

Analysis of senior high school students' emotional intelligence in cooperative based mathematics learning

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Abstract. Mathematics learning is a process of interaction between teachers and students in a learning environment deliberately created by teachers involving various elements of mathematics learning to form the mindset, understanding, reasoning, and problem-solving skills of mathematics. A character can be cultivated through habituation including the integration of emotional intelligence in cooperative learning. This article was part of development research of cooperative mathematics learning model by integrating emotional intelligence. The subjects of this research were Year 10 students. This study focused on describing students' emotional intelligence developed during the implementation of cooperative learning in a mathematics classroom. The data was collected through observation of learning and interview. Qualitative analysis including reduction step, categorization, data interpretation, and conclusion was employed. The results showed that students could productively utilize emotions in learning mathematics as indicated by being responsible, focusing on the tasks given, confident, tenacious, skillful in communicating, more attentive in listening to others' opinion, and satisfied with the award given.

1. Introduction

Students' achievement is likely influenced by two factors, internal and external factor. Internal factor is highly dominated by psychological conditions and various students' potential in the form of intelligence, including the intellectual intelligence covering various abilities, such as numerical, spatial, reasoning, abstract thinking, and verbal skills. One of the students' internal factors contribute to the success of students in learning is emotional intelligence, including perseverance, social skills, empathy, patience, sincerity, resilience, and self-belief. Emotional intelligence is the ability to read her/himself and others to be able to put her/himself in the situation of others while at the same time control himself; to manage every action and reaction through self-control, motivation, perseverance, pleasant personality and courtesy leading to success in everyday life or at work [1].

Emotional intelligence is one's ability to create synergy innovation in teamwork to achieve organizational or group goals; one's emotional intelligence skills involve skills in managing themselves and others; social skills as in maintaining working relationships and interactions in other life dynamics. Thus, it is not sufficient for a person to only have feelings instead it is required to learn to recognize, appreciate your feeling and others in pleasantly and accurately accepting opinions. Under normal circumstances, a person's emotional routine activities cannot be observed. However, emotions can arise



and be observed through facial expressions, voice stress, facial expressions, and body language. This emotional expression can be identified when a relationship with others occurs and there is a mutual need.

Emotional intelligence plays an essential role for the success of one's career in modern life, in a broader sense, it highly contributes on the success of life. There are several aspects of Emotional Intelligence (EI), namely: emotional self-awareness, managing emotions, productively utilizing emotions, empathy, and building relationships [2]. Emotional self-awareness involves the improvement in recognizing and feeling their emotions, having a better understanding of the causes of feelings arisen, recognizing differences between feelings and actions. Managing emotions concern on higher tolerance for frustration and anger management, reduced verbal mockery, fights and classroom disruptions, being able to better express anger properly, without fighting; reduced temporary entry ban from suspension and aggression or self-destructive behaviour; more positive feelings about themselves, school and family, being able to deal better with mental tension, reduced loneliness and social anxiety. Utilizing emotions productively involves: being more responsible, less impulsive, and more self-controlled as well as focusing more on the task at hand. While, empathy, the emotional reading, involves accepting others' points of view, improving empathy and sensitivity to other people's feelings, as well as being a better listener to others.

Emotional intelligence is defined as the ability to recognize our own and other feelings, the to manage emotions well in relationships with others [3,4]. Building a relationship means improving the ability to analyze and understand relationships, better at resolving and negotiating disputes and issues arising in relations as well as being more assertive and skillful in communicating; being more popular, outgoing, friendly; engaged with peers, needed by peers; being more attentive and considerate toward others; being more concerned with social interests and harmony in groups; preferring to share feelings; being cooperative and helpful, more democratic in socializing. Emotional intelligence as a set of abilities, competencies, and non-cognitive skills affecting a person's ability to succeed in performing the task. It also includes overcoming environmental demands and pressures; adjusting to the people around to achieve goals as well as controlling feelings to support the emotional and intellectual development positively.

Cooperative learning is a model of learning designed in which the teacher plays a significant role as a facilitator serving as a bridge for to a higher level of students' understanding based on their notes. Teachers provide students the opportunity to build knowledge in their minds, to gain hands-on experience in applying ideas, as an opportunity for students to find and apply ideas in learning.

Constructivism theory, in which students must individually discover complex concepts and examine the existing information relating to learning material, underlies the cooperative learning. Cooperative learning encourages students to actively and positively interact in a group, to optimize and generate students' potential and to foster activity and creativity which in turn facilitating the dynamics in the learning process. Cooperative learning model can eliminate the nature of individuality and unhealthy competitiveness among students. In this model, learners routinely work in groups to help each other solve complex problems [5].

Cooperative learning facilitates students to assist each other in learning and ensure that everyone in the group achieves a predetermined goal or task. The success of learning in a group depends on the abilities and activities of group members, both individually and in groups. Cooperative learning provides opportunities for students to interact, work in a team, learn from each and respect other's opinions. Therefore, students are expected to manage their emotions in the learning. This article aimed to describe the students' emotional intelligence in cooperative-based mathematics learning in Year 10 senior high school.

2. Method

This is a Research and Development study. The development model in this study refers to Plomp model [6] consisting of five phases: (a) preliminary investigation, (b) design, (c) construction, (d) test, evaluation, and revision, (e) implementation. This article is part of the process of developing cooperative-based mathematical learning model integrated with emotional intelligence to cultivate

students' emotional character and intelligence. The focus of this article is to describe the students' emotional intelligence in mathematics learning. The subjects of this study were 30 Year 10 students.

The research instruments were an emotional intelligence observation sheet and an interview guide. Data are collected through observation during three lessons. Selected students were then interviewed to clarify the unclear information obtained from the observation. The data were then analyzed qualitatively involving the reduction step, categorization, data interpretation, and drawing conclusion. The aspects of emotional intelligence observed in cooperative learning were a productive utilization of emotions and empathy. The indicators of productively utilizing emotion were more responsible, confident, tenacious, and skillful in communicating as well as focusing more on the tasks, accepting the others' perspectives, listening to others, being satisfied with the award given.

3. Result and discussion

The emotional intelligence indicates the ability to read themselves and others so that they can put themselves in other people's situations while at the same time they control themselves. This ability aims to help an individual to manage every action and reaction through the self-control, passion, perseverance, and great personality that may not only bring the success in daily life but also in learning.

The student's emotional intelligence was observed by employing cooperative learning model in three mathematics lessons involving 30 Year 10 students. The teacher divided students into six heterogenous group based on gender and academic achievement. The observer observed the aspect of students' emotional intelligence during the lesson on the topic of drawing the graph of quadratic function. The excerpt of the observation is presented as follows.

The excerpt of lesson 1

Teacher : After determining the coordinates in the table, please proceed to the next step of drawing the graph by plotting the coordinates in the Cartesian plane.

(Student was asked to work as a group while teacher walked around the classroom to carefully supervise and observe the activity in each group. Based on the observation, the teacher was seen to move from one group to another group to give limited guidance to the students who were confused and having difficulty working on the task. The teacher also reminded the student to work together in the group)

Student : Miss. What is the meaning of the negative sign in front of the x variable? Is each number substituting x also negative because of the negative sign?

Teacher : Good question! Well, the negative (-) is a negative sign from the coefficient of negative variable x and the negative sign is not operated with certain x that is substituted. For example: if $x = 2$ then $-x^2 = -(2)^2 = -4$. Do you understand?

Student : Yes, Miss! Thank you!

(Student continued discussing with her group members for the remaining allocated time, the teacher then asked the representation of two groups to present their work in front of the class)

Teacher : Students, discussion time is over! I want two students from different groups to present your group work in front of the class!

(Teacher asked the representation of two groups to present their results in front of the classroom. The two students drew the different graph of the function. Student (a) drew the graph with the curve opening upward and student (b) draw the graph with the curve flipping downward. Teacher asks the other group to pay attention and compare the result of the two students with their works)

Teacher : Ok class. Let see the two results! What are the differences?

Student : The first curve opens upward and the other opens downward, Miss!

Teacher : Correct, we can see here that when the curve open upward, what is the coefficient of a ? And if the curve is flipping downward, what is the coefficient of a ?

Student : The first graph opening upward means $a > 0$, and the graph flipping downward means $a < 0$!

The excerpt of Lesson 2

- Teacher guided the students to work on the worksheet containing the problems related to drawing graph of the quadratic function by discussing with the members of the group.
- Students discussed in the group while teacher walked around the classroom to supervise and observed the activity in each group in detail. It was seen that the teacher stops at each group to give limited guidance to the students who were confused and having difficulty working on the problems. The teacher kept reminded the students to work together as a team in the group.
- One of the students had a question concerning $-x^2$. The student was confused in understanding the negative sign in front of the x . To solve this problem, the teacher then explained that the negative sign ($-$) is a sign of the coefficient of variable x with the value of -1 . Teacher emphasized that the negative sign is not operated with the certain value of x substituting into the variable x . Once this problem was completed, the teacher asked students to work in their group faster.

In lesson 3, teachers were confident and serious in directing students to build their understanding of learning materials. Besides, teachers also seek to generate students' responses indicated by the emergence of the emotional intelligence aspects of students supporting the achievement of learning objectives. The excerpt of lesson 3 is as follows.

- The teacher provided a problem related to drawing the graph of the quadratic function and asked several students to do it in front of the class.
- Students took turn to complete the table of coordinates (x, y) . Each student chose a different value of x and then drew a coordinate. Student drew the function graph using the table to determine the coordinates, drawing the Cartesian coordinate system, determining the coordinates in the Cartesian plane and connecting them to form the graph as a parabola.
- The teacher presented how to draw the function graph by drawing a Cartesian coordinate system and obtained the interception, axis symmetry, and vertex followed by connecting the points to form a parabola. Teacher conveyed that the axis symmetry determined by the formula of $\frac{-b}{2a}$ while for the vertex determined by the formula of $\left(\frac{-b}{2a}, \frac{D}{-4a}\right)$.
- Students solve the problems as a group, investigating the difference between the graph of $y = x^2 + 2x - 3$ and $y = -x + 3x - 2$
- Teacher led students to draw a conclusion that is if the coefficient x^2 positive, the graph opens upward, and conversely, if the coefficient x^2 is negative, the graph flips downward.

Students assigned to come to the class were obedient, while other students also took serious efforts and concentrated to build the understanding of the lesson. The emotional intelligence arised was seriousness, sincerity, tenacious and confident, and skilled in communicating as indicated by student activities during the discussion and completion of tasks in the group. The above results are similar to the research of Myer et al. [6] which also studied the relationship between emotional intelligence and communication skills. A group of Iranian university students, 53 female and 76 male, completed the Emotional Intelligence Scale and the Communication Skills Inventory and the data analysis showed that emotional intelligence was positively associated with communication skills [7].

Teachers rewarded the students when they did the task correctly while providing scaffolding as necessary for students who did not solve the tasks successfully. Teachers also provided students the opportunity to respond to their peers' work or ask questions. In this sense, the empathy of students appeared, that is, the students were responsive and sensitive to the feelings experienced by other students. When one student presented the work, the rest of the students paid close attention. It is in line with the result of [8] stated that the self-perceptions and emotional dispositions are related to the nature

of EI, which affect the students' relationship with their school friends. Compared to colleagues who have low EI score, students with high EI score were more likely to be seen as someone having leadership qualities and is cooperative and less likely to be seen as disruptive, aggressive and dependent people.

During the learning activities, teachers should also consider the types of interactions that occur [5] including two-way communication, communication between teachers and students with feedback from teachers. Multiple direction communication can also occur, i.e., communication between teachers and students as well as communication between students. For example, when a student expresses opinions, other students are free to respond, while the teacher also contributes to the comments. All learning activities should support the emergence of the emotional intelligence aspects of students, namely: being confident to respond or ask questions, to complete the task, engaged in the learning process, and being optimistic in facing problems, as well as concentrating when necessary.

4. Conclusion

Emotional intelligence is one of the vital intelligence to perform. The implementation of cooperative learning model can facilitate the emergence of several aspects of students' emotional intelligence. Aspects of students' emotional intelligence aspects that arise in cooperative-based mathematics learning are students being more serious and sincere, tenacious and confident, skillful at communicating, being a better listener to others' opinions, satisfied with the rewards given.

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