginning of the study. The questionnaire consisted of 20 items. In the pre-writing test, the participants were asked to write a composition and they were provided a topic.

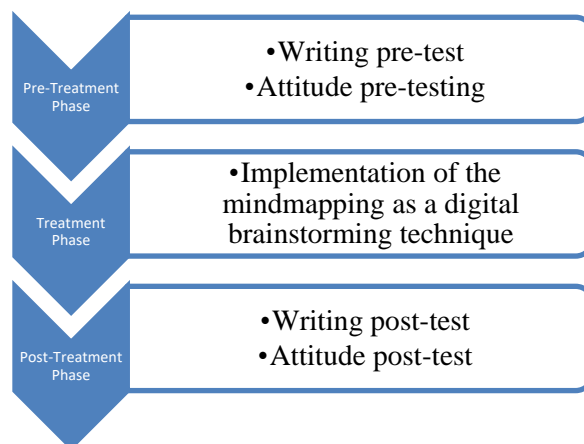
Before the start of the procedure, the students were updated with the purpose of the study and their participation was voluntary. The participants were also provided checklist which will guide them on the criteria of their written output. Further, the researcher oriented the students about the mechanics of their written output which will consist of the introduction, body, and conclusion while using English as the standard language.

#### **Phase 2: Treatment Phase**

The students were asked to use mind mapping as a digital brainstorming technique. They were asked to make a mind map about the given topic for their composition. They have 8 days to do it.

#### **Phase 3: Post Treatment Phase**

After eight days, the students answered post writing test and post attitude questionnaire. Assessment of the written outputs of the students was conducted by two Language teachers. They evaluated the output through the adopted criteria with corresponding subjections: organization (15 points), content (15 points), word choice (10 points), and language use (10 points) with a total of 50 points. A checklist was provided for the evaluators to rate the pre-writing and post-writing output of the respondents.



**Fig. 1:** Treatment Phases of the study

### Data Analysis

To analyse the data, descriptive statistics such as mean, percentage and standard deviation were used on the assessment of the respondents. Inferential statistics such dependent sample t-test was used determine whether there are significant differences on the pre-writing scores, pre-attitude writing, post-writing scores and post attitude scores of the participants. The significance of the mean difference was tested at 0.05 alpha level. As to the writing performance of the respondents, four (4) criteria were adopted with corresponding weighted points: organization (15 points), content (15 points), word choice (10 points), and language use (10 points) with a total of 50 points. To interpret the scores of the respondents, the following scoring range was also adopted: 41-50- excellent; 31-40- Very Good; 21-30- Good; 11-20- Fair; and 10 below- poor.

## IV. RESULTS AND DISCUSSION

### Writing Performance and Attitude of Participants

Table 1 shows the pre-writing and post-writing performance of the respondents. In the result of the pretest, there were 3 students (12%) who obtained excellent marks in their writing task while 17 (68%) scored very good rating and 5 (20%) scored good. It is also interesting to note that most of the participants (16 or 64%) got excellent rating, 4 students (16%) got very good scores, 4 students or 16% scored good, and 1 or 4% got fair score in posttest scores.

**Table 1.** Writing Performance of the Students

Score Range	Descriptive Interpretation	Pretest f	%	Posttest f	%
41-50	Excellent	3	12	16	64
31-40	Very good	17	68	4	16
21-30	Good	5	20	4	16

11-20	Fair	0	0	1	4
10 below	Poor	0	0	0	0
	<b>Total</b>	<b>25</b>	<b>100</b>	<b>25</b>	<b>100</b>
Pre-writing score= <b>34.92</b>					
Post-writing score= <b>40.08</b>					

It is also shown in the table that the students post-writing score is 40.08 and the prewriting score is 34.92. Although the post-writing score is higher than the pre-writing score, both have descriptive interpretation of very good. In this findings, it generally implies that the most of the respondents have obtained higher scores in post-writing compared to the pre-writing. The use of digital mind mapping as encouraged a higher level of student writing success in college classroom. It clearly explains when students are connected with learning experience that will inevitably provide them with the appropriate suggestions and feedback that they want in writing intentionally will improve their writing skills. Previous studies manifest the effectiveness of mind-mapping in teaching writing among EFL learners. (Bukhari, 2016; Tan, et al, 2005; Vijayavalsalan, 2016; Wu & Chen, 2018; Yunus & Chien, 2016; Sanil *et.al*, 2019a).

**Difference between the Pre and Post Writing Scores of the respondents**

Table 3 displays the difference between the pre-attitude scores and post attitude scores of the respondents. This was determined to assess if there was a substantial change in attitude of participants towards writing following the introduction of mind mapping as interactive brainstorming technique.

**Table 2.** The difference between the pretest and posttest performance of the experimental group

Writing scores	Mean score	SD	Interpretation	t-value	df	p
Pre-writing score	34.92	5.35	Very good	24	-3.31	0.003*
Post-writing score	40.08	7.79	Very good			
*= significant at 0.05 level      ns= not significant						

The result showed that there is a significant difference between the pretest and posttest administered to the students with the computed t-value of 24 and p value of 0.003 which is less than the significance value of ( $p < 0.05$ ). This indicates that after the exposure of the respondents to the use of mind mapping they scored significantly higher in the post test with a mean of 40.08 compared with the pre-test score with a mean of 34.92. Hence, there is a significant difference between the pre and post writing scores of the respondents exposed to the use of mind mapping as prewriting technique.

The study shows that the use of mind mapping as digital brainstorming significantly increased the writing performance of the respondents. Mind mapping allows students the opportunity to strengthen their ideas before learning, where they are allowed to effectively pass context or compose summaries. The students were thus capable of writing more detailed and well-organized essays. A further plausible explanation of the mind mapping post score's output is important to the training process per se.

The result of this study collaborates with the findings of Marchisan (2001) explored the influence of mind mapping on writing short story learning skills reported that mind mapping technique is effective in enhancing short story writing for students. Similarly, previous studies highlighted the benefits of mind mapping in the writing skills of students made them more confident to write and express their ideas in written form. Their level of anxiety also decreased because of the positive and favorable learning environment for writing (Abrams & Byrd, 2016; Sanil *et.al.*, 2019b, Sanil *et.al.*, 2019c, Cossette, 2002; Karim et al 2016; Yunus & Chien, 2016).

**Table 3.** The difference between the pre-attitude scores and post attitudes scores of the experimental group

Writing Attitude	Mean score	SD	t-value	df	p
Pre-attitude	3.48	.664	-0.426	24	0.674ns
Post-attitude	3.55	.596			

\*= significant at 0.05 level      ns= not significant

Table 3 Shows the difference between the participants ' pre-attitude scores and post-attitude ratings. Although there is an increase in the mean of posttest attitude (3.55) compared to the pre-attitude (3.48), it shows that there is no significant difference on pre-attitude and post-attitude of the students with the computed t-value of 0.426 and p value of 0.674 which is more than the significance value of ( $p < 0.05$ ). This shows that there no difference on the writing attitude of the respondents before and after the implementation of mind mapping activity. The finding implies that despite of the cognitive effectiveness of mind mapping, the respondents already have established a positive attitude toward writing before and after the implementation of the intervention. The high performance in writing using mind mapping can also be attributed to their high level of attitude towards writing. This indicates that the students are not apprehensive and sufficiently confident in writing composition using English as a means of communication. The findings of the research indicates that attitudes to writing may have predicted achievement in writing. According to Hidi and Boscolo (2007), not only does writing include cognitive and metacognitive mechanisms but it has also efficacious elements such as self-regulation and encouragement. Consequently, Gupta & Woldermariam (2011) highly motivated students practice a high amount of enjoyment, belief, perceived skill, and positive outlook to learning, and use regular writing strategies.

## V. CONCLUSION AND RECOMMENDATION

On the basis of the data obtained, the mapping methodology aims to improve learners' writing skills. The students have already developed a optimistic writing mindset before and after the technique has been applied. Based on its conclusion, the following recommendations are made: first, as the relevance has been identified in pre-test and post-test outcomes, mental mapping is strongly recommended as a teaching and learning tool, as a digital brainstorming technique. Third, as part of the teacher learning plan, the University shall conduct seminars and trainings on the use of writing methods and various strategies such as visual mapping. Thirdly, students must aspire to rethink relational frameworks in writing, because this promotes improved written performance. Finally, a pilot analysis in various subjects will be carried out using greater sampling scales and real observational research so that the impact in visual mapping is also tested not just in writing but also in other abilities.

### Limitations of the Present Study

This study restricts its focus to the participants' written results and attitude by using the smallest post-test research design category, and proposes for future studies that there is a relationship between the attitude of the respondents to write and their personal profile. However, this research restricts its emphasis on the productivity of the prewriting period, which is only one of many phases of the system of writing, and the efficacy of other writing techniques in the creation, revision, publication and presentation process as an approach to writing is still to be studied.

## REFERENCES

1. Abdel Latif, M. M. (2019). Helping L2 students overcome negative writing affect. *Writing & Pedagogy*, 11(1).
2. Abrams, Z. I., & Byrd, D. R. (2016). The effects of pre-task planning on L2 writing: Mind-mapping and chronological sequencing in a 1st-year German class. *System*, 63, 1-12.
3. Ahmed, M. A. E. A. S. (2016). The effect of a flipping classroom on writing skill in English as a foreign language and students' attitude towards flipping. *US-China Foreign Language*, 14(2), 98-114.
4. Bukhari, S. S. F. (2016). Mind Mapping Technique to Enhance EFL Writing Skill. *International journal of linguistics and communication*, 4(1), 58-77.
5. Burner, T. (2014). The potential formative benefits of portfolio assessment in second and foreign language writing contexts: A review of the literature. *Studies in Educational Evaluation*, 43, 139-149.
6. Chen, F., Tsai, S. C., & Tsou, W. (2019). The Application of Translanguaging in an English for Specific Purposes Writing Course. *English Teaching & Learning*, 43(1), 65-83.
7. Cossette, P. (2002). Analysing the thinking of FW Taylor using cognitive mapping. *Management Decision*.
8. Fareed, M., Ashraf, A., & Bilal, M. (2016). ESL learners' writing skills: Problems, factors and suggestions. *Journal of Education and Social Sciences*, 4(2), 81-92.
9. Fu, Q. K., Lin, C. J., Hwang, G. J., & Zhang, L. (2019). Impacts of a mind mapping-based contextual gaming approach on EFL students' writing performance, learning perceptions and generative uses in an English course. *Computers & Education*, 137, 59-77.
10. Graham, S., Harris, K. R., & Beard, K. (2019). Teaching writing to young African American male students using evidence-based practices. *Reading & Writing Quarterly*, 35(1), 19-29.
11. Gupta, D., & Woldemariam, G. S. (2011). The influence of motivation and attitude on writing strategy use of undergraduate EFL students: Quantitative and qualitative perspectives. *Asian EFL Journal*, 13(2), 34-89.
12. Hager, K. D., Kolar, C., & Janke, K. K. (2016). Concept mapping, reflective writing, and patchwork text assessment in a first-year pharmaceutical care course. *Currents in Pharmacy Teaching and Learning*, 8(4), 492-500.
13. Hu, G. (2005). Using peer review with Chinese ESL student writers. *Language teaching research*, 9(3), 321-342.



14. Karim, R. A., Abu, A. G., & Khaja, F. N. M. (2016, November). Brainstorming approach and mind mapping in writing activity. In *Proceedings of English Education International Conference* (Vol. 1, No. 2, pp. 423-429).
15. Karim, R. A., Adnan, A. H. M., Adam, M. H. M., & Zaidi, A. (2019, January). Mobile Technology use in writing classrooms for higher education. In *Proceedings of the International Invention, Innovative & Creative (InIIC) Conference, Series* (pp. 197-202).
16. Lagarrigue, A., Longcamp, M., Anton, J. L., Nazarian, B., Prévot, L., Velay, J. L., ... & Frenck-Mestre, C. (2017). Activation of writing-specific brain regions when reading Chinese as a second language. Effects of training modality and transfer to novel characters. *Neuropsychologia*, 97, 83-97.
17. Latif, M. M. A. (2019). Unresolved issues in defining and assessing writing motivational constructs: A review of conceptualization and measurement perspectives. *Assessing Writing*, 42, 100417.
18. Limpo, T. (2018). Development of a short measure of writing apprehension: validity evidence and association with writing frequency, process, and performance. *Learning and Instruction*, 58, 115-125.
19. Lin, C. J. (2019). An online peer assessment approach to supporting mind-mapping flipped learning activities for college English writing courses. *Journal of Computers in Education*, 6(3), 385-415.
20. Magulod Jr, G. C. (2018). Innovative learning tasks in enhancing the literary appreciation skills of students. *SAGE Open*, 8(4), 2158244018820382.
21. Maharani, S., Fauziati, E., & Supriyadi, S. (2018). An investigation of writing strategies used by the students on the perspective language proficiency and gender. *International Journal of Multicultural and Multireligious Understanding*, 5(5), 185-190.
22. Mahfoodh, O. H. A. (2017). "I feel disappointed": EFL university students' emotional responses towards teacher written feedback. *Assessing Writing*, 31, 53-72.
23. Marchisan, M. L., & Alber, S. R. (2001). The write way: Tips for teaching the writing process to resistant writers. *Intervention in School and Clinic*, 36(3), 154-162.
24. Nolen, S., Hidi, S., & Boscolo, P. (2007). Writing and Motivation.
25. Panggabean, W., Lubis, F., & Lubis, R. F. (2019). Mind Mapping on Students' Writing Descriptive Text. *English Education: English Journal for Teaching and Learning*, 7(02), 164-174.
26. Regehr, C., Glancy, D., & Pitts, A. (2013). Interventions to reduce stress in university students: A review and meta-analysis. *Journal of affective disorders*, 148(1), 1-11.
27. Saddler, B., Moran, S., Graham, S., & Harris, K. R. (2017). Preventing writing difficulties: The effects of planning strategy instruction on the writing performance of struggling writers. In *Students Who Are Exceptional and Writing Disabilities* (pp. 3-17). Routledge.
28. Sanil S Hishan\*, Suresh Ramakrishnan, Ahmad Jusoh, Muhammad Imran Qureshi, Norhalimah Idris (2019a). Multifaceted Meaning of Corporate Social Responsibility (CSR) : A Case Study Among Insurance Company, Non-Government Organization and the Government. *International Journal of Recent Technology and Engineering* , 6(S5)868-872.
29. Sanil S Hishan\*, Suresh Ramakrishnan, Yamunah Vaicondam, Muhammad Imran Qureshi(2019b). Corporate Social and Environmental Disclosure Among Malaysian Listed Companies. *International Journal of Recent Technology and Engineering* , 6(S5) 1606-1609.
30. Sanil S Hishan\*, Ezzat Abdulaziz Mansour, Suresh Ramakrishnan, Nur Naha Binti Abu Mansor (2019c). Ethics in Knowledge Management As A Research Agenda. *International Journal of Engineering and Advanced Technology*,8(5C),1414-1419.
31. Shao, X., & Purpur, G. (2016). Effects of information literacy skills on student writing and course performance. *The Journal of Academic Librarianship*, 42(6), 670-678.
32. Strobl, C., Ailhaut, E., Benetos, K., Devitt, A., Kruse, O., Proske, A., & Rapp, C. (2019). Digital support for academic writing: A review of technologies and pedagogies. *Computers & Education*, 131, 33-48.
33. Tan, L. H., Laird, A. R., Li, K., & Fox, P. T. (2005). Neuroanatomical correlates of phonological processing of Chinese characters and alphabetic words: A meta-analysis. *Human brain mapping*, 25(1), 83-91.
34. Vijayavalsalan, B. (2016). Mind mapping as a strategy for enhancing essay writing skills. *The New Educational Review*, 3(44), 137-150.
35. Wang, H., Smyth, R., & Cheng, Z. (2017). The economic returns to proficiency in English in China. *China Economic Review*, 43, 91-104.
36. Wette, R. (2017). Using mind maps to reveal and develop genre knowledge in a graduate writing course. *Journal of second language writing*, 38, 58-71.
37. Wu, T. T., & Chen, A. C. (2018). Combining e-books with mind mapping in a reciprocal teaching strategy for a classical Chinese course. *Computers & Education*, 116, 64-80.

38. Yunus, M. M., & Chien, C. H. (2016). The use of mind mapping strategy in Malaysian university English test (MUET) Writing. *Creative Education*, 7(04), 619.
39. Yunus, M. M., & Chien, C. H. (2016). The use of mind mapping strategy in Malaysian university English test (MUET) Writing. *Creative Education*, 7(04), 619.
40. Mueen Ahmed, K.K. Citing JCDR articles: An insight(2011) *Journal of Cardiovascular Disease Research*, 2 (3), pp. 192-196.  
DOI: 10.4103/0975-3583.85269
41. Cateni, F., Nitti, P., Zacchigna, M., Procida, G., Lassiani, L., Drioli, S., Florio, C., Pelin, M. Synthesis and antitumor activity of  $\alpha$ -alkyliden- $\gamma$ -lactones(2018) *International Journal of Pharmaceutical Research*, 10 (4), pp. 1-8.
42. Gupta V, Puri R, Gupta S, Jain S, Rao GK. "Tamarind Kernel Gum: An Upcoming Natural Polysaccharide." *Systematic Reviews in Pharmacy* 1.1 (2010), 50-54. Print. doi:10.4103/0975-8453.59512