CHAPTER 6
QUALITATIVE ANALYSIS AND INTERPRETATION

This chapter deals with the qualitative analysis to study the effectiveness of creativity training program on concept map performance of students. The qualitative analysis was carried out to study the quality of changes in the conceptual framework of students’ map and the process that goes in the minds of students during construction of concept maps. For this purpose, content analysis of students’ concept map was done i.e. the concept maps of the students were analyzed as per the rubric selected. The interviews of those selected students were conducted and case studies of those students were maintained.

6.1 Criteria adopted for selection of Students (in Each Grade level):

As it was not possible to analyze the whole sample, therefore, one student achieving highest in concept performance test and one student achieving lowest in concept performance test were selected from experimental group in each grade. Similarly one student gaining highest in concept performance test after the treatment was selected from each grade (see table 6.1). Table shows the scores of selected students of grade IX and X in each component of concept map i.e. propositions, hierarchy, cross-links, examples along with total scores in pre test as well as post test. The concept maps of these students were analyzed according to scoring rubrics and these students were interviewed. The case study of every student was represented to describe the conceptual framework and the extent of meaningful learning that has occurred in every student.
Table 6.1 showing scores of Concept Map Performance Test along with the dimension-wise scores of the students selected for Qualitative Analysis

<table>
<thead>
<tr>
<th>Components of Concept Map Performance Test</th>
<th>Occasion</th>
<th>Name of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Grade IX</td>
</tr>
<tr>
<td>Proposition</td>
<td>Pre-Test</td>
<td>Inderjeet 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inderpal 5</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>Vikrant 10</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>Pre-Test</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Cross-Links</td>
<td>Pre-Test</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Examples</td>
<td>Pre-Test</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Total Scores</td>
<td>Pre-Test</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

6.2 Method of Content Analysis

The content analysis of concept map involves the analysis of structural change in concept map and the learning quality, comparison of terms used by the students with that of expert terms, richness of scores in proposition, hierarchy, linkage quality and the individual understanding exhibited by the students before and after the creativity training. Three different approaches/methods were used to score the above mentioned qualities of changes in the students’ maps. These are detailed as under:

1. Analysis of structural change and learning quality

This approach was based on two criteria. First one is described by Kinchin, Hay and Adams (2000) for analyzing structural change in concept map and other one is described by Hay (2007) for identifying the learning quality. Firstly, the basic typologies of students’ maps were classified as spokes, chains and networks and compared before
and after learning to detect gross structural change on the basis of scoring rubric presented in the Table 6.2 given below:

Table 6.2: Scoring rubric (Kinchin, Hay and Adams, 2000, 57)

<table>
<thead>
<tr>
<th>Map type→Components</th>
<th>Spoke</th>
<th>Chain</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hierarchy</strong></td>
<td>One level only</td>
<td>Many levels, but often incorrect – e.g. ‘female parts’ are shown as subordinate to ‘male parts’ in a concept map</td>
<td>Several justifiable levels</td>
</tr>
<tr>
<td><strong>Processes</strong></td>
<td>Simple association with no understanding of processes or interactions</td>
<td>Shown as a temporal sequence with no complex interactions or feedback</td>
<td>Described as complex interactions at different conceptual levels</td>
</tr>
<tr>
<td><strong>Complexity</strong></td>
<td>So little integration that concepts can be added without consequences for ‘map integrity’ routes’ through the map are available</td>
<td>Map integrity cannot cope with additions, particularly near the beginning of the sequence</td>
<td>Map integrity is high. Adding one or more concepts has minor consequences as ‘other’</td>
</tr>
<tr>
<td><strong>Conceptual development</strong></td>
<td>Shows little or no ‘world view’. Addition or loss of a link has little effect on the overview</td>
<td>Integrated into a narrow ‘world view’, suggesting an isolated conceptual Understanding. Loss of a link can lose meaning of the whole chain</td>
<td>Can support reorganization to emphasize different components to appreciate a ‘larger world view’ or to compensate for a ‘missing’ link</td>
</tr>
</tbody>
</table>

Secondly, for measuring learning quality, the concept maps before and after creativity training were compared according to the criteria given by Hay (2007). The criteria used for learning quality measures were as follows (Hay, 2007):

1) *Deep learning:* is shown by the students when in their second map new concepts are added along with the prior one. New concepts are linked to the prior
one in meaningful way. And the overall knowledge structure of second map is a significant improvement over the prior.

(2) **Surface learning**: defined in two ways: first, by the addition of new knowledge, and second, by the absence of links between the newly acquired concepts and those parts of the prior knowledge repeated in the second map showing no significant improvement in knowledge structure of second map.

(3) **Non-learning**: defined by the lack of new concepts in the second map and by an absence of new links in the prior-knowledge structure. Moreover, first map is not or less different from the second one.

2. **Use of Expert Terms**

This approach comprised of comparison of the frequency of concept labels used in the expert’s map and in the students’ concept maps after learning.

3. **Analysis of Richness and Individuality of Student's understanding**

For this purpose the scoring framework by Hay et al (2008) has been considered. It measures the following constructs:

- Conceptual richness (the richness and relevance of ideas used to describe the topic);
- Linkage and linkage quality (the richness and appropriateness of concept linkage);
- Evidence of understanding (the degree to which the propositions describe understanding);
- Hierarchy and structure (the complexity and validity of the structural representation of knowledge).

6.3 **Results of Qualitative Analysis of Concept Maps:**

The scores of the students and observation of their maps (pre/post) were recorded as per the three approaches followed. Detail of their scores is given in table 6.3.
Table 6.3
Qualitative Analysis of Concept Maps (before and after creativity training)

<table>
<thead>
<tr>
<th>Methods / sub-methods</th>
<th>Learner-1 Inderjeet</th>
<th>Learner-2 Karan</th>
<th>Learner-3 Inderpal</th>
<th>Learner-4 Kashish</th>
<th>Learner-5 Vikrant</th>
<th>Learner-6 Deepansh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method one</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Structural change</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Prior-knowledge structure</strong></td>
<td>Advancing towards Net</td>
<td>Spoke with two branches</td>
<td>Spoke</td>
<td>Spoke</td>
<td>Spoke with four branches</td>
<td>Advancing towards Net</td>
</tr>
<tr>
<td><strong>Structure after learning</strong></td>
<td>Net</td>
<td>Spoke with many branches</td>
<td>Net</td>
<td>Net</td>
<td>Spoke with more branches</td>
<td>Net</td>
</tr>
<tr>
<td><strong>No. retained concepts post learning</strong></td>
<td>17</td>
<td>6</td>
<td>17</td>
<td>17</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td><strong>No. new concepts post learning</strong></td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><strong>No. links between new and retained concepts</strong></td>
<td>17</td>
<td>0</td>
<td>17</td>
<td>16</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td><strong>Learning quality</strong></td>
<td>Surface Learning</td>
<td>Non-Learning</td>
<td>Deep Learning</td>
<td>Surface Learning</td>
<td>Non-learning</td>
<td>Deep Learning</td>
</tr>
<tr>
<td><strong>Method two</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>The teaching material comprised approximately</strong></td>
<td>Plants, Nutrition, root, autotrophic, heterotrophic, green plants, photosynthetic, green plants, parasite, autotrophic, heterotrophic, insectivorous</td>
<td>Plants, leaves, cuscuta, stem, root, leaves, mushroom, photosynthetic, green plants, parasite, autotrophic, heterotrophic, insectivorous</td>
<td>Plants, roots, stem, leaves, photosynthesis, autotrophic, heterotrophic, special mode of nutrition, saprophytic, parasitic, symbiotic, insectivorous plants, mushroom, cuscuta,</td>
<td>Micro-organism, Bacteria, Simplest living organism, Bacillus, Virus, Algae, Fungi, Simplest living organism, Sea weed, Poisonous liquid, non-green, Bacillus</td>
<td>Micro-organism, Bacteria, Virus, Algae, Fungi, Simplest living organism, Sea weed, Poisonous liquid, non-green, Bacillus</td>
<td></td>
</tr>
</tbody>
</table>
### Method three

<table>
<thead>
<tr>
<th></th>
<th>Concept richness score (before/after) (gain)</th>
<th>Linkage quality score (before/after) (gain)</th>
<th>Proposition score (before/after) (gain)</th>
<th>Hierarchy and structure score (before/after) (gain)</th>
<th>Total (before/after)</th>
<th>Total gain scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16/17 (+1)</td>
<td>10/12 (+2)</td>
<td>9/12 (+3)</td>
<td>2/2 (0)</td>
<td>37/43</td>
<td>(+6)</td>
</tr>
<tr>
<td></td>
<td>11/12 (+1)</td>
<td>0/0 (0)</td>
<td>2/5 (+3)</td>
<td>1/1 (0)</td>
<td>14/18</td>
<td>(+4)</td>
</tr>
<tr>
<td></td>
<td>9/17 (+8)</td>
<td>8/16 (+8)</td>
<td>0/10 (+10)</td>
<td>0/3 (+3)</td>
<td>17/46</td>
<td>(+29)</td>
</tr>
<tr>
<td></td>
<td>16/17 (+1)</td>
<td>15/16 (+1)</td>
<td>7/10 (+3)</td>
<td>2/2 (0)</td>
<td>40/45</td>
<td>(+5)</td>
</tr>
<tr>
<td></td>
<td>11/10 (-1)</td>
<td>0/2 (+2)</td>
<td>8/10 (+2)</td>
<td>0/1 (+1)</td>
<td>19/23</td>
<td>(+4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0/15 (+15)</td>
<td>5/10 (+5)</td>
<td>1/2 (+1)</td>
<td>13/43</td>
<td>(+30)</td>
</tr>
</tbody>
</table>

### 6.4 Details of Content analysis and Case Studies

In addition to the data gathered from the content analysis of concept maps; semi-structured individual interviews were conducted with the selected sample to follow-up and illuminate the CM process, as creativity training seemed to deepen the reflective capacity of those students through more structured and socially-mediated activity. Thus,
the information provided in the table 6.3 was used along with the responses of the interviewees to prepare complete case studies of selected students.

**Learner 1: Inderjeet**

Inderjeet was a grade IX student. He was 14 yrs old. He had a younger sister. His father was a businessman. His mother was a house wife. He belonged to a middle socio-economic status family with good financial conditions. He was highly energetic and motivated during the creativity training. His overall score in concept map performance test was 23 in pre test but 46 in post test which was the highest. He had highly positive reactions towards the creative thinking lessons and concept mapping technique.

During content analysis, generally, the topological structure of a concept map indicates shifts in learners’ knowledge structure. A “network” structure indicates a more integrated understanding than a “fragmented” concept map structure. Here, learner’s both concept maps (Fig 6.1 a & 6.1 b) were having ‘net’ type structure showing his integrated understanding. Both maps contained similar concepts although they were expressed in a slightly different way. The second map’s concepts were articulated in a way as if the student had acquired a new way of expressing his understanding. The second map highlighted the answer to the focus question in more specific ways. It also underlined the student’s understanding of the concepts as the number of concepts was almost same. This meant that the student had surface learning.

Analysis of propositions revealed shifts in learners’ understanding. Generally, more quantified relations are seen as an indicator for deeper understanding. The propositional score of this student did not show significant change. It implies that he did not use his cognitive powers to improve his linkage qualities. Although the concept like root, stem and leaves (interlinked to show new links as well as cross- links) were present in the second map as well. Concept richness score, Linkage quality score, Proposition score, Hierarchy and Structure score were almost the same suggesting that this student has not gained much in richness scores after the creativity training session. Still this student has got highest marks in the post test of concept map.
Fig 6.1 (a) Concept Map of Learner-1 (before creativity training)

Fig 6.1 (b) Concept Map of Learner-1 (after creativity training)

Analysis of cross-links indicates the integration of knowledge. These are of special interest as they can indicate creative leaps on the part of the knowledge producer (Novak & Canas, 2006). In this viewpoint, the learner has shown two valid cross links, which means that he has the potential of being creative and he had tried to some extent and if given chance, he will be a creative thinker. Moreover, distinguishing certain concepts (cross-links) as being important can be interpreted as a shift from a surface-level understanding to a higher order understanding.
Network analysis of concepts describes changes of the centrality of concepts. Improved understanding of a complex topic can be tracked through an increase in the prominence of concepts. As he has shown minor increase in the number of concepts, it can be related that his understanding of concepts has increased and considerable although it is negligible.

At first glance, it seemed that there is no significant change in the structure and linkage of both maps but the second map represents a more developed, cohesive and clear vision of student’s learning quality as if the student has acquired both the knowledge to express his concepts and the ability to organize his conceptual vision in a more meaningful way after the creativity session. Although according to Novak’s (1998) typology of learning, this example would most likely be associated with rote learning, it can be argued that by introducing the linkage between the concepts like ‘roots’, ‘stem’ and ‘leaves’ the student made a slight move towards a deeper understanding of content matter.

Interview analysis revealed that the learner had the positive view about the concept map and creativity session. He told that he had problem in learning the subject of history. He would use this technique to learn that subject specifically and also in planning for the future and problem solving. He believed that this technique must be introduced at very early stage so that the students could become an expert in the technique. Using a concept map has made him to know his misconceptions about the topic and rectify them in the second one. As a result his understanding of subject has improved. He told that when he prepared first map, he found that he is lacking something content wise and then he looked into the text again and creativity sessions encouraged him to utilize the concepts in different way. Then only he was able to rectify it in second concept map. He also became more welcoming to new ideas and accepted that his vision has expanded after creativity sessions.

**Learner 2: Karan**

He was IX grade student. He was a very silent student but sincere student. His teacher had high view about him and thought he was very hard working. But his pre test
score was less. He got 7 marks in pre test and 12 marks in post test. He had positive reaction towards getting the creativity thinking lessons to be implemented in schools.

*Content analysis* of this student’s maps (fig 6.2 a &b) revealed that both of the concept maps before and after creativity training were quite similar. At first glance it appeared that he had improved the complexity of his concept map. But a close look in to the content and linkage reveal that there was no significant change in the structure but just the addition of new concepts without understanding the meaning.

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**Fig. 6.2 (a) Concept Map of Learner-2 (before creativity training)**

**Fig 6.2 (b) Concept Map of Learner-2 (after creativity training)**
In his first map, the knowledge structure or the topological structure was a ‘spoke’ with two radiating branches. Concepts were a few and none of them has been linked with linking phrases. No cross-links were present. Although he added a few new concepts to his second map (e.g. root, leaves, cuscuta, saprophytic nutrition, insectivorous plants), they did not really contribute to his overall understanding of topic. The overall view about his learning was that the learning has not occurred anywhere on his part. It was a case of non learning.

The propositional score was not significant suggesting that the learner has not gained understanding of topic. Concept richness score, Linkage quality score, Proposition score, Hierarchy and Structure score were almost the same. Gain score was negligible.

No cross links were present in his both maps. This suggested that the student is very careless about the creative potential.

No doubt, there was a conceptual development in his second map in comparison to the first map but it was negligible. In his second map, although the concepts were more in no. but the organizational structure was not significantly improved. Certainly, it was because of surface learning by this student.

The second map was not advancement over the first. The conceptual richness of the map was not improved and neither the hierarchy, nor the linkage richness, showed evidence of significant learning. Overall his conception of the topic was reinforced but not changed in any meaningful way.

Analysis of interview statements revealed that he liked concept mapping and creativity training sessions. His response was positive when he was asked about preparing the concept maps. When he was asked that there was no significant change in his knowledge structure he told that he could answer the question in traditional manner i.e. in subjective manner. Following concept mapping technique was a little bit difficult as he was not aware of the importance of linking phrases. But after creativity session his thinking has broadened. Now he was able to accept any situation that he does not like and modify accordingly. He showed his interest in knowing more about the techniques, how to prepare propositions and the significance of cross-links. He admitted that though his both maps were not complex structure wise but he has gained much from concept mapping technique and creativity sessions. It had created a spark in him for learning. He
even assured the investigator that he would improve his marks in house tests conducted by school.

**Learner 3: Inderpal**

Inderpal was 13 yrs old student studying in grade IX. Her father was a government employee and her mother was a primary teacher. She had a younger brother. She was an above average girl in studies. She was an obedient but quiet reserved girl.

She got 5 marks in her pre test but showed an improvement in post test scores by achieving 40 marks. She provided the clearest example of deep learning.

During *content analysis* of her first map (fig. 6.3 a) it was found that she used ten concepts to explain the topic. There was no level of hierarchy and all concepts were not linked by explanatory statements. There was no cross-linking anywhere in the first map. The concepts were linked to each other but this was not adequately explained or justified by the linking statements. Concepts were not showing any meaning due to lack of linking statements. Overall, her first map was a trivial exposition of the topic and it gives only a tenuous description of the topic under study.

![Fig 6.3 (a) Concept Map of Learner-3 (before creativity training)](image)
After the training, however, her map was much more explanatory. In her second map (fig 6.3 b), she used seventeen concepts to explain the topic and overall, the knowledge was much better structured. It was also significantly improved in explanatory content and showed a more comprehensive grasp of meaning.

Her first map was a simple spoke structure with two radiating knowledge chains. Both of these chains were extended beyond a single concept, and the two chains that did progress comprised only four concepts each. There was no cross linking in the first map at all.

In her second map, however, she was able to construct a linked network from her knowledge. Cross-links displayed between the concepts such as ‘photosynthesis’, ‘autotrophic nutrition’ and ‘green plants’ were unique for her understanding of the topic. She even added a new concept ‘non green plant’ herself as it was not given in the worksheet. This shows that this student had the creative potential. Training session has made her confident about her understanding and, therefore, she did not hesitate to show her extra knowledge in a meaningful manner. She even had shown three level of hierarchy revealing progressive differentiation nature of her learning. The student had deeper learning quality.

Analysis of propositions revealed that understanding of topic has increased after training. Concept richness score, Linkage quality score, Proposition score, Hierarchy and Structure score were at the bouncing stage suggesting that this student has gained much
after the creativity training session. Overall, the gross structural change in her conception of the topic was considerable.

*Interview session* revealed that initially she had inhibitions and took time to open up even during the interview. The prior knowledge of her topic was good. She even responded positively towards concept mapping technique and training sessions. She felt that she gained confidence after creativity sessions otherwise she was a shy girl in the grade. It had made her to know that she was not always wrong in her answers. This thing was even clear from her post concept map, the way she represented the concepts. She was happy that she has gained confidence after creativity session and she would now be able to tackle her daily life problems in a better way.

**Learner 4: Kashish**

Kashish was a student of grade X. Her age was 15 yrs. She got 22 marks in her pre test and 45 marks in post test. She was talkative girl. She was the only child of a working couple. She belonged to a middle grade family with all the facilities available at home. She sometimes caused disturbance in grade due to her nature. She was very much keen to learn about creative thinking lessons.

Content analysis of her concept maps revealed that first concept map (fig 6.4 a) of this learner’s was ‘spoke’ type and second one (fig 6.4 b) having ‘network’ structure. Both maps contain similar concepts although they were expressed in a slightly different way. The second map highlights the answer to the focus question in more specific ways. It also underlines the student’s understanding of the concepts as the number of concepts was almost same. It suggests that the student already had the knowledge of subject matter in a better way. But as the number of concepts was almost same, it shows that the learner had surface learning.
The concept richness score and linkage quality score showed a slight change i.e. of +1. Propositional score showed a gain of +3 score and there was no change in hierarchy score. From this result it was found that although the student’s first concept map and second concept map had negligible differences after the creativity sessions but they have shown some improvement. Gain in concept richness score indicates that the student had used more concepts in the second map e. g. ‘sea-weed’, ‘non-green plants’, first animals. Linkage quality score gain was less but was considerable.

Analysis of cross-links showed that there was no cross-link in the first map but in the second concept map there was a cross-link. The improvement in cross-link score was
a positive sign that student used his cognitive powers to be creative after creativity sessions.

Moreover, cross-links are important to be interpreted as a shift from a surface-level understanding to a higher order understanding.

Network analysis of concepts revealed changes in the centrality of concepts. As he has shown minor increase in the number of concepts, it can be related that his understanding of concepts has increased although it is negligible. At first glance, it seemed that there is no significant change in the structure and linkage of both maps but the second map represents was much more advanced. It implies that the student had acquired the knowledge to express his concepts in a more meaningful way after the creativity session. The student had made a slight move towards a deeper understanding of content matter.

Interview analysis revealed that the learner had the positive view about the concept map and creativity session. She told that creativity sessions had made her open to challenges and now she was able to take any type of risk for solving the problems. While preparing second map she used her first map. She also consulted the content matter for the second map and found out what was wrong with her first map. By taking creativity treatment she was able to think of better use of linking phrases that helped her to improve her linkage quality.

Learner 5: Vikrant

Vikrant was grade X student. He was 14 yrs old. He got zero mark in his pre test and 9 marks in post test. He was most inattentive student in grade. He looked pale, yellow and very much untidy. Her father was a businessman. He had lost his mother in very early age. He had a step brother and step sister younger than him. It appeared that he was in a desperate need of counseling from a family counselor.

Content analysis revealed that this learner’s both maps were ‘spoke’ structure wise. He was unable to add the explanatory links that would have completed the structure. This suggests that he had a superficial knowledge of the range of concepts and issues comprising the topic. Moreover, he had grasped little of the underlying principles necessary for his concept map to make meaningful.
Concept richness score, linkage quality score, propositional score and hierarchy score were negligible in gain. His second map comprised of same number of concepts, but like her first, her attempt to explain it was entirely without linking statements. In his second map, he re-used concepts like bacteria, virus, algae and fungi from her first map to link with the new concept micro-organism. Otherwise he rejected all that he knew before and replaced it with new content. This is clearly evidence of a step towards meaningful learning. There has been little (or no) attempt to integrate the newly presented...
information with prior knowledge. Furthermore, the second map (like the first) is without links. Nevertheless, his conception of the topic is different; he has learned something; even if he remains unable to make real sense of it. It appeared that he had replaced one set of knowledge with another and he had done so without any increase in understanding.

What he had learnt appears to be little more than a new set of terms. Furthermore, the hierarchy of her second map is better developed than his first. Advancement in hierarchical structure indicates that progressive differentiation has occurred on the part of learner. This suggests that some change in understanding has probably occurred, even if it has yet to be demonstrated in meaningful ways.

*Interview analysis* of this learner revealed that he liked creativity sessions more than the concept mapping technique. When he was asked about the reason behind this, he told that he hated studies. He could not understand what the teacher taught in the grade, what is the logic of learning all these terms. In his view studies are there in the world for just to pass the exam. He did not like learning for the sake of learning and passing the exam. In view of his art and craft teacher, he was good at drawing and painting but all other teachers told that he was a below average student in studies. The investigator has to counsel the student that the technique was not for learning purpose but for planning the future too. The investigator even showed her how concept map can be used for other purposes. Still, he expressed the view that while preparing second concept map he had learnt from the mistakes he had made in the first one and not to repeat in the second one. Therefore, he used other concepts to prepare the second concept maps. Creativity training has led him to be confident. He even wanted to learn more about this method. He found this technique as opportunity to get this life changing experience.

**Learner 6: Deepansh**

Deepansh was a student of grade X. He was 15 yrs old. He got 10 marks in pre test and 35 in post test. He was bright in studies. He was the only child of his parents. In view of his teachers, he was very adamant. In spite of his slow speed during the initial stage of creativity training, he accepted that he learnt many new things from creative thinking lessons.
Content analysis of this learner’s maps revealed that first concept map (fig 6.6 a) was having ‘network’ type structure. No linking phrases were present there, though linking lines were present. No cross-links were there. Although the structure was network type but it did not show any meaningful answer to the focus question. In his second map (fig 6.6 b), structure of concept map was though ‘network’, he showed advancement. Linking phrases were present on linking lines and even the cross-link was present clearly indicating the positive effect of creativity training. It was a case of deep learning.

Fig 6.6 (a) Concept Map of Learner-6 (before creativity training)

Fig 6.6 (b) Concept Map of Learner-6 (after creativity training)

Analysis of propositional score, linkage quality score, concept richness score and hierarchy score showed significant gain. His second concept map showed considerable
number of concepts and linking phrases. Hierarchy score showed that this learner has positive effect of creativity sessions. Hierarchy score determine the ability of learner to distinguish the different meanings of the concepts under consideration. After receiving creativity training, he used two levels of hierarchy showing more general concepts and specific concepts. It is even clear from his concept maps. He even added a new concept ‘lichen’ to show its connection with algae and fungus making a cross-link. As cross links are the indicator of creative potential, it suggested that the learner has the capability of divergent thinking.

Analysis of interview statements revealed that he liked concept mapping technique as well as creativity treatment. He liked the ‘Tec-Pisco’ tool of creativity training program. He even wanted to know more tools of creativity. He told that while preparing second map, he did not use his first concept map as he knew that it was not right. He used all the concepts in a new manner so as to show more meaningful relation. He told that he would like to be a creativity trainer in future as he likes to solve the problems and situations in more satisfying way.

Conclusion:

From the information collected from the content analysis, interviews and case studies maintained, it was clear that the students were quite interested in the method. Following facts were notable:

Whether any student was having surface learning, deep learning or non learning, analysis of structural changes in concept map revealed that the students exhibited an advanced structural change in their concept map. The students, who were possessing ‘spoke’ type structure of their concept map, have either ‘spoke with many branches’ or ‘network’ type concept map.

Comparison with expert terms revealed that the students have shown a very good use of concepts in their concept map after the creativity training.

Analysis of conceptual richness, hierarchy richness, linkage quality richness and propositional scores showed a gain of score. Whether the score of any one attribute was low but it was of certain value that can be considered.
In addition, all students liked and appreciated the concept mapping technique and creativity training program equally. The students of all the three intelligence groups, irrespective of their intelligence level had high willingness (a very simple and general type group discussion was conducted in the grade to know the willingness of students about both techniques though it was not the part of research) to adopt the strategies. They supported that both methods should be implemented in the schools as no special instrumental material is required to implement these.

The students further felt that the method could improve the quality of the education and could begin improvement in educational program without adding to any extra burden on the staff as well as students. The methods also were not time consuming. Students felt that their assessment should be done in the form of concept map construction as it can be administered very easily and quite effectively in classroom.

Whereas most of the students gained much from the training session, the students who gained least were because of inattentiveness, due to major personal problem or due to rigidness in thinking and inability to accept something new.

Along with the change in scores on concept map performance test, the creativity training program was found to be effective in bringing behavioral changes in the students. Whereas no separate test was administered to study the behavioral changes and willingness of the students, these changes were clearly evident while preparing case study especially the students, who scored well in the post-test, were highly influenced by both methods. They became friendlier, cooperative, sharing and got full of ideas and positivity.