A STEAM Integrated Curriculum Activity: How to Make the SAD Alien Happy?

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Abstract

In recent years, there has been a growing recognition of the knowledge and competencies crucial in navigating today's fiercely competitive marketplace and job landscape. Initially heralded by scholars as pivotal for success in the contemporary economy, Science, Technology, Engineering, and Mathematics (STEM) have emerged as indispensable pillars (Kennedy & Odell, 2014). Subsequently, the academic realm has embraced the inclusion of Art as a vital skill set, enhancing students' communication prowess and overall performance, giving rise to the inception of (STEAM) Education. Furthermore, modern educational frameworks of the 21st century prioritize the cultivation of advanced competencies like critical thinking and problem-solving, necessitating diverse instructional methods and strategies such as jigsaw activities and storytelling. These pedagogical approaches are instrumental in fostering a collaborative, effective, and innovative learning milieu. This paper aims to illustrate a research-grounded (STEAM) activity that serves as a model for integration into primary school curricula, exemplifying the synergy between disciplines in modern education.

Keywords: (STEM) Education, (STEAM) Education, Jigsaw Strategy, Storytelling, Role-play, Cooperative Learning.

1. Introduction

In our contemporary era, the subjects of Science, Technology, Engineering, and Mathematics are deeply intertwined and interconnected in multifaceted ways. The acronym (STEM) embodies these four interdisciplinary pillars, blending crucial elements from each field into both educational contexts and professional landscapes. Although not a novel concept, STEM has evolved through diverse iterations and applications across decades until policymakers and educational leaders recognized its profound importance and critical shortage (White, 2014). These four domains, augmented by the fifth art domain in the shift towards STEAM education, serve as pivotal cornerstones for contemporary educational systems, the global economy, and innovative enterprises.

STEM fosters captivating interactions and logical interconnections across STEM domains. Quality investments in STEM programs can deliver substantial benefits for both programs and learners. Partnerships between research and practical application are pivotal in assessing achievements and obstacles, directing program management investments, and reinforcing advocacy and policy endeavours (Allen et al., 2019).

Key factors influencing students' engagement in STEM education include the necessity of emphasizing the junior secondary phase of schooling to sustain student interest and motivation in STEM subjects, adopting effective pedagogical strategies to enhance student engagement and motivation, cultivate 21st-century competencies, and boost academic performance, as well as cultivating a cadre of high-quality teachers to positively influence students' attitudes and motivation towards STEM disciplines (McDonald, 2016).

The digital revolution and the knowledge-based economy have sparked a profound societal transformation, necessitating a shift from traditional teaching methods to ones that can adapt to this revolution. Schools, educators, scientists, and pedagogues are called upon to embrace and support this new paradigm by evolving their approaches. However, conventional teaching systems have shown limited capacity to effectively address all the evolving needs (Fernández et al., 2024).

Although the integrated STEM approach is widely acknowledged for its significance and effectiveness, its successful implementation hinges on various factors, such as numerous teachers face difficulties when trying to link STEAM subjects together or may feel overwhelmed when considering how to successfully integrate STEAM activities while ensuring they cover their subject curriculum effectively. Incorporating STEAM subjects into education necessitates teachers who possess a blend of content knowledge and pedagogical skills in STEM fields, access to relevant learning materials, clearly outlined integrated STEM curricula, and lessons that holistically address all STEM disciplines. Furthermore, the essential components for the successful implementation of this approach include teachers' confidence in their abilities and a well-structured support system (Khut, 2024).

This research article seeks to explore the benefits of incorporating STEAM education into primary school curricula, defining the essence of STEAM education and its impact on improving educational outcomes within a framework designed for primary education needs. The study will showcase a STEAM activity that harmonizes the key objectives of each STEAM subject into a unified curriculum for a particular grade level, providing a tangible illustration of successful integration practices.

2. Literature Review

Many Americans believe that STEM education is better suited for older children and is most effectively taught within formal classroom environments. Regrettably, some parents may fail to recognize their children's early interest in STEM, posing challenges in fostering and encouraging these pivotal moments. Even when parents do acknowledge their child's potential for STEM learning at home, they may encounter difficulties in offering developmentally appropriate support (McClure et al., 2017).

A study by Popa & Ciascai (2017) delves into the experiences of Romanian university students in STEM fields, focusing on their high school background, perceptions of engineering, and required skills. Findings reveal that these students were actively engaged in STEM subjects during middle and high school, influencing their decision to pursue STEM fields in university. Teachers played a critical role in guiding their academic choices. The students expressed a strong belief in the value of engineering, recognizing its essential knowledge and skills.

Examining a cohort of 121 students, Tashtoush et al. (2024) found that students in the experimental group, immersed in the STEM approach, excelled beyond their peers in the control group who adhered to conventional teaching methods. The study underscored the constructive influence of educational STEM activities on learning processes, involving students in observation, discovery, interpretation, and discussions that foster problem-solving skills. As a result, the research suggests integrating educational STEM activities into additional mathematics courses to enrich student learning experiences.

In a study conducted by Akaygun and Aslan-Tutak (2016), findings revealed that the STEM perceptions of the majority of pre-service chemistry and mathematics teachers improved as they shifted towards broader, more integrated perspectives, moving away from intricate details. As a result, their research suggested the importance of integration STEM education into pre-service science and mathematics teacher training programs.

3. Active Teaching Strategies

Existing literature suggests that STEM education aligns with Kolb's experiential learning theory, incorporating pedagogical elements that enhance STEM interventions through hands-on active learning (Syeda & Zahid, 2024). Although the traditional lecture-based format persists in many disciplines, several studies have highlighted the benefits of active teaching strategies in facilitating deeper learning, improving performance, fostering long-term retention, and refining collaboration, communication skills, and social engagement (Calkins, 2021).

Active teaching strategies encompass a range of techniques, including the use of audio and visual aids such as YouTube clips, individual and group work, hands-on activities like designing, creating, and testing projects such as the Medical Mission kit, among others, to actively engage students in the learning process. In this study, we will employ two primary teaching strategies: jigsaw and storytelling activities supplemented by visual aids and role-play.

One such effective strategy is cooperative learning, where small groups of four to six students collaborate on tasks aimed at achieving specific learning outcomes. This approach ensures equal accountability among students, encourages shared rewards, and emphasizes individual efforts as crucial to group success or failure. The Jigsaw method is a widely recognized cooperative learning technique that enables students to work in teams while maintaining personal responsibility (Garcia et al., 2017).

3.1 Jigsaw Strategy

The jigsaw strategy serves as a collaborative learning tool that effectively enhances student engagement within educational settings. Inspired by the concept of a jigsaw puzzle, this strategy mirrors the necessity for each piece to complete the final picture. Translated into the classroom, each student embodies a crucial piece of the educational puzzle, requiring every individual's contribution to successfully accomplish collaborative tasks. The implementation of this strategy typically involves a structured sequence of four key steps: Planning and Preparation, Implementation, Observation, and Reflection (Dhull & Verma, 2019).

Operating as a prime example of the transition from teacher-centred to student-centred learning paradigms, the jigsaw strategy epitomizes cooperative learning, fostering active student participation in the educational process while honing their listening and communication skills (Bhandari et al., 2017). By guiding students through the synthesis of diverse perspectives on a shared topic, this approach encourages the formulation of informed positions (Button et al., 2021). Notably, it boosts student motivation and performance by enabling the coverage of multiple subjects within a condensed timeframe (Bafadal & Rafika, 2015).

Within a jigsaw learning model, students engage in activities that promote the exchange of ideas, constructive debates, information sharing, and collaborative problem-solving, ultimately cultivating advanced skills such as critical thinking, problem-solving proficiency, and the establishment of robust social connections (Subiyantari & Muslim, 2019).

The qualitative case study conducted by Halimah & Sukmayadi (2019) illuminates the transformative potential of the Jigsaw method in augmenting the pedagogical knowledge and communication skills of aspiring teachers. This study underscores the method's intrinsic value as a cooperative learning tool, showcasing its capacity to significantly enhance teacher preparation and effectiveness.

The Jigsaw method adheres to a structured process involving several key steps (Hoerunnisa & Suherd, 2017):

Step1 Group Division: The class is divided into groups of 4 to 6 students, known as "home groups." Each student within these groups is assigned a specific portion of the lesson topic. Students are given time to thoroughly review their assigned segment at least twice to grasp its content.

Step2 Expert Group Formation: Temporary "expert groups" are formed, comprising one student from each home group who shares the same assigned portion of the lesson. In these expert groups, students collaborate to discuss the key points of their respective segments and consolidate their understanding for presentation to their home group.

Step3 Home Group Discussion: Students return to their home groups, where each student explains the segment they were responsible for to the rest of the group.

Step4 Evaluation: The instructor takes the lead in assessing students' learning outcomes, which can involve various methods such as group presentations, competitions, quizzes, discussions, and more to gauge comprehension and retention levels effectively.

Alternatively, the teacher's responsibilities in the classroom, as outlined by Sabbah (2016), encompass the following key tasks

Resources Organization: Arrange the necessary materials for readings and distribute them appropriately among the groups and students.

Procedure Establishment: Define clear classroom procedures and offer guidance to ensure the smooth execution of the activity.

Communication Facilitation: Foster effective communication and discussions within the student groups, promoting engagement and collaboration.

Support and Guidance: Encourage, monitor, and address any gaps in students' understanding, providing alternative explanations when necessary.

Self-Correction Assistance: Assist students in self-correction discussions, offering

support to enhance their learning process and reinforce comprehension.

3.2. Storytelling

Storytelling serves as a powerful pedagogical tool for presenting class material in an engaging and captivating manner. Studies indicate that storytelling enhances students' comprehension of complex theories, fosters a deeper understanding of the world, and helps students visualize themselves in similar scenarios, facilitating easier concept comprehension by demonstrating the relevance of ideas and revealing similarities in diverse experiences (Powell & Murray, 2012).

The prevalence of virtual video clips that narrate stories is evident in today's educational landscape, with examples like the immensely popular "baby Charlie biting his brother's finger" video garnering hundreds of millions of views (Dreon et al., 2011). These quick, sometimes quirky videos can effectively leverage student interest, integrating into the curriculum to enhance engagement and infuse learning with enjoyment.

Scholars have noted that storytelling nurtures an underlying facet of critical thinking, honed through experiential learning (Gallagher, 2011). Digital storytelling emerges as a versatile methodology that promotes creativity, narrative proficiency, and has garnered increasing recognition in recent research as a powerful tool for exploration within social and educational contexts (Rodríguez et al., 2021). Research by Rong & Noor (2019) suggests that digital storytelling also enhances students' writing skills.

A study by Geraldizo et al. (2022) unveiled a positive correlation between storytelling and math performance among Grade 7 students, highlighting the efficacy of storytelling in enhancing mathematical understanding and self-efficacy. Additionally, research by Khodabandeh (2014) showcased the positive impact of virtual storytelling techniques on English-speaking performance. Similarly, a study by Nguyen et al. (2014) on Chinese students learning English as a second language demonstrated improved language skills, comprehension, student engagement, creativity, and self-concept through storytelling.

In a study on Indonesian students by Satriani (2019), storytelling was found to aid in word memorization, vocabulary mastery, moral development, and fostering a love for reading. Further research has indicated that storytelling contributes to enhancing students' speaking abilities (Swari, 2022).

3.3 Role-play

Role-play, as an experiential, student-centred learning strategy, engages students physically, emotionally, and intellectually in their scientific education. It allows them to express themselves within a scientific context, facilitating the comprehension of complex concepts and making science more relevant. As noted by McSharry & Jones (2000), role-play taps into fundamental aspects of human psychology, granting students a sense of ownership over their educational journey.

The effectiveness of role-play as an educational tool is extensively supported in academic literature. In a study by McSharry & Jones (2000), engaging students in role-play scenarios related to the states of matter has demonstrated notable benefits. Students expressed positive attitudes towards learning, finding the experience enjoyable and noting that it significantly enhanced their understanding of molecular interactions.

According to Chauhan et al. (2022), approaches such as jigsaw and role-play are instrumental in training medical students across cognitive, psychomotor, and affective domains. These methods facilitate various forms of training, including problem-based learning and case vignettes, through role-play and simulated patient interactions. Such activities not only cultivate a supportive and motivating learning environment but also contribute to boosting students' self-esteem and attention spans.

This article will employ a combination of jigsaw, storytelling, and role-play approaches. Through these methods, students will engage with an innovative learning framework that delves into various subjects at an advanced thinking level, fostering a creative design model within the educational process.

4. Methodology

A descriptive research design was employed to steer the entirety of this study's process. The methodology begins with an in-depth review of existing literature on STEAM education and different active strategies which can engage students and develop their learning. these strategies will be embedded to design a STEAM integrated activity that can be implemented in primary classroom setting. Insights from research are utilized to inform the design of the proposed activity. Key concepts, successful approaches, and best practices in integrating STEAM principles into primary school curricula will be considered. This design allowed for a more nuanced understanding of how integrating (STEAM) Education influenced student outcomes and experiences.

4.1 Statement of the Problem

According to a study conducted by Huang et al. (2024), data analysis revealed that 75% of the participants strongly supported the integration of art approaches into hands-on science teaching as a satisfying experience. However, 35% of the participants reported a lack of opportunities to engage in improvisation and the integration of art-based teaching methods in practical science, despite its potential as a highly effective strategy for enhancing science instruction among pre-service teachers.

Within our educational context, the absence of readily available STEAM activities for direct integration into the primary school curriculum poses a significant challenge. Many teachers express difficulties in effectively merging STEM subjects together, hindering the seamless incorporation of interdisciplinary approaches into teaching practices. This gap in accessible STEAM resources impedes the holistic development of students and limits opportunities for innovative and engaging learning experiences. To address this gap, a practical STEAM activity tailored for primary schools is proposed. This initiative aims to empower teachers to deliver engaging interdisciplinary lessons, ultimately enhancing student engagement, critical thinking skills, and holistic education in primary settings. Therefore, the primary research question this article aims to address is: How could a comprehensive STEAM activity be envisioned within a primary school context?

4.2 Research Aim

The aim of this research is to design a comprehensive STEAM (Science, Technology, Engineering, Arts, and Mathematics) activity for primary school students. This activity is intended to integrate interdisciplinary concepts and promote creative problem-solving skills among students. The research seeks to explore the impact of this proposed STEAM activity on student engagement, learning outcomes, and skill development in a primary school setting. By designing and evaluating this activity, the research aims to contribute to the advancement of

STEAM education in primary schools and provide practical insights for educators seeking to enhance student learning experiences through innovative and interdisciplinary approaches.

4.3 Activity Conceptualization

The process of conceptualizing the STEAM activity is detailed, drawing from the literature review and personal experiences. The formulation of learning objectives, selection of relevant STEAM components, and design of engaging tasks aimed at fostering interdisciplinary learning among primary students are described.

4.4 Curriculum Alignment

Ensuring alignment of the proposed STEAM activity with primary school curricula and educational standards was adhered. Each component of the activity is linked to specific learning outcomes, supporting the development of critical thinking, problem-solving, and creativity in young learners. This structured methodology for designing a proposed STEAM activity for primary students aims to effectively communicate the rationale, process, and potential impact of the activity design in a scholarly article contributing to the field of primary education and STEAM integration.

5. The STEAM Activity Information and Material

The table below illustrates the specifics of the proposed STEAM activity in this research. These details are designed to assist teachers in assessing the suitability of the activity for integration into their curriculum and classroom environment. Furthermore, they provide insights into potential modifications that can be made to tailor the activity to suit their specific class and curriculum setting.

Table 1. The Details of the STEAM Activity

Items	Description
Grade Level	Grade 6
Number of students	16
Students Levels	Higher, Average and Low Achievers
Classroom Setting	4 groups out of 4 Students
Learning Subjects	Science, Technology, Engineering, Art, Mathematics.
Intended Learning Outcomes	Light the RGB, Improve the RGB intensity, Change the RGB colours by the ICT coding.
Implementation Period	5 Days
Topics	Electrical circuit, Intensity, Lightening, ICT coding, Mathematical Operations, Artwork design.
Learning Domains	Cognitive, Effective and Psychomotor.
Teaching Strategies	Full class lecture, Video-Based visual Learning, Small groups demonstration, Storytelling, Role-play, Jigsaw activity, Peer review, Competitions.
Materials	4 RGB LEDs, 12 Resistors 220-ohm, 4 Potentiometer, 4 9V battery, Jumper wires, Small breadboard, 4 Arduino Uno R3, 4 iPads, Instructional video, Colours, Handicrafts.

6. The STEAM Activity Implementation Steps

Day 1: Establishing "Home Groups"

Through a lecture, the teacher will introduce the primary topic, subtopics, instructions, evaluation criteria, and provide students with materials. This initial session aims to allow students to contemplate the subject, seek clarification, and address any queries. The process involves:

- Dividing the class into non-homogeneous "Home Groups" comprising 4 students each.
- Equipping each group with materials of RGB LED, Arduino Uno R3, 220-ohm Resistors, Potentiometer, 9V battery, wires, a small Breadboard, and an iPad to watch the instructional video.
- Providing an overview of each component's name and function to the students.
- Demonstrating coding procedures and showcasing how to illuminate, adjust intensity, and dim an LED light in front of the students.

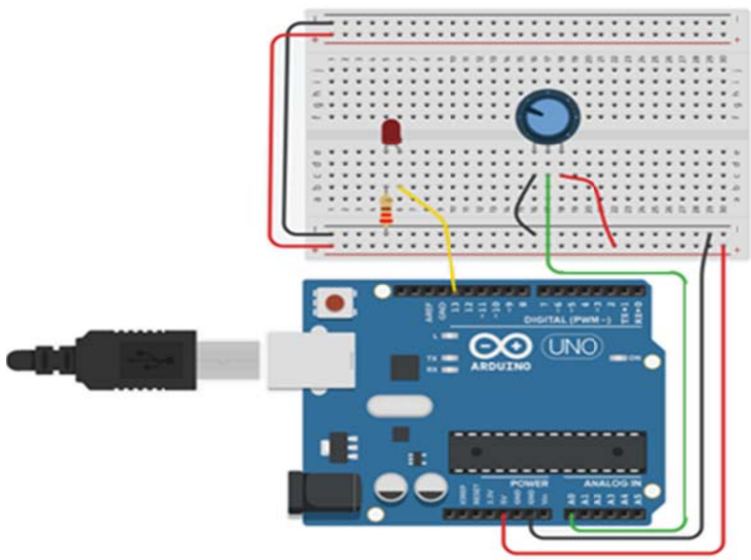

Figure 1. Breadboard showing 1 RGB LED and a Potentiometer

- Students should attentively watch and listen to the teacher to determine which subtopic they would like to specialize in. Each group must include an expert in each of the four subtopics.
- The teacher will guide students in selecting the subtopics based on their academic proficiency. For instance, ICT coding may suit high-achieving students; while illuminating the LED through the electrical circuit could be assigned to low-achievers, adjusting light intensity and creating blinking effects might be more suitable for students of average proficiency.
- Under the teacher's guidance, students will finalize the division of expertise among themselves in the four subtopics of coding, lighting, intensity, and blinking.

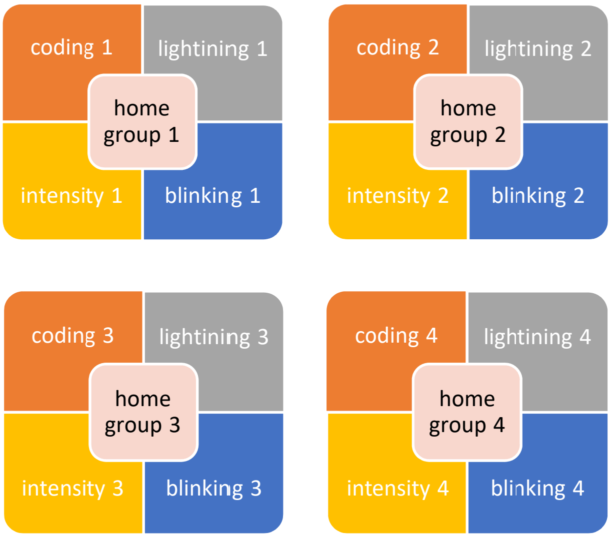

Figure 2. Jigsaw Strategy "Home Groups"

Day 2: Skill Refinement in "Expert Groups"

The teacher will arrange the class into "Expert groups", consisting of students from each home group who will concentrate on specific subtopics. Each student will become proficient in their chosen subtopic through the following steps:

- Equipping each expert group with instructional videos to aid their comprehension of the subtopic concept and illustrate the necessary tasks within their group.
- The Lighting expert group will showcase the process of illuminating an RGB LED.
- The Intensity expert group will demonstrate lighting an LED and then adjusting its intensity using the Potentiometer.
- The Blinding expert group will demonstrate how to light an LED and then blind its light.
- The ICT coding expert group will practice coding to control the lighting, intensity, and blinking of a light, potentially exploring how altering the code affects the lights.
- Students will have the opportunity to watch the instructional videos multiple times, practice the steps, and seek assistance as needed.
- Each member of the expert group is responsible for mastering their assigned subtopic to effectively explain it to their home groups later on.

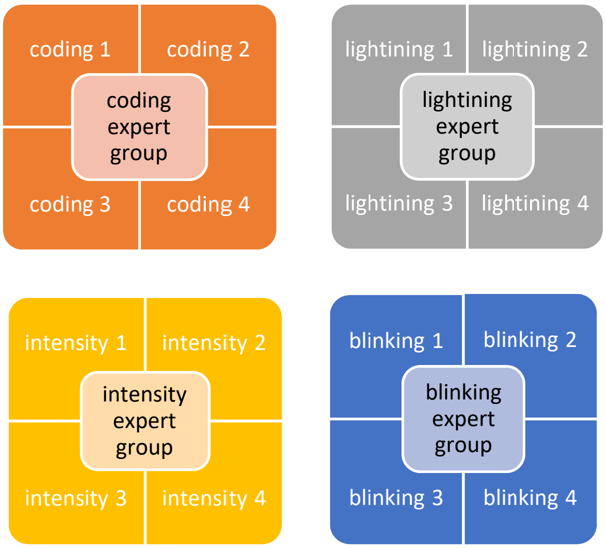

Figure 3. Jigsaw Strategy "Expert Groups"

Day 3: Return to "Home Groups"

During this phase, students should be ready to regroup with their home groups and proceed with the following steps:

- Each student will instruct their home group members on the subtopic they have expertise in.
- The Lighting expert will demonstrate how to light an LED.
- The Intensity and Blinking experts will showcase how to adjust intensity and create blinking effects with the lights.
- The Coding expert will present the essential code sequences needed to illuminate an LED, and they may also demonstrate how changing the code influences the light effects.
- The teacher will act as a facilitator, providing support to the students in their roles.

Day 4: Storytelling with the Sad Alien

In this session, the teacher will utilize storytelling as a strategy to boost students' creative thinking and problem-solving skills. The steps will be as follows:

- The teacher will introduce a narrative about a fictional Alien character and present a problem for the students to solve. The story is as follows:

> *"A lost little Alien from space has landed in the kingdom of Bahrain. He is confused by the fact that all humans have two eyes while he possesses only one. Struggling to make friends and adapt to life on*

Earth, he feels lonely and sad. Seeking comfort, he retreats to the darkness of the desert, choosing to reside beneath the Tree of Life in Sakhir. The Sad Alien believes that his single eye and nose hold no value on Earth. Can you assist the Sad Alien in finding happiness? Perhaps by granting him another eye, demonstrating how to intensify his eye light, or even altering his eye color? This way, he might feel at home and illuminate his nights with beautiful colors".

- After hearing the story, students are tasked with imagining the Alien as a breadboard, his LED light as his eye, the Potentiometer as his nose, and the other components as his features. They must continue the story, ensuring that the Alien ultimately finds happiness, while illustrating how he will appear after the transformations made to bring him joy.
- Students will have access to additional LED lights and electronic tools to aid in crafting their narrative. They will also receive crafting materials and colors to create the final design of the Alien.

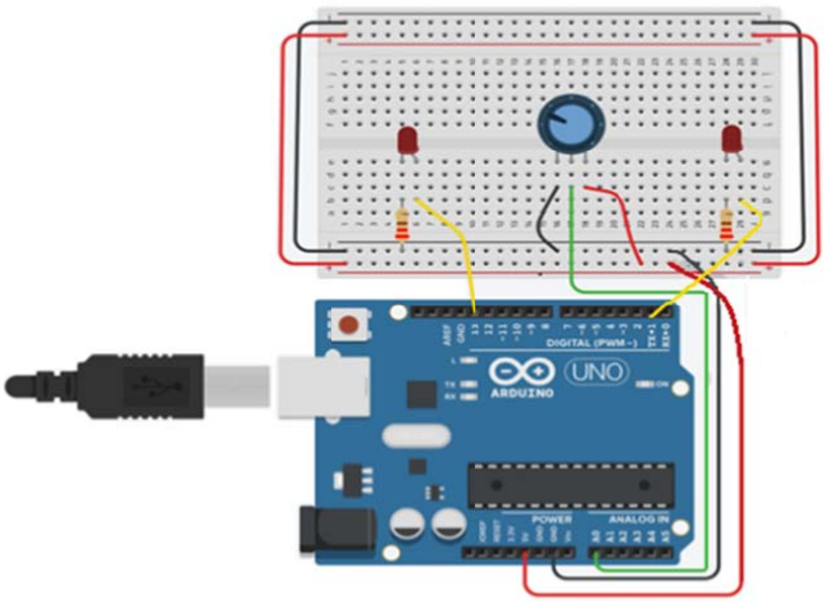

Figure 4. Breadboard Featuring 2 RGB LED Lights and a Potentiometer

Day 5: Role-playing the Sad Alien's Story

By this point, students should have completed their story writing and envisioned how their Alien appears after solving his problem in their unique way. Next, they will engage in role-playing the story they have crafted for the entire class. For instance, consider the following as a sample group role-play:

- *Student1 (narrator): A lost little Alien from space has landed in the kingdom of Bahrain. He is confused by the fact that all humans have two eyes while he possesses only one. Struggling to make friends and adapt to life on Earth, he feels lonely and sad. Seeking comfort, he retreats to the darkness of the desert, choosing to reside beneath the Tree of Life in Sakhir. The Sad Alien believes that his single eye and nose hold no value on Earth.*

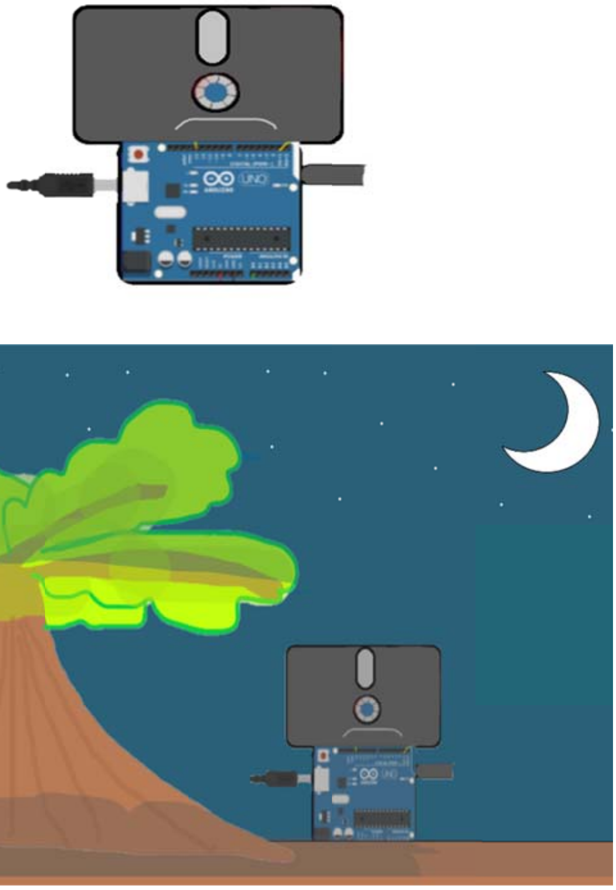

Figure 5. The Sad Alien with One Eye and Useless Nose

- *Student1 (narrator): One morning, a father and his son were visiting the Tree of Life when they spotted the little Alien sitting in deep sadness. The son approached him and asked.*
- *Student2 (Son): Why are you sitting here looking so sad and all alone?*
- *Student3 (Alien): I don't have any friends. Nobody wants to be friends with me because I have just one useless nose and a dull eye.*

- *Student4 (Father): Come along, son. I believe we should help our Alien friend discover how to use his nose and maybe give him another eye, so he can feel more like a human.*
- *Student1 (narrator): The little Alien was so excited to get the help he needed. He was curious about how he would look with two eyes and what his nose could do on Earth. At the same time, the father and son worked really hard to make the Alien look more like a human so he wouldn't scare anyone and could make friends. After many hours of work, this is how the Alien looked.*

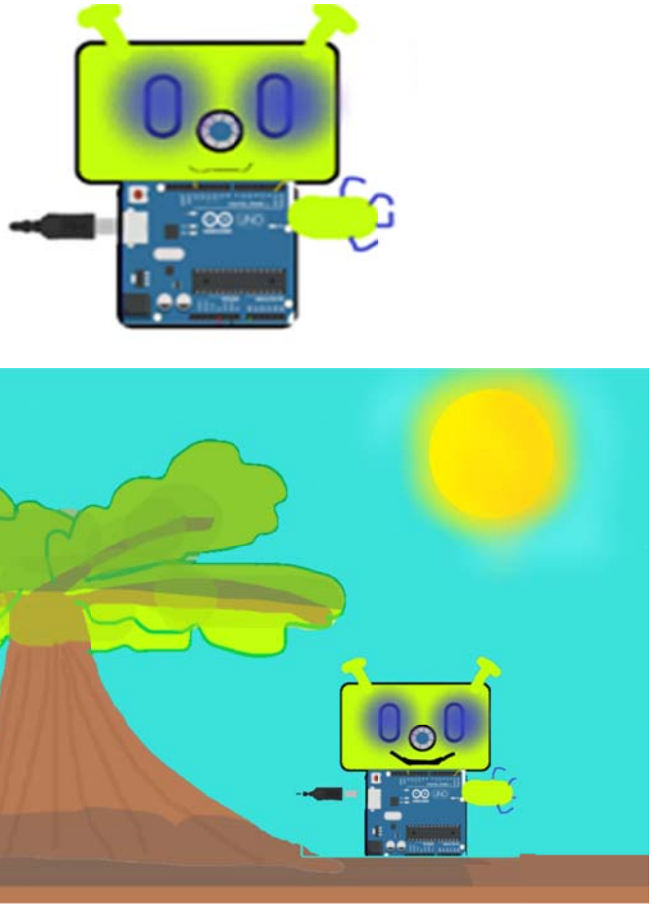

Figure 6. The Little Alien after Receiving a Second Eye and Recognising the use of his Nose

- *Student2 (Son): Wow!! Look at you!! You look so nice; your eyes are glowing!*
- *Student3 (Alien): I know!! Isn't it so fun?? I can't believe that this is me!! What did you do to me? How did this happen?*
- *Student4 (Father): You have some amazing features, dear Alien. Your body has a special electrical circuit that makes your eyes light up. And your nose isn't useless; you can use it to make your eye light even brighter. You can even blink and change your eye*

colors with a few adjustments in your coding! I don't think any human can do that, I'm sure you will have many friends now.

- *Student1 (narrator): After that day, the little Alien made lots of friends; all the children in the Kingdom of Bahrain were thrilled to visit him under the Tree of Life to see and learn about his interesting eyes and nose, especially at night when he could shine in the darkness under the stars.*

By the end of the lesson, all groups will be presenting their stories and their Aliens.

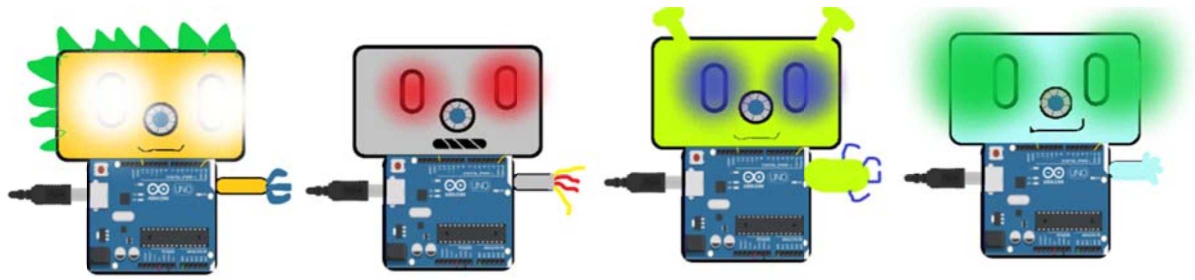

Figure 7. Sample of What the Four Groups Demonstrated Aliens can Look Like.

7. Limitation and Further Studies

Acknowledging limitations in this research methodology is crucial. The designed activity may have overlooked certain factors that could impact the validity and reliability of the

results. Factors such as the students' content knowledge, self-efficacy, and collaborative learning skills are pivotal for achieving success. Without these skills, implementing such a model and achieving the intended results may prove challenging. Additionally, conducting future research where the activity can be applied in a real classroom setting would be highly beneficial. This would enable the assessment of the activity's implementation and provide opportunities for further enhancement. The research findings are poised to offer significant contributions to the realm of (STEAM) Education. By providing practical recommendations for integrating interdisciplinary approaches into primary school curricula, the study aims to enhance student learning outcomes and better equip them to meet the demands of contemporary educational landscapes.

8. Conclusion

Integrating STEAM subjects into the primary education curriculum is crucial for fostering critical thinking and 21st-century skills essential for students' development. In today's rapidly evolving market, there is a rising demand for individuals who excel in teamwork, project confidence, demonstrate creativity, solve problems effectively, and possess a range of other empowering skills. Through the STEAM activity example outlined in this paper, we aimed to delve into the seamless integration of a captivating collaborative activity within STEAM education. By combining hands-on work with diverse STEAM topics and incorporating the Art component, we sought to enrich students' learning experiences and spark their interest. Our approach involved explaining the core principles of STEAM disciplines in a context relevant to students' curriculum and daily interaction, aiming to connect students with their intellectual and cultural backgrounds while exploring various scientific realms. By leveraging the expertise and diverse educational backgrounds of scholars, we aspire to craft innovative curricula that not only meet our educational requirements but also provide students with an engaging, integrated approach to studying traditionally separate subjects.

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