Effects of Jigsaw and Traditional Methods of Instruction with Complex Input on Vocabulary Improvement-A Repeated Measures Study

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Abstract : Students' interest in improving their repertoire of vocabulary and the habit of reading for pleasure and profit seems to have reached a nadir in the current era of social media. As a consequence, students tend to display noticeable inadequacy of comprehension and communication. Several research projects have been carried out to find out suitable methods to enrich and enhance the vocabulary repertoire. The researchers have attempted the present study to find out whether using complex passages and different instructional methods to teach vocabulary enhances learning and internalization of the target vocabulary. Jigsaw, a student-centered method of instruction and the traditional method of instruction were adopted for both the groups and the design followed was repeated measures. The paired t test of the data collected shows invariably the unavailing nature of both methods of instruction and complex input on students' vocabulary. This research work concludes that teaching methods tend to have insignificant impact on vocabulary enhancement when complex input passages are chosen.

1. Introduction

Vocabulary is the fulcrum of language and thus forms the core of reading skills. Biemiller and Boote's study (2003) as cited in Henriches (2009) strongly affirms the importance of vocabulary to become academically successful. They also highlight how inadequate vocabulary prevents them from understanding reading texts. (p.1) Extensive reading enables learners to improve word retention. Incidentally, reading habit appears to have gone down drastically among students. The attempt to find different ways of involving learners in reading intensively in the class led to the evolution of different methods of teaching. Nonetheless, it helps only to some extent. Leavitt et al. (2017) viewed that the traditional method of teaching discourages interaction among students, but emphasizes learning of vocabulary through drilling, imitation or translation utilizing the texts after becoming familiar with rules of grammar. (p.25)

Jack (2014) pointed out clearly that the paradigm shift in ELT pedagogy is the shift from passive learning to active learning based on the communicative needs of the students. (p. 29) This view is based on the assumption that learning takes place incidentally during the interaction among students and their interaction with the reading text. The development of vocabulary is possible through human interaction and the reading process. In addition to that, the advent of technology provides a plethora of opportunities to learn the vocabulary items of the target language. Schmitt (2014) identified how students used their receptive vocabulary knowledge mainly while learning. (p. 7) However, the research studies of Zheng (2012) confirm that more importance is given to the paradigmatic aspect of vocabulary than the syntagmatic one. (p. 208) Students could learn even lower frequency target words and the inputs with low frequency words can be a stimulus. In addition to that, lack of knowledge about collocation is a hurdle for using the learnt or acquired vocabulary. So, the use of appropriate input is necessary to improve their knowledge about different aspects of vocabulary. Hoff and Naigles (2002) in Henriches (2009) concluded that "higher levels of quantity, lexical richness and syntactic complexity of the input" boosts the productive vocabulary of very young learners. (p.2) Milton (2009) identified a positive relationship between the frequency of the words in use and the learning of foreign language vocabulary. (p.198) The correlation study by Henrichs and Schoonen in Henriches (2009) failed to establish any positive association between the lexical density, but identified a positive relationship between lexical diversity and children's vocabulary development. (p.5)

Ravid (2002) as cited in Dickinson (2009) established through his study the ability of adolescent children to improve their vocabulary more from the expository text and written narratives. (p.24) These findings emphasize the role of complex input in influencing the vocabulary development. Therefore, the researchers decided to use complex input to test the hypothesis.

Input in this research also means the items of information and /or descriptions provided to the students and Han (2014) calls it a "staple condition of second language acquisition". (p. 7) The complexity of input either written or oral enriches the vocabulary acquisition as learners attempt to negotiate the semantics of the content. Ellis (1997) asserted that 'comprehensible input' is a self-defeating process in enhancing incidental language acquisition(p.102) and the studies of Long, Krashen and Swain in Freeman's (2014) confirm the necessity for incomprehensibility in the aural and written input to prod learners into reading and re- reading and questioning to comprehend the matter and consequently, the negotiation in their learning leads to the acquisition of language without their being conscious of the acquisition. (p.143) Shannon (2011) underlined through his study that any modifications through interaction enables the listener to understand the complex input and so, the nature of input carries much importance to trigger the acquisition process. (p.20) Pica et al as cited in Sanz (2005) also supported the argument that the complexity of reading or aural input motivates learners to have interactions among themselves. (p. 209)

Sun's (2008) argues that input processing demands the negotiated interaction from learners for comprehension and acquisition of meaning. (p. 5) Schmidt (1995) iterates that attracting deliberate attention on the linguistic aspects of L2 in the input also aids learners to internalize the target vocabulary (p.261) However, Meganathan(2019) held the view that the lexical familiarity is crucial for any student to learn a language (p.52) and Hung(2019) opines that understanding the target words is crucial for word retention.(p.114)

Interaction plays a vital role in providing opportunities for learners to make use of the acquired vocabulary in various contexts. Aukrust (2011) highlighted in his study how social discourses serve the purpose of exposing learners to different circumstances for vocabulary acquisition as well as provide them with the space for employing the vocabulary to accentuate their learning. (p. 171) In the words of Resnick (1989) the rationale for choosing the co-operative method for the current study rests with the 'shared expertise', the concept which forms the basis of all group activities. (p.402) Barkley (2014) emphasized in his article that through the structured grouping technique, the benefit of sharing reaches each learner in the group. (p. 150) According to Lee (2019), despite many attempts that led to "impressive corpus of studies", "uncertainties" cloud teaching-learning approaches and methods on vocabulary improvement. (p. 80) The researchers decided to re-employ two different methods- the traditional method of teaching and the co-operative method of learning, jigsaw to measure their effect on vocabulary improvement and chose repeated measures design for the same.

Jigsaw requires students to be in both home groups and expert groups to be able to complete their assignments. Therefore, they have both collective responsibility and individual accountability. The home group members after receiving the topic assigned to them move to the expert group where their learning starts collaboratively. Expert groups are to share their understanding with the home group. All the students are forced to take the responsibility of learning the part allotted to them. Deep understanding and ability to express whatever they have learnt result from this method of cooperative learning. Aronson et al. (1978) assures a great deal of collaboration in any jigsaw activity. Millis (2010) is assertive about the 'versatility' of cooperative learning method and its 'highly structured practices'. He also iterates that jigsaw activities make the 'large diverse class into a community of supportive teams'. (p.6&7)

The review of literature seems to favour Jigsaw technique and complex input and this encourages the researchers to find out the effect of the method on vocabulary enhancement employing a literary passage which is appropriate to the advanced proficiency level of engineering students in the primary researcher's class. The abbreviation, JMI stands for Jigsaw Method of Instruction and TMI for Traditional Method of Instruction.

2. Hypothesis

Hypothesis (H_0): The mean of vocabulary gain score of the group in the pre- intervention stage is not significantly different from that of the group after JMI.

Hypothesis (H_0): The mean of vocabulary gain score of the group in the pre- intervention stage is not significantly different from that of the group after TMI.

Hypothesis (H_0): The mean of vocabulary gain score of the group after TMI followed is not significantly differently from that of the group after JMI.

3. Methods

The design chosen was Repeated Measure Design to know the effectiveness of the chosen instructional techniques, traditional teacher-fronted and cooperative technique, jigsaw on improving vocabulary. The design followed is repeated measures design which employs the same subjects for all the treatments but at different points

of time and under the same conditions and this way of using same but limited number of subjects minimizes the error since 'the subjects serve their own control'(Verma,2016) and augments reliability of statistical data. (p. 22)

4. Sample

A particular group of students who have registered themselves under FFCS (Fully Flexible Credit System) in VIT Chennai under the primary researcher constitute the sample.

Size of the Sample

38 students were taken for the study among the batches of students who registered themselves under the primary researcher after they cleared their English Proficiency Test(EPT). Though the sample size is 38, the design adopted checks the treatment effect on the fewer number of students in the sample. EPT tests vocabulary knowledge and grammatical competency. Vocabulary questions carry 10 marks out of total 50 marks. The questions are modeled upon (Scholastic Assessment Test) SAT and the test items are taken from online materials and validated with the senior instructors within the institution. The test is online and runs for an hour. 60% is the cut -off mark set for clearing the test. Homogeneity is maintained to a greater extent because of the segregation of students based on their performance. The students who secure the cut-off marks are instructed to choose the advanced level course (2 credit) offered at the university.

Tools Used for the Study

The entry-level performance of learners with the pre-test was available for forming two categories, Above Average and Below Average among the students. The pre-test assessment enabled the researchers to select the students for the intended research work. Marks secured in the test were arranged in ascending order and the average of the total marks was the cut-off mark for dividing the set of students into two blocks. Sampling was constituted selecting students from these blocks. Top 19 in both the blocks were selected for the study.

In the research study, there are two groups of learners i.e. Teacher-Fronted Group and Jigsaw Group. Moreover, the same input was used for both the groups with a view to measuring the impact of these two methods on the students in enhancing their vocabulary. A literary prose passage from George Orwell's 'Politics and the English Language' was chosen for the study as it had all the desired features needed for a complex input i.e. infrequent vocabulary, paragraphs with complex syntactic structures and a rich text.

The researchers employed the traditional method for the first group to make sure that the students would understand the passage as in the traditional classroom. Assessment of the responses was carried out after conducting the post-test to measure the knowledge of words they learnt after the session. For another group of 19 students, the cooperative learning technique, Jigsaw was employed in groups of three. Subsequently, the conduct of a post-test enabled the researchers to assess the level of improvement in their acquisition of words with this co-operative technique.

5. Illustration of the Work Mechanism in the Jigsaw Group

There are nineteen students in each broad group designated for the study. However, the number of students in inner jigsaw group is expected to be three. The learning material, the selected prose passage was divided into three segments according to the number of jigsaw inner group members, and each segment was given to a member of each inner jigsaw group.
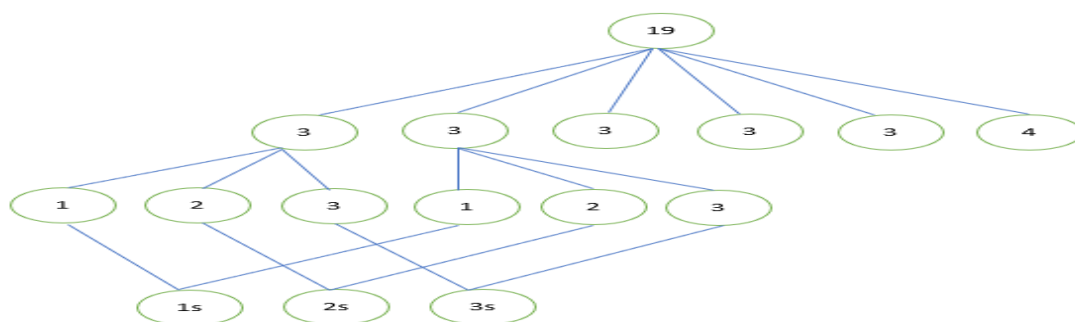

Fig 1. Jigsaw Work Mechanism

Jigsaw Work Mechanism
Totally 19 students
The home groups were six.
Within the home groups, there were three members.
Each one received one segment of the prose passage.
There were three segments from the whole prose passage.
All the ones were together in one group, all the twos formed a group and all the threes formed third group.
They discussed with their home group members after becoming an expert in their corresponding prose segment.

The lab session runs for one hour and forty minutes and this session was utilized for conducting the study. One group consisting of students who secured above average was with the researcher for the traditional method of learning the passage and another set of students who secured below average with a scholar for learning the passage using another learning method. The scholar handled the session because Jigsaw method of instruction is student centric. A list of the hard words from the passage with their meaning was supplied to all the students in the group for refer toence.

In the subsequent week since the weekend came in between, traditional Teacher- Fronted Group was treated as Jigsaw Group and after the intervention, a post-test was conducted to know if any improvement could be detected. In the same manner, Jigsaw group became teacher-fronted group and to check their improvement of vocabulary, if any, a post-test was administered immediately after the lecture.
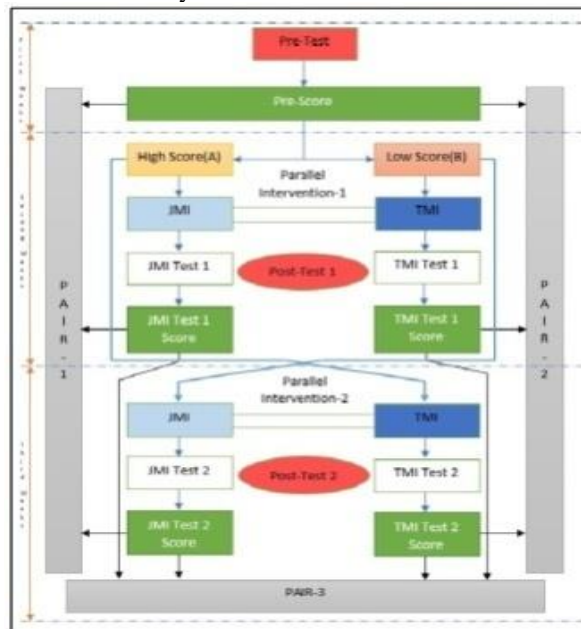

Fig 2. Workflow Diagram

6. Data Analysis
The Normality tests, Kolmogorov-Smirnov and Shapiro-Wilks tests assure the Normal distribution of variables without any extreme outliers. For the analysis of the data and for the comparison of mean values between grades, the application of parametric method and independent samples t-test respectively were carried out but for the comparison of the mean values between teaching methods and between pre and post paired samples t-test was followed.

The significance level fixed for the study is 5%($\alpha = 0.05$) and the analysis of the study was carried out employing IBM SPSS Statistics for Windows, Version 22.0.

7. Paired T-Test to compare mean score between TMI and JMI
To establish the improvement, if any between the groups when compared their pre scores with JMI score and TMI score and comparing their TMI scores with JMI scores.
H_0: The mean of vocabulary gain score of the group in the pre- intervention stage is not significantly different from that of the group after JMI followed in pair 1.
H_0: The mean of vocabulary gain score of the group in the pre- intervention stage is not significantly different from that of the group after TMI followed in pair 2.

H_0: The mean of vocabulary gain score of the group after TMI followed is not significantly differently from that of the group after JMI followed in pair 3.

Table1: Paired T-Test to compare mean score between TMI and JMI

Pair	Score	N	Mean	Std. Dev	t-Value	P-Value
Pair 1	JMI Score	38	13.29	3.683	4.160	<0.001
	Pre Score	38	10.34	3.052		
Pair 2	TMI Score	38	12.45	4.403	2.000	0.053
	Pre Score	38	10.34	3.052		
Pair 3	TMI Score	38	12.45	4.403	0.862	0.394
	JMI Score	38	13.29	3.683		

The values from Table 1 show that the mean vocabulary gain score at pre intervention is 10.3 ± 3.05 and in the JMI, it is 13.3 ± 3.68; these two mean values are statistically highly significant (P<0.001). So we conclude that there is difference in scores in pair1.

The mean vocabulary gain score in the TMI is 12.5 ± 4.40; this TMI is statistically not significant (P>0.05) with Pre score, but we can say that this is a borderline significant as P = 0.053. So we conclude that there is a little difference in scores in pair 2 but it is not that obvious difference.

It is also observed that there is no significant difference (P>0.05) in the mean scores between JMI and TMI. So we conclude that there is no significant difference in scores in pair3.

One sample T-Test to compare mean percentage change from pre intervention with constant "0"
H_0: Mean percentage change of JMI group=0.
H_0: Mean percentage change of TMI group=0.
Table2: One sample T-Test to compare mean percentage change from pre intervention with constant "0"

Percentage change	N	Mean	Std. Dev	t-Value	P-Value
Percentage change in score in JMI group	38	39.2846	56.55960	4.282	<0.001
Percentage change in score in TMI group	38	39.5224	87.71624	2.778	<0.001

Since p-value is less than 0.05, we can conclude that there is significant difference between mean percentage change of JMI group and a constant zero.

Since p-value is less than 0.05, we can conclude that there is significant difference between mean percentage change of TMI group and a constant zero.

Paired T-Test to compare mean percentage change in score between JMI and TMI
H_0: There is no significant difference between percentage change in scores of TMI and JMI in pair1.
Table3: Paired T-Test to compare mean percentage change in score between JMI and TMI

Pair	Percentage change	N	Mean	Std. Dev	t-Value	P-Value
Pair 1	Percentage change in score in TMI group	38	39.5224	87.71624	0.021	0.983
	Percentage change in score in JMI group	38	39.2846	56.55960		

From the above tables it is observed that the percentage change in JMI is 39.3 ± 56.6 and in the TMI is 39.3 ± 87.7. The percentage change in marks between pre and post intervention in these two teaching methods are statistically highly significant (P<0.001). It is also observed that the percentage change in marks between teaching methods are statistically NOT significant (P>0.05). So we conclude that there is no significant difference between percentage change in pair1.

Independent T-Test to compare mean percentage change in score between grades

H_0: There is no significant difference between High and Low Scorers in percentage change in JMI group.
H_0: There is no significant difference between High and Low Scorers in percentage change in TMI group.
Table 4: Independent T-Test to compare mean percentage change in score between grades

Percentage change	Grade	N	Mean	Std. Dev	t-Value	P-Value
Percentage change in score in JMI group	High	19	5.2233	27.17764	4.623	<0.001
	Low	19	73.3459	58.20502		
Percentage change in score in TMI group	High	19	-13.9168	33.92001	4.709	<0.001
	Low	19	92.9616	92.93207		

The values from the above table show that in the JMI group the mean percentage change in scores among high pre score students is 5.22 ± 27.2 and among low pre score students it is 73.3 ± 58.2; these two mean percentage change in marks are statistically highly significant ($P<0.001$). So we conclude that there is significant difference between High and Low scorers in percentage change in JMI group.

In the TMI group, the mean percentage change in scores among high scorers' pre intervention score is -13.9 ± 33.9 [actually the performance of high pre intervention score of students is worsened after intervention of TMI] and among low scorers' pre intervention score is 92.7 ± 92.9; these two mean percentage change in marks are statistically highly significant ($P<0.001$). So we conclude that there is significant difference between High and Low scorers in percentage change in TMI group.

Paired T-Test to compare mean score between teaching methods in High and Low scorers separately

Among the High scorers:
H$_0$: The mean of vocabulary gain score of the group at the pre intervention stage is fromnot significantly different that of the group after JMI followed in pair 1.
H$_0$: The mean of vocabulary gain score of the group at the pre intervention stage is not significantly different from that of the group after TMI followed in pair 2.
H$_0$: The mean of vocabulary gain score of the group after JMI is not significantly different from that of the group after TMI followed in pair 3.
Among the Low scorers:
H$_0$: The mean of vocabulary gain score of the group at the pre intervention stage is not significantly different from that of the group after JMI followed in pair 1.
H$_0$: The mean of vocabulary gain score of the group at the pre intervention stage is not significantly different from that of the group after TMI followed in pair 2.
H$_0$: The mean of vocabulary gain score of the group after JMI is not significantly different from that of the group after TMI followed in pair 3.

Table5: Paired T-Test to compare mean score between teaching methods in High and Low scorers separately

Grade	Pair	Score	N	Mean	Std. Dev	t-Value	P-Value
High	Pair 1	JMI Score	19	13.26	3.397	0.697	0.494
		Pre Score	19	12.74	2.023		
	Pair 2	TMI Score	19	10.58	3.517	2.030	0.057
		Pre Score	19	12.74	2.023		
	Pair 3	TMI Score	19	10.58	3.517	2.023	0.058
		JMI Score	19	13.26	3.397		
Low	Pair 1	JMI Score	19	13.32	4.042	5.846	<0.001
		Pre Score	19	7.95	1.715		
	Pair 2	TMI Score	19	14.32	4.485	5.373	<0.001
		Pre Score	19	7.95	1.715		
	Pair 3	TMI Score	19	14.32	4.485	0.748	0.464
		JMI Score	19	13.32	4.042		

The values from the above table show that for the High pre scorers, the mean score at pre intervention is 12.74 ± 2.02 whereas the mean score of JMI is 13.3 ± 3.40; these two mean values are statistically NOT significant ($P>0.05$). So we conclude that there is no significant difference between scores in pair1.

The mean score of TMI is 10.6 ± 3.52; the TMI score is statistically not significant ($P>0.05$) with Pre score, but we can say that this is a borderline significant as $P = 0.057$. So we conclude that there is a small difference between Pre intervention and TMI scores in pair 2.

It is also observed that there is no significant difference (P>0.05) in the mean scores of JMI and TMI. But we can say that this is also a borderline significant as P = 0.058. So we conclude that there is a small difference between scores in pair3.

Among the Lower scorers, the mean score at pre-intervention is 7.95 ± 1.72 and the mean score of JMI is 13.3 ± 4.04; these two mean values are statistically highly significant (P<0.001). So we conclude that there is no difference between scores in pair1.

The mean score of TMI is 14.32 ± 4.49; the mean score of TMI is statistically highly significant (P<0.001) with that of Pre-intervention. So we conclude that there is no difference between scores in pair2.

It is also observed that there is no significant difference (P>0.05) in the mean scores between JMI and LMI. So we conclude that there is significant difference between scores in pair3.

One sample T-Test to compare mean percentage change from pre intervention with constant "0" in High and Low scorers separately (If post- intervention mark is reduced from pre -intervention marks, the % change will be negative)

Higher scorers:
H_0: Mean percentage change of JMI group=0.
H_0: Mean percentage change of TMIgroup=0.
Lower scorers:
H_0: Mean percentage change of JMI group=0.
H_0: Mean percentage change of TMI group=0.

Table6: One sample T-Test to compare mean percentage change from pre intervention with constant "0" in High and Low scorers separately

Grade	Percentage change	N	Mean	Std. Dev	t-Value	P-Value
High	Percentage change in score in JMI group	19	5.2233	27.17764	0.838	0.413
	Percentage change in score in TMI group	19	-13.9168	33.92001	1.788	0.091
Low	Percentage change in score in JMI group	19	73.3459	58.20502	5.493	<0.001
	Percentage change in score in TMI group	19	92.9616	92.93207	4.360	<0.001

Higher scorers:
Since p-value is greater than 0.05 we can conclude that mean percentage change score of JMI is significantly different from constant zero.
Since p-value is greater than 0.05 we can conclude that mean percentage change score of TMI is significantly different from constant zero.
Lower scorers:
Since p-value is less than 0.05 we can conclude that mean percentage change score of JMI is not significantly different from constant zero.
Since p-value is less than 0.05 we can conclude that mean percentage change score of TMI is not significantly different from constant zero.

Paired T-Test to compare mean percentage change in scores between methods of instruction among High and Low scorers separately

High scorers:
H_0: The mean percentage change in scores of the group after TMI followed is not significantly different from that of the group after JMI followed in pair 1.
Low scorers:
H_0: The mean percentage change in scores of the group after TMI followed is not significantly from that of the group after JMI followed in pair 2.
Table7: Paired T-Test to compare mean percentage change in scores between methods of instruction among High and Low scorers separately

Grade	Pair	Percentage change	N	Mean	Std. Dev	t-Value	P-Value
High	Pair 1	Percentage change in score in TMI group	19	-13.9168	33.92001	1.872	0.078
		Percentage change in score in JMI group	19	5.2233	27.17764		
Low	Pair 2	Percentage change in score in TMI group	19	92.9616	92.93207	1.034	0.315
		Percentage change in score in JMI group	19	73.3459	58.20502		

From the above tables among the High pre scorers, it is observed that the percentage change in JMI is 5.22 ± 27.2 and in the TMI, it is –13.9 ± 33.9. The percentage change in marks between pre and post intervention in these two teaching methods are statistically NOT significant (P>0.05). It is also observed that the percentage change in marks between teaching methods are statistically NOT significant (P>0.05). So we conclude that there is significant difference between mean percentage change in scores of the two groups in pair 1.

Among the Low grade pre score students, it is observed that the percentage change in JMI is 73.3 ± 58.2 and in the TMI it is 93.0 ± 92.9. The percentage change in marks between pre and post intervention in these two teaching methods are statistically highly significant (P<0.001). It is also observed that the percentage change in marks between teaching methods are statistically NOT significant (P>0.05). So we conclude that there is significant difference between mean percentage change in scores of the two groups in pair 2.

8. Result Analysis

The findings of the study measure the progress in students' vocabulary learning when different methods of teaching, TMI and JMI were employed. The difference in the impact of different teaching methods is negligible. The progress in their vocabulary from pre intervention to either JMI or TMI is appreciable but the difference in their improvement on account of the two teaching methods employed is low i.e. almost insignificant.

When the mean percentage change of each method from pre intervention is compared with "0", the scores invariably are positive and the positive values show the improvement in their vocabulary from the pre intervention score by both the method of teaching. (refer to Table No.2) If the score is reduced from pre intervention score, the % change will be negative.

It is noted that if the teaching method is not effective, the percentage change in the marks between pre and post teaching will be "0". Therefore, the percentage change in the marks between pre and post intervention is compared with "0" in each intervention method.

The mean percentage change in scores among the high JMI scorers, low JMI scorers and low TMI scorers from pre intervention shows improvement whereas the same among the high TMI scorers worsened after their exposure to TMI to enhance their vocabulary knowledge. (refer to Table 4)

Limitations of the Study and Suggestions for Further Research:

The study was confined to the UG learners of an institute of technology in Chennai and was carried out within three weeks (three contact hours of one hour and forty minutes) since coverage of syllabus limits the availability of time for a study of this nature. The researchers used a complex literary reading passage for the study in order to ensure interactions among the engineering students. The same study could be conducted in other countries like Oman to measure the efficacy of TMI and JMI with both simple and complex outputs. Counties like Oman offer different challenges as English is taught as a foreign language there. It also would be a fruitful endeavor to include more students in the research work to add vitality to the research findings.

9. Conclusion

The repeated measures design adopted by the researchers, despite showing some progress in vocabulary knowledge, affirms the absence of noticeable difference in the impact of two different methods of instruction i.e. JMI and TMI with complex input. A study carried out by Kirati which also employed repeated measures design confirmed the positive impact of Jigsaw and CSIR in improving the participants' vocabulary in the study. However,

the effect of both the methods in the present study is positively perceived to some extent among the low scorers, but not among the high scorers for traditional method of instruction. The high scorers found Jigsaw favorable to enhance their vocabulary. On the other hand, the effect of TMI on the high scorers was almost nil.

The previous study by Sivakami and Saradha Rajkumar (2018) employed simple and complex input and two different teaching methods, TMI and JMI for the experimental (Simple 2×2 Factorial) design with a view to improving the vocabulary of a single set of students five years ago. The results of the study reveal the mean scores of TMI with simple inputs (5.61) and the Jigsaw method with the same kind of input (3.83) showing statistically significant difference in the performance of students whereas the mean scores of TMI with elaborate input (5.5) and JMI (4.77) showing no statistically significant difference in the performance of students.

This confirms the findings of the present study that teaching methods have little influence on improving the vocabulary repertoire of students if complex input is chosen. The present repeated measure study is neither in favor of JMI or TMI in regard to improving the vocabulary of the research participants when complex input is used.

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