Students' Activities and Responses Based on Emotional Intelligence in Mathematics Learning with a STEM Approach

Sunyoto Hadi Prajitno[1*], Feny Rita Fiantika[2], Angga Dwi Mulyanto[3], and Zulfiatin Ni'mah[4]

[1,4]Department of Mathematics Education, Universitas PGRI Adi Buana Surabaya, Indonesia
[2]Department of Primary School Teacher Education, Universitas PGRI Adi Buana Surabaya
[3]Department of Mathematics Education, Universitas Islam Negeri Maulana Malik Ibrahim Malang
Email: [1]nyoto_hp@unipasby.ac.id and [2]fentfeny@gmail.com*

Abstract— Emotional intelligence can be considered a component that can be taken into account and used as a foundation for effective learning. One of the benchmarks for learning effectiveness is students' activities and responses during the learning process. This study aims to investigate students' activities and responses based on emotional intelligence in mathematics learning using the STEM approach in Grade 10, focusing on quadratic functions. The subjects of this study were students of Grade X-04 at Al-Islam High School of Krian. The method used in this study was a descriptive quantitative method with a one-shot case study design. The data collection techniques employed were observation, questionnaires, and tests. The results of the study showed that students' activities and responses during the learning process using the STEM approach with the STAD (Student Team Achievement Division) learning model over two sessions, based on emotional intelligence, yielded the following outcomes: students with high emotional intelligence demonstrated very active participation and a highly positive response, achieving 95.71%; students with moderate emotional intelligence showed active participation and a highly positive response, achieving 91.67%; and students with low emotional intelligence demonstrated moderately active participation and a less positive response, achieving 58.64%.

Keywords— Students' activities; Students' Responses; Emotional Intelligence; STAD; STEM Approach.

INTRODUCTION

Education is one of the essential efforts to improve the quality of human resources. One way to enhance the quality of human resources is by improving the quality of education through creating an enjoyable teaching and learning atmosphere, allowing students to actively participate in the learning process, and enabling them to gain intelligence and self-control over what they have learned.

Learning is the process of acquiring knowledge, resulting in a two-way interaction between students and teachers (Suardi, 2022). Quality learning can influence the effectiveness of the learning process. Effective learning is essential in mathematics education because when students learn mathematics, teachers are required to use time and energy as efficiently as possible. Prayitno and Alphareno (2021) defined mathematics learning as a teaching method used by teachers to enhance students' problem-solving abilities, improve their understanding of mathematical concepts, and increase their initiative and participation during the learning process

On the other hand, during the learning process, teachers should avoid making students feel intimidated; instead, they should be able to create a pleasant atmosphere. Mood or emotions—whether positive, enjoyable, or unpleasant—can influence the functioning of the human brain structure, as well as impact the learning process and outcomes. During the learning process, students inevitably face challenges, and how they handle these challenges depends on their emotional skills. Students' emotional skills in dealing with problems can be assessed through their emotional intelligence (Prajitno and Auliya, 2022).

Emotional intelligence, according to Prayitno (2020), is an individual's ability to adapt to their environment. Thus, emotional intelligence can be defined as the ability to manage, monitor, control, and regulate one's emotions appropriately. If an individual possesses these abilities, they can be said to have emotional intelligence. Therefore, emotional intelligence can be considered a component to be taken into account and used as a foundation for effective learning. One of the benchmarks for effective learning is students' activities and responses during the learning process. According to Kartini and Putra (2020), students' responses are their social reactions to the influence or stimulus of a situation created by others. Engaging learning processes make

students enjoy the experience and facilitate their absorption of knowledge, as seen from their responses during the learning process. Students with poor responses and a lack of interest in mathematics often perceive the subject as difficult.

Today's learning must be able to adapt to advancements, particularly in technology, during this era of globalization. One such adaptation is integrating aspects such as science, technology, engineering, and mathematics. The STEM approach is a suitable learning strategy. According to Putri et al. (2023), the STEM approach is an educational method that integrates components of knowledge and skills, namely science, technology, engineering, and mathematics. However, many mathematics teachers have not yet implemented the STEM approach due to a lack of knowledge about it (Rahmawati and Juandi, 2022).

STEM, according to Ishak et al. (2021), consists of four aspects of learning: science, which is the natural knowledge accumulated over time through scientific research that can generate new information; technology, which is applied science or skills used to create goods necessary for human survival and to ease human labor; engineering, which is the use of science and technology to organize and design ways to solve human problems; and mathematics, which is the study of patterns and relationships between space, quantity, numbers, and structures. The application of the STEM approach, as explained by Rahmawati et al. (2022), is crucial in mathematics education to develop students with innovative, creative, and critical learning skills, and to shape students with high positive emotional intelligence during classroom learning.

This study was aimed to determine students' activities and responses based on emotional intelligence in mathematics learning with the STEM approach in Grade X on the topic of quadratic functions. A Quadratic Function (Noormandiri, 2021) is a function in the form of $f(x) = ax^2 + bx + c$ where a, b, and c $\in$ R with a $\neq$ 0. The real number $D = b^2 - 4ac$ is called the discriminant of a quadratic equation, symbolized by a letter. The Quadratic Function is related to quadratic equations. A quadratic function in the form of zero is called a quadratic equation. There are several methods to determine quadratic equations: factoring, completing the square, and using the abc formula.

Based on the problems and explanations regarding students' activities and responses based on emotional intelligence with the STEM approach, this study was related to the implementation of the STEM approach in mathematics education. The STEM approach was chosen because it can reveal students' activities and responses based on emotional intelligence in mathematics learning, particularly in the topic of Quadratic Functions in Grade X. Therefore, the researcher was interested in conducting further study on "Students' Activities and Responses Based on Emotional Intelligence in Mathematics Learning with the STEM Approach."

METHOD

This study used a descriptive quantitative method. The study design was pre-experimental with a one-shot case study design, which is an experiment conducted in one class with a single treatment believed to impact students' activities during the learning process. The subjects of this study were students from Grade X-04 at Al-Islam High School of Krian, Sidoarjo. The data collection techniques used in this study were observation, questionnaires, and tests. The observation sheets were used to obtain data related to students' activities, covering aspects of the lesson such as the introduction, core activities, and closing, which were observed over two sessions and summarized at the end of each meeting. The questionnaire sheets were used to obtain data related to students' responses, while the emotional intelligence test sheets were used to assess students' emotional intelligence. The data analysis techniques used to determine the categories of students' emotional intelligence are:

1. High Emotional Intelligence Category

   $X \geq M + SD$

2. Moderate Emotional Intelligence Category

   $M - SD \leq X < M + SD$

3. Low Emotional Intelligence Category

   $X < M - SD$

   Notes:

   M = Mean

   SD = Standard of Deviation

The data to determine the percentage of students' activities were analyzed through the following equation:

$$P = \frac{The\ total\ score\ obtained}{maximum\ score} \times 100\%$$

(Bannang et al., 2023)

Here is the table of percentages for categories to represent student activities:

Table 1. The Categories of Students' Activities

Percentage of Students' Activities	Category
0% ≤ P < 20%	Very Inactive
20% ≤ P < 40%	Inactive
40% ≤ P < 60%	Moderately Active
60% ≤ P < 80%	Active
80% ≤ P ≤ 100%	Very Active

Note: P = Percentage of Students' Activities

Students are categorized as active if the average percentage during the learning process in each session is greater than or equal to 60%. The data to determine the percentage of students' responses were analyzed using the following formula:

$$PRs = \frac{\sum students\ who\ respond\ positively\ to\ indicator\ \text{-}}{\sum students\ who\ responded} \times 100\%$$

(Zaahirah & Kusrini, 2014)

Here is the table of percentage categories to represent students' responses:

Table 2. The Categories of Students' Responses

Percentage of Students' Responses	Category
PRs≥85%	Very Positively
70%≤Rs<85%	Positively
50%≤Rs<70%	Less Positively
Rs<50%	Not Positively

Note: Students' Responses

Student responses can be considered positive if the percentage of students providing positive responses is ≥ 70% in one class regarding the STEM approach in mathematics learning.

RESULT AND DISCUSSION

The highest emotional intelligence test score obtained was 72, and this score was derived from the formula of $X \geq M + SD$. Thus, the high emotional intelligence scores ranged from 65 to 72. The moderate emotional intelligence test scores were derived from the formula of $M - SD \leq X < M + SD$.

Therefore, the moderate emotional intelligence scores ranged from 58 to 62. The lowest emotional intelligence score obtained was 41, and this score was derived from the formula of $X < M - SD$.

Therefore, the low emotional intelligence scores ranged from 41 to 55 (Note: M = Mean, SD = Standard of Deviation). From these results, a table can be formulated as follows.

Table 3. The Test Results of Students' Emotional Intelligence

No.	Emotional Intelligence	Frequency
1.	HIGH	14
2.	MODERATE	12
3.	LOW	11

The results of the study on students' activities conducted during this learning process using the STEM approach with the STAD (Student Team Achievement Division) learning model over two sessions based on emotional intelligence are as follows.

Table 4. The Data Results of Students' Activities

No.	Emotional Intelligence Level	First Meeting	Second Meeting	Mean	Category of Students' Activities
1	HIGH	72.62%	91.30%	81.96%	VERY ACTIVE
2	MODERATE	70.62%	84.78%	77.7%	ACTIVE
3	LOW	54.76%	59.78%	57.27%	FAIRLY ACTIVE

Based on Table 4, it is shown that students with a high level of emotional intelligence achieved an average student activity score of 81.96%, which falls into the very active category. Students with a moderate level of emotional intelligence achieved an average student activity score of 77.7%, which falls into the active category, while students with a low level of emotional intelligence achieved an average student activity score of 57.27%, which falls into the fairly active category.

From the questionnaire results of students' responses in accordance with the formula to determine the percentage of students' responses, the results are as shown in the following table:

Table 5. *The Questionnaire Results of Students' Responses*

No.	Emotional Intelligence Level	Percentage of Students' Responses	
		Positive Response	Negative Response
1.	HIGH	95.71%	4.29%
2.	MODERATE	91.67%	8.33%
3.	LOW	58.64%	41.36%
		82%	18%

Based on Table 5 above, it was found that students with high emotional intelligence achieved a very positive response percentage of 95.71%. Students with moderate emotional intelligence achieved a very positive response percentage of 91.67%. Meanwhile, students with low emotional intelligence achieved a less positive response percentage of 58.64%.

The results of the students' activity data showed that students with high emotional intelligence exhibited very active participation in learning activities. This finding aligns with the study by Muis and Santosa (2022), which stated that the higher a student's emotional intelligence, the more it enhances their engagement during learning. This condition occurred because students were able to manage their emotions well during the learning process and could understand the material effectively after being taught using the STEM approach. Despite challenges encountered during the learning process, these students were able to continue learning effectively and remained unaffected by changes in the learning environment. Meanwhile, students with low emotional intelligence exhibited fairly active participation in learning activities, possibly because even slight changes in the learning environment could prevent them from learning effectively.

The data results of students' responses showed that students with high and moderate emotional intelligence provided very positive responses, while students with low emotional intelligence gave less positive responses. This finding aligns with the study by Hidrolik et al. (2021), which stated that STEM-based learning can enhance students' positive responses in understanding mathematical concepts and improve their learning outcomes.

CONCLUSION

Based on the description above, it can be concluded that the activities and responses of students during the emotional intelligence-based learning process using the STEM approach with the STAD (Student Team Achievement Division) model over two meetings yielded the following results: students with high emotional intelligence exhibited very active participation and very positive responses, namely at 95.71%. Students with moderate emotional intelligence showed active participation and moderately positive responses, namely at 91.67%. Meanwhile, students with low emotional intelligence exhibited moderately active participation and less positive responses, namely at 58.64%.

Based on the results of the study on the implementation of the STEM approach in mathematics learning, the researcher offers the following suggestions: Teachers can optimize mathematics learning by using the STEM approach while paying attention to students' emotional intelligence to enhance the quality of learning. Teachers can provide new insights into mathematics teaching approaches that integrate students' emotional intelligence with the STEM approach, making the learning process more effective.

REFERENCES

[1] Bannang, A., R. Uloli, & T. Abdjul. (2023). Pengembangan Perangkat Pembelajaran Menggunakan Model Pembelajaran Kooperatif Dengan Pendekatan Inkuiri Pada Materi Fluida Statis. AKSARA: Jurnal Ilmu Pendidikan Nonformal, 9(1), 749–760.

[2] Gusteti, M. U., & Neviyarni, N. (2022). Pembelajaran Berdiferensiasi Pada Pembelajaran Matematika Di Kurikulum Merdeka. Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika, 3(3), 636–646. https://doi.org/10.46306/lb.v3i3.180

[3] Hadi Prayitno, S. (2021). Efektivitas Pembelajaran Problem Based Learning Dengan Zoom Meeting Di Sdn Kebraon Ii. Jurnal Pendidikan Dasar, 12(01), 130–138. https://doi.org/10.21009/jpd.v12i01.21804

[4] Hidrolik, R., Tinjau, D. I., Hasil, D., Dan, B., & Kediri, I. (2021). Pengembangan Media Pembelajaran Berbasis Stem Respon Siswa Terhadap Matematika. 3(2), 125–138. https://doi.org/10.30762/factor-m.v3i2.2611

[5] Ishak, A. M. F., Israwaty, I., & Halik, A. (2021). Penerapan Pendekatan STEM untuk Meningkatkan Hasil Belajar Siswa Sekolah Dasar Kelas Lima di Kabupaten Baru. Pinisi Journal Of Education, 1(1), 38–58. https://ojs.unm.ac.id/PJE/article/view/26603

[6] Kartini, K. S., & Putra, I. N. T. A. (2020). Respon Siswa Terhadap Pengembangan Media Pembelajaran Interaktif Berbasis Android. Jurnal Pendidikan Kimia Indonesia, 4(1), 12. https://doi.org/10.23887/jpk.v4i1.2498

[7] Klorina, M. J., & Juandi, D. (2022). Kesulitan Belajar Matematika Siswa di Indonesia Ditinjau dari Self-Efficacy: Systematic Literature Review (SLR). Symmetry: Pasundan Journal of Research in Mathematics Learning and Education, 7(2), 181–192. https://doi.org/10.23969/symmetry.v7i2.6435

[8] Muis, A., & Santosa, A. B. (2022). Pengaruh Kecerdasan Emosional Siswa, Motivasi Belajar terhadap Keterlibatan Siswa di Sekolah Dimoderasi oleh Lingkungan Keluarga di SMA Islam Sultan Agung 1 Semarang. Jurnal Pendidikan Tambusai, 6(2), 16173–16189. https://jptam.org/index.php/jptam/article/view/4964

[9] Mustofa, B. (2022). Keaktifan siswa matematika. Islamic Elementary Education Journal, 1(2), 79–88.

[10] Nasution, N. A. (2022). Efektivitas Pembelajaran Matematika dengan Model Blended Learning melalui Pendekatan STEM (Science, Technology, Engineering, Mathematics) di SMK Sandhy Putra – 2 Medan. Jurnal Fibonaci: Jurnal Pendidikan Matematika, 3(2), 22. https://doi.org/10.24114/jfi.v3i2.40691

[11] Noormandiri, B. . (2021). Matematika untuk SMA/MA Kelas X (Taryo (ed.)).

[12] Prajitno, S. H., & Auliya, A. F. (2022). The Effect of Visual Learning Style and Problem Based Learning towards Mathematics Learning Outcomes Viewed from Emotional Intelligence. Jurnal Pendidikan MIPA, 23(2), 392–399. https://doi.org/10.23960/jpmipa/v23i2.pp392-399

[13] Prayitno, S. H. (2020). Pengaruh Kecerdasan Emosional Dalam Pembelajaran Matematika Abad 21. 171(November 2017), 8557.

[14] Prayitno, S. H., & Alphareno, O. J. (2021). Efektivitas Model Pembelajaran Anchored Instruction dalam Pembelajaran Matematika Terhadap Kemampuan Berpikir Kritis Siswa. Jurnal Cendekia : Jurnal Pendidikan Matematika, 5(2), 1842–1853. https://doi.org/10.31004/cendekia.v5i2.565

[15] Purwasih, S. M., & Rani Kurnia Putri. (2020). Peningkatan Keaktifan dan Motivasi Belajar Mahasiswa melalui Pendekatan Kontekstual. J Statistika: Jurnal Ilmiah Teori dan Aplikasi Statistika, 13(2), 1–4. https://doi.org/10.36456/jstat.vol13.no2.a2998

[16] Suardi, M. (2022). Belajar Dan Pembelajaran Tujuan Belajar Dan Pembelajaran. In Uwais Inspirasi Indonesia (Nomor March). https://www.coursehero.com/file/52663366/Belajar-dan-Pembelajaran1-convertedpdf/