
Written in the Stars: Advocating for an Astronomical Literacy

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“Cosmos Writing Assignment due on Friday,” read the whiteboard in the room full of telescopes and astro-photographs in early 2017, my senior year of high school. Mr. Gyra, my astronomy teacher, always delegated writing responses to the class. In this instance, we had to write a response to a Neil deGrasse Tyson episode of *Cosmos*. As I was writing this homework down in my agenda, I noticed that there was an AP English Literature essay due on Friday also. In this English class, we *always* had to write redundant, formulaic essays on bland topics, such as theme or character. I found that I was far more inclined to approach and complete the astronomy paper first rather than plowing through the grueling English paper. The battle between these two types of writing continued throughout my entire senior year, with astronomy always coming out triumphant. By writing Gyra’s astronomy assignments, I felt creative, unhindered and unconfined, able to make my mind roam. In contrast, English essays were punishing, focusing on deadlines and key points in a prescribed manner. Most students in my class felt the same way about astronomy writing. Guided by my experiences in high school and by the unique benefits I have received from astronomical literacy, I am still left wondering why astronomical literacy is not more of a driving force throughout society like it has been in my experience.

Astronomical literacy can be defined as the understanding, application, and incorporation of astronomy topics into writing or drawings. Many scholars have explored the scope of astronomical literacy as it relates to education and pleasure. For example, Greenstein, Garland and Ratay, and English investigate a “writing to learn” strategy that allows their students to grasp a full understanding of astronomical topics. These scholars found that their students were able to effectively convey astronomical ideas by writing their thoughts out in their papers. On the other hand, Brandt, in her book *The Rise of Writing: Redefining Mass Literacy*, discusses the implications of a writing-based literacy. She specifically discusses how a “writing-based literacy for civic purposes” can benefit education and society, rather than a writing-based literacy for purely educational purposes (166). Some scholars have touched upon the fact that an astronomical-based literacy compliments a general literacy, like the one mentioned by Brandt (Bowler; Beutler). Bowler and Beutler both mention the idea that “the goal [of astronomy] is not to learn about astronomy in itself, but to use it as an incentive to learn” (Bowler 9). Bowler continues to analyze this relationship briefly and concludes that an astronomical literacy can serve a wider literacy that transcends the field itself. Bowler mentions that this astronomical literacy urges people to learn more not *just* about astronomy, but also about everything else. To complement this connection, researchers detail the benefits of an astronomy education aside from a more traditional education, which include a heightened connection to the planet Earth, a willingness to learn, and a greater understanding of government and politics, among others (Percy; Wallace et al.; Yocco et al.). Even with these benefits well understood by scholars, an astronomical literacy is still not prevalent in our educational system or society, as Krumenaker notes in his article surveying the rarity of astronomy in education.

These articles address, although not directly, how an astronomical literacy compares to a general writing-based literacy—a gap that I explore in this analysis. Furthermore, most articles do not include a call to advocate for astronomical literacy despite these well-defined benefits. By excluding this connection and implication, researchers are not providing a complete view of a true astronomical literacy. Brandt explores a writing-based literacy in depth, while researchers like Wallace et al., Yocco et al., Bowler, Beutler, and many others study an astronomical one. These analyses offer glimpses into each, but these researchers study each independently, not interdependently. This approach leaves a gap in the scholarship, making room for my story.

In this article, I effectively speak to both sides to fill this gap in scholarship; I compare astronomy and English from a first-hand perspective, unlike these scholars. I offer a detailed analysis of personal sources that are omitted by these researchers. Furthermore, I compare the unique benefits of an astronomical literacy to those of a more general writing-based literacy, like the one mentioned by Brandt and utilized in my AP English course. For the purposes of this paper, when I mention a “more general literacy” or a “writing-based literacy,” I am referring to a literacy grounded in English conventions to write essays and papers, or even for day-to-day activities, such as the literacy mentioned by Brandt. In addition, this analysis provides a bolstering argument to most of the scholars’ theories mentioned earlier, such as Greenstein’s, Bowler’s, Beutler’s, Yocco et al.’s, and others. My experiences detailed in this account strengthen these scholars’ arguments while also permitting me to participate in and further the conversations about an astronomical literacy to show how my experiences are different. Ultimately, I argue that an astronomical literacy should be incorporated into society (through education and pleasure) far more than it is. By doing so, it will supplement a literacy that is used in daily life and garnered from traditional topics.

Approach and Methods

To gather information on how an astronomical literacy compares to a general writing-based literacy, I employ an “autoethnographic” approach. Autoethnography is a form of self-reflection that explores personal experiences and connects them to wider understandings. Canagarajah describes autoethnography as “research conducted and represented from the point of view of the self” that allows for an “insider perspective on an experience” (113-14). This strategy is useful to employ because I am, after all, the sole author of the texts that will be discussed in this paper. Thus, I hold a tangible personal connection to the works of literature, which tends to be absent in most researchers’ articles. I use this autoethnographic approach to evaluate my sample texts, such as astronomy papers written in Mr. Gyra’s class and distinct astronomy texts written outside of school. After examining these, I compare my experiences with a more general literacy, such as a basic writing-based literacy when completing papers for school or general day-to-day activities. By comparing this general literacy and astronomical literacy, I am effectively able to display the unique benefits of an astronomical literacy and bolster my main argument for advocating for astronomical literacy in and out of school.

I chose to include astronomy writing assignments done in school because these tasks can be easily compared with papers written in classes like my AP English course. Therefore, it will be useful to see how these two relate to one another from a literacy perspective. Furthermore, I chose to include some personal texts outside of the scope of school because this broadens the analysis. For example, I chose to include a doodle that I have drawn. It is useful to analyze this piece of literature because it is unique compared to works done for a more general literacy as mentioned by Brandt. In addition to these sources of autoethnographic accounts, I have included a snippet of my interactions with an “Astro Pen Pal” in high school. This demonstrates the argument of the inclusion of an astronomical literacy in action. My experiences and arguments are mirrored in this pen pal’s case.

By selecting texts from in and out of school, I gather a holistic view on how an astronomical literacy differs from a more general writing-based literacy mentioned by scholars like Brandt. As a result, my analysis encompasses literacies in both educational settings and personal settings. This analysis is deployed to answer one key question: How does an astronomical literacy differ from a traditional, writing-based literacy?

My Cosmic Journey with Astronomical Writing

Prior to writing about astronomy and space, I viewed writing as an educational tool through which to analyze works of literature. No more and no less. A mere literary service. Unlike some of the students interviewed in Brandt's *The Rise of Writing*, I never wrote for pleasure. Rather, I wrote for school and for simple day-to-day activities, such as keeping an agenda or focusing on notes in my classes. However, I realized that my attitude towards writing altered as I began to explore my passion for astronomy.

Astronomy was more than the everyday, concrete topics we learned in school. It was far greater than that, unlike anything I had experienced before; it was a dream I wanted to pursue.

A couple of years ago, I began watching Neil deGrasse Tyson's TV series *Cosmos*. His show details different astronomical events, such as the Big Bang, the lifetime of stars, and the history of our planet. I was drawn in by the topics he spoke about and soon found myself yearning to discover more. Tyson's show was the initial surfacing of my interest in astronomy. The fundamental question would be: why astronomy? Astronomy was more than the everyday, concrete topics we learned in school. It was far greater than that, unlike anything I had experienced before; it was a dream I wanted to pursue. With astronomy came unknown questions regarding our origin, and if we are truly "alone." To me, there is something about the unexplored regions of our universe that reels me in, much more than learning about history and English in school.

At this point in my life, I had read countless books, articles, and social media posts about astronomy. I began to associate reading and the urge to write with these works of literature. I realized that I sought to join the conversations going on around me; instead of *reading* and *watching* as a distant audience member of astronomical works and shows, I wanted to *write* about my passion as a direct member of it. Writing permitted me to take a more active role in what I'm interested in—it's my thoughts and insights on astronomy shared with an audience. This is in stark contrast to the value I get from merely reading about astronomy. Contributing to conversations about astronomy has affected multiple facets of my life, even in school. Guided by these experiences in astronomy in an educational venue and outside, I can analyze astronomical literacy and ultimately advocate for this special literacy.

The Cosmos Confined to the Classroom

In my senior year astronomy course, I was exposed to a completely different kind of education and writing. Prior to enrolling in Astronomy, I was under the confines of writing English rhetorical essays, historical analyses, and AP exams. Unconsciously, I was essentially "trapped" in this limited view of writing until I began my astronomy course. In this new class, we were often tasked with writing assignments in response to short films or lectures, like the one mentioned at the opening of this paper. Although not necessarily labeled as "creative writing," this new form of writing became a creative outlet for me. Below is an astronomy writing assignment completed in

Mr. Gyra's class in October of 2016. Our task was to connect the behavior of the atom (one of the smallest units of structure) to the galaxies (one of the largest) after watching a short film—a seemingly daunting task compared to a rhetorical analysis done in English class.

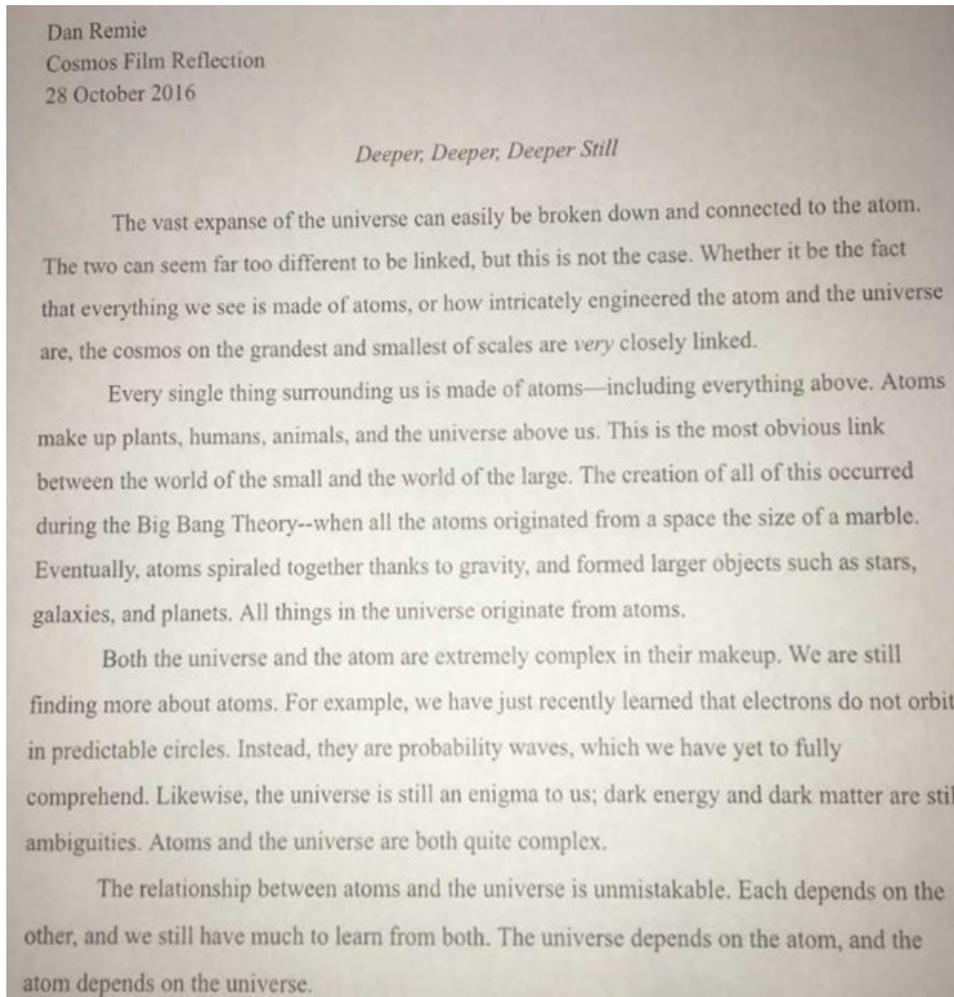


Figure 1: *Cosmos* Film Reflection

It is often believed that beginning students “do not know enough about science to write intelligently about it” (Greenstein 1). However, Greenstein, like English, believes that students learn better by thinking for themselves initially, by “writing to learn,” especially in astronomy classes. This approach to astronomical writing is discussed in Greenstein’s paper “Writing Is Thinking: Using Writing to Teach Science.” This strategy was employed in this assignment and many others in Mr. Grya’s course. In my experiences with both English and astronomy writing, the “writing to learn” strategy is wildly different in each discipline. When writing an essay in my English class, I needed an understanding of the topic prior to writing; my sense was that one must plan and outline their essay to know what their organized train of thought will be. In contrast, astronomy assignments like the one detailed above are different. To begin this assignment, I could have done the same thing in terms of outlining. However, I found writing as I went *far* more productive. By doing so, I was able to gather thoughts along the way in my writing that allowed me to understand the topic at hand and structure my writing while doing it. Personally, I know that this new approach to writing was not easy to grasp at first when I enrolled in astronomy. However, with instruction in

each form of writing and thus a strong astronomical literacy and writing-based literacy, I have been readily able to use both approaches to writing at my disposal. This is one asset of having knowledge in each literacy: being able to leverage the benefits of the two approaches (creative and planned), no matter what the scope of an assignment may be.

This is proof that “writing is learning” boldly holds true for astronomy courses, whereas in my experiences English literacy requires more learning prior to writing and constructing an essay. This is a key difference between the two forms of writing. Both approaches are independent—creative and planned—and can be employed in various situations when appropriate. However, writing for an astronomical literacy provides one thing that writing for a general literacy does not—the ability to gain a true, deep understanding of the material by “writing to learn” (Greenstein 1). Unfortunately, as noted by Krumenaker in his article “What It Would Take to Increase the Number of High School Astronomy Courses: A Survey of Principals and a Comparison to Astronomy Teachers, and a Prescription for Change,” students very rarely receive an education in astronomy; most schools do not even offer the course due to a lack of understanding of the literacy benefits, a general absence of interest, or insufficient teachers. Krumenaker notes that there is an inherent issue with the “straight-jacketed curricula” that focuses on testing more than understanding (5). As a result, students are stripped from the instruction of how to “write to learn” and understand problematic topics by writing their thoughts out, as displayed in the above example. To this end, astronomical literacy should be incorporated more into education to introduce a different approach to writing. These approaches are valuable and can arguably only be learned by being exposed to different literacies.

An astronomy-based literacy like I have described is not about structure and grading; rather, it is a place of self-actualization used to gain a deep comprehension of the world around us, satisfying mainly intrinsic rewards.

Furthermore, in my own experiences, writing a paper like the one above provides grounds for more creativity and exploration than a more traditional, structured essay. Writing an astronomy paper gives the writer the freedom to use astronomical terms, break those down, and even end up understanding them on the way. For example, the “electron cloud,” an idea that electrons do not orbit the nucleus in defined routes, is touched upon in my paper. As I wrote, I was able to construct my thoughts and write them out to understand the idea more comprehensively. Even though the concept of an electron cloud is extremely difficult to grasp, I was able to work my way into the conversation by “writing to learn.” In his paper, Greenstein further instructs his students to avoid astronomical jargon by describing terms in their own way, much like I did in this example (2-3). As a result, astronomical literacy is unique because it is not simply an analysis of a piece of literature like many essays in school are. An astronomy-based literacy like I have described is not about structure and grading; rather, it is a place of self-actualization used to gain a deep comprehension of the world around us, satisfying mainly intrinsic rewards.

Ultimately, I have found that writing for astronomy allows me to approach my writing with a general curiosity, unlike with my previous English assignments. For astronomy papers, my imagination is activated, while my creativity in English essays is overshadowed by making sure I hit all of the key points. This is a key discrepancy between the two literacies in an educational setting as I have encountered them. These differences call for an expansion of the reach of astronomical literacy; an astronomical literacy provides intangible educational benefits that cannot be taught in other courses. These benefits eventually nurture and complement a more traditional literacy.

Field to “Your Daily Life,” characterized by deadlines and homework. In this doodle, my purpose is not to say that this kind of daily work isn’t important, because it is. Rather, I am arguing that, too often, people’s conceptions of their lives are far too limited and individualistic. People’s true sense of belonging and purpose gets shrouded in work; we are caught with eyes cast down rather than up in amazement.

A key benefit from astronomical literacy like this doodle outside of school is a heightened sense of self-awareness and mindfulness of the rarity of our planet. In particular, Wallace et al.’s subjects in their study, “Astro 101 Students’ Perceptions of Science: Results from the Thinking about Science Survey Instrument,” had a largely unanimous agreement that astronomy is “necessary for the discovery, development, and conservation and protection of natural resources and the environment in general,” as well as necessary for personal development (4). Numerous instances from history can be used here to justify this statement. However, in my own experiences, I have realized that astronomical literacy has positively influenced my conception of my place in the universe, or “worldview,” as Wallace et al. call it. I have realized that my day-to-day interactions with people are significant. I have realized that our Earth is extremely valuable, as it is shrouded in darkness. These realizations have sprouted from my engrossment in an astronomical literacy; my experiences with an astronomical literacy have heavily influenced my perception of my place in the universe. Ultimately, astronomical literacy provides benefits that transcend literacy itself: ample ground for self-actualization, self-awareness, and alertness of what’s going on in society. This is in stark contrast to a more general literacy. In my day-to-day activities, a general literacy includes writing notes, emails, and tasks of that nature. These responsibilities serve a more functional service and are certainly important. However, astronomical writing outside of school results in a deep understanding of worldviews on top of the previously discussed unique writing abilities. Due to these particular assets, an astronomical literacy is valuable; it is completely different from a purely writing-based literacy, especially outside of school.

Deeper, Deeper Still: Dominic’s Case

Yocco et al. discuss the implications of this astronomical involvement on society in their article, “Factors Contributing to Amateur Astronomers’ Involvement in Education and Public Outreach.” Yocco et al. argue that involvement in astronomical clubs or extensive education in the field—inside or outside of school—made amateur astronomers engage more in education and public outreach about astronomy. They participated in these activities to impart their knowledge onto others, thus benefiting the entire field as well. Most notably, Yocco et al. mention that engrossment in the field of astronomy ultimately facilitates the “goal of improving public understanding of society” (Yocco et al. 7). The implications of an enhanced comprehension are discussed in Wallace et al.’s article, permeating through numerous aspects of society. Personally, I have engaged in public outreach due to the field of astronomy and can attest to the literacy benefits this field has on others.

Our senior astronomy class was assigned a 3rd grade pen pal to correspond with in hopes of sparking their interest in astronomy and science. I was assigned to a student named Dominic. Unfortunately, as Krumenaker notes in his scholarship, astronomy and other science electives have been put on the back burner in school, while more “standard” topics like English and Math are the focus of high-stakes, standardized testing. This was especially true for these students. The 3rd graders did not learn about science at all; it was almost completely taken out of their curriculum. English and math test scores were the only quantified force in their education. As Dominic’s “science teacher,” I knew I had a big responsibility in his literacy development. Although this work was done in a classroom setting, most of the meetings we had with the kids were not during our school hours, and they were voluntary; we met on the weekends to provide demonstrations for the

3rd graders, allowed them to look through telescopes, and more. On December 6th, 2016, I wrote to Dominic:

Hi Dominic!

How are you? I hope you enjoyed my last journal entry and I'm looking forward to hearing more from you! This picture displays what is known as the "Hourglass Nebula," which is what happens to a star when it dies and runs out of fuel. Although it seems like it is a normal-sized object, it's a **lot** bigger than you think. It is nearly 47,000,000,000,000 miles away from Earth, and a lot bigger, too! It's a massive amount of gas that gives the nebula the red color you see in the picture. It was discovered 100 years ago. I think the middle of the nebula looks really cool--the green "eye." I hope you enjoy this image!

Your Astro Pen Pal,
Dan Remie 12/6/2016

Mentioned in the above entry is the infamous Hourglass Nebula, which is pictured below for reference:



Figure 3: Hourglass Nebula

This text exemplifies Yocco et al.'s notion of the "likelihood [of astronomers] to engage in education and public outreach" to display the effects astronomy has on society (7). Since I have such a passion for astronomy, I wanted to be able to convey the importance of astronomy, while keeping the journal entries fresh and engaging. At the same time, however, I had to break things down into readily understandable terms for Dominic. I had to avoid "astronomical jargon," as

Greenstein suggests, while still communicating my meaning (2). This pen pal experience provided benefits to me for an astronomical literacy by giving me the chance to practice communicating what I had learned. More importantly, Dominic’s astronomical literacy was affected as well.

For Dominic, this new way of learning and writing in scientific terms took him for a spin, and I could tell by the way he acted when we met. Dominic was completely enamored with the cosmos because it was so different from the prior material to which he was exposed. As Partridge

Other unique literacies—such as historical, geographical, or archaeological—could reap the benefits of this passionate, unrestrained approach to writing.

and Greenstein argue in their paper, “Goals for Astro 101: Report on Workshops for Department Leaders,” astronomy has “a broad appeal and wide-ranging issues” that provide “well-established links with other fields,” making astronomy “intrinsically interdisciplinary” (3). Besides the obvious fact that writing about astronomy was training for his communicative abilities for a general literacy, our correspondence served Dominic in other ways. For Dominic, I could tell through our messages that literacy in astronomy was extremely appealing to him. Each time we wrote to one another, Dominic would formulate questions based on what we were discussing. He also would try to solve math equations—proof that astronomy has a wider range of applications to other literacies. These examples may seem small, but are large in the scope of things;

astronomical literacy provided Dominic with a wide range of exclusive profits, which is evidence of the need to advocate for astronomical literacy inside and outside of school.

Dominic’s example effectively demonstrates the argument that an astronomical literacy fills in gaps that a more general literacy does not offer. One may think that Dominic’s case is a rare one, but an astronomy education and the resulting literacy is seldom taught as Krumenaker notes in his article. As a result, students (and non-students) are barely—if at all—receiving an education in astronomy. Therefore, people are missing out on the particular benefits of the literacy itself. Dominic’s example sheds light on the existence of a link between astronomical literacy and a more general one. However, this connection has not been explored in-depth by scholars to date.

The Big Bang: Conclusions and Implications

This analysis provides a plethora of takeaways for an astronomical literacy. First and foremost, writing for astronomy encourages writers to avoid astronomical jargon and “write to learn” (Greenstein; English). This contrasts with work done for a more general literacy, such as one mentioned by Brandt, that urges structure prior to writing. More importantly, this paper highlights the fact that this literacy provides numerous intangible benefits, such as a heightened sense of awareness, more community involvement, and a different approach to writing itself (Wallace et al.; Yocco et al.; Percy; Bowler; Beutler). Beyond that, however, an astronomical literacy has changed my conception of what qualifies as “writing.” As mentioned previously, before writing for astronomy, I viewed writing as a mere functional service. I was blind to what else writing could be outside of essays and analyses. After I got into astronomy and became literate in it, my view of writing changed. Even still, however, it is important to teach both literacies. This will provide people with a holistic approach of what writing really is and can be for them.

With the benefits of astronomical literacy displayed here, I argue that astronomy should not only be incorporated *more* into the classroom, but be incorporated *better*. Astronomical literacy is a different kind of literacy; it sparks creativity and allows people to escape from the confines of a more general literacy. It is important for teachers to teach about English conventions for a more general literacy, but teachers should task their students with assignments that truly make them

learn and develop a passion for a subject like astronomy. This could include assignments that prompt students to go outside, look at the stars, and write down what their thoughts are afterwards. Tasks like these, however, need not be limited to an astronomical literacy alone. Rather, other unique literacies—such as historical, geographical, or archaeological—could reap the benefits of this passionate, unrestrained approach to writing. Astronomical literacy and those like it are vastly unique; as such, teachers should impart the benefits of an astronomical literacy and others like it to students in a way that truly make them learn in a hands-on manner.

Furthermore, teachers could widely adopt the strategy of “writing to learn” in astronomy and demonstrate how this approach can be employed in a variety of situations. For example, writing in my astronomy class did not focus much on structure and grades. Rather, emphasis was (and should be) placed on comprehension. Knowing this, there are different tactics to writing for astronomy and for a general literacy—creative and planned. Teachers should readily acknowledge this variance in writing; sometimes it’s not about how well you can convey ideas, but rather how well you truly *know* them.

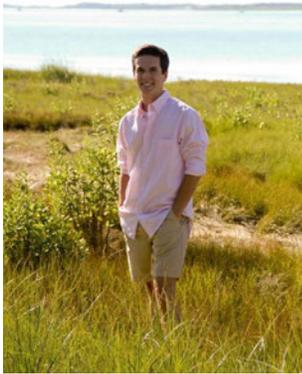
Dominic’s case discussed above is not a rarity for researchers; as Krumenaker notes, fewer and fewer people are being exposed to an astronomical literacy because assignments for a more general literacy are emphasized. Researchers should explore even more how an astronomical literacy can be incorporated into a general literacy. A careful study should be done to see how these two literacies complement one another and to what degree. By doing so, researchers will be able to provide an apt course of action for teachers that will allow students to truly learn subject material. This autoethnographic account, coupled with Dominic’s story, has touched upon this, but it can be used as a stepping-stone in the discovery of this research question. This paper largely serves as an introduction to the suggested course of action for researchers and teachers. Ultimately, an astronomical literacy should be studied more in depth. In doing so, astronomical literacy might be expanded, allowing its unique benefits to reach an innumerable amount of people.

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