RBL-Stem Learning Activities: Enhancing Students' Socio-Emotional Thinking Skills in Comparing the Growth of Bullying and Praising Plants

O A Safiati[1]*, Purwaningtyas R[2], Chususiyah S[3], D P Lestari[4], Zainur Rasyid Ridlo[5], Dafik[6]

[1]UPTD Satdik SDN Tegal Besar 04, Jember, Indonesia
[2]SD Negeri 4 Setail, Banyuwangi , Indonesia
[3]UPTD Satdik SDN Karangsemanding 02, Jember, indonesia
[4]Dinas Pendidikan Kabupaten Jember, Indonesia
[5]Department of Sciences Education, Universitas Jember, Indonesia
[6]PUI-PT Kombinatorika dan Graf, CGANT Research Group, Universitas Jember, Indonesia
*Email: octyanis@gmail.com
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A B S T R A C T

The RBL-STEM (Research-Based Learning in Science, Technology, Engineering, and Mathematics) approach is an educational strategy that merges STEM subjects with real-life scenarios to enhance students' socio-emotional competencies. One of the implemented strategies in this approach involves analyzing the parallels between bullying behaviors and the way plants respond to positive reinforcement. This study focuses on advancing students' socio-emotional abilities through RBL-STEM activities. Utilizing methods such as observations, interviews, and document reviews, students explored the relationship between human social behaviors, like bullying, and how plants react to commendation. Findings indicated that this innovative RBL-STEM activity, which juxtaposes plant growth with social behaviors, significantly bolstered students' socio-emotional skills. Engaging in this comparative analysis deepened students' collaboration, communication skills, and awareness of social behavior consequences. This educational design serves as a valuable model for educators aiming to incorporate connected, relevant, and STEM-integrated lessons to foster students' socio-emotional development, thereby laying a solid groundwork for their success in academic and non-academic spheres.

Keywords: Bullying and prasing plants, Socio-emotional skills, STEM

1. INTRODUCTION

Education transcends mere academic learning, encompassing the personal and social growth of students as well. The Merdeka curriculum, now being implemented, integrates social-emotional learning, recognizing the significance of fostering holistic student development in a student-centric educational environment. This approach aims for students to excel not just intellectually but also in their social and emotional competencies. A key strategy in promoting this type of learning is through the mobilizing teacher program. Embedding social-emotional learning from an early stage is crucial, as it plays a pivotal role in students' academic achievements, career prospects, and interpersonal relationships.

Social and emotional learning (SEL) is a crucial yet sometimes neglected aspect of education, significantly influencing children's overall growth and development. SEL enhances students' social and emotional skills, fosters a supportive learning atmosphere, and boosts students' positivity and acceptance towards themselves, their peers, and their educational environment. Furthermore, incorporating SEL into classroom practices is linked to improved academic performance. It lays a solid groundwork for students to thrive in various life aspects beyond school, contributing to their overall psychological well-being. Noble and McGrath (2016) highlighted that optimal student well-being is a consistent emotional condition marked by positive emotions and attitudes, healthy relationships with peers and educators, resilience, personal growth, and high satisfaction levels with their school experiences.

SEL (Social and Emotional Learning) plays a pivotal role in equipping students to navigate life's challenges, underscoring the importance of nurturing well-rounded individuals. This educational approach is designed to create enriching learning experiences that cultivate the five core SEL competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Teachers, as key facilitators, are tasked with embedding SEL into the educational fabric through various strategies. These include explicit instruction in both curricular and extracurricular settings, incorporating SEL principles into teaching practices and academic content, fostering a classroom and school culture that reflects virtuous values, and enhancing the social and emotional skills of educational staff through role modelling, participatory learning, and community collaboration. SEL's focus extends to empowering students to actively participate in their learning journey, honing their analytical, communicative, and cooperative abilities. It is a

holistic approach that addresses emotional recognition and regulation, effective problem-solving, and cultivating meaningful interpersonal connections. The aim of SEL is to integrate behavioral, cognitive, and emotional growth (Widyastuti, 2022), supported by a collaborative network involving schools, families, and communities (Zins & Elias, 2006).

Table 1. Social Emotional Competencies (NYSED, 2018).

KSE	Example
Self awareness	Competence in understanding others' emotions, personal goals, and values such as being able to accurately assess strengths and weaknesses, having a positive mindset, and self-efficacy and optimism.
	A high level of self-awareness requires the ability to recognize how the connections between thinking, feeling, and acting.
Self-management	Emotion and attitude regulation competencies, such as goal-achievement skills, ability to resist gratification, stress management, impulse control, and resilience when facing challenges
Social awareness	Competence in taking perspective and respecting different backgrounds and cultures and emphasizing empathy and compassion, understanding social norms and recognizing family, school, and community resources and supports.
Relationship skills	Competence in communicating clearly, active listening, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and providing help when needed.
Responsible decision making	Ability to consider ethical standards, consider safety, make accurate attitudinal assessments to make realistic evaluations of the consequences of various actions, and consider the health and well-being of self and others. Take responsibility for decisions that require knowledge, skills and attitudes. Ability to make constructive choices about personal attitudes and social interactions in different settings.

The aims of SEL include assisting students in attaining a comprehensive awareness of themselves and their peers, equipping them with the abilities and knowledge to navigate their emotions, form their identities, and establish objectives, while also alleviating the stress and pressures associated with learning. Through SEL, students are empowered to harmonize their academic and social-emotional competencies, paving the way for a life marked by fulfilment and achievement. This underscores the imperative of integrating Social and Emotional Learning within educational settings, as it promises not only enhanced academic outcomes but also lays a robust foundation for students to excel in various life facets post-education, contributing to their ultimate psychological well-being (Yo, 2022).

Enhancing students' social-emotional capabilities is anticipated to decrease bullying occurrences within schools. Bullying, characterized by one person's or group's threatening behaviour through verbal or physical violence, was reported by the National Centre for Educational Statistics in 2016 to affect 20.8% of students. The repercussions of bullying are severe, potentially leading to anxiety, depression, physical harm, and even suicidal tendencies (Kurnia, 2018). One strategy to mitigate these issues is the integration of Research-Based Learning (RBL) with the STEM (Science, Technology, Engineering, and Mathematics) framework. RBL fosters academic excellence and self-directed learning and knowledge construction (Blackmore & Fraser, 2007), while STEM provides a comprehensive approach to applying various disciplines in addressing real-world challenges (Priemer in Changtong et. al. 2020).

In the context of RBL-STEM, one innovative activity involves observing the growth of mung bean plants subjected to differing treatments—receiving either positive encouragement or negative bullying. This exercise is designed to refine students' social-emotional skills by encouraging them to examine how the plants' growth is influenced by their treatment. It prompts students to reflect on the broader social and emotional ramifications of these actions and to recognize analogous behaviour patterns in human interactions. This dual focus not only augments students' scientific understanding related to plant biology but also enhances their insights into social and emotional interrelations in their surroundings.

This framework underpins the research initiative aimed at bolstering students' socio-emotional abilities through a comparative analysis of plant growth under positive and negative influences, utilizing the combined RBL-STEM.

2. RESEARCH METHODS

This study used qualitative narrative method as the research approach. The research process began with collecting literature related to social-emotional skills, Research-Based Learning (RBL), and Science, Technology, Engineering, and Mathematics (STEM) for review. From the review, a syntactic framework for RBL-STEM integration was developed with a focus on improving socio-emotional skills. Furthermore, learning outcomes and research objectives are presented, including the development of indicators and sub-indicators related to socio-emotional skills.

The research continued with an exploration of the role of the four main elements in the STEM approach to solve the previously identified problems. Only then, an in-depth description of each stage of RBL involving learning activities was conducted. The final step of this research is to comprehensively describe the indicators and sub-indicators related to socio-emotional skills, including the development of relevant and comprehensive assessment instruments. This narrative qualitative approach that emphasizes an in-depth understanding of the RBL-STEM integration and its application in the context of social-emotional skills makes this research an important contribution in increasing learning motivation, which in turn increases their ability to learn and achieve better results and is oriented towards future challenges.

3. RESEARCH RESULTS

3.1. Syntax of Research-based Learning with STEM Approach

Below we describe a framework for combining the Research-Based Learning model with the STEM approach to improve students' socio-emotional skills through the implementation of an innovative activity comparing negatively and positively treated plants. In the early stages of the RBL syntax, problems emerged from the research group that stemmed from open problems. The research focused on plants subjected to negative and positive treatment as an innovation to reduce bullying and improve students' socio-emotional skills. The next step involved planning the project together with the STEM approach, collecting tools and materials to grow mung beans with two different containers, implementing the project, and analyzing the development of the negatively and positively treated plants.

The actions taken on the two plants prepared by each student are given the same treatment that distinguishes only the act of bullying and praising the plant will affect its growth. In line with Choube and Sharma, (2021), the plant to which we talked positively and used encouraging words grows better compared to the plant to which we talked negatively and used discouraging words. Just like plants, the type of words can also affect people. In fact, education about it is one of the most important agendas to be carried out. Hence the need for education on the impact of bullying to be introduced early on. In detail, the framework for integrating research-based learning with the STEM approach can be seen in Figure 1.
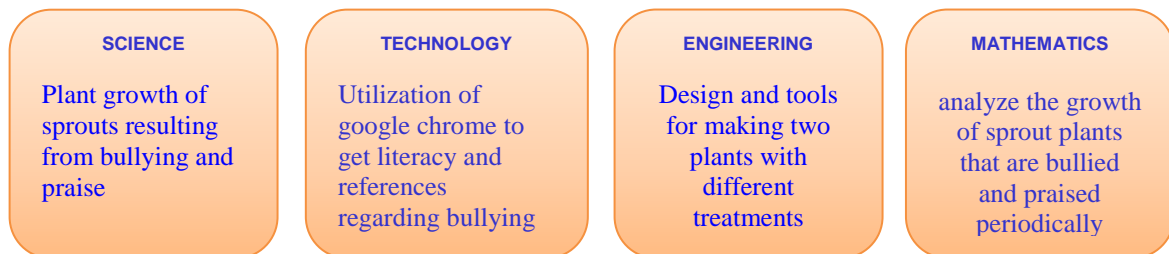

Figure 1: STEM elements in plant growth problems

The RBL-STEM activity will involve the following series of stages: (1) identification of underlying problems related to bullying, which is a serious problem in many schools, (2) problem solving through innovation by conducting research on plants subjected to positive and negative treatment, (3) collaboration with teachers to plan joint projects, (4) data collection related to students' social-emotional skills, (5) analysis of the growth of plants subjected to bullying and plants receiving praise, and (6) drawing conclusions and reporting the results of the research based on observations on the sprouting plants and KSE in students. Further details of the RBL-STEM integration framework can be found in Figure 2. In detail, the framework for the integration of Research-Based Learning with the STEM approach can be seen in Figure 2.
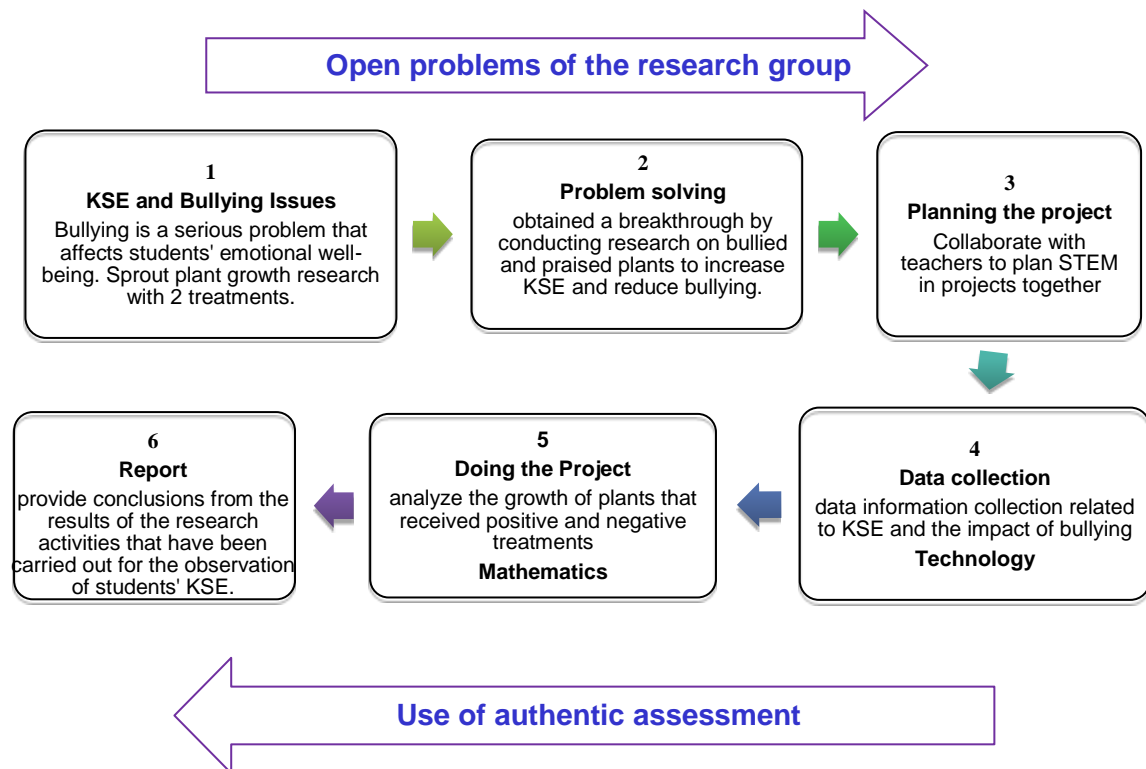
Open problems of the research group

1 **KSE and Bullying Issues** Bullying is a serious problem that affects students' emotional well-being. Sprout plant growth research with 2 treatments.	**2** **Problem solving** obtained a breakthrough by conducting research on bullied and praised plants to increase KSE and reduce bullying.	**3** **Planning the project** Collaborate with teachers to plan STEM in projects together
6 **Report** provide conclusions from the results of the research activities that have been carried out for the observation of students' KSE.	**5** **Doing the Project** analyze the growth of plants that received positive and negative treatments **Mathematics**	**4** **Data collection** data information collection related to KSE and the impact of bullying **Technology**

Use of authentic assessment

Figure 2. framework RBL syntax framework with STEM approach.

3.1.1 Learning Outcomes and Objectives

The learning achievement obtained is the improvement of students' social-emotional skills and the reduction of bullying behavior through the implementation of research on plants that experience negative and positive treatment. The learning objectives resulting from the Research-Based Learning approach with STEM approach aim to facilitate the development of students' social-emotional skills, with the hope of reducing the incidence of bullying in the school environment. The details of these objectives are outlined as follows.

- Science

  Students plant 2 sprouting plants using cotton and analyze their growth.

- Technology

Students have the ability to search for information through the Google Chrome search engine related to bullying and its impact on child psychology.

- Engineering

Students have the skills to prepare two plants in different containers.

- Mathematics

Students analyze the growth results of plants that were bullied and those that received praise.

3.1.2 Positive and negative treatment sprout plant research to improve students' socio-emotional skills and reduce bullying actions.

Science Element Problem.

In this lesson, the science aspect emphasized involves observing the development of plant sprouts grown on cotton media, by providing treatment in the form of bullying and praise. The purpose of this study is to improve students' social-emotional skills and reduce the incidence of bullying in the school environment. Through the analysis of the research results, it is expected to make a positive contribution to the development of students' social-emotional skills and create a safer and more supportive learning environment at school.

Figure 3. Observations of bullying and praising chili and mung bean plants

Elements of Technology.

Students can utilize Google Chrome to search for literacy about bullying and its impact on children's psychology. In this context, research involving negatively and positively treated sprouts is expected to improve students' socio-emotional skills and effectively reduce the incidence of bullying in the school environment. Through understanding the literacy of bullying, students can develop a deeper insight into its impact on child psychology, strengthen their social awareness, and encourage more positive and inclusive behavior among fellow students.
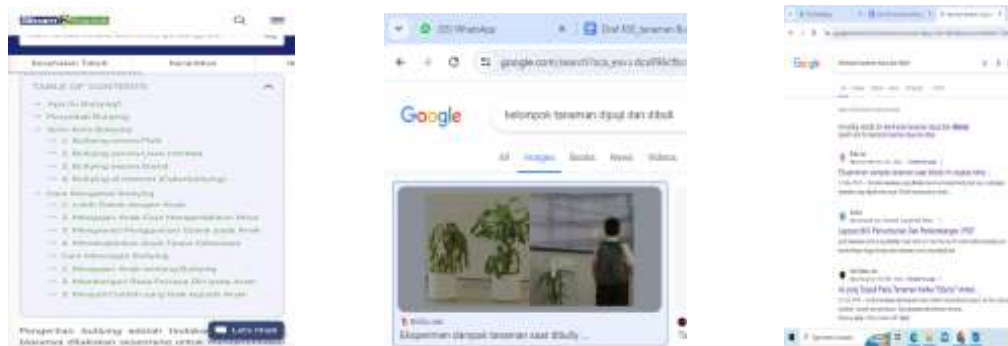

Figure 4 utilization of google chrome to get information about bullying and its impact

Technical Elements

Students prepare the equipment and materials to carry out the sprout growth research, while observing the relevant literacy. Required components include 10 mung bean seeds, 2 plastic cups, masking tape, and cotton wool. Students distribute the 10 mung bean seeds evenly into the cotton cups and label them "praise" and "bully". After that, they placed both plants in the same location and periodically and simultaneously gave praise to the plant labeled "praise" and bullying to the plant labeled "bully". By paying attention to literacy, students can better understand the context and purpose behind each action carried out during the sprout growth experiment. The integration of literacy allows students to dive deeper into related knowledge and concepts, making their learning experience richer and more meaningful.

Figure 5: Planting mung bean seeds

Elements of Math

The mathematical concept applied is when students record the development of the two sprouts routinely and analyze their growth. Students use mathematical literacy to perform calculations. By engaging mathematical literacy, students are able to develop a deep understanding of the sprout growth data, hone analytical skills and gain more critical insight into the information generated from their experiments. This provides an additional dimension to learning, enriching students' experience in understanding mathematical concepts in the context of plant growth. The results of students' calculations can be seen in the figure:
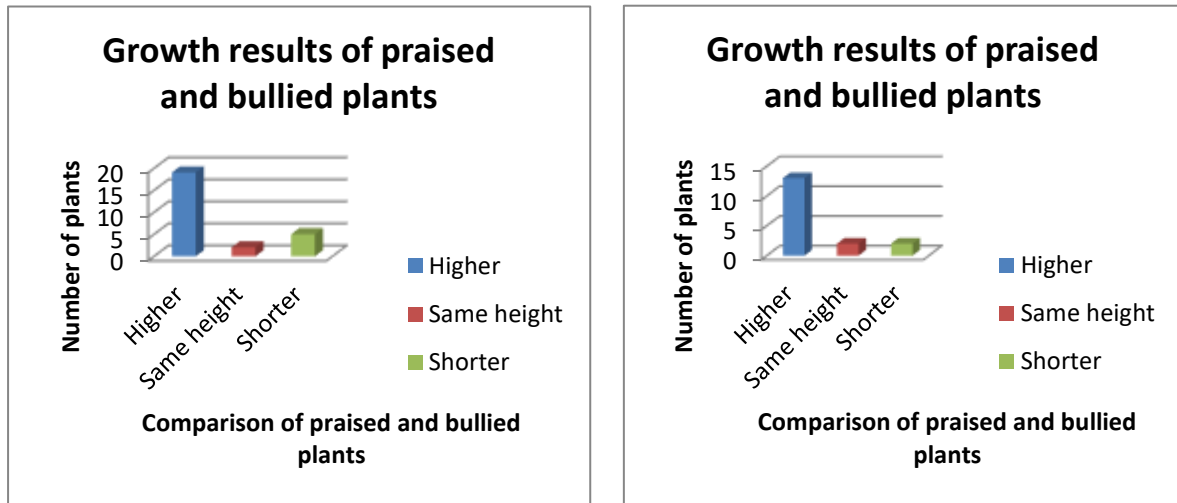

Figure 6. The results of statistical data calculation by students of SDN Tegal Besar 04 and SDN 4 Setail

3.1.2. Research Based Learning with STEM Approach in improving students' socio-emotional skills through the activity of comparing bullying growth and praising plants.

In this section, we will describe in detail each stage of the Research-Based Learning (RBL) model with a STEM approach, which consists of six steps. These stages will provide an in-depth picture of how students, through RBL_STEM learning, can improve their socio-emotional skills through comparing the growth of plants that received positive and negative treatments. Literacy integration is crucial to better understand each step and link it to related concepts and knowledge.

1.   Based on Figure 2, the first stage (science) proposes a fundamental problem related to bullying that affects students' emotional well-being. The researcher will ask students to conduct research on plants that give positive and negative treatment. For more details can be seen in Table 2 below.

Table 2. Stage I RBL-STEM learning activities

Stage One	Learning Activities	
Propose problems related to bullying that affect students' emotional well-being by conducting research on sprout plants (SCIENCE)	1.	The teacher shows the students pictures of bullying actions.
	2.	The teacher asks questions about the students' experiences of seeing or doing or even being victims of unpleasant behavior at school.
	3.	The teacher asks questions about how students feel when they bully or are bullied by their friends.
	4.	The teacher asks what are the reasons or causes of bullying.
	5.	How can you prevent/reduce the impact of bullying?

2. The learning activity of the Research-Based Learning model with the STEM approach in the second stage (engineering) is to develop innovative activities by conducting research on the activity of planting sprouts using two plastic cups. The teacher asks learners to determine the tools and materials needed for the research. For more details, see Table 3 below.

Table 3. RBL-STEM learning activities stage 2

Stage Two	Learning Activities
Collecting tools and materials needed in research activities	1. Students discuss with their groups to determine the tools and materials needed.
(ENGINEERING)	2. Students divide the group tasks in preparing the tools and materials.
	3. Students create the steps of planting sprouts for the research activity to be carried out

3. The learning activities of the Research-Based Learning model with a STEM approach in the third stage (technology) are students invited to use software or utilize technology to access information related to bullying and its impact on students' emotional well-being. The integration of literacy at this stage allows students to more deeply understand the use of technology as a relevant source of information in the context of research on bullying and students' emotional well-being. See Table 4 for details, which are as follows.

Table 4. RBL-STEM learning activities stage 3

Stage Three	Learning Activities
Gathering relevant information in the context of the research on bullying and students' emotional well-being.	1. Students with their groups gather information related to bullying
	2. Students together with the group gather information related to the impact of bullying.
	3. Students look for references on how to prevent bullying
	4. Students search for literacy about bullied plants

4. Learning activities using the Research-Based Learning model with the STEM approach in the fifth stage (mathematics) are analyzing the growth of sprout plants that are bullied and praised regularly. For more details see Table 5 as follows.

Table 5. RBL-STEM learning activity stage 4 sprout growth results bullied and praised

Stage Four	Learning Activities
analyze growth data of plants that received positive and negative treatments	Students record the growth of their plants periodically
	Students analyze the average growth of their sprouts every 2 days

5. Learning activities using the Research-Based Learning model with the STEM approach at stage six (report) carried out by students to convey and explain the objectives and conclusions of the learning activities of research results related to RBL_STEM learning: improving students' socio-emotional skills through activities to compare bullying growth and praising plants. In this case, students will conduct a Focus Group Discussion (FGD), so that researchers can observe students' socio-emotional skills. For more details, see Table 6 below.

Table 6. Learning activities of RBL-STEM stage 5 utilizing the comparative results of the growth of sprouts that are bullied and praised in improving children's socio-emotional skills.

Stage Five	Learning Activities
Provide student research reports related to RBL_STEM learning: improving students' socio-emotional skills through activities comparing bullying growth and praising plants.	1. Students make conclusions from the research that has been done.

Figure 8. Documentation of RBL-STEM learning activities

Meanwhile, the plant treatment activity can be seen on YouTube https://www.youtube.com/watch?v=BxLaOg_L4fk.

3.1.3. Social-Emotional Skills Assessment Instrument Framework

The following will present the assessment framework for the social-emotional skills instrument, as provided in Table 7.

Indicator	Sub-Indicator	Test Material
Self-awareness: *self concept*	1. Knowing what our strengths are	1. Has your experience with praising and bullying plants made you care more about your friends, other animals or plants? 2. How did you feel when you saw the plants you praised grow and thrive, compared to the plants you bullied? 3. What do you usually do when the plants you care for have difficulty growing or developing?
Self-awareness: pengetahuan tentang emosi	1. Knowing how we feel when we can't focus 2. Knowing the emotions we feel 3. Knowing how to calm ourselves down	1. How do you feel when the plants you care for do not grow as expected? 2. How do you cope or manage these feelings? 3. How do you usually calm yourself when facing challenges or difficulties in caring for plants that are praised or bullied?

Indicator	Sub-Indicator	Test Material
Social awareness	1. Learn from others when having different opinions 2. Knowing what others feel from their faces 3. Knowing when others need help	1. How do you respond when a friend has a different opinion about how to care for plants and is praised or bullied? 2. Do you find differences in the facial expressions of others when your friends are praising and bullying? explain! 3. How can you tell when your friend needs help in caring for a plant that is being praised or bullied, and what can you do?
Self-management: regulasi emosi	1. Can get through difficult circumstances despite frustration 2. Remains patient despite being very excited 3. Completes tasks even when they are difficult 4. Setting one's own goals 5. Doing schoolwork even if I don't like it 6. Preparing for tests	1. How do you usually deal with challenges or difficulties in caring for plants that are praised or bullied? Are there any specific steps you take to ensure that you are prepared for challenges or situations that may arise when caring for plants?
Relationship skills	1. Respect a friend's opinion even if you disagree 2. Get along with all friends	1. How do you respond when your friend takes care of a plant that is praised or bullied in a different way to you?
Responsible decisionmaking	1. Thinking what will happen before making a decision 2. Understand what is right and wrong 3. Focused and consistent	1. How do you consider consequences before drawing conclusions from observations of the growth of bullied and praised plants? 2. Did you observe the same growth of the bullied and praised plants? 3. If they are different, do you understand the right and wrong actions that caused their growth to be different? 4. What lessons can you learn from caring for the praised and bullied plants in the context of your life?

3.1.4. Follow-up of Learning Tool Development

For the learning device development stage, the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) developed by Raiser and Mollenda will be used. This model consists of analysis, design, development, implementation and evaluation. First: the analysis stage, which analyzes student characteristics, learning materials and processes, as well as learning media to be used. Second: the design stage is designing the integration of the RBL model into the STEM approach. At this stage, teaching materials, namely syllabus, lesson plans, LKPD, pre-test, post-test, and other assessment instruments, are prepared by the teacher. Third: the development stage, which is testing teaching materials and instruments to check the validity of teaching materials and practicality. The validation results are content validity, format validity, language validity, and practicality level. Fourth: the implementation stage to determine the effectiveness of RBL-STEM teaching materials in improving students' socio-emotional skills through activities to compare bullying growth and praising plants. Fifth: the evaluation stage is a reflection activity to assess whether the application of RBL model learning materials with a STEM approach can improve students' socio-emotional skills through activities to compare the growth of bullying and praising plants.

4. DISCUSSION

The results of the RBL_STEM learning activity, which aimed to improve students' socio-emotional skills through comparing the growth of sprouts that received positive and negative treatments, made a valuable contribution and deserve further investigation. The findings of this sprout study are not only a research result, but also a guide that has the potential to lead to more in-depth research in subsequent research activities. There are at least two additional research activities that can be explored further, namely: (1) developing RBL-STEM learning materials by applying the ADDIE development model, and (2) analyzing the implementation of RBL-STEM learning in improving students' socio-emotional skills through activities to compare the growth of plants that receive positive and negative treatments. By investigating and combining related literacies, these studies are expected to provide deeper insights and benefit the development of RBL-STEM-based learning methods.

This research was conducted at SDN Tegal Besar 4, grade 6, with 26 students as respondents. Each student planted green beans in 2 different containers. The first container was written "bullied" with the intention that the plant received bullying treatment, and the second container was written "praised" with the intention that the plant received praise treatment. Students put the two sprout plants in the same place and care method. Students made observations on the bullied and praised plants periodically and the results of student observations were different, 19 student mung bean plants showed higher plants that were praised, 2 plants were the same height and 5 plants showed higher plants that were bullied. The results of this study indicate that plants that receive positive treatment will grow optimally. To corroborate the results of this study, a similar study was conducted by grade 6 students at SD Negeri 4 Setail Banyuwangi with chili plants media. The students conducted activities to improve socio-emotional skills through activities to compare the growth of plants that were bullied and praised. The results obtained from the growth of 17 chili plants through the activity of being praised and bullied were 13 praise plants were taller than the bullied plants, 2 were the same height, and 2 praise plants were shorter than the bullied plants. This proves that the praised plants experienced good growth compared to the bullied plants. The results of this study are in line with Choube and Sharma, (2021), the plant to which we talked positively and used encouraging words grows better compared to the plant to which we talked negatively and used discouraging words. Just like plants, word types can also affect people.

An interesting thing was found during the treatment of plants that were praised and bullied, students seemed enthusiastic and sometimes experienced feelings of "baper" (carried away) when doing plant treatment. They seemed happy, happy and enthusiastic when praising the plants with good and positive words. Whereas when bullying the plants they were loud and loud as if they were expressing their emotions towards their surroundings and there were several students at the end who felt guilty after doing negative words by shedding tears, crying and hugging their classmates. And the changes in students from the activity of comparing the growth of bullying and praising plans can be seen at the following link https://youtube.com/shorts/ooGyNbu5eEk?feature=share.

5. CONCLUSIONS

The results of this study illustrate the syntactic integration of Research-Based Learning (RBL) with the Science, Technology, Engineering, and Mathematics (STEM) approach. The main achievement of this research is the development of a product that is highly beneficial in improving students' socio-emotional skills, particularly in an effort to reduce the incidence of bullying in the school environment. Through research involving different treatments on the growth of the sprouts, the results of the plant growth analysis showed a positive impact on improving students' socio-emotional skills and the effectiveness of reducing bullying behavior in schools. As the results of this study provide an opportunity to better understand the link between plant growth and students' socio-emotional aspects, further research can easily be conducted to explore and develop the findings within a broader framework.

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