CHAPTER 5

ANALYSIS OF TEACHING TECHNIQUES

5.1 INTRODUCTION

The development of IT and WWW provides different teaching strategies, which are chosen by teachers. Students can acquire knowledge through different learning models. The problem based learning is a popular teaching strategy for teachers. Based on the educational theory, student’s increases learning motivation, which can increase learning effectiveness. In this chapter, we make a study on concept map for each student and staff using rough set theory. This map finds the result of the subjects.

Feedback allows teachers to qualify their own teaching performance by means of evaluations received from their own students. Participants express their opinion about the course’s technical contents, its didactic qualities, the level of interactive communication achieved, and the like. Course managers can
then use the information obtained to reflect on and improve teacher performance process.

Individual differences between learners have been found to predict performance and thus, educational systems attempt to improve performance by adapting to these differences. Learning style can be defined as the habitual manner in which a person approaches or responds to learning tasks that is consistent over long periods of time and across many areas of activity. It describes how learners process and represent knowledge, how they behave when dealing with the demands of specific learning situations and how they interact with different educational material. The concept of learning styles is of interest as some researchers report that they can be used to predict performance in ways that go beyond intelligences. Intellectual abilities have been also found to be predictors of performance with students demonstrating measurable differences in intelligence and ability levels.

A teacher always wants to know how to evaluate the knowledge of the students in the teaching process. The teachers can understand the mental model of a student through brainstorm map, which emphasizes the group discussion and the teacher can ask the students to draw their own brainstorm map about
the problem [63]. Moreover, the teacher is a only facilitator to students in the teaching process [64].

This chapter proposes a tool to analyze results of the subject based on the teaching taught by the teacher. The brainstorm map is created when the students are trying to solve the problems that proposed by teacher in a class. Since the brainstorm map represents the concepts in student’s minds concretely, teacher can used the brainstorm map to check what students have learned in class and guide the learning direction. Moreover, teacher could adopt his/her teaching strategies according to the brainstorm map.

In an educational system, student may belong to the group of categories. According to this category, the student’s learning method is varied. The teacher should be aware of their knowledge and the teacher must provide the teaching materials to them. For improving their result, we form an integrated map by combining both student and teacher maps. The concept map can help teacher to know the weakness of students. Based on the result, the teacher can adjust teaching strategies.
5.2 ROUGH SET METHOD IN TEACHING ANALYSIS

The Rough Set Theory is a recent mathematical theory employed as a data mining tool with many favorable advantages.

The UP and BND sets will be taken into consideration while developing a mechanism to find the sequence of the lacks of concepts of the student. In order to assist a teacher much more in a problem based environment, some interaction must be retrieved from the concept maps of the students and the teacher. This must be discovered at first. For example, from the concept maps that a student might be missing could be found. However, finding the hidden information inside the concept map is difficult. Since the rough set theory is usually used to discover the hidden data pattern.

5.3 RELATIONSHIP BETWEEN CONCEPT MAP AND ROUGH SET

The brainstorm map is very hard for teachers to check if the concepts in student’s mind are either correct or partially correct. The brainstorm map is too
complex to understand. A concept map which includes node (terms or concepts), linking lines and linking phrases which describe the relationship between nodes. Concept map always assumed a hierarchy. General and rough concepts are located in higher level.

In problem based environment, the teacher is a facilitator during the teaching process and also draws his/her concept map in the brainstorm time. At this moment, the student’s brainstorm map could be transformed to a tree like concept map. In order to compare the difference between tree like concept map of student and the teacher as integrated map id is generated and then maps both student and teacher. After an integrated map is generated, the rough set theory can be used to analyze the difference between the student and teacher.

In an integrated map, the green circle indicates the concepts that exist in the minds of student and teacher, the red circle represents the concept is missing in the student’s mind. The element of UP and LOW sets in each level will be the green circle and the red circle. Regarding the boundary set, we have taken as parent node of the elements of the UP and LOW sets as the elements of the BND set. The following three conditions might help to construct the integrated concept map.
i) The concept is consistent in the teacher’s map but not consistent in the student’s map.

ii) The concept is inconsistent in the teacher’s map but consistent in the student’s map.

iii) The concept map is consistent in the teacher’s map and in the student’s map.

Teacher will easily find the concepts in the integrated concept map with different colors. In condition (i), the concept node will be in red. In condition (ii), the concept node will be in green and in condition (iii) the concept node will be in green.

(i) Concept map of Teacher
STUDIES ON DATA MINING TECHNIQUES USING ROUGH SETS

(ii) Concept map of Student

(iii) Integrated Map of both Student and Teacher

Figure 5.1: Concept Map
Teacher will get the lacks of concept from students easily and provide the necessary supplemental materials to students according to the lacks of concepts and also find the results. Each of the lacks of concept will be assigned to a value with the sequencing algorithm. After an integrated map is constructed the rough set theory can be used to analyze the difference between student and teacher.

5.4 ALGORITHM FOR STUDENT FEEDBACK MECHANISM

The algorithm discussed in this chapter will calculate the bottom up important degree of each concept except the leave nodes in the integrated map. We design a formula to calculate the feedback mechanism.

$$\alpha_{level}(C_i) = \frac{|\text{Children}(C_i) \cap \text{POS}_{level+1}|}{|\text{Children}(C_i)|}$$

Where,

BND \((C_j) = \) Weight of the boundary set.

The concept set is defined as,

\(\{C_i\} = \{S, U_1, U_2, U_3, U_4, U_5, C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8, C_9, C_{10}, C_{11}, C_{12}, C_{13}, C_{14}\}\)

The children concept set of \(C_i\) is \(\text{Children}(C_i)\)

\(\text{Children}(C_i) = \{S, U_1, U_2, U_3, U_4, U_5, C_2, C_3, C_5, C_7, C_8, C_9, C_{12}\}\)
The upper approximation, Lower approximation and Boundary set of each level will be denoted as $\text{UP}_{\text{level}}(C)$, $\text{LOW}_{\text{level}}(C)$ and $\text{BND}(C)$. The elements of UP, LOW and BND set for each level is shown below.

$\text{UP}_{\text{level}}(C) = \{C_2, C_3, C_5, C_7, C_8, C_9, C_{12}\}$

$\text{LOW}_{\text{level}}(C) = \{C_1, C_4, C_6, C_{10}, C_{11}, C_{13}, C_{14}\}$

$\text{BND}(C) = \{U_1, U_2, U_3, U_4, U_5\}$

### 5.5 ROUGH SET AND THEIR ELEMENTS

First in order to by pass the leave nodes of the integrated map, those leave nodes are identified. Since the deepest level of the integrated map is 2, the boundary set of level 2 is $\text{BND}_2(C)$ will be processed. This is shown in Table 5.1.

**Table 5.1 : Rough set elements in integrated concept map**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{POS}_2(C)$</td>
<td>$C_2, C_3, C_5, C_7, C_8, C_9, C_{12}$</td>
</tr>
<tr>
<td>$\text{NEG}_2(C)$</td>
<td>$C_1, C_4, C_9$</td>
</tr>
<tr>
<td>$\text{BND}_2(C)$</td>
<td>$U_1, U_2, U_3, U_4, U_5$</td>
</tr>
<tr>
<td>$\text{POS}_1(C)$</td>
<td>$U_1, U_2, U_3, U_4, U_5$</td>
</tr>
<tr>
<td>$\text{NEG}_1(C)$</td>
<td>$U_2$</td>
</tr>
<tr>
<td>$\text{BND}_1(C)$</td>
<td>$S$</td>
</tr>
</tbody>
</table>
Using the above table, the teacher can decide how much percentage of the results he/she can achieve and based on that he/she can also decide to provide the supplemental teaching materials in sequence to either a student or a group by the important degree of the concept. He/She can decide the order from either small to large (0.00 to 0.99) or large to small (0.99 to 0.00). If the important degree of concept node is 1.00, the whole branch from the concept is known clearly by the student. The result is calculated by the formula as shown in Table 5.2.

Table 5.2: Result Analysis for Student Feedback Mechanism

<table>
<thead>
<tr>
<th>BND Set</th>
<th>Level</th>
<th>Children(C_i)</th>
<th>Children(C_i) ∩ POS_{level+1}</th>
<th>Children(C_i) \cap POS_{level+1}</th>
<th>a_{level}(C_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_1</td>
<td>2</td>
<td>C_1, C_2, C_3</td>
<td>3</td>
<td>C_2, C_3</td>
<td>2/3=0.66</td>
</tr>
<tr>
<td>U_2</td>
<td>2</td>
<td>C_4, C_5, C_6</td>
<td>3</td>
<td>C_5</td>
<td>1/3=0.33</td>
</tr>
<tr>
<td>U_3</td>
<td>2</td>
<td>C_7, C_8</td>
<td>2</td>
<td>C_7, C_8</td>
<td>2/2=1</td>
</tr>
<tr>
<td>U_4</td>
<td>2</td>
<td>C_9, C_10</td>
<td>2</td>
<td>C_9</td>
<td>1/2=0.5</td>
</tr>
<tr>
<td>U_5</td>
<td>2</td>
<td>C_11, C_12, C_{13}, C_{14}</td>
<td>4</td>
<td>C_{12}</td>
<td>1</td>
</tr>
</tbody>
</table>

Expected Result = \frac{Total}{Size} = \frac{2.74}{5} = 0.548
The actual result is compared with the expected result which is shown in Table 5.3. The grade is provided to that result for separating the student and providing the teaching material according to their skill. If the result is greater than or equal to 75% then grade is ‘A’ else if the result is greater than or equal to 50 then grade is ‘B’ else if the result is less than 50% then the grade is ‘C’.

Table 5.3: Assigning Grade to Student Feedback Mechanism

<table>
<thead>
<tr>
<th>BND SET</th>
<th>EXPECTED RESULT (In %)</th>
<th>ACTUAL RESULT (in %)</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>U₁</td>
<td>100</td>
<td>66</td>
<td>B</td>
</tr>
<tr>
<td>U₂</td>
<td>100</td>
<td>33</td>
<td>C</td>
</tr>
<tr>
<td>U₃</td>
<td>100</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>U₄</td>
<td>100</td>
<td>50</td>
<td>B</td>
</tr>
<tr>
<td>U₅</td>
<td>100</td>
<td>25</td>
<td>C</td>
</tr>
</tbody>
</table>

The graphical representation (Line Chart) of the result analysis is shown in figure 5.2.
5.6 EXPERIMENTS AND DISCUSSIONS

Our experiment system focuses on providing supplemental teaching materials for teacher and analyzes the results. Usually, teacher will make his/her teaching plan before a teaching process. By using this technique based on the
student feedback systems, a teacher can revise his/her teaching plan and may improve his/her results. We collected student details such as their Register number, name, Department, details of the subjects for corresponding semester for examining our feedback system and acquire some processing results.

In this study, the teacher is a facilitator and who can’t make learning activities with students anytime. The teacher only provides to the students clues for finding and solving problems in most of the time. Teacher hopes to understand that what major subject is discussed by the students and how they understand the subjects. In this chapter, we provide a feedback system for teacher to understand student’s learning situation. By using concept map technique, how much percentage the students understand the subject and the teacher can determine what is necessary for students. From that we can improve the result of the students.
5.7 CONCLUSION

In this chapter, we analyzed the technique of concept map method for teaching. It makes a teacher know what students are thinking and how to modify his/her teaching method. The major contribution of this chapter is to help teacher find what the lack in concepts in students is and immediately supply to them. It is very easy for him/her to realize the lack of concept of students and provide necessary assistance to the students. Using the technique discussed in this chapter, one can access the performances of a particular subject which is accessed by a teacher.