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Succinctly Science: How Poetry Can Help Make Science Accessible and Enjoyable

Nancy Heiss

Abstract

STEM subjects (science, technology, engineering, and mathematics) are a valuable part of a student's education. However, not all students find STEM subjects engaging on their own. This paper investigates the relationship between science and poetry and how these seemingly disparate subjects can be used in tandem to better understand and explore each other. This site-specific case study offers a glimpse into how a single alternative classroom located in the state of Georgia linked scientific and poetic inquiry to increase student understanding and enjoyment of science and writing. Results show that science and poetry work synergistically to foster an environment of active learning across multiple age groups.

Keywords: homeschooling, STEM, arts in education, STEAM, poetry, science

Succinctly Science: How Poetry Can Help Make Science Accessible and Enjoyable

Pierides, et. al. (2017) note that one benefit of reading—and I would add *creating*—a short poem, or "micropoem," is that a short poem facilitates "memory consolidation and remembering" (p. 7); therefore, they consider the haiku form to be powerful tool for communication and connection. As Holmes (2017), the founder of the Sciku project, observed: "Haiku are quick to consume, but they linger in the mind" (p. 966). One inherent challenge in creating a short poem, however, is condensing a big idea into very few syllables (17 in the case of haiku). Such a task requires precise language and understanding. Padel (2011) suggests that both poetry and science "get at a universal insight or law through the particular… Scientists and poets focus on details. Poetry is the opposite of woolly or vague. Vague poetry is bad poetry—which, as Coleridge said, is not poetry at all. Woolly science is not science" (n.p.).

This paper will examine the use of poetry to support interdisciplinary learning in a homeschool classroom. While this site-specific case study only offers a glimpse into a single alternative classroom, it is my hope that it may also "inspire discussion and innovation in more traditional educational settings," as well as in other alternative education classrooms (Efford & Becker, 2017, p. 48). One challenge of traditional education settings is that "the design and purpose of traditional institutional education dampens…curiosity by requiring that a child only learn what is being taught in that classroom at that moment with the only measurement of success being able to reproduce the material as it was taught" (Efford & Becker, 2017, p. 46). Students are often directed away from meaningful learning experiences when teachers instruct them "to use citations rather than teaching them to explore their own words and imaginations" (Cahnmann, 2003, p. 34). Efford and Becker (2017) suggest that a homeschool setting may provide "students the luxury of mastering concepts before moving on," and can offer students the

freedom to engage with curriculum creatively, encouraging critical thinking and alternative approaches of learning and assessment (Efford & Becker, 2017, p. 44).

Literature Review

The existence of learning styles is a myth that has long been perpetuated in traditional education, one that can limit students' willingness to explore new ways of engaging with information. The idea is that students each develop a particular style of learning—be it kinetic, visual, auditory, or other—that, when appropriately catered to, will allow that student best to learn (Kirschner, 2017; Newton & Miah, 2017). This notion was readily accepted in education, perhaps because it offers a tidy solution to fostering learning. Unfortunately, however, purported learning styles have little to no effect on learning outcomes, at best, and, at worst, may even have negative learning outcomes (Kirschner, 2017). Newton and Miah (2017) assert that "it is not possible to teach complex concepts such as mathematics or languages by presenting them in only one style" (Newton & Miah, 2017, p. 5). Conversely, it may be of benefit to present information in a way that uses multiple senses because multimodal messages are more effective than targeted single-modal messages at "[priming] all the cognitive processes for active learning" (Mayer, 2003, p. 132). Just as we learn best when we use multiple strategies and engage multiple senses, thinking about subjects (e.g., science, history, language arts, visual arts) as complementary rather than rivalrous may have a positive effect on higher-level learning.

Januchowski-Hartley, et. al. (2018) explain that in the nineteenth century, "Victorian researchers exploring the natural world made an explicit shift from being natural philosophers to calling themselves scientists, a neologism…modeled after artist" (p. 908). Whereas before this semantic split poetry and visual arts were intertwined within natural philosophy, after this split science began to be considered a serious subject while poetry and the arts began to be considered

separate—more frivolous—subjects, when in reality they "are a collection of skills and thought processes that transcend all areas of human engagement…[benefiting] learners in every aspect of their education" (Sousa & Pilecki, 2013, p. 17). The belief that the hard sciences and mathematics are more useful subjects to study—and thus required more rigorous attention in schools—eventually led to the creation of STEM programs, highlighting science, technology, engineering, and mathematics in the early 2000s (Krystal, 2019; Loewus, 2015). Unfortunately, this push to engage with STEM subjects often leads to the neglect of artistic study, particularly in the lower grades; further, funding often favours STEM subjects, while "art and music programs are among the first to be reduced or eliminated" (Sousa & Pilecki, 2013, p. 14).

Encouragingly, there have been ongoing discussions reevaluating the impact of the arts on education and whether the arts merit inclusion in the STEM acronym, thus turning it into STEAM (Comparing STEM vs. STEAM, 2020; Krystal 2019). Science and art—specifically, for the purposes of this paper, the art of *poetry*—are not easily separable and engaging in either will help enhance the other. Sousa and Pilecki (2013) note that "the arts create a very subjective view of the world, while science creates an objective view of the world. A person's brain needs both views in order to make suitable decisions" (p. 10). Poetry offers one way to allow the world of science and the world of art to support growth in both subjects. Furlan, et. al. (2007), note that cross-curricular endeavors such as involving poetry in the science classroom can "bring out…student learning outcome[s] that none of the single disciplines is capable of generating" (p. 1629).

Januchowski-Hartley, et al. (2018) share several examples of combining science and poetry, including one teacher who "asked his students to select a topic related to human impacts on Earth's ecosystems, research it, and then write a haiku about it"; the teacher found that the

constraint of the haiku form instructed students on the "importance of selective word choice and the value of concentrated reflection on the topic" (p. 906). Likewise, the contest creators of "Dance Your PhD" suggest that contestants "start by explaining your Ph.D. to your friends with a 30-second time limit. It's hard to do. You'll find that you're forced to boil it down to its essence. That essence is what your dance is about" (Dance Your PhD, n.d.). Without having done adequate research to become experts in their given topic, the students would have been unable to write—or dance—a successful poem. Notably, in addition to choreographing an interpretive dance communicating their dissertation topic, several recent winners of the "Dance Your PhD" contest also composed an original song—often with poetic verse (see, for example: Simu Group, 2021; VU Kinetinis Teatras, 2022; Yapa, 2018). This liminal space *between* science and the arts seems to be a place where students find joy in learning and an ability to communicate new knowledge "touched by [their] own personality" (Mason, 2017, p. 18), thus better internalizing information and engaging in higher level, active thinking.

Bringing poetic inquiry into the homeschool science classroom

As a homeschool educator, I feel fairly comfortable teaching my children most subjects. My background lies in the arts, however, so teaching science can be a challenge for me. I haven't been satisfied with curricula we've tried, having struggled to find a curriculum wide enough to address the needs of my students, who are stratified across several grades, which covers basic principles for my younger students while generating the passionate curiosity necessary to dig deeper into these principles for my older students.

The purpose of this paper is to investigate the relationship between science and poetry and how these seemingly disparate subjects can be used in tandem to better understand and explore each other in a homeschool classroom located in the state of Georgia. Our classroom will

examine scientific poetry in open-ended discussions and use student-generated writings to see how closely major historical events are tied to scientific advances and discoveries, and how beautifully poetry can express those links. This paper seeks to answer the following research question: How will linking scientific and poetic inquiry increase my students' understanding and enjoyment of science and writing?

Methodology

This study was carried out in a single-family homeschool composed of four siblings, spanning preschool through high school: Amelia (age 6), Thomas (age 9), Nora (age 12), and Lisa (age 14). All names have been replaced with pseudonyms. Their mother, the author of this paper, acts as the primary teacher in the home. The homeschool is of an eclectic philosophy, adopting principles from Unschooling, Unit Studies, and Charlotte Mason Methods, the latter of which suggests that educators "spread an abundant and delicate feast in the programmes" and allow "each small guest [assimilate] what he can" (Mason, 2012, p. 183). Indeed, our homeschool is filled with both literature and encyclopedia-style books on various scientific topics; we have equipment to carry out science experiments, as well as access to various science documentaries. However, my children have so far seemed untempted by this "feast" and remain unmotivated to engage with our science curriculum out of sheer curiosity. The problem of sparking their curiosity remains, and thus I wondered whether the key to getting my children to engage with STEM subjects might lie in encouraging a more creative, literary approach.

Contrary to how haphazard the term Unschooling sounds, the educational method involves the "utilization of self-directed, intrinsically motivated, multifaceted learning," with Cognitive Evaluation Theory at its core, stressing competence and autonomy as two major goals of education (Riley, 2020, p. 21). The Charlotte Mason Method also values self-driven education

and places an emphasis on narration as evidence of learning. However, it places a stronger emphasis on routines, habits, and literature. Like Levison (2006), I have found "a structured morning followed by an unstructured afternoon to be the best compromise between unschooling…and a rigorous 'school at home' format" encouraged with the Charlotte Mason Method (p. 83).

Unit Studies help "integrate lessons for students of varying ages and abilities" and can work well with either the structured nature of the Charlotte Mason Method or the flexible nature of Unschooling (Suarez & Suarez, 2006, p. 89). Students of all ages engage in a single theme—or unit—selected either as a passion project or as a means to approach a specific educational goal. Unit Studies allow the children in a homeschool to collaborate on a larger project, give students opportunities to mentor each other according to their strengths, and encourages "relatedness…based upon 'interpersonal affiliation, authentic care and the sharing of enriching experiences'" (Deci & Ryan, 2009, p. 570, as cited in Riley, 2020, p. 25).

Data Collection

Before engaging in creating our own scientific poetry, our classroom first explored scientific poetry together. According to Charlotte Mason, "Children's minds…reject twaddle or stale, desiccated texts" (Smith, 2008, p. 5), thus "living books" that breathe life into the mind and imagination of the child, should be employed in lieu of drier textbook-style curriculum. As such, we selected Lee's (2017, 2019) *Elemental Haiku* as our text.

Each of the four children in our homeschool classroom had their own copy of either the online version (Lee, 2017) or the paper version (Lee, 2019) of the text. Rather than reading the volume from cover to cover, students explored the contents at their pleasure, reading aloud haiku as they felt moved. Our classroom discussion stemmed from haiku selections the children chose

to share; we engaged in discussion about the form and content of selected haiku and looked up information to help us understand scientific or historic details alluded to by particular haiku. Throughout our discussion I took "spontaneous 'field' notes" (Berkwits & Inui, 1998, p. 195).

After discussing Lee's poems and doing some background research together, I had my students write some "practice" haiku, challenging the older students to write about an element and allowing the younger students to write about anything they've been learning in science recently. The students in this study were already familiar with the haiku form, but it was beneficial to review the structure of haiku and introduce the "portmanteau word for scientific haiku" (Haiku and Sciku, n.d., n.p.), which is "sciku." The haiku form originated in Japan and is composed of 17 syllables divided into three lines 5, 7, and 5 syllables each. Traditionally, haiku contain reference to the seasons; sciku, on the other hand, must contain a reference to science, which "isn't an especially great leap to" make (Haiku and Sciku, n.d., n.p.), considering the role science plays in explaining the natural world.

Students composed these initial haiku in their writing journals and read them out loud as they completed them. Confident that my students understood the sciku form, I charged them with writing sciku summaries of what they were learning in science over the next several weeks. Lisa (14) and Nora (12) submitted their haiku via a Google Form document designed to act as a reflection log for their studies, and which they were previously accustomed to filling out as part of their regular homeschool record-keeping and accountability. Thomas (9) and Amelia (6) continued to compose haiku in their writing journals since they do not yet fill out their own reflection logs. As their homeschool instructor, I had daily access to these journals. Classroom conversations were recorded using an audio recorder and/or spontaneous field notes.

Analysis: Our Experience

To help my students understand the kind of precise language necessary to write a short poem about science, I felt it would be useful to first explore some scientific micropoetry together. Mary Soon Lee's (2017) *Elemental Haiku* seemed a fitting introduction. The collection was first published online in an interactive format where users can "click or hover over an element on the Periodic Table to read the haiku" (Lee, 2017). I also obtained a print version of *Elemental Haiku* (Lee, 2019), which includes illustrations as well as brief explanations about the principles Lee details in each haiku.

The print version gave us some insight to Lee's writing process and the revisions she went through as she wrote her poems. For example, Lee's 2017 haiku for Yttrium, featured online, reads as follows: "That is not a name. / That is a spelling error. / Or a Scrabble bluff" (n.p.). For the print version of this poem, however, Lee (2019) took the opportunity to revise her work and include more information about the element itself, rather than simply talking about its quizzical name: "Superconductor / working for minimum wage: / liquid nitrogen" (p. 45). She also included her 2017 Yttrium poem, however, noting the reason for the change, and giving my children tacit permission to revise their own work. The insights from the print version of the book were invaluable; however, my students and I appreciated being able to access the online version of *Elemental Haiku* (Lee, 2017) on our devices simultaneously.

The children enjoyed clicking around to read and share poems they found piquing. Some of the information Lee presented in her haiku held no obvious meaning for us and required further research to understand why she chose to write about the elements the way she did. The print copy was useful in this regard, but we also enjoyed looking up references to inventions and

historical events alluded to in Lee's poems using other resources as well. In general, we found it easier to understand poems about elements we already knew quite a lot about.

Perhaps in part because of their prior knowledge of the element, the haiku on iron (Lee, 2017) was one my children enjoyed discussing:

Anvil, axe, nail, plow,

engine, railway, factory.

Servant, friend, partner.

I asked them to carefully consider each line of the poem and think about the intention and meaning behind what at first glance seems to be a simple list of words. After reading through the poem a few times and giving them plenty of time to think, Nora (12) pointed out that the first line refers to simple tools (all of which could certainly have been used during the Iron Age), while the second line talks about more modern (and complex) ways to use iron. The last line is more ambiguous. Thomas (9) felt that it was referring to a future where we'll have more robotic things in our lives. Lisa (14) and Amelia (6) felt that it was simply saying that iron is useful.

Uranium was another haiku we found intriguing in its ability to relate science, history, and wordplay in so few syllables (Lee, 2017):

Manhattan Project.

The elephant in the room,

never forgetting.

Thomas (9) immediately connected this poem to WWII. After hearing how Russian President Vladimir Putin had put his nuclear forces on "high alert" a mere three days after invading Ukraine on February 24, 2022 (Karmanau, et. al., 2022), Thomas (9) read his copy of *What was the Bombing of Hiroshima?* and thus was able to give our class context, explaining

that The Manhattan Project "was the code name for the secret plan to make an atomic bomb" and that uranium is the material used in nuclear weapon development (Brailler, 2020, p. 28). Additionally, the children discussed whether the "elephant in the room, / never forgetting" (Lee, 2017) referred to uranium having an incredibly long half-life or whether it was a cry for readers to remember how devastating nuclear warheads are. It was interesting for us to see how closely big historical events are tied to science and how beautifully poetry can express those links. This single micropoem inspired us to discuss and research both current and historical events, as well as explore the properties of uranium and the researchers who had a hand in its discovery and development, such as Martin Klaproth, Otto Hahn, and J. Robert Oppenheimer.

Science and Poetry at Work in the Classroom

After reading and discussing Lee's (2017, 2019) *Elemental Haiku*, I challenged my students to engage poetically with their own scientific studies. Amelia (6) and Thomas (9) have been learning about sound waves in their physical science curriculum. After reading their assigned text for the day, they each composed a sciku based on what they had read.

Amelia (6) wrote about bats' use of echolocation:

Bats can hear for miles.

They live in dark caves, caves, caves…

They are nocturnal.

She was particularly proud of the way she used font size to visually inform her audience to read "caves, caves, caves…" like an echo, since bats use echolocation to navigate in the dark. Given the limited real estate within micropoetry, repeating the same word three times in one line was a bold move for her to make, especially since we had discussed the importance of word selection—and avoiding fluffy "filler" words—prior to writing our poems. However, her mindful

decision to repeat the word “caves” and the visually dramatic way she decided to do so make her middle line feel very intentional and strong. Had she repeated the words, “very, very, very” within her poem, for example, she would have lessened its impact and ability to communicate the message she wanted to convey. Even using “very,” which I consider a filler word, a single time would have weakened her middle line. Compare, for example, “they live in very dark caves” to “they live in dark caves, caves, caves…”The former is a true fact but does not hold the energy or information present in the latter.

Thomas (9) decided to write about another creature that uses echolocation:

Sonar and sound waves:

Dolphins use them to catch food.

Made from vibration.

Thomas’s (9) first line quickly identifies the subject of his poem. Then, very to the point, he offers two facts that he gleaned from his reading. Thomas (9) has ADHD and dysgraphia, a trait often associated with ADHD wherein the person exhibits poor handwriting skills, with difficulty forming and spacing letters, as well as struggling with spelling, grammar, punctuation, and so forth. Dysgraphia “causes significant frustration for students and interferes with their ability to learn, complete schoolwork, communicate and record ideas, and demonstrate their knowledge” (Mayes, et. al., 2019, p. 787). Thomas (9) is often easily frustrated by handwritten assignments, and in keeping with the Charlotte Mason Method, I often allow him to “verbally [narrate] what he just read” (Levinson, 2006, p. 80), but this micropoem assignment was short enough that he readily tackled it. His mindfulness is apparent in the way he expressed complete ideas on the page, successfully “recreat[ing] the information in [his] own understanding using [his] own language” (Smith, 2008, p. 5).

After finishing her biology readings for the day, Nora (12) wrote several haiku about genetic disorders. In a poem about Turner syndrome, she introduced the idea of genetics as a game of Tic-Tac-Toe:

Tic-Tac-Toe, XO

Turner Syndrome, just one X

Genetic disorder

She carried this metaphor into another haiku about Trisomy X (a duplication that occurs on the 23rd chromosome):

Trisomy two three

You've won the Tic-Tac-Toe game

Three X's lined up

Norah (12) reported that linking the scientific principles with an extended metaphor in these micropoems helped her remember how to correctly identify karyotypes of various genetic disorders in her chapter assessment. She found this process of synthesizing information helpful enough that she has continued to write scientific haiku in her reflection log to summarize—and solidify—what she's been learning.

Lisa (14) did not adopt sciku as her notetaking mechanism. However, she enjoyed the challenge of writing scientific poetry and went to great lengths researching about the methane-carbon-graphite-diamond cycle on Jupiter (analogous to our water cycle on Earth) during our practice writing session and wrote the following haiku:

Electricity

Turns carbon into graphite

It's raining diamonds

Lee's (2019) haiku on carbon discusses the idea of being "decked out in diamonds" (p. 12). Lisa (14) noted that this reminded her of something she had read once about Jupiter's atmosphere raining diamonds. Although her mind recalled that fact, the requirement of writing a poem is what led her to doing research on that topic. Notably, Lisa (14) employed enjambment, breaking the single thought "electricity turns carbon into graphite" into two lines: "electricity / turns carbon into graphite." This was a more sophisticated use of line breaks than my other children used. Lisa (14) favoured the initial freedom to compose a haiku about *any* element of her choice over the assignment to summarize what she had learned. In the future, I will be careful to word my instructions so she feels free to write about what she found interesting in her readings, rather than to summarize what she learned, as I believe this may lead to deeper engagement for her.

Conclusion

Linking poetic inquiry to science education gave my children another tool with which to interact with their world. Lisa (14) enjoyed the autonomy of selecting a scientific topic to research, Nora (12) found that creating a metaphor helped her understand and recall the material better, Amelia (6) found joy in using language to express what she had learned. It is particularly encouraging to me that Nora (12) has continued to use poetry to connect personally with what she is learning.

Thomas (9) finds both written and verbal narration difficult, so I often allow him to show me what he's been learning in other ways. He spends a lot of time in what we call "The LEGO Room" creating intricate models. Frequently the things he is learning about show up in his LEGO play; he will read about something and want to recreate what he has learned using LEGO

as a medium. With his creative props in hand, he will launch into a detailed explanation of what he's made and why he chose to make it that way. After studying Lee's (2017, 2019) *Elemental Haiku* and trying his hand at crafting his own sciku, Thomas (9) and I were in "The LEGO Room" together when he stopped building and remarked, "Writing is like building with LEGO."

I quickly pulled out my phone, hit record, and asked him to continue his thoughts. He said that he "used to just take random blocks and just stick them together, but now I'm older and [I realize] that it doesn't look that good. It just looks like a blob…. But if you choose the right pieces and stick them together the way you want it to be you can make better LEGO creations. First, I think in my mind about what LEGO pieces I need and then I dig through the box for them…" Sometimes he looks for blocks that follow a certain colour scheme or he will search for specialty pieces like "grilles and vents" to add detail and authenticity to his work. Regarding writing, he said, "I used to just take any words out of my head and put them together…but now I think about it…and look for words that will fit my vibe in the poem." Whereas Thomas (9) ordinarily is intimidated by the idea of writing, the nature of micropoetry's miniscule word limit created a welcoming environment for Thomas (9) to slow down and think about what he'd learned and how he might meaningfully communicate that.

Poetic inquiry helped my children to think deeply about and show how they were engaging with their science readings. Thinking about science through the lens of a writer led them to do more research; adhering to the constraints of the poetic form—while expressing a complex scientific idea—required them to be very intentional about their word choice. Thus, both science and poetry worked together to foster an environment of active learning that each of my students, from early elementary to high school, found uniquely useful. Using poetry inquiry

to support scientific inquiry (or vice versa) may help students find new interest in their education, engaging them with science *and* the arts, rather than science *or* the arts.

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Biography: Nancy Heiss is a recent graduate from the Literacies and Children's Literature master's degree program at the University of Georgia. She is a homeschooling educator of six children and an avid supporter of keeping the arts in education. Her own poetry has been published by BCC Press, WordPeace, W-Poesis.