

STEAM Education in the Middle School Language Arts Classroom

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ABSTRACT

*This paper examines the integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) principles into middle school language arts classrooms to enhance engagement, comprehension, and interdisciplinary learning. STEAM fosters creativity, critical thinking, and problem-solving by connecting literature to real-world applications. Using novels such as *The Westing Game*, *My Side of the Mountain*, and *The Memory Thief*, the study highlights how incorporating scientific concepts—such as forensic science, environmental biology, and neuroscience—into literature lessons deepens students' understanding of texts and STEM topics. This approach also benefits students with reading disabilities by providing multimodal, hands-on activities that support alternative learning pathways. Additionally, the integration of STEAM promotes 21st-century skills such as collaboration and communication. Despite challenges like limited resources and teacher training, STEAM-based language arts instruction offers a dynamic way to prepare students for success in a rapidly evolving world.*

Keywords: Collaboration, critical thinking, Interdisciplinary learning, Language arts, Reading disabilities, STEAM education

INTRODUCTION

STEAM (Science, Technology, Engineering, Arts, and Mathematics) education provides an interdisciplinary framework that integrates the arts with STEM subjects, fostering creativity, critical thinking, and problem-solving skills. While traditionally associated with science and mathematics, STEAM principles can be

effectively applied in middle school language arts classrooms to enhance student engagement and comprehension by connecting literature to real-world applications. This paper explores how integrating STEAM into language arts education, using examples such as *The Westing Game*, *My Side of the Mountain*, and *The Memory Thief*, can enrich the learning experience (Bequette & Bequette, 2012).

LITERATURE REVIEW

Integrating STEAM (Science, Technology, Engineering, Arts, and Mathematics) into education has gained increasing attention to promote interdisciplinary learning and enhance student engagement. According to Bequette and Bequette (2012), the arts are crucial in connecting creative thinking with STEM fields, enabling students to approach complex problems with analytical and innovative perspectives. This framework provides opportunities for applying theoretical concepts to real-world scenarios, improving comprehension and retention.

Henriksen (2017) emphasizes that STEAM-based education fosters collaboration, communication, and critical thinking, essential 21st-century skills. By blending hands-on activities with academic content, students better understand STEM and non-STEM disciplines. These activities also increase student motivation and participation by making learning more dynamic and relevant.

Research by Wu et al. (2022) highlights the benefits of STEAM for students with learning disabilities, particularly in language arts classrooms. Multimodal and interactive activities, such as building models and conducting experiments, offer alternative learning pathways to support students struggling with traditional text-heavy instruction. This approach provides inclusive educational experiences that promote both academic achievement and self-confidence.

Incorporating technology into STEAM lessons further enhances learning. Papert (1996) introduced the concept of constructionism, which emphasizes learning through creating and experimenting with tangible objects. Digital tools like simulation software and devices like Micro: bit enable students to visualize abstract concepts and engage with material in accessible ways. Madden et al. (2013) argue that integrating such tools into the curriculum can improve cognitive and practical skills, mainly when applied to problem-solving tasks.

Despite its potential, implementing STEAM in language arts classrooms poses challenges. Quigley et al. (2017) note that teachers may face barriers such as insufficient resources, lack of STEM training, and time constraints. Professional development and collaboration between STEM and language arts educators are critical to overcoming these obstacles. Furthermore, balancing literary analysis with STEM activities is essential to maintaining the integrity of both disciplines.

Overall, the literature supports that STEAM integration enhances educational experiences by fostering interdisciplinary connections, engaging diverse learners, and promoting critical skills for future success. These findings provide a foundation for exploring how novels like *The Westing Game*, *My Side of the Mountain*, and *The Memory Thief* can serve as effective platforms for STEAM-based instruction in middle school language arts classrooms.

Integrating STEAM into Language Arts

Incorporating STEAM principles into middle school language arts classrooms extends learning beyond traditional literary analysis, fostering interdisciplinary connections and hands-on learning. For instance, integrating forensics into a study of *The Westing Game* or environmental biology into *My Side of the Mountain* allows students to see how literary themes connect to scientific disciplines. Such integration deepens students' understanding of the text and builds skills in collaboration, critical thinking, and innovation (Henriksen, 2017).

Supporting Students with Reading Disabilities

STEAM-based lessons in language arts can be particularly beneficial for students with reading disabilities. By incorporating hands-on and multimodal activities, these lessons provide alternative pathways for learning and comprehension. For example, activities like building models, conducting experiments, or creating animations engage students through tactile and visual learning modes, which can compensate for difficulties in decoding text. Research indicates that integrating technology and hands-on activities can improve reading comprehension and engagement among students with learning disabilities (Wu et al., 2022). Moreover, collaborative projects encourage peer support, allowing students with reading challenges to contribute meaningfully to group tasks without feeling overwhelmed by text-heavy assignments.

For instance, while reading *The Memory Thief*, students could use stop-motion animation to illustrate how neurons communicate, enabling them to grasp complex concepts through visual storytelling. Similarly, using Micro: bit devices to simulate neuron communication provides an interactive and accessible way for students to engage with the material, reducing reliance on textual explanations. These activities make the content more inclusive and foster confidence and a sense of accomplishment among students with reading disabilities.

Lesson Example: The Westing Game and Forensics

Ellen Raskin's *The Westing Game* is a compelling mystery novel that challenges students to think critically and solve puzzles. A STEAM-focused lesson could involve teaching forensic science concepts to help students analyze the clues in the novel. Activities might include:

Fingerprint Analysis: Students learn about the science of fingerprinting by studying patterns and practicing techniques used in forensic investigations. This hands-on activity provides a tactile learning experience that benefits all students, including those with reading disabilities.

Crime Scene Investigation: Students can recreate and analyze fictional crime scenes using scenes from the novel, applying scientific methods to deduce potential suspects. Incorporating digital tools like crime scene mapping software can further enhance the activity (Madden et al., 2013).

Problem-Solving Challenges: Collaborative activities where students work in teams to solve riddles and puzzles, mimicking the problem-solving techniques used by the characters. For students with reading challenges, visual aids and verbal instructions can be incorporated to ensure accessibility.

Integrating hands-on activities fosters deeper engagement and improves students' ability to apply abstract concepts to real-world scenarios (Bequette & Bequette, 2012).

Lesson Example: My Side of the Mountain and Environmental Biology

Jean Craighead George's *My Side of the Mountain* offers opportunities to explore themes of survival, nature, and self-reliance. A STEAM lesson for this novel could integrate environmental science and biology. For instance:

Ecosystem Exploration: Students study ecosystems similar to the one Sam Gibley inhabits, identifying local flora and fauna and discussing their ecological roles. Digital tools like virtual ecosystem simulations can provide interactive experiences for students (Hunter-Doniger & Sydow, 2016).

Survival Skills Science: Students learn about the science behind building shelters, purifying water, and finding edible plants, connecting these activities to the novel's themes. Incorporating video tutorials or augmented reality (AR) apps can make the lessons more engaging and accessible. This can also align with health, physical education, and social studies.

STEM Project: Students design and build small models of sustainable living spaces using natural and recycled materials. For students with reading disabilities, providing visual guides and step-by-step demonstrations can make the activity more inclusive. Students can use the descriptions given in the novel to model the tree Sam has made his home. Such lessons help students understand the interplay between humans and the environment while fostering ecological awareness (Henriksen, 2017).

Lesson Example: The Memory Thief and Neuroscience

Lauren Mansy's *The Memory Thief* explores themes of memory, identity, and human connection. A STEAM lesson for this novel could incorporate neuroscience concepts and hands-on technology projects:

Neuron Communication with Micro:bit: Students use Microphone devices to simulate neuron communication via radio signals. This activity demonstrates how neurons transmit messages in the brain while offering an interactive, technology-driven experience.

Stop-Motion Animation: Students create animations to illustrate how signals travel through neurons, reinforcing their understanding of neural processes. Software like Stop Motion Studio can provide user-friendly tools for students, including those with reading disabilities, to create their animations (Papert, 1996).

Memory and Identity Discussions/Activities: Students analyze the novel's portrayal of memory and discuss its scientific and philosophical implications, linking the literary themes to real-world neuroscience. Students could conduct experiments to see how they can memorize lists of items (visualization of a word, seeing an item, hearing the item, etc.) Incorporating multimedia resources like videos or interactive diagrams can help make these discussions accessible to all students. Technology and creative projects enhance comprehension and build technical and artistic skills (Bequette & Bequette, 2012).

Benefits of STEAM in Language Arts

Integrating STEAM into middle school language arts classrooms offers several benefits. First, it fosters interdisciplinary connections, helping students see the relevance of literature to other fields of study. Second, it engages diverse learners by combining analytical and creative activities. Research indicates that STEAM activities can boost student motivation and improve learning outcomes by making lessons more dynamic and interactive (Henriksen, 2017).

Additionally, STEAM education promotes 21st-century skills such as collaboration, communication, and critical thinking, which are essential for future success (Bybee, 2010). For example, when students work together to solve forensic puzzles or build neuron animations, they practice teamwork and problem-solving in a meaningful context.

Challenges and Considerations

Implementing STEAM in the language arts classroom requires careful planning and resources. Teachers may face challenges such as a lack of training in STEM fields, limited access to technology, or time constraints within the

curriculum. Professional development programs and collaborative planning with STEM colleagues can help address these challenges (Quigley et al., 2017).

Furthermore, lessons must be designed to balance literary analysis and STEM activities to emphasize both disciplines equally. For example, while building neuron animations, students should also engage in discussions about the novel's themes and characters to maintain the integrity of the language arts curriculum.

DISCUSSION AND CONCLUSIONS

STEAM education provides an innovative framework for enhancing middle school language arts instruction. Teachers can foster interdisciplinary learning and engage students in new and exciting ways by integrating scientific concepts and hands-on activities into literature lessons. Lessons based on novels like *The Westing Game*, *My Side of the Mountain*, and *The Memory Thief* demonstrate how STEAM principles can bring literature to life, connecting classroom learning to the real world. As educators continue to explore the potential of STEAM, they can inspire a new generation of learners equipped with the skills and creativity to succeed in an ever-changing world.

IMPLICATIONS

Integrating STEAM in language arts education has significant implications for teaching practices and student learning. First, it encourages educators to adopt interdisciplinary approaches that connect literature with real-world applications, making lessons more engaging and meaningful. Schools can create a more cohesive curriculum that enhances creative and analytical skills by fostering collaboration between STEM and language arts teachers.

For students, particularly those with reading disabilities, STEAM-based instruction offers accessible learning experiences through hands-on and multimodal activities. These approaches help students overcome barriers associated with traditional literacy instruction by providing visual, tactile, and interactive pathways for comprehension. Furthermore, the emphasis on problem-solving and critical thinking in STEAM lessons equips students with skills essential for academic and career success.

Additionally, integrating technology and innovative teaching strategies supports the development of 21st-century competencies, including communication, teamwork, and adaptability. Schools that invest in professional development and infrastructure to support STEAM initiatives will likely see improvements in student motivation, participation, and overall achievement. This approach can prepare students to navigate complex challenges in an increasingly interconnected and technology-driven world.

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