

**A Case Study: Embedding Disciplinary Literacy Strategies in a Pre-Advanced
Placement Biology Class**

by
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Abstract

Background: The No Child Left Behind Act mandates the raising of academic achievement levels for all students, including students with learning challenges, traditionally low-performing students, and students of color. The improvement of literacy initiatives, often through the implementation of content-area literacy programs, has been viewed as the primary mechanism for doing so despite current studies showing such programs have struggled to improve student literacy growth and test scores nationwide. Research has concluded that for students to be successful using literacy to access knowledge within specific disciplines, content-area teachers should provide explicit instruction of literacy within their content areas. However, due to increased emphasis for students to demonstrate growth on summative state assessments, many content-area teachers neglect literacy instruction within their subjects. Disciplinary Literacy (DL) represents an alternative to failing literacy initiatives by approaching students' literacy acquisition in the content areas through apprenticing students in the practice of thinking and using literacy as content experts. **Purpose:** The purpose of this study was to develop a classroom culture rich in disciplinary literacy ideology and strategy usage to observe the overall result such practices have on student literacy growth and teacher instructional practices. Students learned to navigate Biology in a pre-advanced placement classroom within the framework of an inquiry-based instructional approach highlighted with disciplinary literacy strategies. The following research question was used for this study: How do disciplinary literacy strategies affect student literacy growth and inform teacher practices? **Methods:** This study employed a qualitative case study approach to collect and analyze data from both the principal researcher, serving as the teacher of record, and

twenty-nine students participating in lessons built around disciplinary literacy strategies. Data collected included an initial and final Metacognitive Awareness Inventory, a 52-item true/false survey administered to identify knowledge and regulation of metacognitive skills, researcher reflections captured in a weekly journal, classroom observations conducted by the researcher, student exit-tickets, and student work samples. Twelve DL lessons were developed to examine student growth in disciplinary reading, writing, thinking, and communicating and were implemented by the researcher over the course of thirteen weeks. A thematic analysis approach (Creswell, 2002) was used to analyze all data sources and to allow themes to emerge. Three peers, with science experience and from diverse educational backgrounds, reviewed findings to guard against researcher bias. **Results:** The study found that the consistent use of Disciplinary Literacy strategies improved some students' literacy growth and significantly informed teaching practices. Analysis of data revealed three emergent themes: 1.) DL strategy implementation resulted in instances of both very positive and negative student and teacher engagement; 2.) DL strategy implementation resulted in growth of student and teacher metacognitive awareness through the development and use of interim texts; and 3.) DL strategy implementation resulted in an increase in the frequency, comfort level, and sophistication of academic conversations for the teacher and students. Student cell phone use emerged as the primary avoidance behavior observed when students were presented with DL strategies. **Conclusion:** DL strategies have a positive impact on both student and teacher metacognitive and literacy development. DL strategies also have a positive impact on teacher efficacy.

*Keywords: disciplinary literacy, metacognition, culturally responsive teaching,
practitioner research*

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Chapter I

Introduction of Research

Embedding Literacy in a Science Classroom

Disciplinary literacy represents a new model in literacy instruction, one that approaches student literacy acquisition and development through the examination of how *literacy is used within a discipline* and by challenging students to wield literacy skills in a similar manner. This approach is emerging as a potential alternative to failing student literacy initiatives across the country, the most popularized of those being Content-area literacy, which employs generic literacy strategies broadly across all subject-areas. Unlike these Content-area literacy programs that have struggled over the years to significantly increase student literacy growth and test scores, Disciplinary literacy offers an opportunity for students to access and demonstrate true understanding of content, increased depth, interdisciplinary connections, and higher-level thinking because they are using literacy as their primary tool for acquiring knowledge.

When students are apprenticed in the investigation of disciplinary reading, writing, reasoning, and speaking, they are engaged in examining the very texts and issues that experts in that field would, learning both how and why literacy functions the way it does as they endeavor to solve real-world problems. Combining a Disciplinary literacy approach with strategies aimed at improving the development of a students' metacognitive skills offers unique opportunities to cultivate and remediate student thinking habits while seeking to acquire knowledge, consider that knowledge, and ultimately share newly acquired knowledge successfully.

This study identified Pre-AP Biology as a subject worthy of examination for the following reasons:

1. Biology is a course of extreme importance in a students' educational process, being the only science in Texas evaluated by way of a standardized test in high school.
2. Biology can clearly be identified as a unique scientific discipline and one that has **unique literacy practices.**
3. Biology has thousands of subject-specific vocabularies, hundreds of which high school students are expected to learn, integrate, and successfully use in demonstrating mastery.

Disciplinary literacy challenges educators and students to dive into their discipline in ways they never have before; through student-conceived, student-led, and student-expressed literacy usage. Significant appraisal of teacher and student practices provided relevant insight into the process of DL as an instructional practice. Student metacognitive strategies were infused alongside Disciplinary literacy strategies to support introspection and critical thinking within the discipline of Biology.

My Personal Research Narrative

Having taught science in public school for several years, I have seen students of all ethnicities, intelligences, and socio-economic backgrounds struggle to grasp subject-exclusive vocabulary and the discipline-specific approach required for learners to truly comprehend science content. Chemistry, Biology, Anatomy and Physiology, Astronomy, and Physics represent some of the major branches of science that secondary students are

expected to demonstrate mastery in, each branch containing quite literally hundreds of vocabulary words *unique to that discipline*. To further compound the issue, students enter the class with ranging literacy deficiencies; low reading skill, low writing skill, dyslexia, other impactful accommodations, even learning to read, write, and speak a new language altogether. As a scientifically minded practitioner, I wondered exactly how it could be possible to support these students, help them improve their individual abilities in accessing the content, and help them to be successful not only in my class, but in every class.

Early on in my career as a teacher and researcher, I began with the very narrow focus of trying to find a way to improve student vocabulary retention during my master's thesis. My reasoning was that students needed some better way of memorizing all the vocabulary words they would need to know for my class. The previous statement shows just how naïve I was as a first-year teacher, and how much my understanding of student literacy would need to grow to help students elevate their literacy skill. The process of conducting that research opened my eyes to a vast ocean of obstacles students faced to developing skill in literacy usage. As a result, I began looking at potential solutions to these obstacles that would help any student overcome them.

I quickly recognized that I needed to improve my craft as an instructor to accomplish my goals. Early on, I would often revisit my lesson plans dozens of times to find potential solutions, and I began trying a wide array of instructional strategies. I started scaffolding assignments, providing students with process and content differentiation, and using technology and writing assignments in student assessment. These yielded some positive results but were largely ineffective in growing student literacy skill. I moved on to trying

different modalities and methods, incorporating tactile-kinesthetic learning, collaborative group work, and gamification of lessons and activities. Again, each strategy provided benefits in the overall quality of the lesson, however these also failed to generate improvement of reading and writing. I then began to focus on incorporating literacy strategies such as sentence stems, graphic organizers, and modeling thought-processes to target literacy skills more directly. While I was seeing marginal results, this was only from a small percentage of my students.

When I uncovered the concept of Disciplinary Literacy and began examining existing research, I was instantly intrigued. At this point in my career, I was acutely aware of the shortcomings of my own research approach and was looking to broaden my scope in the quest for literacy skill development. I wanted to find strategies that would not only fulfill my needs as a science teacher, but also were easily replicable and would translate to other disciplines as well. Disciplinary Literacy accomplishes this by weaving literacy texts, skills, and approaches into the process of knowledge acquisition. The true strength of this approach springs from the importance placed on changing the role of the student in the learning process. Rather than simply attempting to learn and demonstrate mastery of content, students are invited to “apprentice” alongside each other and the instructor to help create the learning process using the texts, skills, and approaches demonstrated by experts in their respective fields.

I am eager to continue researching Disciplinary Literacy strategies for a variety of reasons. Initially, I want to establish some research that will inform the impact that a Disciplinary Literacy approach will have on student literacy growth in the subject of science. Provided my assumptions and early leanings are correct, I would then expand

that research to examine effective practices for implementation of a school-wide Disciplinary Literacy program. Once that is accomplished, I hope to narrow the focus to quantify the effectiveness of Disciplinary Literacy strategies in improving specific skills across a broad range of subject areas and teacher effectiveness levels. My goal is to create a path for administrators and educational professionals to consider when choosing a quality literacy program that will provide students the tools and skills they need to eliminate obstacles to their learning and be successful in any area they choose.

Statement of the Problem

Educators have fallen short in improving student literacy growth through the systemic implementation of generic literacy strategies, an area of weakness in the public education system that has been well documented. Research within the field of literacy development has moved toward identifying and seeking to understand literary programs and instructional strategies that have proven effective in growing a student's conceptual understanding and correct utilization of literacy skills. The emergent use of Disciplinary literacy strategies as a method of utilizing relevant literary structures within a discipline provides a promising research aim.

Purpose

The purpose of this study is to develop a classroom culture rich in Disciplinary Literacy ideology and strategy usage to observe the overall effect instructional practices have on the learning environment. Examination of the impact that both Disciplinary Literacy practices and purposeful Metacognitive skill development have on pupils is the focus of the study. Students will navigate learning science within the framework of an inquiry-

based instructional approach and a prescribed Pre-AP curriculum, being supported with the DL and Metacognitive development. Data pertinent to the effect on the learning environment will be derived from how effective/ineffective Disciplinary Literacy and Metacognitive strategies are in promoting student literacy growth, as well as their usefulness in improving the overall quality of teaching instruction in the learning environment.

Significance

Given that many content areas approach the use of literacy within their discipline in a very singular manner, this study seeks to inform teachers and students of each specific subject area as to the relevance and usefulness of Disciplinary literacy as an instructional strategy. Math, Science, Physical Education, Art, etc. all use literacy in different ways to define, discuss, and further research within their fields. This specialized method of literacy instruction represents the identification of a clear set of attainable goals for student literacy achievement inside every discipline. Additionally, the support of student metacognitive development alongside Disciplinary literacy instruction serves as a logical companion that ensures equitable access as students strive to think and respond as experts. Understanding how Disciplinary literacy strategies affect literacy growth in the classroom allows the measuring of multiple individual strategies and hopefully represents a significant data set when considering best practices in literacy instruction.

Essential Question

How do Disciplinary literacy strategies impact student literacy growth and inform teacher practices?

Conceptual Framework

This study is grounded in Constructivist Theory, which is a broad term within the field of cognitive psychology representing several theories evaluating the way people acquire information. Piaget's Theory of Cognitive Development (Piaget, 1966) served as the primary basis for later theories that would further define Constructivist Theory, such as Vygotsky's Theory of the Zone of Proximal Development (Vygotsky, 1978) and Bruner's Theory of Discovery Learning (Bruner, 1985). These theories laid the groundwork for the development of pedagogical constructivism, which examines a constructivist approach to student knowledge acquisition within an educational setting.

Definition of Terms

CRT- Culturally Responsive Teaching

Content-Area Literacy- The use of generic literacy strategies that are inserted into all subject areas, and are not subject specific (Shanahan & Shanahan, 2012).

Disciplinary Literacy- The spectrum of knowledge found within a field of study, and the specific way that information is unearthed, shared, and evaluated (Shanahan & Shanahan, 2012).

EL- English Learners

IRB- Institutional Review Board

Metacognition- The use of one's internal thinking to evaluate and control their own cognitive processing before, during, and after learning concepts (Livingston, 2003).

Metacognitive Awareness- recognizing the gulf between one's knowledge and their ability to complete an assignment, as well as the understanding of effective strategies to employ (Purnomo et al., 2017).

NCLB- No Child Left Behind Act of 2001

STAAR- State of Texas Assessments of Academic Readiness

TEKS- Texas Essential Knowledge & Skills

Summary

The usefulness of Disciplinary literacy strategies in promoting student literacy growth will be evaluated alongside prescribed curriculum in a Pre-AP Biology classroom. This examination, in conjunction with an emphasis on individual metacognitive skill development, will inform teacher practices as to the effectiveness that such an approach offers in assisting students in deepening their learning, as well as communicating what they have learned in a discipline-specific fashion. Further implications as to the nature of how students approach the learning process and how teachers instruct these strategies will be compiled and discussed.

This study hopes to create discussion as to the superiority of a Disciplinary literacy approach to both teaching content and developing student literacy skills within the content areas. Additional findings and emergent themes will be assessed and categorized according to importance. This paper will identify applicability and context for this study by surveying relevant literature in each of the primary areas of focus with an emphasis on the interconnectivity of these areas to the research

Chapter II

Review of Literature

The Shortcomings of a Content-area Literacy Approach

The prevailing school of thought regarding the instruction of literacy strategies in content area classrooms has been that generic literacy strategies are sufficient and applicable across disciplines (Lenski and Thieman, 2013). Moon et al., (2019) state that Content-area Literacy research up to this point has sought to understand how critical language and universal literacy structures are used to impact student understanding within content areas. This early work has thus far focused on how teachers present and communicate their content in their discipline and how students interpret and construct knowledge. Therefore, teachers should strive to provide student opportunities and support to improve reading comprehension and fluency, discipline-specific vocabulary acquisition, and classroom discussion and writing as a means of demonstrating knowledge (Fleming et al., 2007.)

In their research, Moon et al., (2019) concluded that for students to be successful in accessing the literacy demands of secondary content disciplines, content area teachers must provide explicit instruction of literacy within their content areas. However, Lenski and Thieman (2013) found that teachers failed to integrate common literacy strategies to increase critical interaction with texts, citing concerns that teachers do not fully understand literacy processes. The research seems to support a lack of direct teacher instruction regarding literacy strategies, as well as a lack of demonstrated expertise.

Fleming et al., (2007) observed that content-area teachers taught reading comprehension strategies while investigating texts during only 3% of the instructional time spent on these activities.

Ness (2007) found that studied teachers taught using a teacher-centered lecture model heavily focused on the transmission of content-area information, also observing very limited direct reading comprehension instruction. The strategies that did occur reflected poor quality and scope, most often amounting to students writing summaries of texts and answering literal questions (Ness, 2007). Moon et al., (2019) reported misapplication and misunderstanding of literacy strategies, with some errors being egregious, i.e., using open-ended questions, rather than closed-ended questions in an anticipation guide, which would have helped students to narrow their focus while reading. As such, graduating teachers may in fact cause greater confusion and frustration for their students by ineffectively teaching literacy strategies or misidentifying student misconceptions (Moon et al., 2019).

The skill requirement and amounts of literacy strategies used in classes changed depending on the ethnicity and poverty level of the students being instructed (Lenski and Thieman, 2013). Moon et al., (2019) expressed concern that all students, particularly culturally and linguistically diverse students might not be receiving quality literacy support because there has been so little direct research focused on the incorporation of reading strategies into content areas. Lenski and Thieman (2013) did report pre-service teachers successfully demonstrating summarization and annotation strategies in observations, however none of these future teachers showed mastery of supporting students in strategy usage, i.e., differentiating the texts based on student ability. This

deficiency is significant, because many students struggle to read and understand discipline-specific assigned readings, so much so that often they do not even attempt the assignments (Fleming et al., 2007).

In a survey, Fleming et al., (2007) noted that a significant number of teachers believed that they lacked the requisite teaching skills to help students read, acquire vocabulary, and comprehend discipline-specific texts, even within their own areas of expertise. In fact, Moon et al., (2019) found that pre-service teachers did lack skill necessary to teach literacy in their content; failing to identify causes of student reading difficulty, choosing text resources poorly, and having limited personal knowledge of writing skills and genres. Upwards of 30% of pre-service teachers demonstrated what characterized as “poor ability” in both preparing appropriate literacy materials and correctly judging the causation of student difficulties in literacy activities (Moon et al., 2019). Fleming et al., (2007) mentions the lack of teacher preparedness upon graduating from their educator programs and cites the need to reimagine the teacher education system so that newly certified teachers can successfully incorporate literacy strategies into their content.

Perhaps the most important obstacle in implementing literacy in content areas is teacher attitude and investment toward incorporating literacy strategies. According to McCoss-Yergian (n.d.), there is a direct correlation between teacher attitude, willingness, and comfort level to employ literacy practices, and the success level of their students in the classroom. Moon et al., (2019) noticed several factors, (personal language and literacy competence, teacher knowledge about language, and teacher capacity to learn) that led varying levels of teacher effectiveness in implementing literacy strategies once taught to them. This lack of proficiency and understanding could impact the comfort level of

content teachers to teach literacy in their subjects and explain some of the negative perception teachers have regarding Content-area Literacy.

The primary objection given by teachers as to why they are not implementing literacy strategies in the classroom is their belief that student reading improvement cannot be focused effectively due to the large amounts of content that must be covered (Ness, 2007; McCoss-Yergian, n.d.). Moreover, the assimilation of literacy and reading supports into content-specific instruction is viewed by teachers as an additional time-consuming task rather than an effective tool for improving student learning and retention of content (Ness, 2007). Ness (2007) further reported that secondary teachers surveyed did not believe that reading comprehension instruction is their instructional responsibility, instead arguing that the covering of their content in preparation for state standardized testing was their primary focus.

Proving Necessity for Disciplinary Literacy

Literacy skills and proficiencies have increased dramatically for students (and teachers for that matter) in twenty-first century educational settings. Students are asked to be able to read, write, reason, and speak effectively to acquire knowledge; to engage and access discipline-specific knowledge in discipline-specific ways; and to do so while skillfully modifying their approach multiple times daily to correctly match their area of study (Goldman, 2012; Vaughan et al., 2016). Disciplinary Literacy, as it has been coined, considers the spectrum of knowledge found within such a field of study, and the specific way that information is unearthed, shared, and evaluated (Shanahan & Shanahan, 2012). This vein of understanding within the literacy field is often confused with Content-Area

Literacy, which conversely is the use of generic literacy strategies that are inserted into all subject areas, and are not subject specific (Shanahan & Shanahan, 2012).

To fully understand Disciplinary Literacy or DL, it helps to visualize its position within a literacy developmental hierarchy. Students begin by acquiring emergent literacy (learning to read and write), before demonstrating proficiency and moving on to Content Area Literacy (applying universal literacy strategies across all subjects). Disciplinary Literacy (discipline-specific literacy strategies used by experts in that field), would represent the pinnacle of student literacy development, and the most complex iteration of individual literacy skill. Students who use DL strategies skillfully can identify, evaluate, attain, parse, and re-organize information effectively, at a level that resembles experts within that field, and across a variety of disciplines (Vaughan et al., 2016). When teachers intentionally integrate disciplinary literacy strategies, students are empowered to use the tools they are developing as independent practitioners, both in the educational environment and out in the professional world (Shea & Roberts, 2016).

While many content area teachers have great confidence within their area of expertise, many do not feel they possess the adequacy to incorporate literacy instruction into their discipline, or to accurately resolve their deficiencies as a literacy instructor. In fact, many educators surveyed believe that teaching reading techniques in their classrooms was a waste of valuable time that could be spent on content instruction, often referencing a lack of instructional time as the primary reason for avoiding the incorporation such strategies in their lessons (McCoss-Yergian, n.d.). Reframing content in a disciplinary literacy manner, purists argue, is not unreasonable, paying great dividends in helping students

understand and utilize literacy in acquiring and creating learning within subjects (Vaughan et al., 2016).

In a similar manner, the overall attitude and approach of teacher educators towards literacy may have a tremendous impact on the beliefs and attitudes of prospective teachers' view employing these strategies within their content (Dharamshi, 2018).

Dharamshi (2018) portends that pre-service teachers require authentic learning opportunities and support in their understanding of disciplinary literacy strategies to effectively transfer them to their students. These future educators will also benefit greatly from Disciplinary Literacy mentorship, further becoming aware of expert practices within their own discipline (Cook & Dinkins, 2015).

Pre-service teachers face the challenge of growing as literacy leaders. In surveys, student teachers expressed that being a life-long learner and researcher of instruction is part of the job, and that future practitioners must endeavor to push themselves well beyond their present understanding of both content and delivery (Dyenia et al., 2016). In another study, when teacher educator supervisors provided support and encouraged student teachers to incorporate complex disciplinary literacy strategies into their lessons, across the board they were willing to step outside their comfort zone and attempt them (Leckie & Wall, 2016).

Presently teacher educator courses are providing generic strategies to assist pre-service teachers in equipping students to successfully read and write texts across a variety of subjects. The unfortunate truth is that disciplinary literacy requires students to skillfully wield specific and unique skills that will help them interpret the meaning of deep and

information rich texts, where generic strategies often fall short. However, recently a greater portion of prospective teaching candidates are learning their subject matter from experts in their fields who are modeling these literacy practices and revealing the types of thinking and design necessary to invite students to learn the how, and not just the content knowledge (Cook & Dinkins, 2015).

For disciplinary literacy to not only succeed but flourish, even experienced teachers need to receive consistent support and guidance as they operate both as content-area experts and as skilled literacy instructors. When surveyed, teachers unanimously agreed that literacy coaches are instrumental in schools, and they lamented the lack of quality, discipline-specific training, and professional development provided to them towards becoming more effective as disciplinary literacy experts (Edwards et al., 2015). Teachers are not being asked to share universal information acquisition and reading skills, but rather to teach students to access reading in the manner their subject specifically demands, which is a significant challenge for literacy coaches (Vaughan et al., 2016).

If students are to read like experts in the disciplines of math, science, history and English, most disciplinary reading instructional strategy must take place within the content-area classes (Goldman, 2012). Teachers must have a great depth of understanding in the discourse, or way the discipline specific language is used within their content area, as well as being well versed in their content knowledge, and intentionally unpack that discourse so that students can visualize it (Hickey & Lewis, n.d.). Only then can the disciplinary educator perform their most challenging task; that being to identify the appropriate scaffolds in helping students read, think, and communicate in discipline-specific ways (Hickey & Lewis, n.d.).

The reading of deep, rich disciplinary texts does not occur overnight, and certainly not without a thorough understanding of the requisite skills and abilities students will need to be successful, and preventative challenges they may face. Students must be able to draw out background knowledge from multiple sources, determine relevance and reliability of these sources, analyze new information, effectively reason across a variety of texts and content areas, and discuss, synthesize, and evaluate information gleaned both individually, and as a member of their learning cohort (Goldman, 2012). Students are asked to participate in highly iterative processing steps: creating models depicting primary goals and strategies from texts; considering the completeness of a source or if additional information is required; examining relevance and bias; drawing inferences within the text sources to fit their created model; discussing and synthesizing information alongside peers; settling on an appropriate task product such as an essay or report; and finally whether their model and product met the goals of the texts or whether revision is necessary (Gersten et al., 2007).

Continuing, Gersten et al., (2007) depicts expert readers being required to include construction of multiple interpretations derived from texts, the evaluation of claims made by authors through the lens of literary constructs and theories, and the manipulation of character and theme within the primary source documents. However, there is a singular and prohibitive problem in students' attaining this level of reading comprehension and synthesis, namely that they are not even remotely prepared to do so. Helping students to understand their own deficiencies and illuminating targeted strategies to them is paramount (Gersten et al., 2007).

How can teachers differentiate and scaffold instruction so that readers can read and interpret primary sources and texts as experts, rather than simply scanning the source with the sole purpose of finding the right answer (Kopish & Lane, 2019)? When considering the vast number of students in middle and high school who read below grade level, Hurst & Pearman (n.d.) draw a direct correlation between the cessation of reading instruction at the sixth-grade level and the lack of noticeable improvement in their reading ability once that reading instruction stops. How then should practitioners seek to remedy these challenges?

Duhaylongsod et al., (2015) note that one viable starting point is to begin by reducing the difficulty of the expert level texts for students. Creating fabricated sources that act as simulated primary texts makes high-level textual content accessible to middle and high school students. These “simulated texts” retain the overall point of view and relevant information, while empowering the reader to examine the source in a discipline-specific manner, such as identifying reliability and bias. Clarence & McKenna (2017) believe that allowing students to help create these varied texts will provide understanding regarding the key concepts and methods of thinking across various canons of knowledge.

A potential extension includes reading these “simulated texts” aloud. The benefits of students being able to hear these high-level texts read aloud include increased comprehension, vocabulary acquisition, and reduced effort in the decoding of texts (Hurst & Pearman, n.d.). Through “read-alouds” students learn the larger meaning of the text, what it says, and how it is being used in the discipline (Shanahan et al., 2016). The relationship between reading comprehension and vocabulary acquisition is well

documented, and by reading these texts to students, educators will assist them in internalizing the text for the purpose of expert analysis.

The answer according to Harmon and Wood, (2018) lies in teacher preparation, and how content vocabulary is introduced and supported throughout the lesson. The authors suggest that key words and phrases should be intentionally curated relative to the student's conceptual progress and provide clear paths toward supplementing the reader's existing academic vocabulary. While the strategic selection of vocabulary may seem basic, it truly shines for low-level readers and can greatly add to the student's working vocabulary, which must become more extensive and discipline-specific for students to be successful (Leckie & Wall, 2016). Ultimately, teachers must have a clear understanding of the student's background knowledge to make informed decisions as to the most appropriate words to target Harmon and Wood (2018).

Unsurprisingly, students are struggling to read the high-level texts of field experts and are spending most of their cognitive energy trying to decode the discipline-specific vocabulary found inside, leaving limited mental energy for processing and comprehension (Hurst & Pearman, n.d.). Because many students are lacking the appropriate literacy tools, many novice readers are not intrigued and frustrated, refusing to engage with these complex texts (Gersten et al., 2007). Disciplinary Literacy as an instructional practice relies heavily on students being able to understand, internalize, and use academic vocabulary. Helping students navigate this demanding task is a critical component in turning them into disciplinary thinkers and learners (Harmon & Wood, 2018).

If vocabulary acquisition represents the doorway into Disciplinary Literacy, then perhaps class-wide discussion and debate could be the path that leads students there.

Duhaylongsod et al. (2015) argues that classroom discussion drives high-level text comprehension, because students must combine complex reasoning, use of academic language, and perspective in their interactions, and must go back to the text for supporting evidence. Goldman (2012) suggests that to achieve student engagement, teachers must have well-conceived classroom norms in place that support student conversations, assisting them in developing their ideas, listening to others, and considering multiple perspectives that enrich the literary works.

Continuing, Goldman (2012) cites a need for the discussion prompts to be structured logically to move students from initial understanding of the text toward idea development and perspective identification, content examination, and taking critical stance on elements found in the writing. Asking students questions such as “How will you go about making sense of this source?” “What kind of information will this type of document tell you?” and “What information are you missing here?” focuses student thinking within the discipline (C. Shanahan et al., 2016). In doing so, students are invited to go beyond reading a paragraph or two of writing and challenges them as to how experts might use that content to acquire new knowledge (Goldman, 2012).

Framing meaningful classroom discussion while understanding the challenges facing students and teachers is critical. Goldman (2012) extolls student understanding of inquiry frames that readers are required to bring to text as a skill that both students and teachers need to be exposed to. The educator must be constantly assessing, and carefully evaluating necessary next steps for learners, taking account of student progress, and

developing an environment of self-reflection and metacognition (C. Shanahan et al., 2016).

Harmon & Wood (2018) establish a clear link between verbal communication and vocabulary comprehension in different disciplines using debate, specifically benefitting below grade-level readers. The practice of debate requires students to defend their arguments and engage in deeper contextualization of the text to weaken their opponent. This serves to motivate student attention toward the text and has shown to facilitate middle school students thinking and arguing in a way that is not as rigorous as authentic disciplinary discourse, but clearly resembles it in form (Duhaylongsod et al., 2015). Therefore, the goal should be to move students toward Disciplinary Literacy mastery in three ways; To promote academic language usage and complex reasoning, helping students attain deep reading comprehension, to focus classroom discussion as a tool in assisting development of awareness of how texts are manipulated within a discipline, and finally to create an engaging disciplinary atmosphere, which is crucial to inviting students to participate as experts in their respective field (Duhaylongsod et al., 2015).

Through decades of research, a common understanding that academic literacy is too varied and unique across the subject areas to apply generic writing strategies solely learned in a composition course (Lampi and Reynolds, 2018). Shea & Roberts (2016) found upon surveying teachers that there is clearly insufficient dedicated writing time for students to learn and practice effective strategies, depicting roughly 6% of instructional time for writing strategies and approximately the same amount of time for demonstrating writing. There is no wonder that students are failing to comprehend the mythical art of

writing necessary for interacting as an expert within their discipline (Lampi & Reynolds, 2018).

Incorporating functional writing within a discipline is difficult primarily because students are generally confused as to how to approach doing so. The lack of clarity transfers not only from discipline to discipline, but also from course to course within a discipline (Lampi & Reynolds, 2018). A particularly intriguing study by Hickey & Lewis (n.d.) shows that multilingual learners actually embraced challenging writing across disciplines, which eschews the common thought that low-level learners are barred from achieving disciplinary writing proficiency and encourages educators to scaffold meaningful and effective ways for multilingual learners to engage in a variety of possibilities in writing as experts. Analyzing the differences between researching and writing in all disciplines will assist all levels of students in being able to code switch throughout the school day and in an appropriate manner for any assignment (Vaughan et al., 2016).

This research flies in the face of a worrisome trend regarding practitioners substituting high-level disciplinary texts with alternate or lower-level tasks because they feel that their multilingual students will be unable to perform in this arena (Hickey and Lewis, n.d.).

The authors continue to challenge teachers to focus on the techniques of this style of writing for all students, purporting that the professors themselves will come to help them to understand their own writing, and then allow them to clearly demonstrate the nuances of the genre that they are working within. It allows them to train students to not only demonstrate knowledge of their content area, but to be able to work within that area as a disciplinary member (Hickey and Lewis, n.d.).

An Examination of Metacognition

The term metacognition refers to the use of one's internal thinking to evaluate and control their own cognitive processing before, during, and after learning concepts (Livingston, 2003). This internal thinking can be broken down into two specific functions:

Metacognitive knowledge, which consists of one's existing understanding of cognitive tasks, strategies, and self-understanding about how they acquire knowledge; and

Metacognitive regulation, or the implementation and monitoring of one's cognitive processes during learning (Flavell, 1979). According to Noushad (2008), both functions seek to connect the learner with their own thinking, delineating between how they acquire knowledge in the world around them (cognition), and how they examine their own minds' ability to act and regulate that cognitive processing (metacognition).

Coming to a full understanding of the scope of metacognitive processes and how to study them can be quite confusing. Hacker et al., (1998) classifies metacognition into three aspects of thinking: Metacognitive experience, or the individuals' present state of cognitive awareness, Metacognitive skill, or how one is currently processing actions, and Metacognitive knowledge, or what one knows about their own knowledge base.

Conversely, Jaleel and Premachandran (2016), following an extensive examination of the history and development of metacognitive theory present only two categories in defining metacognition: reflection, or one's ability to examine current knowledge, and regulation, or one's ability to manage how they undertake and evaluate their learning process.

Brown et al., (1987) acknowledges that the use of “metacognition” and the origin of this concept is widely disputed, difficult to define, and that “processes metacognitive” have been examined and considered by psychological researchers like Dewey and Thorndike more than fifty years before John Flavell coined the term. The decades of research utilizing various terminologies has brought about a great deal of difficulty in streamlining the conceptual understanding of exactly what Metacognition is for the purpose of furthering research. John Flavell, (1979) is generally agreed upon as having most clearly defined “Metacognition” as being composed of metacognitive knowledge and regulation. Additionally, metacognitive knowledge is further subdivided by Flavell into three domains: an awareness and understanding of person, task, and strategy variables (Livingston, 2003). This “awareness of variables” results in the term “Metacognitive awareness” often being used interchangeably with metacognitive knowledge.

To streamline the components of Metacognitive Theory, Wilson (2001) presented three functions of the metacognitive process: Metacognitive awareness, Metacognitive evaluation, and Metacognitive regulation. This simplification both encompasses conceptual understanding of relevant literature and serves to further clarify focus for future researchers. According to Noushad (2008), the term “Metacognitive awareness” involves the understanding of where one is in the learning process, their own abilities related to problem solving and learning, and what content-specific knowledge they possess in the area they are examining. Purnomo et al., (2017) further defines Metacognitive awareness as recognizing the gap between one’s knowledge and their ability to complete an assignment, as well as the understanding of effective strategies to employ.

From within Flavell's domain of Metacognitive regulation, the concept of Metacognitive evaluation has been derived as a separate area of focus. Metacognitive evaluation considers one's abilities and limitations regarding their thinking processes, and the identification and perceived success of potential strategies in attempting to solve a problem or complete a task (Purnomo et al., 2017). Noushad (2008) suggests that a particular function of metacognitive evaluation might be an individual deciding how effective the thought processes or strategy choices they selected were in accomplishing their task, also stating that this evaluative function is necessary and perfunctory to engaging in metacognitive regulatory processes.

Metacognitive regulation, as defined by Nelson and Narens (1990) is the action of monitoring one's cognitive processes while learning and attempting to control them. The ability to actively identify and define relationships between the learners' initial understanding and the proposed learning outcome are critical, as well as how to formulate and when to implement effective strategies (i.e., goal setting, planning, and progress monitoring) represent foundational skills in the regulation of metacognitive processes (Noushad, 2008). Noushad continues that critically revisiting both the cognitive strategies being used in the learning process, and the entire scope and sequence of the learning process during learning will help to identify strengths, mistakes, and areas for improvement.

Flavell (1987) suggested that the opportunities for self-conscious learning in the educational environment are abundant, and as a result, the best schools should endeavor to become "hotbeds of metacognitive development". Gunstone and Northfield (1994) went on to say that metacognitive instruction is paramount within teacher education and

should be central to the teacher education process. Livingston (2003) argues the necessity for educators studying metacognitive activities in students, stating that empowering them to control their cognitive resources significantly impacts successful learning.

Researchers have pursued the boundaries of “successful learning” as it pertains to a Metacognitive approach. Schraw and Dennison (1994) when examining Metacognition and student testing found a significant correlation between students who exhibited use of Metacognitive knowledge and regulation and increased test performance. In another study, Scruggs et al., (1985) found that students that received direct instruction of metacognitive strategies showed increased learning.

Butler and Winnie (1995) recognize that for students to understand the appropriate metacognitive strategies to use and when to employ them, then teachers must be able to identify which skills need to be instructed and how to teach them. This necessitates competent educators to be able to think metacognitively and demonstrate awareness of their metacognitive knowledge and regulatory skillset to make these practices transferrable to students (Hashmi et al., 2019). According to Schofield (2012) effective modelling and instruction of metacognitive skills by educators has a clear correlation with rising student achievement.

What is particularly exciting about the use of metacognitive processes in education is the evidence that these practices not only inform and benefit the students, but the teachers themselves as well. In a research study exploring Metacognition in pre-service teachers, Hashmi et al., (2019) noticed the highest levels of performance by teachers were those who scored high in Metacognitive awareness and regulation, adding that they had

mastery over planning, organization, strategy implementation, and time management.

Schofield (2012) adds that teacher educators who practice reflection of their teaching practices are better able to conceive how they are impacting student achievement, and in turn become able to evaluate and regulate their own metacognitive approach more effectively.

To effectively inform their approach and scaffold metacognitive instruction, Jaleel and Premachandran (2016) suggest that teachers seek to understand the level of metacognitive awareness of every student in the classroom, as well as the individual differences in their learning styles, so that metacognitive ability may increase for every student. This is important, because students need to create a plan for learning, monitor their own learning processes, and evaluate their learning after every activity (Schofield, 2012). The author continues that student awareness of how they individually learn material is best supported by the explicit teaching of metacognitive skills in a way that provides opportune times for students to evaluate their learning goals, and what steps they can take to improve their own learning. Skills such as demonstrating specific awareness of the learning objective, independently articulating their learning goals, explicit knowledge of the cognitive skills they will need to access their own learning and scaffolding their own understanding. However, only by instructing students on several meta-cognitive strategies, and only by cultivating an environment that nurtures metacognitive analysis can students actualize their metacognitive potential and internalize when and where to use a specific strategy (Baker, 2002).

That is not to say that the instructional processes (and benefits) stop there. When students are correctly trained to employ metacognitive strategies, they can increase their self-

knowledge as readers of text, identify genre and structure, and plan their reading by orienting their goals through the lens of self-monitoring of their comprehension, and strategy regulation as they progress through their cognitive endeavors (Ozturk and Senaydin, 2019). Additional strategies include Teacher modelling of text-specific metacognitive goal setting, clear distinction between cognitive and metacognitive practices as students read, explicit metacognitive strategy discussion and instruction, student analysis of other student thinking and implementation of strategies, and teacher and student assessment, scaffolding, and feedback regarding their effectiveness in integrating these practices into their interpretation of text (Ozturk and Senaydin, 2019).

Responsive Pedagogy in the Sciences

Student acquisition of science content using inquiry-based instruction has long been considered best practices for generating authentic learning in a science classroom (Seneviratne et al., 2019). According to Zambak et al., (2017), inquiry-based instruction as it relates to the sciences is student-centered, relying on educators to provide experiential opportunities for students to not only investigate the nature of the scientific process and how scientists obtain and validate information, but also to explore and expand their understanding of scientific content. The tenets of student investigation and exploration found within inquiry-based instruction derive from the constructivist approach to learning and align with the concepts of student-centered and active learning. Holmes (2019) ascribes the following student criteria to the Constructivist approach; the learner must be actively and directly involved in the process of obtaining their own learning, the learner must be able to assimilate mental constructs of new information and integrate them into existing information, and the learner must not rely solely upon the

teacher as the source of correct knowledge. Baeten et al., (2013) contributes that for learning to be truly student-centered, educators must provide lessons allowing students to actively construct their own knowledge, to do so by participating in authentic assignments offering real-world problems to solve and supported by a teacher who is acting in the role of instructional facilitator and coach, rather than the bearer of knowledge. Holmes (2019) adds that students cannot perceive their role to be that of a passive vessel to be filled up with knowledge by the teacher, and that for active learning to take place the responsibility for learning must diffuse from the teacher to the student.

Rule (2006) argues that for authentic learning to take place, the following principles must be present in an activity or lesson: (1) students are provided choice in guiding their learning through active, hands-on activities, (2) activities are inquiry-based and focus on student development of metacognitive skills, (3) activities are parallel with the issues experts in their field might face, and (4) learners are able to refine their endeavors through active discussion in a social learning environment. For these activities to foster student inquiry, they must encourage students to make observations; allowing them to reference existing knowledge in primary texts and other informational sources; providing time to plan investigations and procedures; guiding them in the analysis and interpretation of data gathered with appropriate tools; and providing a forum to discuss, evaluate, predict, and communicate results (Seneviratne et al., 2019). Holmes (2019) describes inquiry-based activities simply as any activity that encourages student collaboration in the pursuit of knowledge, fixation on a topic, and opportunity for reflection.

While research demonstrates consistency regarding what successful science instruction should look like, how educators advocate the selection of specific instructional strategies to effectively craft inquiry-based instruction varies considerably. According to Cheung et al., (2016), professional development that will ultimately have the greatest impact on student outcomes should be directed at improving a teachers' ability to create cooperative learning opportunities, integrate literacy, guide student metacognitive skill development, and use technology appropriately. Holmes (2019) identifies practices such as debate, cooperative learning, project-based work, and learning by doing as pivotal practices that educators need more time to develop for students to actively learn. Marlatt (2018) champions the use of scaffolding, rubrics, multiple text documents of relevant current events, critical thinking circles, and writing-to-learn strategies as supports central to inquiry-based instruction.

Within the sciences, Hurley & Henry (n.d.) expound on the rigor of scientific work, citing the importance of inquiry and investigation, which is a prerequisite in defending and outlining findings precisely and accurately, and in a manner familiar to scientists. Hurley & Henry (n.d.) desire for students to be able to create meaningful models depicting the scientific phenomena and their understanding of content; charts, tables, diagrams, even mathematical representations that extend far beyond simple recall of information. Physics and Chemistry present opportunities for the utilization of mathematics as an expressive language to describe scientific processes at work within their field.

Placing high value on the credibility of research design, dissection of specific claims, and a critique of source limitations, Cook & Dinkins (2015) argue that reading strategies are paramount in the sciences to support readers in determining the effectiveness of a

scientific authors' claim and to establish an acceptable range of doubt and certainty.

Klucevsek (2017) continues that the most effective way for students to appraise the authenticity and effectiveness of a science text is for them to actively seek out and read research documents that are as close to the original source as possible. Stover (2015) encourages teachers breaking down and identifying new vocabulary that may be encountered in assigned texts by identifying and explaining root words, prefixes, and suffixes that might be familiar to students to help them access background knowledge.

Moeed & Easterbrook (2016) advocate the use of content differentiation when students read, allowing them choice between three documents of varying difficulty levels.

Providing advanced-level texts that are vocabulary rich and as close to expert level as appropriate; middle-level texts that have more pictures, easier to understand vocabulary and a shorter length; and a novice-level with simple text, pictures, graphs, and diagrams to assist struggling readers in grasping the concepts being examined will allow students to appropriately take charge of their reading (Moeed & Easterbrook, 2016). Students will typically gravitate towards the appropriate level text for their reading ability, and will demonstrate increased motivation in having choice, even if they are aware the texts are teacher-created (Stover et al., 2015). Vacca et al., (2011) identify the use of a before, during, and after reading framework as pivotal for students to build understanding through reading texts. This allows the student to establish a purpose for their reading, build background, and informs the teacher of necessary support and reinforcement of key concepts that students need to clarify their learning during and after reading. Stover (2015) continues that to properly evaluate a students' reading abilities and needs, teachers need to be able to observe and assess them reading daily.

Hoffenburg and Saxton (2015) note that regardless of the instructional approach to learning specific content, if students can understand the way scientific knowledge is built then they will be able to acquire scientific knowledge in a more sophisticated fashion, and in turn understand and replicate the mental habits of scientists by developing critical explanations of their learning. Because scientists view exploration within their field as a multistep, reflective process that is rarely linear, but rather cyclical in nature, it is especially important to consider the scientific process when seeking to understand how students should communicate results within the discipline (Klucevsek, 2017). Students themselves have some key instructional requirements to access scientific knowledge correctly within an inquiry-based instruction framework. There are challenges such as classroom management and differentiated assessment associated with allowing students open-ended exploration and explanation of their findings, Hoffenburg and Saxton (2015) observed an increase in the quality of student explanations as a result.

Strong understanding of content knowledge is vital in a scientific inquiry approach for both teachers and students to have success utilizing context in the construction of explanations and the validations of claims (Hoffenburg and Saxton, 2015; Seneviratne et al., 2019). Hoffenburg and Saxton (2015) highlight the importance of thoughtful lesson planning in supporting a student's ability to obtain background knowledge, generate questions, and defend and successfully argue their claims amongst their peers. Moeed & Easterbrook (2016) found in a survey that students listed the practices of teachers' explanation of learning intentions and success criteria and end-of-class reflection of these objectives as most useful in supporting an inquiry-based approach. Stover et al., (2015)

emphasize the challenge in supporting all learners in an inquiry environment, given the vast difference in students' individual strengths and instructional abilities.

However, even with quality instruction, students have several areas where misconceptions and shortcomings in their process become evident as they become emergent researchers. Klucevsek (2017) revealed that students that were attempting to diagram steps a scientist needed to take during research rarely included essential steps such as reviewing pertinent literature and analyzing and sharing results with the scientific community, illuminating a weakness in their understanding of the scientific process. C. Shanahan et al. (2016) noticed that a large percentage of students were able to make a sound claim after evaluating relevant literature, however few were able to defend or support their position with qualifying evidence found in the text.

Hoffenburg and Saxton (2015) also found a lack of value placed on data when attempting to validate a claim, citing that even the students in their study that did reference experimental data in their arguments failed to provide specific data within their explanations. Klucevsek (2017) pinpoints the essential nature of training our science students to be aware of all literacy options available to argue their perspective, and for students to be carefully groomed as key contributors to future academic research.

Providing a simplistic yet effective strategy, Stover et al., (2015) targets the use of brief five-minute conferences between students and teachers during inquiry and explanation activities, allowing students to explain successes and difficulties they are having and providing the educator an opportunity to suggest and model an appropriate skill or strategy to assist them in clearly expressing their scientific opinion.

Culturally Responsive Teaching and Disciplinary Literacy

The No Child Left Behind Act of 2001 (NCLB) created a dramatic shift in national education policy by implementing a system of standardized performance-based assessments tied to a school's ability to receive federal funding. NCLB legislation required states to raise academic achievement levels for all students, including students with learning disabilities, traditionally low-performing students, and students of color (Simpson et al., 2004). While the policies and procedures educators developed to meet the requirements of NCLB had intended to improve student growth and close the achievement gap, growth data for students of color continue to remain largely unaffected. According to Hutchison and McAlister-Shields, (2020) marginalized students of color continue to be separated from white and Asian students in both academic achievement levels and graduation completion rates, despite having been “made equal” legally in public school systems since *Brown v. Board of Education* (1954).

Over the last two decades since NCLB, culturally responsive, multicultural, and bilingual approaches to teaching have largely been replaced by standardized curricula and pedagogy, pushing culturally responsive pedagogy out of the mainstream of instructional practices (Sleeter, 2011). This is concerning due to the established importance of inclusive practices in the teaching of disadvantaged students, particularly during literacy instruction. Wearmouth (2017) argues that basic literacy skills; speaking, reading, and writing are developed naturally by children within their own cultural context as they grow. Continuing, Wearmouth (2017) found in a study that culturally responsive pedagogy is tied to improving student performance, and that the creation of a learning environment that imitates student cultural context is crucial.

Hammond (2015) found that a disproportionate number of culturally and linguistically diverse students are classified as dependent learners. Sleeter (2011) identified significant disparities for marginalized students of color, including: low teacher expectations, lack of ethnocentric curriculum, and disproportionately high rates of disciplinary referrals and special education placement. Hammond (2015) further suggests that English learners, poor students, and students of color are not struggling due to a culture of poverty or differing community values toward education, but rather because educational policies and teacher practices are slanted towards showing growth in most students.

To positively impact student literacy growth for minority students considering current educational policy, the need for teacher education and professional development focused on the integration of culturally responsive practices into the classroom is essential. Current and prospective educators should be provided with the understanding that racial and cultural identities are humanistic factors that should be considered, taught, and demonstrated in their educational environments (Hutchison and McAlister-Shields, 2020). Hutchison and McAlister-Shields, (2020) in an examination of culturally responsive teaching practices in teacher educator programs, found that pre-service teachers often complete their program of study without formally being introduced to the depth of impact that societal issues found in classrooms can create, such as those produced by race, class, and culture. The authors further assume that incorporating culturally responsive teaching practices in teacher training is imperative, and that the expectation for pre-service teachers to focus and include culturally responsive teaching strategies within the construction of their assignments should be established.

Gay (2010) defines culturally responsive pedagogy as an educator's use of cultural knowledge, prior experiences, frames of reference, and the performance styles of ethnically diverse students to make learning encounters more relevant to and effective for marginalized students of color. Hammond (2015) advocates beginning with teacher creation of social routines, culturally appropriate classroom aesthetics, and especially academic talk structures designed to help cultivate a flexible environment that allows dependent learners to build their intellectual capacity and engage in meaningful academic dialogue. Piazza et al., (2015) also identifies the importance of ethnocentric classroom dialogue as a culturally responsive practice, noting that the discussion of texts, ideas, and issues provide prime opportunities for learners to critically reflect on their own perspective while experiencing others' thoughts and processes.

Additionally, promoting the use of collaborative discussions framed around social issues establishes the usefulness of literacy as a social practice that provides students freedom to extend their understandings of texts and mentor each other in improving their comprehension, vocabulary, critical thinking, and as a byproduct, engagement (Piazza et al., 2015). Appropriate use of culturally responsive teaching strategies in the classroom has shown the ability to act as a powerful cognitive scaffold for culturally and linguistically diverse learners (Hutchison and McAlister-Shields, 2020). Conversely, Garland and Bryan (2017) suggest that any teaching model that ignores a students' developed modes of communication and social interactions learned from within their cultural settings is likely to spark resistance to the learning being presented.

Disciplinary Literacy likewise values collaboration, communication, and inquiry across all subject areas, however this is a difficult ask. Lent (2016) cautions that students will

likely not remain on task or always participate, will struggle with making deep connections to learning, and will frequently unveil misconceptions during collaborative learning or classroom discussion. Continuing, Lent (2016) encourages teachers to stay the course in creating a safe environment that supports risk-taking, viewing these practices as the socialization of intelligence and knowledge in which the teacher facilitates student collaborative knowledge creation.

While providing marginalized students of color with multiple occasions and structures to assist them engaging in academic discourse is vital, perhaps more pressing is the need for culturally responsive reading instruction. While instructional time as a resource is finite, teachers can provide marginalized students with time to engage in content that they themselves compare and assess in relation to their communities and cultural context (Lawrence et al., 2019). When modeled correctly, students can further drive meaningful instruction using strategies such as close reading, selecting multiple primary sources, and introspection as to how events found in readings mirror real life (Lawrence et al., 2019). Furthermore, when students are empowered to self-select texts that they find interesting and connect them to their own life experiences, they respond positively and demonstrate more engagement and investment (Shealey, 2007).

When reading through a disciplinary literacy lens, many of the same instructional strategies supported through culturally responsive teaching align. Lent (2016) extols the value of using engaging and student-centered activities such as: modeling through reading aloud, using real-world texts from the student's environment, and providing independent reading opportunities where students choose their own text. Continuing, Lent (2016) encourages the use of "repeated readings" in which students utilize the same

passage of reading for different purposes over a period, a strategy that helps students master unfamiliar vocabulary and tackle challenging texts. Repeated readings provide occasions for guided reading, modeling, and direct instruction found to be effective when working with students of color (Shealey, 2007).

If the need for culturally responsive reading instruction is considered most pressing, then culturally responsive writing instruction falls squarely into the category of most daunting. Nam (2016) laments the inequality found in the number of minority people as characters found in published books, showing in her research that there were fifteen times as many white characters as there were minority characters. It is difficult for students of color to write their own narratives about characters who look like them and come from their neighborhood if they do not have examples to draw from, and it is up to teachers to select inclusive texts that promote racial diversity and culturally relevant contexts (Nam, 2016).

Current research into culturally responsive pedagogy around writing is sparse, though there is evidence of successes. In a ten-week study, Estrada and Warren (2014) implemented culturally responsive writing strategies by promoting student choice through process and product differentiation, emphasizing that writing topics provide a benefit to their community, and designing moments for self-evaluation and goal setting within the writing process. By focusing on key skills such as fluency and creativity in approach, previously unsuccessful students demonstrated fewer instances of failing to complete essays, improved writing skill, more essays submitted graded as passing, and expressed that they experienced less difficulty while writing (Estrada and Warren, 2014).

Disciplinary writing requires intentional planning, differentiation in content and structure, and the establishment of a write-to-learn culture in the classroom, where students experience writing as a process that helps them learn new concepts and connect them with existing knowledge (Javeed, 2019). Lent (2016) supports that such an approach to writing can enhance the brain's ability to interpret, process, retain, and retrieve information, and additionally increase success in learning discipline-specific vocabulary, concepts that are unique to that discipline, and complex material in general. Javeed (2019) identifies exposures to disciplinary writing strategies as critical in preparing students for the level of rigor found in colleges, and that teachers must provide writing experiences that extend beyond worksheet responses and rote note taking.

Chapter III

Method

Overview

As school districts across America continue to evaluate actionable literacy programs and innovative strategies to support student literacy growth, many practitioners have turned to the examination of their own teaching practices for answers. Lent & Voigt (2019) suggest that when individual teachers become involved in inquiry of their own literacy teaching practices, transformational and lasting change often occurs throughout that school. The study of one's own practice, coupled with peer collaboration and discourse regarding each educator's successes and failures represent crucial initial steps for reflective practitioners to begin to refine their instructional ideology and approach.

Stake (1995) likewise asserts that expertise comes from hard work and critical examination from colleagues and mentors, and that reflective practices draw attention to issues of concern and the appropriateness of proposed data-gathering methods.

Furthermore, the work of the educator in the field should be guided by the research question(s), informing all actions, focusing the triangulation of data, and informing the sensibility and skepticism of the researcher (Stake, 1995). In general, a qualitative research perspective should provide detailed information presented through the voices and actions of the participants in which they provide their experiences (and the meanings they derive from them) set within the context of their setting (Creswell, 2008).

This qualitative case study research moves forward alongside such traditions, focusing on how disciplinary literacy meets the demands of the 21st century learner. A simple question lies at its core: How do Disciplinary-literacy strategies increase student literacy growth and inform teacher instructional practices? Administrators, literacy specialists, teachers, researchers, politicians, parents, and other invested populations, both locally and globally, benefit greatly from the examination of practice and series of actions that will provide answers to this question.

Methodologically, this research was conducted as a qualitative case study. Additionally, the principal researcher sought to identify appropriate and useful methods for developing such a research plan through examination of Practitioner research, Narrative research, Self-studies, and Autobiographies. Commonalities between these methodological traditions include the focus on one's own practice and the emphasis placed on both narrative and self-reflective methodology. *The Art of Case Study Research* (Stake, 1995) and *The Action Research Dissertation* (Herr and Anderson, 2014) informs my research approach, along with examinations of the research strategies in relevant current literature.

Context

The purpose of this study was to develop a classroom culture rich in disciplinary literacy approach and strategy usage to observe the overall effect such practices have on the instructional environment and on individual student literacy growth. The principal researcher has no prior experience in framing lessons around these strategies, nor in recording observations during the implementation of a new strategy, and least of all in examining the learning of content through a disciplinary literacy theoretical lens.

However, this does not necessarily place the researcher in a disadvantageous position, as this research seeks to inform content-area teachers who might find themselves in a similarly trying new literacy strategies. In this instance, the researcher's inexperience may in fact provide valuable and relatable struggles for likeminded practitioners and perhaps engender encouragement for those who have faced or will face similar obstacles.

While it is plausible that some case study participants may have been exposed to one or more of the individual strategies being implemented in this study, given the emergent nature of the concept of DL within recognized literacy strategies the likelihood is that none of the participants have experienced such a comprehensive approach operationalizing these purposes. DL encourages the learning of content through student ownership and disciplinary apprenticeship. Without a clear instructional framework directing the utilization of these strategies as a tool for knowledge creation, literacy strategies can feel like an added task to be completed, unrelated to the actual task at hand, and disconnected from the goal of literacy being the vehicle in which knowledge is acquired. Romanticizing Disciplinary literacy strategy instruction as a "cure-all" is certainly not the aim of this case study, however the potential for DL to provide solutions to students failing to properly use literacy in class merits investigation.

The impetus for choosing this case centers on the opportunity for conducting initial research of disciplinary literacy strategies within a biology classroom. Gathering data regarding these strategies and the impact they have on student literacy growth provides insight as to whether DL instruction represents a transferrable model for student literacy development across the country and around the world. Locally, treatment results will be shared at the district level to inform the usefulness of DL strategies as an instructional

approach for supporting literacy growth. Positive data could merit the development of a district-wide literacy initiative, with a DL mindset at the forefront.

Globally, this research seeks to contribute to the validity of DL research that has previously taken place. According to Shanahan and Shanahan, (2012) DL emphasizes the way literacy is used within the various disciplines, the “how” and “why” terminology is created within a discipline, and whether disciplinary terminology or expert perspective is most important within a specific discipline. This study seeks to inform that discussion from the vantage point of the Biologist, requiring a very technical understanding of vocabulary founded in Greek and Latin roots, and a clinical and objective approach to the interpretation of text.

This case is recognized as being predominantly influenced by the emphasis placed on literacy growth by the No Child Left Behind (NCLB) Act of 2002. NCLB legislation required states to raise academic achievement levels for all students, including students with learning disabilities, traditionally low-performing students, and students of color (Simpson et al., 2004). Since enactment, the state legislature has continued to focus on how students develop literacy skills by advocating for the use of literacy strategies in all content areas. Over the last two decades since NCLB, culturally responsive, multicultural, and bilingual approaches to teaching literacy have largely been replaced by standardized curricula and pedagogy, pushing all other pedagogies out of the mainstream of instructional practices (Sleeter, 2011). Presently, school districts are promoting and often funding research into unique and effective methods for promoting student literacy growth in content area classrooms.

Research Design

This research was conducted as a qualitative case study. Stake (1995) describes case studies as “the study of the particularity and complexity of a single case”. Stake (1995) further describes case studies as specific and complex, requiring the researcher in the field to observe the episodic and nuanced nature of the workings of the case, and to record these occurrences dispassionately while simultaneously examining meaning and refining the research approach. This approach is further informed by Yin, (2013) who speaks to the case study approach including a cogent sequence, initial research questions, and a conclusive presentation of findings.

Positionality

Serving as the principal researcher positioned as an insider examining their own practice, it is important to briefly consider both the emic perspective of such a position, as well as identifying the personal biases, assumptions, and past experiences that could prove detrimental in impacting the validity and trustworthiness of the research. Chief among these is that as the teacher of record for these students, I am placed in a position of power over students and participants and must anticipate the negative impact this could have on the slant and quality of resultant research, findings, and participant interactions.

Ultimately, reliance upon intentional triangulation strategies will edify trustworthiness during data evaluation and will assuage prospective barriers to the validity of findings presented during the examination of this case.

Setting

This qualitative research study took place during the 2020-2021 school year, beginning roughly six months into the COVID-19 pandemic. Education in America (and the rest of the world for that matter) was scrambling to adjust to the “new normal”. States were responding to a multitude of considerations regarding the virus status in their areas. Districts were all over the map regarding their plans to respond to the virus and were tested in their organizational health and communication skills.

Still, the emphasis of providing quality instruction in the classroom and meeting federal accountability standards remained. STAAR testing was a huge area of focus in the state of Texas given that the prior year there were no tests administered, with the incoming freshmen in this study having missed four unique STAAR tests (Biology, English, History, Math). Another area of concern was how growing numbers of EL students would be supported and monitored during this challenging time. The biggest challenge of all this year was coming to terms with how much the COVID-19 virus would affect student and staff attendance and our ability to serve students.

This study was conducted in a high school classroom in an urban school district in Texas. A combination classroom and lab with 24 individual student desks in the front of the classroom and six four-seat lab tables in the back of the classroom served as the site of research. All treatments occurred within this environment, and an effort was made to include a variety of groupings to include individual, partner, and small group activities within the learning environment.

Pine Tree Independent School District

Established in 1847, Pine Tree Independent School District makes the short list of one of the oldest continuously operating districts in Texas, established only one year after Texas achieved statehood. Located in the northeast portion of the state, Pine Tree ISD serves the city of Longview, Texas and is one of three school districts that serve roughly 80,000 residents. Providing education to approximately 4,700 students the district boasts six distinct campuses consisting of a primary, elementary, intermediate, middle, junior high, and high school, several of which have been constructed within the last fifteen years. Approximately 650 full time staff members and 315 full time teachers work in the district.

PTISD is decidedly urban, with virtually all the campuses being surrounded by residential areas, facilitating many students walking to and from school. By virtue of being in “the rich side of town”, PTISD has served primarily white upper-class students and boasts a rich history of excellence and academic achievement. The high school was twice recognized as a National Blue-Ribbon campus in 1988-89 and 1992-93, in those days playing host to teachers and administrators from other districts around the state, modeling innovative instructional techniques and practices. During this time, Pine Tree ISD was viewed by many educators as one of the top school districts in the state.

In the last twenty years or so, the homes that were built surrounding many of the campuses aged, shifting both demographics and economic status of the students served by the district. Today, Hispanic, and White students are evenly represented at roughly thirty-five percent, while twenty-three percent of students are African American. Over

sixty percent of students are considered economically disadvantaged, and close to twenty percent of learners identified as English Learners.

This demographic shift, along with revamped state educational accountability measures challenged teachers instructionally and procedurally. In speaking with many employees who have spent their entire careers with the district, many educators struggled to adjust to this change, leading to much lower student achievement, increased classroom behavioral issues, and teacher dissatisfaction. However, with the hiring of the current superintendent three years ago PTISD is rebounding, and there is considerable optimism and improvement overall within the district.

Pine Tree High School

Located on a sprawling yet walkable campus reminiscent of an older community college, Pine Tree High School is home to roughly 1,300 students. The walkways and thoroughfares throughout campus are large and neatly adorned with azaleas and other various forms of landscaping. Mature pine trees extend skyward in courtyards and between buildings giving the campus a natural, open-air environment. A mixture of older buildings and new additions, the high school consists of nine corridors of classrooms (100-900 halls), a library, auditorium, cafeteria, and other expected facilities.

Participating in UIL as a 5A school, PTHS boasts a variety of athletic and academic programs, in some cases competing at the state level. Programs of note include a strong, state-recognized student leadership program, competitive online gaming teams, and an internationally acclaimed winter guard program. A robust CTE program offering training

in food services, medical, automotive, and city service occupations rounds out the school's offerings of extracurricular activities.

Piloted by an experienced principal, the campus environment has been generally well run and student focused over the last decade. Many unique challenges were faced following the outbreak of COVID-19, resulting in a departure from "normal" instruction for the 2020-2021 school year. Virtual instruction was offered to all students and resulted in roughly ten percent of students choosing this option. Classroom teachers, in addition to providing face-to-face classroom instruction, developed and maintained online curriculum via Google Classroom. Passing periods between classes were extended to ten minutes, allowing for teachers to disinfect and sanitize student desks and computers. Medical pre-screening forms and temperature checks were established for student athletes, and the mandatory wearing of masks was established to prevent the spread of the virus.

However, the impact the virus had on instruction has been undeniable. Students contracting the virus or determined to have been exposed to the virus were quarantined at home and required to participate virtually in classes until they were able to return. In the fall semester, prior to this research being conducted, one in three students participated in "short-term virtual learning" due to COVID-19, representing the apex of affected students during the school year.

Room 912

The 800/900 building is located on the very edge of the high school campus in a modern building positioned perpendicular to and butting up against the street. Constructed within

the last fifteen years, the building is stylized like what you might find on a college campus today. The hallways are wide and neutrally toned, with plenty of natural light coming in through walls of glass-paned windows in the stairwells or the connecting thoroughfare that leads to the rest of the older portion of campus. On one side there is a staff parking lot surrounded by a U-shaped student pick-up/drop-off point. On the other side, a practice field for the marching band. Somewhat attached and behind lies the cafeteria, band hall, and an attendance office. The rest of the buildings that make up the campus stretches out to the west and south.

The 900 hall is positioned directly above the 800 hall and consists of sixteen classrooms. Divided by a central staircase leading up from the ground floor, each “half” of the hallway contains eight classrooms and is bookended by staircases on each end. The particular “half” room 912 resides on is made up entirely of science labs. On the furthest end of the 900 halls, closest to the bookending staircase and the street, and furthest away from the rest of campus, you will find room 912.

Walking through the door located on the short end of a long rectangular shaped room, the first impression is that the room is quite large. The classroom is separated into two spaces: a traditional classroom area in the foreground, and a lab area in the back half of the room. The focal point of the classroom area begins along the short wall to the right of the entrance, which serves as the “front” of the room. A long whiteboard that spans most of the front wall gives way to a ceiling hung projector and screen angled forty-five degrees in the corner of the room. A portion of the whiteboard has been sectioned off and labeled “Learning Objectives” in colorful, patterned letters. Here, students find a bulleted daily itinerary written in dry erase marker. Twenty-four individual student desks directly

face the whiteboard and projector screen. The student desks are new; quality made with aluminum legs, neutral tops, and school-color blue seats. They are arranged precisely in six rows with four desks per row.

Providing separation between the student desks and the whiteboard lies the teacher desk area. A large, multi-height desk assists in defining a walkway for students running parallel along with the front row of student desks. A smaller desk and Chromebook cart dovetail into the teacher desk, creating a large L-shaped teacher workspace. The teacher workspace is simultaneously neat and stacked with books, notebooks, and papers. A nice, large computer monitor gives way to some knick-knacks, a density thermometer, framed family picture, a jar of colored pens and other office supplies. The far edge of the whiteboard leads to a doorway that connects to another classroom by way of a mutual office, storage room, and kitchen. Like the shared bathroom configuration of many college dormitories, each pair of classrooms feature adjoining spaces that are mirrored by another pair of classrooms on the other side of the hallway. This effectively creates a “quad” of classrooms, with two such “quads” per side of the hallway, or four of these in the 900 halls.

The classroom portion extends almost halfway towards the back of the room, where a transition from carpet to tile floor further demarcates the boundary of the two class spaces. On the long-left wall extending from the entrance hang two large bulletin boards, positioned directly above a countertop that runs toward the back of the room, undermounted with various cabinet drawers and doors. The bulletin boards feature student posters of varying topics, though they are clearly quality examples from that assignment. One board is adorned with the title “Biologists, assemble!” expressed

through the aforementioned colorful patterned letters, while the other features the title, “Vocab...?” each offering pops of color to the mostly bare neutral toned walls of the room.

On the counter below rests two turn-in trays labeled, “Handouts, Take One!”. Further along the counter towards the back of the room are two trays labeled with “Sanitized Passes” and “Used Passes” (a procedure developed because of the COVID-19 virus) which are accompanied by a restroom sign out sheet. Unbelievably, this day records that after Jennifer and before Daniel signed out, Batman, Spiderman, and Superman all had to use the restroom in succession.

The other long wall on the right side of the classroom features another shorter yet similar countertop and cabinet setup. Six turn-in trays, labeled by period, dominate most of the available counter space. Framing the turn-in trays to the left is an ornate bronze bowl filled with various pencils, pens, and highlighters for students to take as needed, a stack of individual student whiteboards, along with trays featuring notebook paper and copies of recent assignments for students to retrieve if they were absent.

To the right of the trays is the student resource center which features pencil sharpeners, scissors, three-hole punch, tape, post-it notes, etc. Above this station on the wall is a poster entitled, “10 Things that require zero talent”, which advocates such practices as “being on time” and “doing a little extra”. Mounted to the left is a similarly sized cork board, pin cushioned with a monthly calendar, and thank you letters and cards from students to the teacher. Further down the right wall, straddling the transition of floor materials that separates the spaces are two large windows that overview the band practice

field and the Junior High campus in the distance. These windows provide the only connection for students to the outside world.

The back half of the room is an attractive and neatly organized science lab. The space is defined by clean surfaces and straight lines, giving the familiar air of sterility and functionality. Six lab tables arranged in two rows of three provide a research space for twenty-four students. Each table is approximately eight feet long by three feet wide, covered in a sleek and durable black countertop, and comes equipped with four bar stools, numerous well-placed electrical outlets, and a double faucet sink on one end. On the other end of the tables stacks of vertical drawers provide storage for various lab equipment. A generous walkway divides the rows of lab tables.

Upper and lower cabinetry surround the side and back walls framing the lab space in a “U”, with the glass-paned upper cabinets revealing supplies and equipment that are labeled and organized. The black countertops on the left and right walls match the lab tables and are clean and empty save for a goggle sanitizer on the left and a sharps container on the right. On the wall in the area between the upper and lower cabinets normally reserved for backsplashes in kitchens, small color printed signs depicting the seven Army values (Loyalty, Duty, Respect, Selfless Service, Honor, Integrity, and Personal Courage) are spaced around the back half of the lab, utilized by the instructor to denote stations during certain learning activities.

Along the back wall of the room from left to right consists of an additional and rarely used classroom door, emergency eyewash and shower, a large sink, a vent hood, and large floor to ceiling cabinets that house various equipment. A circular wall clock hangs

centered high on the back wall. Bright LED fluorescent tube lighting illuminates the room arranged in four rows of six light fixtures deep. In all, the classroom area projects a sense of organization and lends the impression of being simplistically designed for structured student behavior. The lab is modern and clean, if not minimalistic and a bit boring. Students must certainly feel the weight of institutionalization in such an environment, while at the same time reaping the benefits of a state-of-the-art science classroom.

Participants

Participants in this study represent a convenience sample. Research participants included twenty-nine out of a possible one-hundred and four ninth-grade students taught by the principal researcher. Participants represented a small percentage of each class out of my five Pre-AP Biology classes. Six male students and twenty-three female students from various economic and cultural backgrounds made up the participant group.

Procedures

This study consisted of implementing and recording data on twelve disciplinary literacy lessons, with instructional strategies equally represented and falling in four distinct categories: DL reading, DL writing, DL thinking, and DL speaking. Representative strategies for each category were selected based on ease of implementation, perceived student impact, usefulness regarding best practices in disciplinary literacy instruction, and alignment with curriculum. Length of instruction/participation ranged from twenty minutes to ninety-five minutes, depending upon the strategy being utilized. Methods of data collection included a practitioner reflective journal, classroom observations, post-instruction student short-answer responses (exit tickets), and student work samples.

Data Collection and Instrumentation

Before, during, and after teaching I provided myself with a variety of data collection methods to record my thoughts in. I kept a handwritten journal, an opened tab on my computer screen with an online version of a reflective journal, and my phone handy to dictate notes throughout the day. I felt that having multiple ways of recording my reflections was important as it allowed me to capture ideas the moment that inspiration came.

Before the lesson, I anticipated how things might go, reviewed my plans, double checked supplies and equipment needed for a lesson or lab, ensured I had the student welcome slide and lesson objectives posted, and prepared my teaching materials and resources. Throughout the lesson, I reflected on my effectiveness, observed student engagement, considered the types of student questions I was receiving, and the quality of their work. I would also consider how what I was seeing might impact future lessons within the unit as well.

During and after the lesson, I would write down thoughts and concerns, ideas for future lessons, anecdotes I found interesting, and other various forms of data. Sometimes these thoughts never made it on paper, and I would remember them as I replayed the lesson in my mind later along with my reflective journal. I would try my best to set aside time to reflect as soon as possible following a lesson, during my next conference period, after school, during my evening drive home, or on a rare occasion, several days or even weeks later. Self-reflection of the lesson's implementation, along with evaluation of the pertinent data streams represented the end of the data collection process for a lesson.

Instruments in this study included a metacognitive awareness inventory (MAI), DL classroom observation form, and student response forms. A metacognitive awareness inventory was given to students only two times during research, once before any treatments were applied to the participants, and once after the entirety of the disciplinary literacy lessons were concluded. The inventory was included in this research to examine the extent an individual student's metacognitive awareness increased throughout the research. Cross comparison with individual and group participant data was examined for potential evidence that might promote metacognitive awareness as a precursor or companion to quality disciplinary literacy instruction.

A classroom observation form was created for the purpose of examining to what degree student lessons represent disciplinary literacy instruction. Essentially, the higher the observed score, the more interaction and proficiency demonstrated in DL strategies during that lesson. This classroom observation form was derived from a pre-instruction checklist created by Dr. Timothy Shanahan, which identified the alignment of a proposed lesson with major tenets of disciplinary literacy instruction. This form was designed to identify and evaluate disciplinary literacy strategies in a lesson, determine their effectiveness, and evaluate student participation during their use.

Twelve DL "Lessons" were examined during instruction as to their alignment with the form and observations were conducted. Following the lessons, the instructor recorded the scores for each category to understand areas of focus and strengths/weaknesses for each of the lessons. These observation forms were and can be used to provide a framework for how DL treatments compare with other forms of classroom instruction, providing context and a resource for comparative analysis.

Exit tickets were collected and analyzed over the duration of the study. Students voiced opinions of disciplinary literacy activities, considered their effectiveness, and provided a broad view of how students feel about literacy activities, student perception of their literacy abilities and teacher effectiveness. All written responses were collected immediately following lessons; responses were coded, categorized, and grouped by theme. Participants were assigned a random, gender-appropriate pseudonym to preserve anonymity of students.

Anecdotal data in the form of reflective journaling by the principal researcher was used to inform teacher practices and further develop findings obtained through other data collection sources. Journal entries reflect thoughts, observations, ideas, and general pertinent information observed by the principal researcher during the DL lesson.

Additional time reflecting on strategies was conducted at the next convenient opportunity to ensure sufficient examination of each of the twelve treatments. Whether positive or negative, reflections included examination of DL strategy fit to curriculum, teacher strategy explanation and modeling, teacher and student strategy implementation, student participation and engagement, student demeanor, and the sophistication of student DL work.

During research, it became evident that teacher and student created texts were emerging as a potential data stream that could inform the research question, so those were collected, coded, and analyzed as well. Additional considerations included perceived hindrances in accessing content, appropriate scaffolds, differentiation opportunities, and potential outliers to observed data collected. These methods supported understanding how DL strategies benefit student literacy growth and in what ways they inform teacher

instructional practices.

The research process was conducted during the spring semester of 2021, and only following IRB approval from the University of Houston obtained in the winter of 2020. Data was grouped according to whether they addressed primarily disciplinary reading, writing, thinking, or communicating. Data was collected, organized, and analyzed categorically based on the focal point of each disciplinary literacy strategy presented. Furthermore, classroom observational data, reflective journals, student responses, and student work samples were analyzed for connections with specific DL strategies and were also examined independently to allow themes to emerge. Lastly, all resultant data was examined to determine how specific strategies supported culturally responsive pedagogy in the classroom.

Disciplinary Literacy strategies were presented to all the students I had on record. However, *only* participant work samples and exit-tickets were included in the data analysis section of this research. Again, participants were given a gender-appropriate pseudonym to protect their identity when directly referred to in the research regarding either a work sample, exit-ticket, or a comment or question described in the teacher's reflection or analysis. An example of a *participant* response might be "Sonja began writing at once...". Additionally, student work samples or images of their work/ exit-tickets will have their assigned pseudonym covering their actual name.

It is important to note that non-participants received an identical classroom experience to participants. They also submitted work samples and completed exit-tickets, however their samples were not directly referenced or included in this research. The purpose of gathering data from these students was primarily to paint a clearer picture of how these

strategies affected a larger number of students, and to provide supporting data relative to the participant data being collected. While there are some examples of non-participant data being used to elaborate on research themes, the primary focus is on participant data. For example, non-participant data might be presented in the following manner: “Several students demonstrated that...” or “One student commented that”.

Assessments

The purpose of this research was to examine the use of strategies and how they affect student literacy growth and teacher instructional practices. During the research, various formative and summative assessments were used throughout the semester to determine student mastery of concepts. Some of the DL strategies conducted in class served the function of assessing mastery of a concept and were included in the analysis phase, such as work samples and exit-tickets. However, larger unit assessments and other summative assessments were not analyzed to determine the impact of DL strategies.

The omission of assessment analysis was intended to keep the focus on the strategies themselves and to streamline the scope of the research. Given the variety of factors that could influence student assessment performance, the isolation and determination of specific instances where increased performance directly correlated with DL strategy usage proved extremely difficult. A broader approach of examining student literacy progression and skill development through examples and unique instances was selected to ascribe value to student growth, as opposed to raw test score data. An overview of testing procedures is provided below for clarity in understanding teacher instructional practices.

Unit tests were created and reviewed by the Biology Team. We reviewed the test from the previous year in its entirety, discussing and modifying it if necessary. Discussions were held regarding how students would demonstrate mastery through answering a question correctly. Most corrections included changes of sentence structure for clarity, refinement of answer choices to elicit student understanding more clearly, or the addition or removal of a diagram/table/graph.

Unit tests were administered as close as possible to the pacing guide. Students were allowed an entire block class (90 minutes) to take the test. Typically following the test administration 30-45 minutes of class remained either for test corrections or an introduction to the next unit. Unit tests were scored and entered the grade book on the same day. Student results on unit tests were subsequently examined to determine overall student proficiency, questions that students did poorly on, and areas needing improvement and focus during STAAR prep.

Trustworthiness, Bias, and Replicability

This study was conducted with clear consideration regarding perceived obstacles to trustworthiness, bias, and replicability. The search for appropriate validation strategies began with an examination of the principal investigator's position as the teacher-of-record for the class in which participants were gathered. Given that the principal researcher innately occupies a position of power over the grading of participants, careful actions were taken to demonstrate awareness and intentionality concerning the planning and approach of potential treatments and how they might oppress or influence students, regardless of what data might emerge. Opportunities to incorporate participant voice and

choice were embedded in each treatment, and participant responses were carefully evaluated and necessary adjustments to the research approach were made.

These treatments were intentionally conducted and presented from the perspective of a teacher attempting to implement unfamiliar strategies as a novice for the first time. The goal in doing so was to establish replicability and generalizability to the study, and to encourage other educational practitioners to follow this approach with little-to-no pre-requisite experience. Provided the cross-curricular nature of disciplinary literacy as an instructional strategy, such a template can be followed readily with transferable data that remains applicable in most instructional environments. Additional validation strategies such as the inclusion of the triangulation of evidence and data, appropriate search for occurrences of disconfirmation, and the generation of rich descriptions further edify both the position of the researcher and the validity of findings. Participants ranged in age from 13-17 years of age and were 9th grade pre-advanced placement students. A collaborative relationship was sought out and developed to facilitate potential suggestions and specific feedback regarding research.

Representation of Findings

All data sources were evaluated based on how they improved student literacy growth and informed teacher practices. From those data streams three unique themes emerged.

Pertinent data was color coded and grouped into categories. Student work samples and interim texts were analyzed to determine student success in using each strategy. The role of metacognition in supporting DL reading, writing, thinking, and communicating was investigated.

Care was taken to clearly identify how the use of DL strategies might inform educator instructional practices. Teacher reflective journals, classroom observation forms, and interim texts were analyzed to identify areas of interest in teaching practice and the implementation of lessons. Visual texts, such as figures, charts, and graphs, were created to help edify and clarify data interpretation. Rich descriptions of students, teacher approach, classroom experiences, and findings were written, connections examined, and potential implications for future research discussed.

Chapter IV

Analysis and Findings

What Makes This Research Unique?

The rarity of disciplinary literacy strategies that was unearthed in this research is the transferability of DL across a variety of disciplines and purposes. These lessons are structured so students can; 1.) think about the task being given, 2.) perform the task, and 3.) reflect on their performance. Essentially, they are practicing modeled internal analysis of a process and considering the results of such a process *regardless of the content being studied*. Engaging in such practices translates to a variety of workplaces and will aid them in developing preparedness and analytical skills for life.

DL lessons acted as an increasingly familiar vehicle for students to practice using while learning content, with students benefitting greatly from increased use. Both the instructor and the participants became very aware of the potential of these strategies to be successfully used not only in Math, History, and English, but also in Art, Welding, and Athletics. This unfolded into revelation that there are multiple ways that disciplines interconnected with our learning of Biology. It was students that first realized DL lessons were also transdisciplinary in nature.

The practical application of having students practice literacy skills as a way of learning content speaks to the strategies' interest to proponents of culturally responsive teaching. Students are receiving time-on-task in doing the work of developing literacy skills daily.

Students are also speaking, reading, and writing using discipline-specific vocabulary, a testament to their usefulness for targeting EL student populations.

As I present my analysis and findings my hope is that you would focus on the uniqueness of this research. I tried to highlight the stories of the participants and place the significance of their individual experiences at the forefront. Broad strokes were used in data analysis and presentation to support and inform observational data, not define it. I wanted to show the interconnectivity of the emergent themes and turn the eye of the reader to the significant, the normal, and of course, the *unique*.

Participants

The invitation to participate in this research was presented to one hundred and four students enrolled in the principal researchers' pre-advanced placement courses on February 1st and 2nd, following IRB approval. This invitation consisted of a cover letter explaining the research, a parental consent form, and a student assent form. Twenty-nine out of a possible one hundred and four participants formally enrolled in the research. This clearly represented a convenience sample, and as a result consideration must be given regarding the validity and replicability of this study.

Participant Demographics

Of the twenty-nine research participants, there were twenty-one female students and eight male students. Within the female participant population, eight were Caucasian, five were African American, six were Hispanic, and two were Mixed race (two or more). Within the male participant population, four were Caucasian, two were African American, one was Hispanic, and one was Asian (Middle East). Fourteen were classified as being Gifted and Talented or GT students. Three were classified as being English Learners or EL's.

Two were classified as being dyslexic. One student was known to be on the Autism spectrum.

The Researcher

As the sole investigative researcher conducting this study, allow me the opportunity to introduce myself. I am a thirty-seven-year-old husband and father of two young children. I entered the field of education later than most at thirty years old, following military service in the United States Army and attending University and receiving a bachelor's degree in Life Sciences in 2013. I taught high school Biology for one year upon completing my undergraduate, and after an eighteen-month hiatus from education for personal reasons returned to teach eighth grade science for three years. During this time, I went back to school and completed my master's degree in Educational Administration in 2016, writing a thesis paper on the use of manipulatives in improving vocabulary retention in Science. Early on I identified the sheer amount of scientific vocabulary that students must master to be successful within Biology. This research ignited my interest in the use of instructional strategies to assist students in meeting the demands of coursework within content areas.

The following year I was presented with a unique opportunity to create a pseudo-military leadership elective at the junior high level like JROTC at the high school level. Although this process was very enjoyable it did not offer much in the way of continuing my research interests. I also began the pursuit of a doctorate degree in Educational Leadership with a Literacy emphasis and knew that I wanted to continue my investigation of student learning practices in science. After the 2019-2020 school year was abbreviated by the COVID-19 pandemic I applied and was hired to teach high school Biology at Pine

Tree ISD. I would also serve as a cross country and basketball coach during the 2020-2021 school year.

During my coursework I came across the concept of disciplinary literacy and knew immediately that I wanted to conduct my dissertation research on this topic. I spent much of the fall semester of 2020 developing my understanding of the various disciplinary literacy strategies and designing the study for spring. While I would consider myself an educator who is knowledgeable in their subject matter, I would rate myself as a novice at implementing literacy strategies in my classroom. This made the prospect of conducting this type of research appealing as it provides an example for educators to mirror as they strive to improve their own practices.

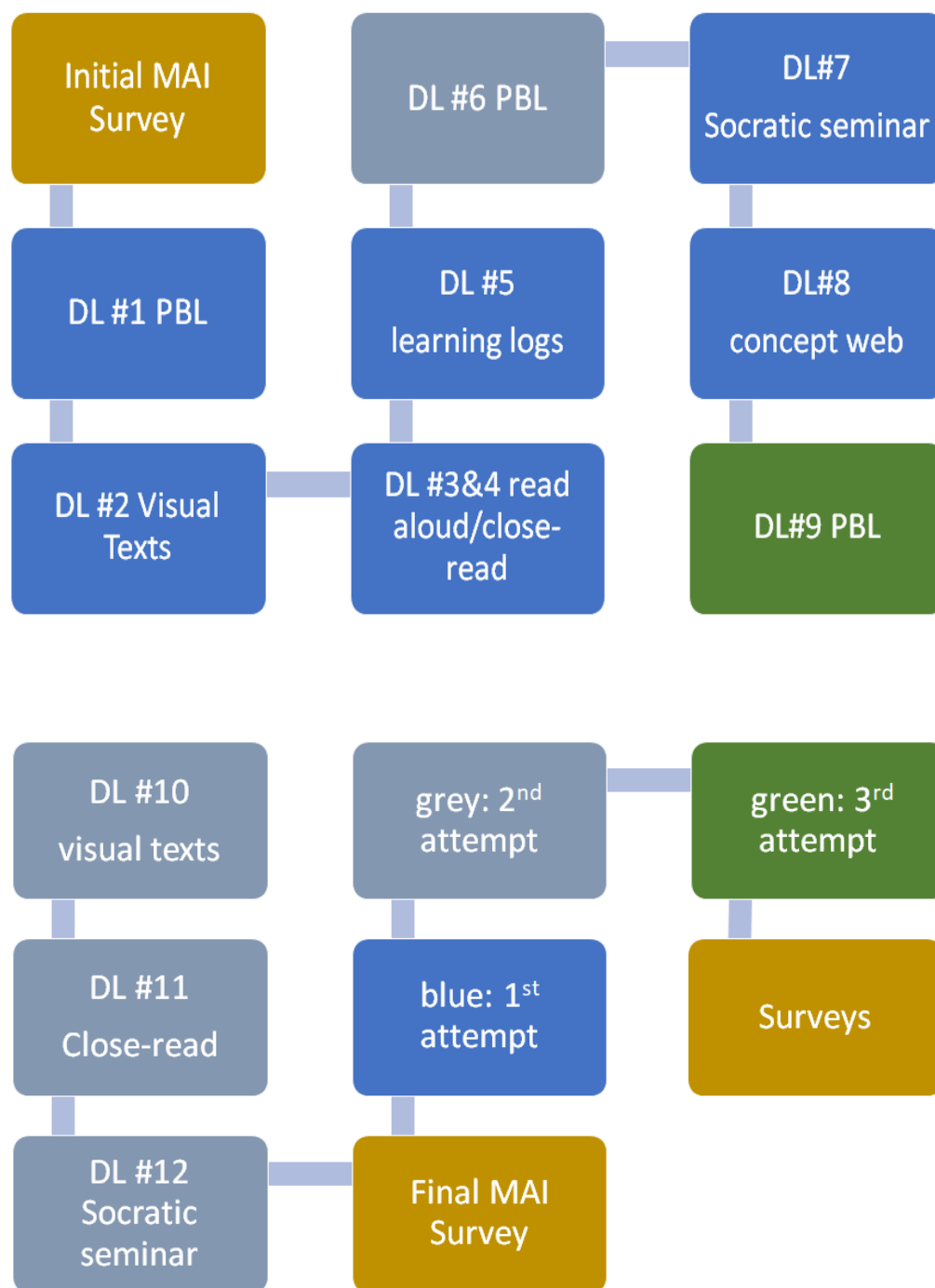
Prior to this study, I would characterize my instructional approach as student-centered and designed around experiential learning. Inquiry-based labs, collaborative activities, and some project-based learning assignments dominated many of my lessons. I purposefully have tried to limit the amount of direct instruction, while certainly necessary in any subject, to twenty-minute blocks of time, and to vary the mode of presentation to keep interest and focused participation high, i.e., slideshow lecture, color notes, etc. My goal was to integrate these strategies seamlessly into my normal instructional approach and to adjust moving forward as I received feedback from my students and reflected on my teaching practices.

Research Overview

This case study was designed to examine my instructional practices, student behavior, and student work samples of DL lessons over the course of thirteen weeks. I wanted to evaluate two main areas within my practice; How disciplinary literacy strategies would

have an *impact on student literacy growth* and how the implementation of these strategies might *inform my practices as a teacher*. My initial plan and research timeline was created in November of 2020, and the research was conducted from January 2021 through May 2021.

During the research timeline, I intended to present a new disciplinary literacy strategy each week, creating a continuous stream of DL lessons. I was to present students with twelve DL lessons throughout the spring semester, (one per week not counting spring break) equally divided amongst four domains; reading, writing, thinking, and communicating. Additionally, a metacognitive awareness index (MAI) would be administered prior to the DL strategies being used and following all strategies implemented during the research to determine if there was a correlation between Disciplinary Literacy strategy usage and student metacognitive development. The following represents an overview of each treatment provided in the order it was implemented in the study.

Figure 1*DL Lesson Implementation Plan*

The visual text was created to provide reader clarity. It was color coded to represent the number of times a strategy was attempted and the order in which the research occurred (note the number of PBL attempts). The final four squares represent the key.

My plan changed over the course of the research for two main reasons. First, I had failed to consider how having a two-week STAAR test review period and a week of actual STAAR testing would impact my research. Rather than attempt to “force” a DL strategy into the review period instead I only implemented one strategy where it logically fit.

Another unanticipated adjustment came when I spent most of one week out of school due to a death in the family. During these weeks I did not conduct any research

Whether or not these changes negatively impacted my research is unclear. However, it is important to note that as a result I was not able to achieve my goal of having a new strategy every single week for twelve weeks. Additionally, these changes pushed my research timeline later into the year, with the final strategy being administered during the last week of the school year. Conventional thought would say that students may have been checked out mentally at this point, and there was some evidence in the classroom to support that point.

While each of the Disciplinary literacy strategies can be divided amongst the domains of reading, writing, thinking, and communicating, it can be argued that many of these strategies blur the lines between them or in fact represent all the domains simultaneously. Grouping these strategies was done for the purpose of identifying perhaps the primary and secondary modes of student interaction, rather than being the focal point of the research. Each lesson was not intended to exist in a vacuum. One of the goals of the

research was to create a disciplinary literacy culture, with the focus being on the *collective impact* on the learning environment.

I wanted to insert DL strategies at logical moments throughout the semester where they made sense in the pacing of a particular unit of study. Where the class was within a unit and whether the DL strategy would serve as an anticipatory set, the focus of the lesson, or as a comprehensive review was another primary consideration. Additional thought was given to how students were engaging in learning and how that mode of interaction supported their acquisition of the content.

Ultimately, I felt that I did the best I could given my level of experience. My focus was on improving student learning and framing their experience to promote content *and* literacy growth. I was confident that all students would receive at least some level of benefit throughout the research. Additionally, with students being provided opportunities to engage with the content in multiple ways I was excited to see how these DL strategies might help take my teaching practice to the next level.

Integration of DL Lessons

The following details the initial stages of my lesson planning process and how DL strategies were integrated into the lesson plans. My approach began by previewing the upcoming unit and considering as many possible factors as possible that might impact my instruction and student ability to meet the cognitive demands of a particular lesson. The time required to properly cover the unit, relevant TEKS (Texas Essential Knowledge & Skills), required resources, and anticipated student misconceptions were initial considerations. The amount of time necessary to devote to a particular TEK relative to the likelihood that students would see questions over this section on the STAAR test also

played a large role in determining how lessons were paced and presented. After all, the biology team represented the only STAAR tested subject in high school, and as such, had a certain level of responsibility in preparing our students effectively for success.

I worked with the “Biology team”, which consisted of myself, our department head and one other teacher. Each of us looked at the YAG (Year-at-A-Glance), our pacing guide (weekly lesson plan for the year, compared resources, and began initial lesson-planning together. Traditionally, we would plan for each unit of material, with the purpose of conducting a unit test as a formative assessment upon completion of the lessons in that unit. However, once this general plan was established each of us were free to create lessons as we saw fit. While we do share common resources, labs, assessments, projects, and other materials, for the most part we taught the content in different ways that reflected our own instructional preferences.

From this point I would generally look at the resources I had available and create a “roadmap” that walks students along a logical learning path for students to be able to achieve the expectations. I tried to envision the specific areas where a student might derail from the progression of knowledge being presented to them. For areas of perceived weakness, I searched for required background knowledge they should have received, adjusted instruction with scaffolding or differentiation opportunities, and allowed for extra instructional time. When planning for material I believed students would easily manage, I looked for ways to elevate the level of difficulty in how students engage with the content (moving from fill-in-the-blank to student discussion, for instance) what technology skills or other abilities could be introduced, or how I might increase the level of rigor.

Once a particular unit was planned out, I would then begin searching for ideal locations to insert DL strategies into the pacing of that unit. The following bulleted notes are taken directly from my reflective journal as I was thinking and writing out how I would implement Lesson #5 (Learning Log):

LESSON #5 Differentiated Learning Log

- Lesson Planning reflections: This treatment is hard for me to figure out how to integrate into a particular lesson, because I feel that the strategy works with any subject matter. I want to find a good video that explains the concept and shows examples because I feel that this would be a good opportunity to take the focus away from me as the teacher and place control of their learning on them as individuals. My goal is to help them make sense of the video by making a learning log about the learning log video (next level)!
- As their guide on the side, I will assist them in understanding the process, help them make sense of what learning logs are and what they look like after they attempt their own, and model/show them what mine looks like.
- I want to provide students with as much choice as possible and reward all efforts to move in this direction (I'm thinking of my low effort/low writing skill students) so one-on-one assistance and scaffolding will be used here. I am thinking about having three tiers of options for students to choose from: (Low-level: A 3-2-1 reflection, Mid-level: A T-chart with experience/sensemaking, and a Top-level fully student independent version). I will allow them to choose whichever level they want, however, after two weeks on a level they must progress to the next level.

- I want to allow them to choose their own format, digital or paper. I also want to allow them to determine their frequency of use, challenging them to use them as much or as little (in this class and others) as they choose (minimum once a week).
- I want to use this strategy for the rest of the semester (*so, I need to plan out at least 1-2 opportunities per week to do so!*) and believe that it will help my students to process information and formalize their questioning for upcoming class discussions.
- Perhaps I can post top examples in the classroom or on google classroom or *I can allow peers a chance to review each other's work and provide feedback*
- I anticipate running into resistance from about half of each class based on what I have seen so far. Early on I will be intentional about how I am moving students through this process and what specifically I am saying that might elicit a negative reaction from students.
- I will create a breakdown of this assignment in google classroom so that students can review when necessary. I feel this will help those students who were struggling to start/complete the assignments. I will also post the video in that same week so that they can go back and rewatch it, as necessary.
- Additionally, I need to create Low-level 3-2-1 and Mid-level T-Chart templates in Google classroom for students who are just stuck in getting started. Students can only stay at a level (beginner or intermediate) for two weeks until they move to the next level. This will allow them process differentiation to their level of comfort but ensure that they are being scaffolded toward more difficult tasks and not just choosing the easiest option. To be fair, during the busiest times of the year, I condensed this process. Other times, I spent multiple weeks wrestling with a certain strategy. When attempting to implement

Socratic seminars for the first time I struggled and spent a large amount of time on how best to attempt this strategy. Regardless of how easily the process came to me, the process was always the same. The following represents the general outline when it came to conducting each disciplinary literacy lesson:

DL Lesson Analysis Process

1. DL treatment researched and integrated into pacing of lesson plans.
2. DL treatment materials created and prepared for the lesson.
3. Treatment implemented, during which the instructor reflectively journaled and collected data.
4. Following DL treatment, Student Exit-ticket and work samples collected.
5. Analysis and reflection of teacher and student data streams.

The amount of prep work prior to an assignment could potentially be much shorter or much longer depending on how little experience I had with the strategy. Lesson #8 (Concept Map) was much easier for me personally than many others. Oftentimes, my process of planning happened very quickly and then stalled out over the next few days. Thinking through the student experience, their perspective, and which areas students might excel, or struggle was a process that took place before solidifying my approach. Once I felt that I had solidified it, I created and/or gathered the resources needed, stored them until needed, and returned to reflecting on the lesson a day or two prior to teaching it.

This process often helped me identify some inadequacies in my initial approach and I would adjust them at this stage. Identifying procedures ahead of time that I might need to

put in place for the lesson or transitions between components of the lesson helped the flow of the class immensely. Often during instruction, I would recognize my shortcomings and misconceptions during the first or second class and adjust.

I focused on managing the flow of the lesson, asking students questions, providing clarity, and reflectively journaling, and completing the classroom observation form while the students were attempting the DL strategy. During and after, I would ensure that student work samples and exit tickets were collected and archived. Immediate reflective journaling took place after the lesson, if possible. Later, student work and exit-tickets were examined for the connectivity of their responses, examples of student literacy growth, and how they might inform teaching practices.

It is also important to note that each DL strategy resulted in a unique classroom experience for both the students and me. Some of these experiences resulted in several pages of detailed teacher reflection, while others provided very little interesting data. On some occasions, the student work samples and data collected required a significant time investment to examine. However, this was not always the case. The quality and quantity of data streams varied from strategy to strategy and even from class to class.

Descriptions of DL Lessons

Full descriptions of each of the strategies used in this study are available as a stand-alone document in the *Appendices* section:

Emergent Themes

Following implementation of all lessons and the collection and analysis of all student and teacher data streams, three unique themes emerged. Student literacy growth and teacher practices were both influenced by the amount of engagement in the classroom, the social

interactions taking place during the lesson, and the practices of thinking metacognitively before, during, and after the DL strategy was implemented. Each theme was broken down using a combination of analysis of data derived from DL lessons and the recounting of the classroom experiences themselves. Researcher conclusions and theories were examined considering current research and are grounded alongside supporting cases.

The Student-Teacher Engagement Continuum

“Look...if you had... one shot... one opportunity... to seize everything you ever wanted... in one moment... would you capture it? Or just let it slip.”

-Eminem, *“Lose Yourself”*

“You can drag my body to school, but my spirit refuses to go.”

-Bill Watterson, *The Essential Calvin and Hobbes*

The Role of Student Engagement

Imagine the most intelligent, positive, affluent, and dedicated student that could exist in the world today. Picture how that student might arrive for class. Organized and prepared, focused, and introspective. Their responses to questions are thoughtful and rich in disciplinary vocabulary. Their coursework meticulously pored over and full of creative and analytical thinking. Such a student would likely be skilled at an instrument or participate in many extracurricular and academic activities. It would also be reasonable that they have a network of support and resources that they could draw from.

Now imagine the student in the world that would represent the opposite. What kind of challenges would they face? How engaged in the learning process are they? How large of a gulf separates this student's coursework from the previous example? Do they face unsafe living conditions, abuse, neglect, poverty, or all the above? Do they lack the basic skills to interact with the task set before them?

It is important to preface any discussion on student engagement and the successes and failures of certain strategies with the understanding that somewhere along this broad spectrum, or continuum, lies every student in your class. While the intent is to remain focused on student engagement during DL strategies and how they impact student literacy growth, many other factors influence a student's willingness to engage in a lesson. Socio-economic status, stability in the home, race, English proficiency, educational background, intellect, trauma, and many others bear consideration. While some of these barriers to engagement can be mitigated through teacher understanding, product differentiation, and an increase of teacher assistance and support, they cannot be completely remedied. These are all pieces of the puzzle when it comes to helping every student reach their full potential and the acknowledgement of such barriers helps provide an appropriate lens in which to view research data.

Early on, I knew that I wanted to examine the engagement levels of students during these "new disciplinary literacy lessons" that my students would be attempting. Boekaerts (2016) broadly defines student engagement as a student's participation and active involvement in school learning, consisting of all student reactions and interactions with the learning material. As an experienced teacher this seemed like a fair definition, however I would place an emphasis on "active involvement". If you have ever been in a

conversation with someone who is texting on their phone instead of listening to you speak then you know what it is like to teach a student who is not actively involved in the learning process.

With such experiences in mind, I felt that student engagement was critically important in determining how DL strategies would impact student literacy growth. Initial expectations were that overall student engagement would fluctuate wildly depending upon the DL strategy, the individual student, and the length of time students remain on task. Most of the data collected related to student engagement came from my own reflective journaling. I would often write down a “snapshot” of the engagement levels I observed in the classroom as students were attempting a DL lesson. I tried to provide a basic breakdown of the behaviors I observed and the total number of students in class who were on task. Here is an example of a student engagement snapshot from DL #3&4 (read aloud/close read):

- 20 minutes into the task, and 0 out of 16 students are on their phones. All engaged with disciplinary texts!

It is important to note that I did not take a student engagement snapshot in every class for every DL lesson, but rather did so until I felt I understood the general engagement level for that strategy across all my students. During some lessons, the level of student engagement fluctuated wildly from class to class. When I noticed this, I did my best to take note. This student engagement snapshot was taken from the class period immediately following the previous example:

- Approximately 5 out of 16 were on their phones the entire time. One student was watching anime on his phone with earbuds in. When I walked by, he did not respond at all. After 15 minutes, sidebar conversations are opening throughout the room.

Other times, I also attempted to capture a sense of what the engagement level was for all the students in a particular class. Here is an example of such a snapshot:

- On a scale of 1-5, with one being minimal effort and five being maximum effort, I would say that six students would be “1” or the lowest, six would be a “3” or middle, and four would be a “5” or maximum engagement.

Occasionally I would write down specific behaviors I observed, both positive and negative, to provide further context regarding how students were engaged. If students were mentioned their behaviors were different from the rest of the class, whom I considered somewhat successfully engaged in the learning task and required no mention in my journal. Here is an example of a positive engagement instance, followed by a negative engagement instance:

- Four students seem to be really embracing the activity. They are locked in and engaged in the discussion of the text.
- Only 5 students out of 16 appear to still be engaged with the assignment. Seven students were on their phones, one person had highlighters stuck to their fingers, one had their head on the desk, one had wandered to the back of the lab to play with water in the sink, one had a different book out reading. (10 total off task)

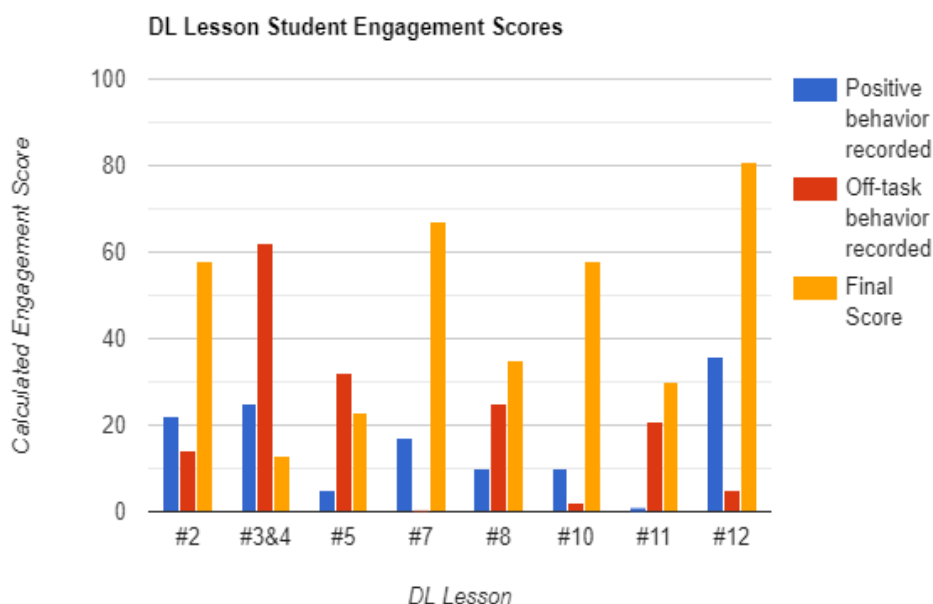
Recording these student engagement snapshots of DL lessons throughout the research period provided me with a sense of how the level of student engagement varied based on

each DL lesson. In retrospect, one of my shortcomings was that I did not standardize my data collection methods regarding the examination of student engagement across all DL lessons. Doing so would have allowed me a much greater level of clarity with respect to how students were engaging with these lessons.

I would return to my reflective journal following instruction, re-read all my notes, and count the *number of instances* where students were displaying *off-task behaviors*. An off-task behavior was characterized as any behavior in which a student was not actively engaged in the learning process. This was much easier to manage than collecting all the comments referencing positive student engagement, as students were typically focused and engaged on the task at hand. I did however record the number of instances of exceptionally *positive engagement behaviors*, which were simply classified as those that I had taken the time to highlight in my journal. Given my limited total data, I thought it would provide contrast against the negative behaviors I observed and bring a better overall understanding of the quality of engagement in each DL lesson.

I would like to mention that I did not include instances in which students got a delayed start to an activity as an “off-task behavior” unless it was more than five to ten minutes later than the rest of class. I also did not include instances in which students were struggling in understanding the task but were engaged despite having little resultant work to show for it. If a student or group finished a task early, I did not count it as an off-task behavior unless they were done far too early to be considered successful, or if I made a note that they did not produce a quality product.

I cross-referenced data from my reflective journal with classroom observation forms, the quality of student work samples, and student exit-tickets to evaluate the engagement level for a particular DL lesson. This served to confirm the data pulled from my reflective journal, however I did not move the engagement score for a DL lesson more than a few points in either direction as a result. Following aggregation of all student engagement data, I created a point system to rank the twelve DL lessons from highest observed student engagement to lowest. DL lessons were given an initial baseline score of “50”. For each off-task behavior I recorded in my reflective journal, I counted “one point” *against* the overall score. Likewise, each instance of positive engagement behavior counted as “one point” that would be *added* to the overall score. DL #1, #6, and #9 had insufficient data present to provide them with a score. DL lesson #1 (PBL) was completed mostly outside of the classroom, and the reflective journal for DL #6 (PBL) and #9 (PBL) did not contain any data involving student engagement. The following figure illustrates the student engagement score for remaining DL lessons.

Figure 2*DL Student Engagement Scores*

As you can see, throughout this research, there were many instances of significantly high and low student engagement, often within the same DL lesson. The two lessons with the highest engagement scores were DL # 7 and DL #12, both of which were Socratic seminars. I attribute this primarily to increased student interest in the discussion topics and the fact that there was no formal “assessment” of their learning required, meaning that they did not have to produce a final product, only participate in the discussion of the topic. Notice that both the number of positive engagement behaviors and the total engagement score for the lesson increased the second time the strategy was implemented DL #12. In fact, DL #12 had the greatest number of positive engagement instances recorded throughout the research with thirty-six.

The two with the lowest engagement scores were DL lesson#3&4 (read aloud/close read), and DL #5 (learning logs). I believe this may be since both had the highest reading and writing requirements of any lesson. The lesson containing the greatest number of off-task behaviors recorded was by far DL #3&4, with sixty-two instances recorded, most related to DL #4 (close-read). However, during their second attempt at a close-read in DL #11, the number of off-task behaviors greatly decreased. I would suggest that this is a result of having experience in completing the task, as well as having completed a significant number of DL lessons at that point in the research.

At different times throughout the research period student engagement responses to DL strategies ranged from mild intrigue to palpable excitement, to abject despair and avoidance. My intent is to show the range of these responses through the sharing of their classroom experiences to show how their level of engagement impacted a student's ability to develop literacy skills. A brief study of supporting literature will follow the investigation of some of the more seminal examples of student and teacher engagement from the research.

Let us begin with the positive. Content differentiation, or the ability for students to choose what topic they use to learn a concept, created some of the highest levels of engagement I observed in class. The following example shows student response to being allowed creativity and freedom as a decisionmaker in the learning process. This dialogue took place during DL #10 (visual texts). Students were tasked with creating a dichotomous key using variables from present-day culture:

Rachel: “Wait a minute, so we can pick, like, whatever we want to do this over? Like ANYTHING?”

Female Student: “Ooh, we could do characters from a show... like VAMPIRE DIARIES!”

Rachel: “Or TEEN WOLF! That would be kinda hard though...”

Female Student: “Ok, what can we use for the dichotomous key that would be easy...”

Rachel: “OMG, we could make it using HOT GUYS! DYLAN O’BRIEN! SEBASTIAN STAN!”

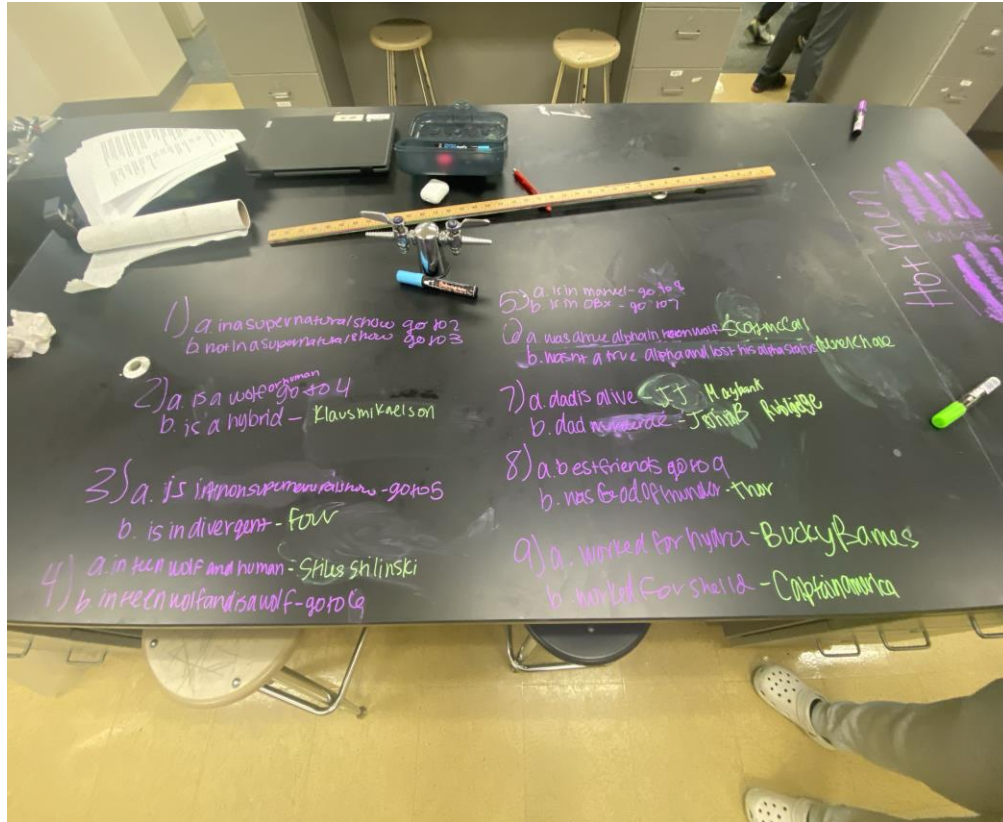
Both: “!@%\$*&!!!!” (Unintelligible shrieking and squealing)

Rachel: We are DEFINITELY DOING THIS!!

The text here, as it often can, fails to do justice to the excitement level exhibited by these girls. They were jumping up and down, giggling, smiling, and eagerly setting about their work. Because their interest in their chosen topic was so high, they became fully devoted to finding a way of making their topic fit into the task at hand. Combining something that they loved and found interesting with the learning task dramatically boosted both their energy and engagement levels. In the end they created an amalgamation of both of their ideas, incorporating present-day movies and television shows as the “traits” that would allow them to differentiate between various “hot guys”. To complete this assignment, they had to take a photograph of their completed dichotomous key and upload it into Google Classroom. The following image was submitted.

Figure 3

Rachel's group submission (DL #10 visual texts)



While undoubtedly messy, their final product represents a solid understanding of the concept of a Dichotomous Key, albeit minus a title. They did spend about five to ten minutes finalizing their list of hot men who would be included, (notice the crossed-out list on the right-hand side of the image) however much of their time was spent discussing how to distill their list down to where each guy could make it into their key. They made mistakes, erased, argued with each other, rewrote, and were fully invested in the business of learning.

Most importantly, they interacted with and examined mentor texts, or disciplinary examples of dichotomous keys to derive how to construct their own. Observing them it became clear that Rachel had a much fuller understanding of how a dichotomous key worked than her partner and was helping explain to her how and why they were creating it. Their partnership during this activity is an excellent example of reciprocal teaching, an excellent disciplinary literacy strategy that was not included as a studied strategy in this research. ***Reciprocal Teaching*** allows students to interact with a text by summarizing, questioning, clarifying, and making connections with each other (Palincsar and Brown, 1984). What is important to note is that these students, having engaged in the learning process, were able to take ownership of their learning and autonomously develop both their understanding of content and literacy skills without direct assistance from the teacher.

Teaching would be a breeze if all lessons turned out this way. Naturally, this is not usually the case. Let us review the impact of poor student engagement on a DL lesson. The following excerpt is a segment of dialogue from the group portion of DL #3&4 (read aloud/close read). The question being discussed by the group is asking them to reflect on the author's point of view following their exploration of the text and if there were any additional questions they would ask the author about the content if they were provided an opportunity to do so.

Student: “Look, why is the author’s name so weird? What???”

Mark: “C’mon man, we are supposed to be working on...”

Student: “So, where do you think she sleeps? (Pauses for a few seconds) What does she eat for breakfast?”

Mark: “Dude, it's not that big of a deal. We really need to get this done.”

Student: (Student stops, gets up off his stool and walks around to the other side of the lab table. He throws his hands up in the air and speaks with increased volume and an air of frustration) “I DON’T KNOW WHAT TO SAY!!!”

Mark: “It’s ok, chill, we got this.”

Prior to answering reflective questions over their close read as a group, each individual student had over a half-hour to read and annotate their copy of the disciplinary text. The “Student” in this dialogue had been sabotaging the group’s success since the outset of the group reflection portion of the DL lesson. While I was moving through the class checking on groups, I asked him which paragraph was the hardest for him to understand from the text. He rather sardonically replied, “The letter A”.

During the previous task of close reading the text, this student annotated his copy of the disciplinary text in a very minimal fashion, mostly underlining indiscriminately in pencil. He is however undoubtedly intelligent, having scored an “A” on his STAAR test despite exhibiting very low engagement during most classes throughout the year. Knowing the

student and having been present in the room during the above exchange, he seemed almost equal parts surprised and furious at not knowing what to do.

In this case, I felt that he was not engaging effectively with the DL strategy because he either; a.) unsure of what the question was asking him to find within the text, b.) was struggling to find the information within the text, or c.) understood perfectly how to find the information within the text, considered the amount of time/effort required to complete the task and decided against it. My hope is that it was one of the former options, but my fear is that it was the latter. This student demonstrated very little resilience in the face of adversity throughout the year when it came to overcoming challenges while learning but was even more adept at making “business decisions” when it came to the amount of effort, he was willing to put into coursework.

Meanwhile, Mark is doggedly trying to facilitate the group’s participation. I have yet to mention that there was in fact a third member of the group who had yet to meaningfully participate at all because he had been watching anime on his phone with headphones on. Given the challenge of working with these two, Mark eventually quit trying to corral them and completed the reflective questions himself. The lack of engagement from his group members and their avoidance of the task denied both themselves and Mark the benefit of quality reflection and discussion of a disciplinary text, both of which would have helped develop their literacy skills.

The third member of this group provides an excellent opportunity to discuss the primary avoidance behavior that was observed during DL lesson implementation, student cell phone use. Students attempted to avoid DL lessons (and any learning task throughout the

year, really) in a variety of ways. Side-bar conversations and well-timed restroom breaks were dependable options to keep from engaging in a learning task. Attempting to sleep or simply staring off into space were other class favorites as well.

Unfailingly, many students chose to text, search the web, watch videos, listen to music, or scroll social media periodically during class. I noticed that these behaviors intensified class wide during the implementation of DL lessons. To this point I recorded the following observation.

- When I was sharing during DL #3 (read aloud), I noticed at one point that more than half of the class was on their phones. Was this due to anxiety regarding the difficulty of class activities? Was this an avoidance mechanism? Either way, students are showing that they flat out do not like to read/write/annotate/interact with text. I need to make sure to set expectations on technology use for next period.

And so, I did. The next class period I set the expectation that cell phones needed to be put completely away prior to the beginning of the DL lesson. I even shared with them my reflection from the previous class to provide them with rationale for my request.

Something akin to begrudging agreement took place, along with an undercurrent of veiled hostility emanating towards my desk. The class did however remain off their phones, and after a few minutes of social awkwardness, set to the task and became fully engaged in the DL lesson. Later in the research, many lessons were prefaced with the “no cell phone” procedure. Such procedures positively impacted the overall observed levels of student engagement.

Some particularly gifted “artisans” were able to employ various avoidance behaviors in a layered approach to delay learning as long as possible. The apex example is when a student came in after the tardy bell, was sent back out to the downstairs hall kiosk to get a tardy slip, returned, and asked to use the restroom ten minutes later, and if that was not granted requested to see the nurse yet another ten minutes after that. During DL #11 (close read) a student successfully layered avoidance techniques until there were only five minutes remaining for his task. At that point we kind of just looked at each other and he shrugged and wrote his name on the blank paper and turned it in.

In other cases, student engagement in a lesson might be categorized as intermittent. During DL #11 (close read), I observed a student named Steve as he read and annotated a passage of disciplinary text. I had an excellent view of Steve as he sat on the front row directly in front of my desk. During the thirty-or-so minutes allocated for the close-reading of the text, Steve vacillated between typing on his phone and returning to his paper to work approximately fourteen times. He would alternate between work for a minute or two and returning to his phone. The following images are of Steve’s completed close-read text. Take note of the volume and sophistication of his interactions with the text.

Figure 4

Steve's submission (DL #11 close-read)

5/11/2021 Invertebrate numbers nearly halve as human population doubles -- ScienceDaily

ScienceDaily STEVE 7th 5/13/21

Your source for the latest research news

Invertebrate numbers nearly halve as human population doubles

Date: July 24, 2014

Source: University College London

Summary: Invertebrate numbers have decreased by 45 percent on average over a 35 year period in which the human population doubled, reports a study on the impact of humans on declining animal numbers. This decline matters because of the enormous benefits invertebrates such as insects, spiders, crustaceans, slugs and worms bring to our day-to-day lives, including pollination and pest control for crops, decomposition for nutrient cycling, water filtration and human health.

FULL STORY

why have they decreased? That doesn't seem like a lot

Invertebrate numbers have decreased by 45% on average over a 35 year period in which the human population doubled, reports a study on the impact of humans on declining animal numbers. This decline matters because of the enormous benefits invertebrates such as insects, spiders, crustaceans, slugs and worms bring to our day-to-day lives, including pollination and pest control for crops, decomposition for nutrient cycling, water filtration and human health.

How, they are gross insects! now do they just go away? Doesn't make sense?

The study, published in *Science* and led by UCL, Stanford and UCSB, focused on the demise of invertebrates in particular, as large vertebrates have been extensively studied. They found similar widespread changes in both, with an on-going decline in invertebrates surprising scientists, as they had previously been viewed as nature's survivors.

The decrease in invertebrate numbers is due to two main factors -- habitat loss and climate disruption on a global scale. In the UK alone, scientists noted the areas inhabited by common insects such as beetles, butterflies, bees and wasps saw a 30-60% decline over the last 40 years. -- That's a lot

The diminishing status of invertebrate populations greatly compromise nature's ability to provide us with what we need. In economic terms, they provide us with important services, often worth billions of GBPE. ← what is this? be the pollinators our flowers. That's a lot

Pollination -- insect pollination is required for 75% of all the world's food crops and is estimated to be worth 10% of the economic value of the world's entire food supply. Globally, pollinators appear to be strongly declining in both abundance and diversity. The economy would crash

Pest control -- in the US alone, the value of pest control by native predators is estimated at \$4.5 billion annually, these costs could escalate with the decline in predator number.

Nutrient cycling and decomposition -- insects and vertebrates (birds, for example) are important for cycling nutrients and moving them over long distances, without which the integrity of other ecosystem functions such as plant productivity could be compromised. we need clean water some people don't get over

Water quality -- decline in amphibian populations has led to increased algae and the biomass of waste matter, which in turn reduces nitrogen uptake.

Without these invertebrates here would be a mess in many things and would be world seriously.

1/3

<https://www.sciencedaily.com/releases/2014/07/140724141606.htm>

5/11/2021 Invertebrate numbers nearly halve as human population doubles – ScienceDaily

Human Health decreasing invertebrate numbers are known to compromise food production due to reduced pollination, seed dispersal and insect predation but the impact the continuing loss of animals, including invertebrates, has on the spread of human disease needs to be better understood as a priority.

Scientists believe there is a growing understanding of how ecosystems are changing but to tackle these issues, better predictions of the impact of changes are needed together with effective policies to reverse the losses currently seen. Using this approach, conservation of species can be prioritised with the benefit of protecting processes that serve human needs, and successful campaigns scaled-up to effect a positive change globally.

Dr Ben Collen (UCL Biosciences), last author of the study, said: "We were shocked to find similar losses in invertebrates as with larger animals, as we previously thought invertebrates to be more resilient. While we don't fully understand what the long-term impact of these declining numbers will be, currently we are in the potentially dangerous position of losing integral parts of ecosystems without knowing what roles they play within it."

"Prevention of further declines will require us to better understand what species are winning and losing in the fight for survival and from studying the winners, apply what we learn to improve conservation projects. We also need to develop predictive tools for modelling the impact of changes to the ecosystem so we can prioritise conservation efforts, working with governments globally to create supportive policy to reverse the worrying trends we are seeing."

Professor Rodolfo Dirzo (Stanford Woods Institute for the Environment), lead author of the study, said: "Where human density is high, you get high rates of defaunation, high incidence of rodents, and thus high levels of pathogens, which increases the risks of disease transmission. Who would have thought that just defaunation would have all these dramatic consequences, but it can be a vicious circle."

"We tend to think about extinction as loss of a species from the face of Earth, and that's very important, but there's a loss of critical ecosystem functioning in which animals play a central role that we need to pay attention to as well. Ironically, we have long considered that defaunation is a cryptic phenomenon, but I think we will end up with a situation that is not cryptic because of the increasingly obvious consequences to the planet and to human well-being."

Handwritten notes:
 - "Crazy!"
 - "we need to work together worldwide. Instead of worrying about dominance."
 - "I don't think I'll get to that this time."
 - "What's the point?"
 - "???"
 - "???"

Story Source:

Materials provided by **University College London**. Note: Content may be edited for style and length.

Journal Reference:

1. R. Dirzo, H. S. Young, M. Galetti, G. Ceballos, N. J. B. Isaac, B. Collen. **Defaunation in the Anthropocene**. *Science*, 2014; 345 (6195): 401 DOI: 10.1126/science.1251817

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<https://www.sciencedaily.com/releases/2014/07/140724141606.htm>

2/3

This is an attempt at close reading that I would consider excellent. While it can be argued that he was a bit heavy handed in underlining some sections of the text, look at the number of times that he interacted with the text, writing questions or comments regarding what he read out to the side. Following DL # 3&4 (read aloud/close-read), I decided to count all the unique comments or questions that students wrote on their copies of the text

during the close-read lessons. I wanted to examine how well students engaged with the text, more so than simply underlining, or highlighting words. Here is the breakdown of the data I collected.

Question/Comment counts by sex, averaged per student

Females studied- 34. Total comments 478. Average 14.06.

Males studied- 46. Total comments 467. Average 10.15.

Steve's attempt contained 28 unique comments or questions. What was astonishing to me was that I saw him complete the task one small chunk at a time while he was simultaneously doing something else entirely on his phone. I remember thinking that he looked extremely bored as he worked, and that the quality was likely to be very poor. I was wrong. It bears consideration that on rare occasion students like Steve were able to demonstrate excellence in a task at times without appearing to put forth much effort. As a result, simply searching for sub-optimal engagement levels or instances of cell phone use in DL lessons did not provide the full picture.

To provide perspective on the quality of his submission, compare the richness of Steve's close-read with the example that I created and shared with the class for DL # 3&4 (read aloud/close-read).

Figure 5

Instructor's exemplar (DL #3&4 read aloud/close-read)

← makes me think of Ichthyosaurus, a water dinosaur... 20 min

Ichthyologist Jack Randall Dies

* What does the title and subtitle lead me to believe this article will be about?

The taxonomist described more than 800 species of fish.

Kerry Greis
May 7, 2020
41

1 context clue

ABOVE: RANDALL FAMILY

John "Jack" Randall, a marine taxonomist who described hundreds of species of fish, died April 26 at age 95. The Washington Post reports.

his field... wow!

According to a 2016 profile in Hakai Magazine, Randall had described more marine species than anyone else in history. "[Jack is] an absolute living legend," Gerry Allen, a former graduate student of Randall who is now a research associate at the Western Australian Museum and a consultant for Conservation International, told Hakai. "There's just no one that even approaches his productivity."

* Service during this time tells me a lot about his character.
Discipline - value of life - gratitude

Randall was born in Los Angeles in 1924. After serving in the military during World War II, he earned a bachelor's degree in zoology from the University of California, Los Angeles, and a PhD in ichthyology from the University of Hawaii. The vast majority of his career—42 years—was spent at the Bernice Pauahi Bishop Museum in Hawaii.

Did he help w/ other species? I wonder how much changed due to his 40+ year impact?

According to a 2018 article by the University of Hawai'i Sea Grant College Program, fish taxonomy was a mess when Randall's career started, with some species having duplicate records from scientists working independently. "Randall helped bring order to fish taxonomy, methodically cataloguing newly identified species, with an uncanny ability to notice when

**Imagine thinking you had discovered a new species only to find out it was a juvenile of an existing one!*

several different-looking fish were actually the same species at different life stages," the article states.

a little nutty... innovator and pioneer came to mind.

Randall observed animals in their natural habitat, initially using rudimentary—and sometimes dangerous—diving equipment. According to *Hakai*, he once filled a tank with pure oxygen (with no untoward effects because he didn't dive deep that time) and coated long johns with latex to keep warm. He ultimately became a knowledgeable and safe diver, and was "one of the first scientists to use scuba gear, allowing him to access fish that no one else had ever seen," the profile states.

**doesn't this cause "the bends?"*

Randall's career took him to places such as Easter Island and the *Îles Marquises* to catalog fish where few had been documented before, according to *Hakai*. The *Post* notes that Randall described 830 species by the time he died.

**Incredible.*

a lifetime of professional research. Made a huge impact.

Randall authored 900 scientific papers and numerous books, according to the *Post*, and won the International Coral Reef Society's Darwin Medal in 2016. A memorial to Randall includes numerous testimonials from fish biologists and enthusiasts describing his profound contributions to the field, both as a scientist and as an inclusive mentor.

He is survived by his wife Hejen Au, two children, four grandchildren, and two great-grandchildren.

- Key vocabulary
- Key locations and organizations
- Publication source
- Initial reactions
- Reflections and summarizations

**What was this article about?*

I would categorize my own level of proficiency as that of a novice and I was very impressed at his mastery of the task. I spoke with him following the completion of the lesson and asked him about being on his phone during the close read. He said that a friend was texting him and he did not want to be rude. I asked him if he thought it was difficult for him to read the disciplinary text, metacognitively reflect, and annotate his

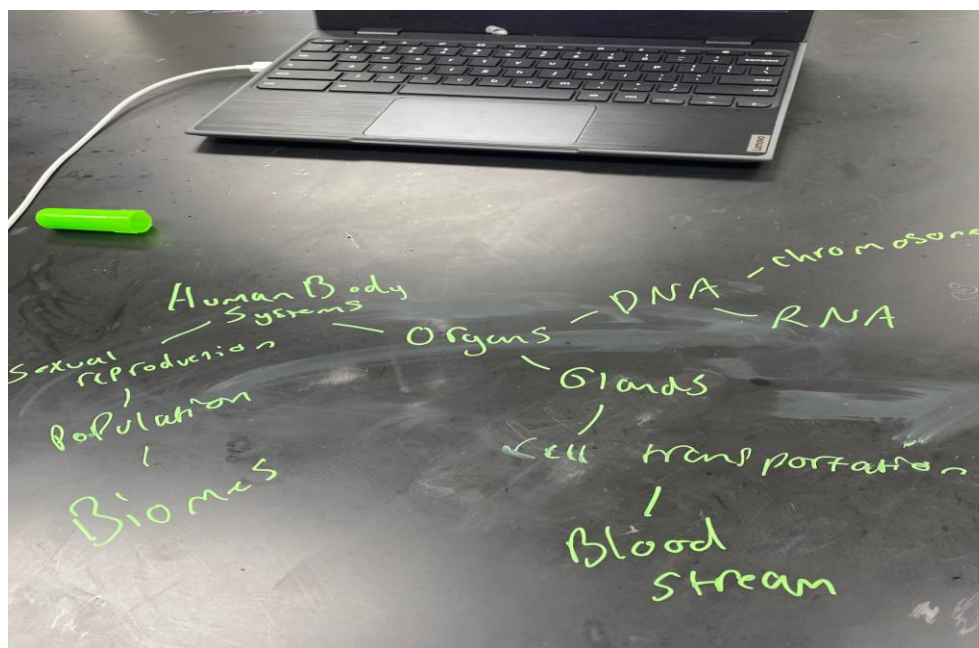
thoughts while also conversing with his friend. He said no, not really, but that he could not really do both at the same time effectively, so he just took turns going back and forth.

Sometimes classroom engagement came about in unexpected ways. One such example occurred when a group of boys took the “I’m too cool to be doing this” position during a DL lesson. I will refer to them as the “second period boys”. Although there was plenty of data to mine involving their lack of engagement, I would like to point out how they indirectly influenced one DL lesson in a very positive way.

I would describe the “second period boys” as video-gaming, questionably smelling, and habitually un-engaged in the learning process. Full of obscure one-liners (that only they get) and “that’s-what-she-said” jokes, these students are sure to challenge even the most veteran teachers. The quality of the work produced when they were focused on the learning task left much to be desired. Here is an example of the final product submitted by the “second period boys” during DL #8 (concept web).

Figure 6

“Second period boys” submission (DL #8 concept web)



The image above equates to a half-hour of them connecting the concepts they learned in Biology throughout the school year. In fairness, they most likely would have produced a better concept web had one of their group members not been sent to the office inappropriate classroom behavior. As it turned out, the greatest contribution of the “second period boys” to the research was removing them from the learning environment during DL #12 (Socratic seminar). Going into teaching that lesson I understood that I would have several challenges in this class in keeping the class engaged and on topic. I knew that Daniel was super G/T and would challenge and want to debate everything I said. I also knew that Rachel and her group of friends would talk and laugh and need to

be redirected often. But the biggest threat was the “second period boys” hijacking the lesson by not taking it seriously and blurting out distracting and off-topic questions.

On cue, the leader of the group almost immediately began trying to delay the start of the lesson by asking if this task was “really necessary” (yes, he used air-quotes) given that the students had already completed their STAAR test. I informed him of what a seminar was, the literacy skills we would be practicing and developing, and how the topic directly connected with their lives. With a confused look on his face, he looked around to the class and said, “So wait, like uh, so we are really doing this then?”. I decided to allow him and his colleague who had also made some prior remarks to sit outside of class for the remainder of the period.

In sacrificing two students' participation, (one of the “second period boys” was absent on this day) the class was rewarded with a deep and introspective discussion about issues that were affecting their lives. Students addressed the topic of “Whether or not their generation had a difficult time being happy/successful in life?”. The initial responses were thoughtful, directed at the topic, and students were courteous. What is more, students were actively engaged, considering the argument of an expert in his field, writing out their thoughts, and explaining their position in support or opposition of that expert. Here is an excerpt from my reflective journaling during this class after the two boys left.

- 2nd Period: Class got very personal, students were letting their emotions out, sharing very personal stories. I did not expect this at all. What I found interesting is how much I enjoyed facilitating this type of discussion and how much some students enjoyed it. Not

all, but some. Some were passively taking in the conversation, but perhaps were not comfortable enough to speak their mind. It was surprising to me how much many students yearned to share their opinions and speak on a topic that they felt was deep and meaningful.

The mood and energy level in the room was *interesting*. When I opened the classroom for initial responses to the seminar prompt, there were one or two students who raised their hands. Once they began to share, I would listen attentively as they spoke and reframe, extend, or support their statement, being sure to always thank them for their position. As the first student was finishing speaking, two or three hands were shooting up to be next, repeating several times over. Students began leaning forward in their seats, becoming animated, and nodding or shaking their heads in agreement or disagreement. Of course, several students were blurting out their thoughts, which required me to continue to set behavioral expectations throughout the lesson.

The key takeaway here is that students were having deep, meaningful conversations with each other, and while it did connect with their topic, what they were really sharing was their lives. A lot of emotion was coming out of students as they spoke, depending on what they were sharing. Students were talking about childhood trauma, sibling and parent relationships, and positive and negative life experiences. This is partly why I described the mood in the room as interesting because the discussion was kind of all over the place.

Some of the students chose not to contribute by speaking yet were visibly engaged and tracking the discussion. Others were almost squirming in their seats, my assumption being that some of the stories being shared were hitting a little too close to home and

were making them uncomfortable. While every student was not engaged in every component of the seminar, *all students* received time on task in either listening, thinking, speaking, or writing.

The following is a key example of how personal the discussion turned when Veronica decided to share her story. She spoke on her upbringing a good deal more than what I share here, which was condensed for brevity. I wrote down our discussion as best I could remember later that day.

Instructor: “Do you agree with this? Do you believe that your generation is subjected to, as he said in the video, failed parenting strategies?” [*here, I provided the class with think-time, at the conclusion of which multiple students raised their hands*] “Ok, we will go Veronica first, and then Daniel next.”

Veronica: “I would say that I definitely agree with that. [*student took a deep breath and adopted a very serious expression*] So, I grew up basically as the parent figure to my two other siblings. because my parents were passed out all the time with needles in their arms in the living room. They did drugs all the time and didn’t take care of us kids. I always tried to protect my siblings and keep them from seeing that, and I fed them and took care of them the best I could. I would try to clean up filthy dishes in the sink and bathe my siblings. It was really hard on me as a kid. My dad, like I didn’t really understand why he did that. I still loved him, because when he wasn’t high he did nice things for me like...umm...you know... buy me a candy bar when we went to the convenience store. Like, I’m not trying to say that my life is so much harder than others. Other people have

it hard growing up too. My siblings and I are in a different family situation now, and we are doing much better.”

Instructor: “You know, I would say that that was a really tough situation for anyone to go through. Veronica, if you don’t mind me asking, are your siblings older or younger than you?”

Veronica: “I’m the middle child, one’s older, one’s younger.”

Instructor: “I was curious, because in my experience when children have a parent situation like Veronica’s, one of the children usually assumes the role of the parent. Most people I think assume that it will be the oldest, but that is not necessarily true. It could potentially be the younger sibling, or the middle in Veronica’s case. But the bottom line is that as young children, we need parents. And unfortunately, not everyone gets to start off life with amazing parents. The good news in all this is that you do not have to let it define who you are, and ultimately the person you will become. Sure, it may be harder for you than for some of your friends. But it is not impossible for you to move forward and control what you can. Thank you so much for sharing Veronica.”

There were several more back and forth exchanges between Veronica and I, but the honest nature of our conversation created a shift in the classroom atmosphere from “doing a lesson” to being engaged together in discussion around a topic in a way that I had never experienced as an educator. Veronica’s willingness to open to the class and share very intimate details of her life was an unintended result of the DL lesson, one that I certainly did not anticipate. The whole class was engaged as she spoke, even the

students who had yet to participate by speaking yet were listening, and her story one hundred percent set the tone for the lesson.

The meaning that can be derived from such a classroom experience is substantial. For me, the uniqueness of this event provided a significant perspective on the number of ways that student engagement could impact student learning and development. I remember feeling as if I was no longer a teacher in a classroom, but a mentor and facilitator of my students' discussion and a contributor to the value of their lives.

Facilitating Student Engagement

Each individual student's engagement level can fluctuate dramatically throughout the day and change from day-to-day. As the teacher it is my responsibility to manage the energy and engagement levels of all the students in my class. Some students are naturally more energetic in the morning, others are night owls, and others seemingly have a never-ending supply of energy that will survive well into a post-apocalyptic future. Sometimes, this energy could be *adjusted* or *harnessed* in various ways to help increase student engagement. I would like to briefly examine some of the actions that I was able to employ to help students engage in the learning process.

The greatest overall challenge was to design the flow and progression of a lesson to support and maintain student engagement. Even the most thought out of lesson plans often very quickly revealed areas of shortsightedness, sometimes only minutes into the implementation of a lesson. Here are a few examples from my reflective journal that illustrate both weaknesses in my instructional approach that inhibited student engagement and specific adjustments I made to improve engagement.

- Rough start. I was super ambitious.. Students did not address the questions from the board well at all. I quickly typed and printed the questions out on paper for next classes.
- I observed many examples of students “classically” avoiding an assignment: moving to looking at their phones, zoning out, “falling asleep” etc. I have got to find a way to boost interest.
- The time frame to complete the task is too tight. I need to make sure that I am very focused on the timeline in my next classes and need to try to adjust to produce better conversations. Conversations did pick up once the close reading handout was introduced. For the sake of time, I am going to make that the only conversation piece, because I want them to discuss deeply.

While there were many other cases, the important takeaway is that facilitating student engagement was an ongoing process that never really stopped, even after teaching a lesson to several classes. Regardless of how well conceived a lesson may have been, the task being placed before students made a significant difference in their engagement level. In my experience, the more reading or writing involved in a task, the less engaged or enthusiastic students became. The following is an excerpt from my reflective journal during implementation of DL #5 (Learning logs):

- ...Students had already checked out mentally once they figured out what was coming. You can see it in almost an instant... the slouch in their desk, the earbud being popped into an ear away from the teacher, or just the open looks of frustration and shaking of heads, accompanied by the all too familiar “air of resignation” that enshrouds many students when faced with a difficult writing or reading task.

I went on to further remark on the extremely low levels of student engagement that took place in some classes, with students exhibiting “bare minimum” participation, let alone introspection or reflection. Leona often responded to writing tasks in this manner. Here is an example in which she shows her disdain for close-reading during her exit-ticket response to DL #11 (close-read).

Figure 7

Leona’s exit ticket (DL #11 close read)

Name: **LEONA** Date: 5-13-21 Class: 3rd

Exit Ticket- What do you feel is the most difficult part of this activity for you personally?
What comes most naturally or is easiest?

The most difficult part is finding the motivation to do it, other than that it isn't difficult.

While lack of interest in a task emerged as the primary inhibitor to engagement, other times during the research period student engagement would be low due to students simply having **extremely high** levels of energy, making it difficult to get and keep students focused on their learning task. One class, my 7th period, came in as if they had all been drinking rocket fuel seemingly every day. In other classes, there was a disharmonious blend of both hyperactive and apathetic learners. As a classroom teacher it can be incredibly challenging to lift some students up “off the floor” while simultaneously scraping others “off the ceiling”.

The targeted use of certain instructional strategies and procedures helped me as the instructor to assist students in adjusting their energy levels. Skillful deployment of

various warm-up activities or brainteasers, diverse methods of learning content, or even short brain breaks during transitions from one activity to another helped to corral student energy and boost engagement in DL lessons. One such strategy I employed was to have students take fifteen minutes of “color notes”. Students would enter class to find low lighting and soothing music playing. As the instructor, I would guide them in a casual and relaxing combination of lecture, note-taking, and coloring, either introducing them to new content or reviewing the prior day’s learning. This activity was very effective in lowering student energy levels to align them with an upcoming task, for instance disciplinary writing.

Conversely, if the class energy level was much too high for an assignment, often I adapted the activity itself if I was able. At times I would be unable to manage energy with procedures. During DL #6 (PBL) I recorded this reflection on class energy.

- Students were crazy hard to focus initially. The excitement for what they were doing was palpable, even though none of them came out and admitted it. Several students spread throughout the room investigating, moving from station to station, inspecting the flies, playing with the stereoscope, etc. I had to write out several pre-lab procedures on the board for the next class.

One example of harnessing student energy by adapting the activity itself would be converting a test review into an active, student-driven game of trashcan basketball.

“Trash-ketball” allows students to shoot balled up test review questions and opposing teams to steal points by answering test review questions correctly. Changing the process of how students reviewed for a test to a tactile-kinesthetic, competitive game helped to channel excessive student energy into excitement centered around the learning process.

The myriad of engagement types and student responses to tasks combined to influence and comprise the overall makeup and dynamic of my classes. Each class took on their own “personality”. This personality was especially impacted by class makeup, (all boys, all girls, low energy, etc.) of which I had all three of the previous examples. My personal favorite class this year might have been my seventh period class. They were incredibly high energy and constantly off-task, yet they were my most intellectually gifted class and the most likely to engage in robust discussion of disciplinary content. They had to be heavily supported with classroom procedures to function on certain tasks, but the work was worth it.

It is important to note here that there is only so far that procedures and strategies can take a class. Instructors certainly can and should position students to engage in learning through varied use of interest, strategy, gamification, etc., but it is ultimately up to the learner as to how willing they are to engage. Management of the engagement levels of students must be made a priority to maximize both student acquisition of content and literacy development within the classroom.

Student engagement levels in any lesson run the gamut from very high to very low, and for a variety of reasons. Factors affecting engagement included the amount of reading and writing required, student energy levels, and behavioral and emotional responses.

Intermittent engagement was observed by students and did not necessarily have a negative impact on literacy strategy usage.

It is reasonably difficult to expect a teacher to be able to accommodate all the elements influencing student engagement levels, while acknowledging that some efforts can be

made to mitigate or augment them. Continuous engagement in the supported use of literacy strategies has shown to significantly boost a student's literacy development. Skillful wielding of instructional strategies and providing opportunities for student choice (content/process differentiation) provided the largest observed increase in student engagement.

Literary Support

Investigation of the literature involving student engagement as a critical component in developing student literacy skills revealed several examples of supporting research.

Fredricks et al., (2004) defines student engagement as consisting of behavioral, (effort, participation, absence of disruptive behaviors) emotional, (boredom, anxiety, identification) and cognitive (investment, self-regulation, using strategies) dimensions.

While much of the research reviewed established the link between using student engagement boost literacy development, few of the studies investigated the inverse relationship, approaching the issue with literacy practices as in this study.

Varuzza et al., (2014) noted that student interest is a critical factor in increasing student motivation to read, which correlates with the research data showing that student interest increased engagement in literary tasks. Furthermore, the authors found that teachers assigned reading assignments that featured topics enjoyed by their students and additionally used high energy activities such as acting, debates, and games to amplify student engagement. However, in their research of children in sixth and seventh grades, Varuzza et al., (2014) did report that they used the disciplinary literacy strategy of a read aloud as motivating students to read, a result contradicted by what was observed in this research.

In their recent research into using engagement and disciplinary literacy strategies with EL learners, Lou (2020) engaged students through explicitly teaching many discipline-specific vocabulary terms, word structures, and through extensively modeling reading comprehension strategies. The researcher invites educators to consider the complexity of the learner's perspective and to apprentice students in analysis of certain types of features found in disciplinary texts and discourse. Lou (2020) identifies students as co-constructors in acquiring knowledge and developing literacy skills and benefitting from effective scaffolding measures helping link new learning with the foundational understanding they have in their native language. Lemley and Hart (2019) in their research of DL literacy strategies also identified a need to scaffold secondary level students to increase their understanding of disciplinary literacy strategies and focus their engagement.

Regarding the increase in student engagement when creating visual texts, Lubis (2019) noted that visual texts created fantastic opportunities for dialog amongst students filled with the exchange of ideas, specifically those related to media forms of visual texts like those found in DL #7 and #12 (Socratic Seminar). Lubis (2019) unveiled that the opportunity to deeper analyze student conversation occurred when looking beyond information retrieval and envision visual texts as opportunities for gamification, creative and challenging tasks to complete, and opportunities to examine what meaning they are finding in a visual text. The creation of visual texts over protein synthesis and dichotomous keys in this research also showed increased student engagement and collaboration through the creation of challenging tasks involving visual literacy.

Concerning teacher use of strategies to promote classroom engagement, Pedler et al., (2020) states that teachers should strive to understand the behavioral, emotional, and cognitive dimensions impacting student engagement and manage the integration of effective, engagement boosting pedagogical strategies. Such strategies included establishing clear classroom procedures, incorporating collaborative activities, and allowing students to choose the content they are going to learn and how they will show mastery (Pedler et al., 2020).

Öncü and Bichelmeyer (2021) in their research found that collaborative practices provided the greatest impact on student engagement, requiring a significantly higher level of investment from students. Learner-centered teaching practices were also shown to correlate directly with student engagement and allowed for more freedom and control over the learning process for the students (Öncü and Bichelmeyer, 2021). Rodriguez and Koubek (2019) linked student reflective learning processes, specifically those tasked with connecting ideas to previous learning, with high levels of student engagement on multiple occasions within their research. Collaborative discussion fueled by the writing of rough drafts help students to display competence, write with purpose, and learn from one another (Rodriguez and Koubek, 2019).

Davies et al., (2018) showed that teachers generally approach engaging students through a variety of experience driven strategies, and were especially successful when providing students with autonomy, a finding edified by the increase in student engagement in lessons where students had content and/or process differentiation. Kapoyannis (2019) found that providing EL students with culturally relevant texts and scaffolding materials strongly engaged students in the developing use of disciplinary specific vocabulary in

relevant ways as they connected with the text and shared about their own lives.

Naujokaitienė et al., (2020) used analytics to show how teachers fostered student engagement through critical thinking, making connections between prior knowledge and content, and reflection, which empowered students to construct and communicate their new knowledge. The author suggested that scaffolding measures act as an extension of the teacher during these activities, helping students to develop literacy skills as they progressively engage with other students in a variety of thinking tasks.

Following analysis of both teacher and student engagement in a lesson, here are some key takeaways to consider when attempting to engage students with Disciplinary Literacy strategies:

1. ***Choice matters.*** Process Differentiation or providing students with the opportunity to choose how they complete a task, significantly boosts student engagement.
2. ***Make a path students can follow.*** Lessons must be purposeful, tasks clear, and procedures in place to prevent students from using avoidance tactics in the face of difficult tasks.
3. ***At the same time, be flexible.*** When students are not engaging, pivot quickly and find a strategy that will garner student interest.

Social Interactions

“Listen with curiosity. Speak with honesty. Act with integrity. The greatest problem with communication is we do not listen to understand. We listen to reply. When we listen with

curiosity, we do not listen with the intent to reply. We listen for what's behind the words.”

-Roy Bennett, *The Light in the Heart*

“A lively discussion is usually helpful, because the hottest fire makes the hardest steel.”

-Tom Clancy, *Debt of Honor*

The Student in a Social Context

Following my coaching assignment at the Junior High campus during the first period, I would arrive at the High school at roughly 9:05 am. On “B” days, this meant that I would see third, fifth, and seventh period classes. On many such “B” days, even though first period did not end until 9:10 am, I would find one of my third period students waiting by my door. Michelle carried an electronic tablet and had gamer headphones (the ones where you have a microphone so you can communicate in-game) on her head at every possible moment. Once I opened the door, without acknowledging me she would promptly go to her seat of choice (the left-hand lab table behind the last row of individual desks) and set up her “nest” of backpack, blanket, water bottle, and tablet. Dressed in comfy pants and a shirt with obscure Anime on it, she would rustle around in her backpack until she produced a snack, usually a bag of chips. While I prepared for the day’s lesson in the front of the class, she would type furiously, munch on her chips, and occasionally laugh at a video being watched via her tablet.

Socially, Michelle was quite awkward. Her interests seemed to include obscure Anime and little else. She struggled controlling the volume of her voice, often either blasting the ears off whomever was listening or mumbling to the point of being unintelligible. Given that her *modus operandi* was to isolate herself, her forays into social exchanges regularly consisted of her interjecting into others' conversations while often clearly interrupting the person talking. She would routinely try to steer conversations toward topics that interested her whether it made sense to do so in the context of their conversation or not. This frustrated other students in class and many subsequently avoided her. Sometimes she would get into verbal altercations with students because of her failings in communication. Several of the students in class did not withhold their dislike for Michelle and were openly rude to her.

During group stations or lab assignments the majority of students actively shunned Michelle and she was often unchosen for group assignments. Her questionable hygiene practices, lack of focus, and social awkwardness contributed to this fact. When it came time for groups to be formed, she would avoid eye contact and retreat into her tablet and headphones, while at the same time occupying a prominent lab table in the room which caused students to seek other workspaces.

Her participation in group activities typically occurred when working individually was not an option. If she were chosen, for a group to accommodate Michelle's personality it needed to be small and could only contain one or two of a handful of kids in class. Often, she would be added on to a group after I approached her and informed her that she would be unable to work individually. I would generally go to a group that I felt would not reject her, or that might work best with her and ask them to include her. I do not believe

that a group ever tried to tell me no, but most responses I received were reluctant and negative to put it mildly.

Her ability to contribute to a group setting would be described as very poor. Typically, her first choice of action once joining the group would be to withdraw into her tablet and headphones. Upon noticing this behavior, I would ask her to put them away, on occasion several times during a class period. I believe I had to write her two or three referrals during the research period for not being able to disengage from her tablet to work with her group. She seemed relatively unfazed by correction or discipline most of the time, although on one occasion she did argue with me very convincingly that she did not deserve a referral and I agreed with her in part.

In the meantime, her group members would collaborate on the learning task independent of her participation. When Michelle did decide to work with the group, she fluctuated between hijacking their focus and momentum and operating as a separate entity that provided little benefit to her colleagues. She would often demand a certain role within the group or declare that she would not cooperate. Alternatively, she would aggressively seek the leader position within the group and break down the task they were supposed to be attempting as a group into smaller, individual tasks. She would then delegate those tasks, assigning herself whichever task she preferred. If after loudly and emphatically making her wishes known she was unable to collaborate in the manner of her choosing, she would complete the task in isolation, at times completely leaving the group's table. Over half the time she would approach me early on in class and request to work on assignments individually. When at all possible, I agreed.

When she worked by herself her progress was often slowed down by “technology breaks” to the point that what she turned in was rarely completed. Either she would alternate back and forth between the assignment and her technology or rush to complete her schoolwork so that she could have as much time as possible to use it. When she was able to give her full attention to an assignment, whether due to interest or simply because she decided to, her work was appropriate and creative if not a bit unorganized. Many of her assignments were incomplete or not turned in on time. Others demonstrated lack of significant effort or demonstrated rudimentary thinking.

Earlier in the year Michelle demonstrated a much different social dynamic within my class. She was still loud and awkward, but she was much more comfortable interacting verbally and socially in class. At that time there were two other students in her class that were friendly with her, and she felt at ease communicating with. As the weeks went by, Michelle and her other two friends were beginning to become a problem in class as they were very adept in sidetracking instruction with frequent and off-topic questions. They would converse loudly and regularly having little regard for the instructional focus in the classroom. However, prior to the beginning of the research period, one of her lackeys changed class schedules out of my class which left her with only one other friend in class. From that point on, it was apparent that she did not feel nearly as comfortable speaking and interacting in class. She no longer asked very many questions and would not participate in anything other than individual work unless conditions were optimal.

One of the few students to fail my class for the year, Michelle scored an “A” on several unit tests throughout the year. Intelligence was not the issue here. Her social isolation and consistent use of technology as an avoidant behavior caused Michelle to miss out on

several opportunities to really use her intellect and develop her content knowledge *and* literacy skills. Below are two contrasting examples of Michelle's work.

Figure 8

Michelle's submission (DL #11 close-read)

ScienceDaily
Your source for the latest research news

MICHELLE

Invertebrate numbers nearly halve as human population doubles *title*

Date: July 24, 2014 *Important date*

Source: University College London *Important source*

Summary: Invertebrate numbers have decreased by 45 percent on average over a 35 year period in which the human population doubled, reports a study on the impact of humans on declining animal numbers. This decline matters because of the enormous benefits invertebrates such as insects, spiders, crustaceans, slugs and worms bring to our day-to-day lives, including pollination and pest control for crops, decomposition for nutrient cycling, water filtration and human health.

different invertebrates

FULL STORY

Invertebrate numbers have decreased by 45% on average over a 35 year period in which the human population doubled, reports a study on the impact of humans on declining animal numbers. This decline matters because of the enormous benefits invertebrates such as insects, spiders, crustaceans, slugs and worms bring to our day-to-day lives, including pollination and pest control for crops, decomposition for nutrient cycling, water filtration and human health.

Important percentages

The study, published in *Science* and led by UCL, Stanford and UCSB, focused on the demise of invertebrates in particular, as large vertebrates have been extensively studied. They found similar widespread changes in both, with an on-going decline in invertebrates surprising scientists, as they had previously been viewed as nature's survivors.

Important factors

The decrease in invertebrate numbers is due to two main factors -- habitat loss and climate disruption on a global scale. In the UK alone, scientists noted the areas inhabited by common insects such as beetles, butterflies, bees and wasps saw a 30-60% decline over the last 40 years.

Important percentages

The diminishing status of invertebrate populations greatly compromise nature's ability to provide us with what we need. In economic terms, they provide us with important services, often worth billions of GBPE:

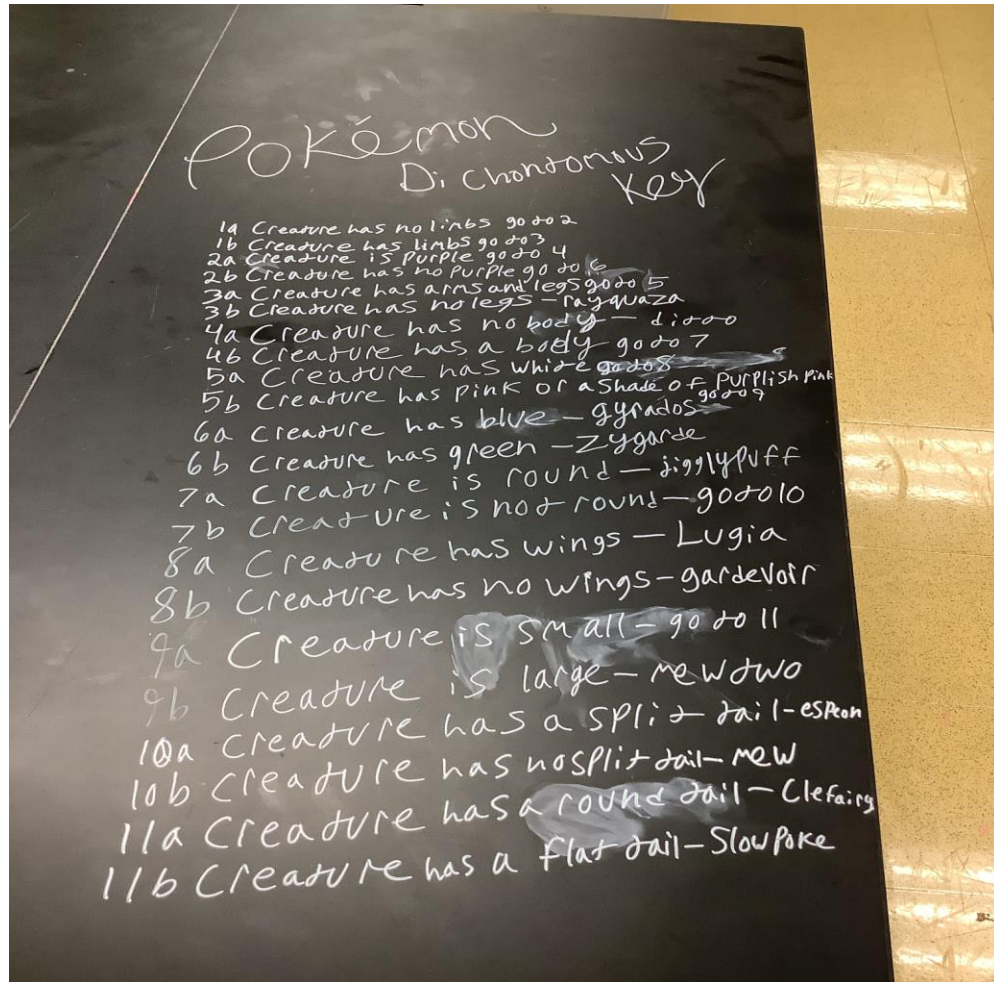
- Pollination -- insect pollination is required for 75% of all the world's food crops and is estimated to be worth ~10% of the economic value of the world's entire food supply. Globally, pollinators appear to be strongly declining in both abundance and diversity.
- Pest control -- in the US alone, the value of pest control by native predators is estimated at \$4.5 billion annually, these costs could escalate with the decline in predator number.
- Nutrient cycling and decomposition -- insects and vertebrates (birds, for example) are important for cycling nutrients and moving them over long distances, without which the integrity of other ecosystem functions such as plant productivity could be compromised.
- Water quality -- declines in amphibian populations has led to increased algae and the biomass of waste matter, which in turn reduces nitrogen uptake.

COMPARISON
important factors
important percentages
important places
important factors
important percentages
important factors

Reviewing Michelle's close read, pretty much everything says "important" on it. This represents a typical submission from her containing very little evident thinking.

Figure 9

Michelle's submission (DL #10 visual texts)



Here Michelle created one of the more quality examples of a dichotomous key across the entire grade level even though it is undoubtedly messy (per her usual). Notice the first five options all involve moving to another level. She separates these *fictional, video game characters* based on anatomy and specific shades of color, even differentiating between the overall shape of the “organism” and the presence of limbs.

As a teen, I enjoyed playing Pokémon on Nintendo Gameboy which gave me a decent background in understanding the game and at least a cursory knowledge of many characters. I checked the ones I was able to positively identify almost every single one was correct. This example shows how successful she was and highlights one of her few errors.

Figure 10

Ditto Pokémon (Nintendo, 2021)



Michelle sorted Ditto within the dichotomous key as having; a.) no limbs, b.) being purple, and c.) having no body. This is correct. Compare this “organism with the following example.

Figure 11

Jigglypuff Pokémon (Nintendo, 2021)



Michelle sorts Jigglypuff within the dichotomous key as having no limbs, being purple and having a body, and being round. While Jigglypuff is at least remotely purple, it clearly has limbs, albeit slightly under-formed. While not perfect Michelle does perform significantly better during this lesson than at any other time during the research. Her interest in Pokémon and the ability for her to complete this assignment individually contributed to her exceptional level of success.

Group Interactions

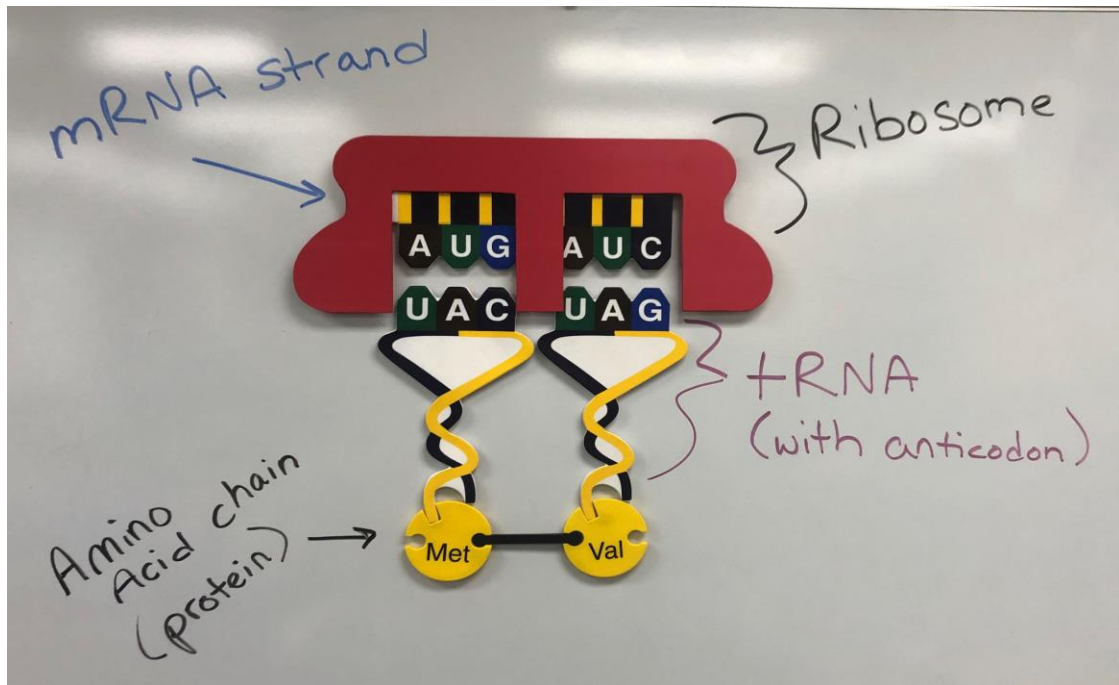
On the other end of the spectrum, you have the successful group dynamic. Filled with bright minds and well-rounded learners, this group excels at every task and uses the benefits and contributions of multiple group members to their advantage. Throughout the research period, Benjamin, Allyssa, and Sonja's group collaborated very effectively and almost *exclusively* together. They consistently produced outstanding work regardless of the task. These students combined to represent the pinnacle of cooperative, collaborative learning.

However, during one lesson, DL #2 (visual texts), they struggled mightily early on and were even arguing to a degree amongst themselves. Frustrations were mounting as they were striving to all get on the same page. The primary reason for their discombobulation was that they chose to create a visual text over DNA translation, the most difficult of the three processes of protein synthesis they could choose from to represent visually. The process in which proteins are made in the body, protein synthesis, is one of the more complex and difficult units of study in the ninth-grade Biology curriculum. Below is a simple model of the DNA translation that I labeled and placed on the whiteboard during

DL #2 (visual texts). The following image is a simplified recreation of what students were shown during the lesson to provide a brief overview of the concept.

Figure 12

Instructor's exemplar (DL #2 visual texts)



Proteins are made in the following way: 1.) a specialized ribonucleic acid (RNA) called messenger RNA or (mRNA) leaves the nucleus with a copy of a short segment of deoxyribonucleic acid (DNA) to make a protein and arrives at ribosomes scattered throughout the cytoplasm of the cell; 2.) The mRNA strand is passed through the ribosomes in three-letter segments called “codons”; 3.) Once codons are read by the ribosome, another specialized ribonucleic acid known as transfer RNA (tRNA) arrives containing the matching “anticodon” and bringing with it to the ribosome a specific amino acid; and 4.) The amino acids are chained together, making a protein which then breaks off and goes to wherever the body needs it. This is a simplistic explanation of one

of the processes that the students were tasked with learning, but it will serve the purposes of helping relay the sophistication of this group's final product.

The fact that many students were having a hard time did not surprise me. Creating a visual text of DNA translation was challenging for several reasons. Traditionally, students struggle to understand this and other *cellular processes* because they occur at a microscopic level. It is difficult for students to identify and comprehend what they cannot see or connect with prior experiences in the real world. Additionally, DL #2 (visual texts) served as the first time they were being introduced to these processes, having just seen protein synthesis modeled and explained to them roughly twenty minutes prior. I expected many students to need encouragement and feedback. The following reflection was taken down during this lesson after I noticed their difficulty:

- Despite all that creativity, upon returning 10 to 15 minutes later what they had created was surprisingly unpolished for them and used mostly words instead of images. I may have shocked them by telling them it wasn't very good and encouraged them to use images rather than words for their "visual text". They really took it to heart, restarting their process, reflecting, and finding other misconceptions that people could have given their initial design. They are currently revamping their visual text.

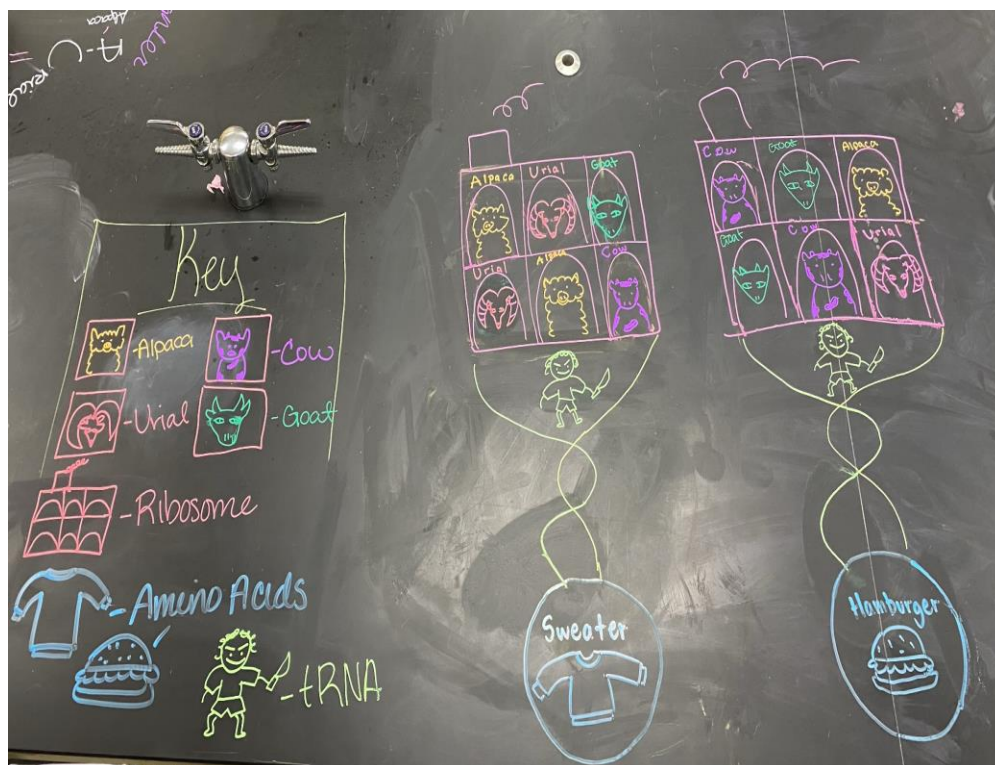
Their initial version was mostly words with very little "visual" to their text. I challenged them to consider the purpose of a true visual text. I somewhat blatantly told them that what they had done so far was not very good, and not truly up to the standard for the

assignment. It quickly became apparent that they took my criticism very seriously. Rather than shutting down, pivoting to an easier task, or simply shrugging it off, Benjamin, Allyssa, and Sonja demonstrated resilience and perseverance in the face of a difficult task.

They each grabbed a marker and began writing out what they knew about how proteins were synthesized, conceptualized what their final product would look like, and divided tasks up amongst each other to ensure that each member contributed to their area of strength. They were animated as they determined what symbols would represent each part of the process, and even used their phones to research the name of a slaughterhouse employee (an Abattoir) to properly complete their analogy of using a slaughterhouse to represent DNA translation. In the end however they simply drew a picture of a man with a knife to make it more visual rather than textual. They supported each other well in their task using Allyssa's artistic skills, Sonja's understanding of protein synthesis, and Benjamin's creativity to complete the task. Here is the final version of their visual text.

Figure 13

Benjamin, Allyssa, and Sonja's submission (DL #2 visual texts)



In my opinion, this was the most successful collaboration in a DL lesson from the entire research. It was clear from their created visual text that they fully understood the process of DNA translation. The analogy of the slaughterhouse worked beautifully as the animals (alpaca, urial, cow, and goat) represented each of the four bases found in RNA (adenine, uracil, cytosine, and guanine). They correctly illustrated the base-pairing rules in which adenine must pair with uracil and cytosine with guanine (A-U, C-G).

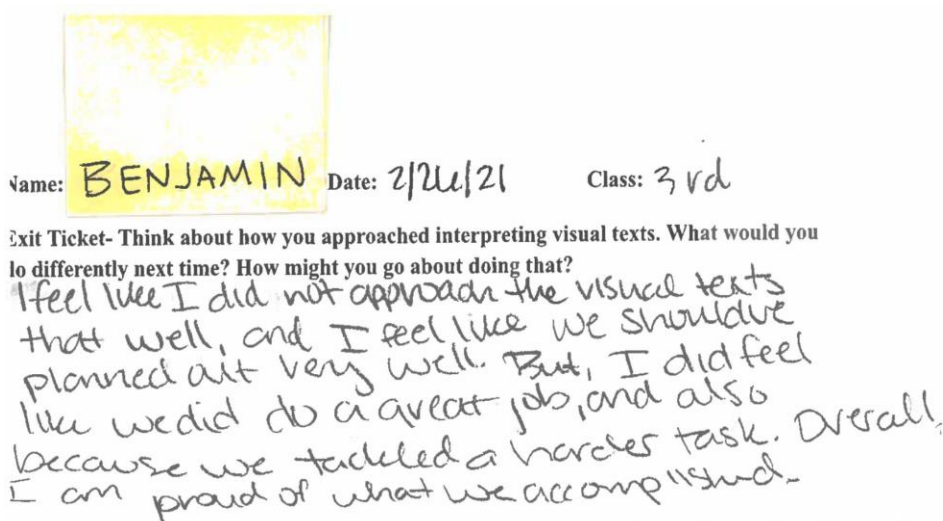
Notice how they matched the animals up into three pair segments, correctly demonstrating how codons are grouped. Furthermore, they understood the importance of

transfer RNA in bringing various amino acids to the ribosome, as their example used the Abattoir as the transforming agent that rearranged their animals (RNA code) into the sweater or hamburger (amino acid). If that were not enough, the color scheme used in their key also matched the colors in the example I created on the board only minutes earlier in the lesson.

Afterwards, I asked the group how they thought they did. Allyssa said that she was honestly shocked at how good their final product ended up. Benjamin, as he was metacognitively reflecting on his group's performance, had this to say in his exit-ticket.

Figure 14

Benjamin's exit-ticket (DL #2 visual texts)



Name: BENJAMIN Date: 2/26/21 Class: 3rd

Exit Ticket- Think about how you approached interpreting visual texts. What would you do differently next time? How might you go about doing that?

I feel like I did not approach the visual texts that well, and I feel like we should've planned out very well. But, I did feel like we did do a great job, and also because we tackled a harder task. Overall, I am proud of what we accomplished.

Socratic Seminars and Literacy Growth

The success of Socratic seminars in growing the literacy skill of effective communication cannot be overstated. They provided the opportunity for students to share their lives and emotions in real, unfiltered ways. The emotional connection students had to certain topics created engagement and provided impetus for debate that was deep, meaningful, and

abundantly rare according to many students. The following dialogue took place during DL #12 (Socratic seminar).

Denise: “Kids nowadays don’t really feel comfortable sharing the stuff in their life that is hard with other people their age. Everyone judges each other so much on social media that it makes kids like they cannot trust anyone. It makes you feel completely alone.”

Instructor: “Do you think this is what he meant in the video when he said that kids are really good at “putting filters on things” like in Snapchat?”

Denise: “It’s like you are trained to hide your emotions. Everyone’s fake and act like they care but they don’t, and they talk about you behind your back.”

Instructor: “Yeah, don’t do that. People that talk about other people, no one likes them. Be a better person. It is ok to be frustrated, upset, hurt, angry, etc. Having emotions is completely normal. Kids today really need to learn the skill of being able to express themselves emotionally... [brief pause, to the class] When was the last time you guys had a deep, meaningful conversation like this in class?”

Elfida: “I don’t know. Maybe never. Maybe once in English, but it’s always about some book that doesn’t really apply to today’s world.”

Adaeze: “Teachers just want kids to talk about boring stuff and like not get off topic. If you start being real, they just shut you down.”

Denise: “I think if we did this more in class then maybe kids nowadays would actually know how to talk to each other and wouldn’t be so mean.”

More than any other lesson, Socratic seminars provided instances where students could formulate and share their beliefs and opinions with their peers. Here are some more specific examples of how this strategy resonated with students:

- 1.) As a result of the discussion centered around transgendered athletes during DL #7 (Socratic seminar) one of my students felt comfortable sharing with me in confidence her identification as a member of the LBGTQIA community. She had not shared this with any of her classmates and said that only her closest friend knew that she was considering transitioning into a male. While most of the discussion surrounding the topic argued against the inclusion of transgendered athletes in women's sports, she did say that she was surprised and encouraged that her classmates were so accepting of the of transgendered community and said that it gave her hope of being accepted for who she is.
- 2.) During DL #12 (Socratic seminar) Zugeily shared that she struggled immensely with social anxiety. I had always known her to be quiet yet thoughtful in class and she predominantly interacted only with her friend, Elfida, in the same class. All the same, she felt comfortable enough to share that she struggled with ordering at restaurants because of perceived pressure to get it right and not knowing the waitstaff. Several students echoed her apprehension and provided her with acceptance and a safe environment to share.
- 3.) Another student in a different class shared about how her father had died four years earlier and how that had impacted her and her mother's relationship. She was able to convey to her peers how that loss and her grief had changed who she was and how she viewed the world. As the instructor I was able to provide perspective and clarification for

the class who in turn shared examples of loss and how that had helped shape them as well.

- 4.) Alicia, during our discussion of failed parenting strategies, very emotionally expressed her hatred and vitriol towards her mother. She talked through how her mother would manipulate her, her siblings, and everyone around her, calling her a “classic narcissist”. Alicia was clearly venting her emotional pain and frustration to the class.

During my 4th period class’s attempt at DL #12 a discussion occurred that I felt embodied the pinnacle of social interaction during this study. I started this class in the same manner that I had before. This time during one of the discussions breaks the class began to communicate to and with each other rather than me. I wrote this at the end of class.

- 4th Period: This class by far was the most mature and successful of all my classes. Students FINALLY began to speak directly to each other, asking questions and clarifying EACH OTHER’s statements, not mine. Alicia, Catherine, Leigh, Lilly, and Cadence are all major participants today.”

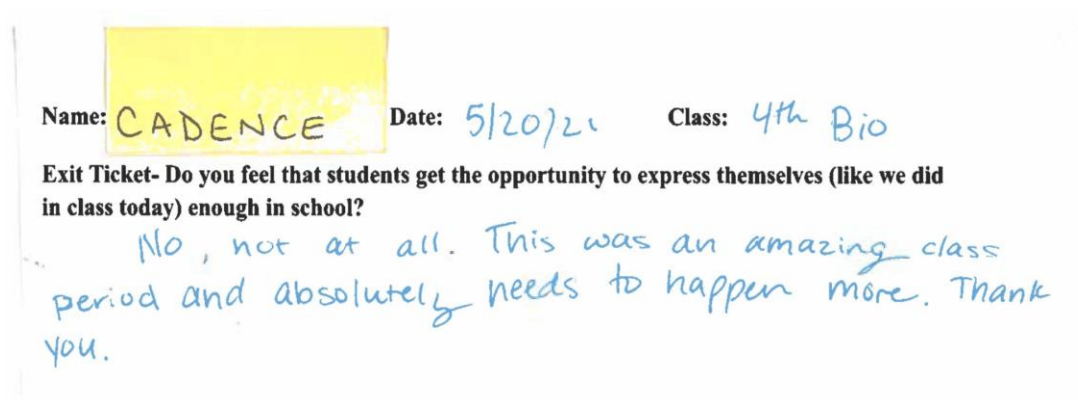
Out of all my classes, this group achieved being able to drive discussion and analyze each other’s arguments. I became a spectator rather than the catalyst for about fifteen minutes, realizing that no one in class was looking at or directing their responses toward me. As the students took over, they asked each other clarifying questions, reframed others’ statements and positions, and challenged and supported each other’s opinions. They, as the group, were deciding what information could be excluded and what was important as they shaped the conversation.

In short, they were acting as an expert would in their field. This was disciplinary literacy in action. Ten minutes after the completion of DL #12 (Socratic seminar) and following the completion of their exit-tickets they were *still* discussing their views on the topic.

This archetype captures the emotional feedback that many students provided.

Figure 15

Cadence's exit-ticket (DL #12 Socratic seminar)



Name: **CADENCE** Date: 5/20/21 Class: 4th Bio

Exit Ticket- Do you feel that students get the opportunity to express themselves (like we did in class today) enough in school?

No, not at all. This was an amazing class period and absolutely needs to happen more. Thank you.

Social Inhibitors to Literacy Growth

During the research there were many examples of social interactions having a negative impact on a student's ability to engage in developing their literacy skills. Students constantly had the ability to be socially stimulated; during conversation, throughout class, via texting with friends absent from the classroom, or intermittently through social media. The following illustrations show how DL lessons were interfered with by social interactions and motives.

1.) Adaeze is a student that I would describe as being the "social butterfly" in almost any group. Likeable, intelligent, and active in a variety of sports, her popularity allowed her

to fit seamlessly into most circles of friends. An immigrant from Ethiopia, Adaeze demonstrated exceptional English-speaking skills and a knack for humor.

During DL lessons, she often struggled to stay on task, preferring to crack jokes and share the day's events from social media posts. On multiple occasions I would catch her making TikTok videos consisting primarily of choreographed dances she would rehearse and record until she deemed them worthy of posting. She frequently instigated chasing or being chased by boys in class. These behaviors led to her racing to complete assignments at the last minute.

Now and again, she would leave her phone, phone charger, Apple air pods, or some other technological device in a previous class and ask to leave to go retrieve it. These interruptions were often accompanied by restroom breaks along the way and, of course, taking the long way to get there. Immediately upon her returning to class she would link up with her group and copy down what they had completed. Correspondingly she had significant gaps in her understanding and that much of her time-on-task with DL strategies was fragmented at best.

As the research progressed it became apparent that my class was not the only one in which this conduct was occurring. Towards the end of the year, she began showing up with Erica, another research participant, regularly during my conference period asking to hang out or to make up assignments (of which there were rarely any) to avoid her English class.

2.) Another student whose concentration suffered during DL lessons was Samantha.

Samantha's focus at school seemed to be her phone rather than her educational

experience. Almost daily she would snap “selfies” of her with her tongue hanging out and always the camera high over her head at a diagonal slant. She routinely had her phone in her hand during class, scrolling through social media sites during instruction and assignments. Samantha was clearly emotionally invested in what was happening in the concurrent reality of her phone as she routinely displayed happy, sad, and angry emotional outbursts according to what was happening on it.

3.) I had another student every three weeks or so who would come to class clearly emotionally disturbed, often crying. She would either go sit in the very back of class and not engage in class at all or ask to speak with me outside in the hall. She would tell me that she was being victimized online and was prey to cyberbullying. On more than one occasion she would get so emotionally charged that she would break out in hives and need to go see the nurse. In those instances, she rarely returned to class.

4.) Denise preferred the social engagement of cutting up with friends in person rather than interacting with them online. One of my brightest, Denise began the school year as a model student, however her focus on class began to wane as side-bar conversations with her friends in class devolved into being off-task for most of the instructional period. Denise was clearly aware of her emergent misbehavior and on multiple occasions came to me and apologized for her actions during class. She was metacognitively aware of her shortcomings though her behavior did not improve.

Grouping Students

A critical component regarding social interactions in the classroom was the management of grouping students for DL lessons. I allowed students to choose their own groups most

of the time. Many students were able to make wise selections and choose group partners that would focus and support each other's learning. Some simply chose to be in groups with their friends so they could talk with each other. If a group proved too ineffective, I would step in and reorganize them but for the most part groups worked together in a successful manner.

The disparity of groupings created a variety of group skill levels to simultaneously monitor, engage, support, and focus during the DL lessons. Here is a line from my reflective journal that is perhaps the greatest negative constant that can be taken from groups attempting literacy strategies in this research.

- Groups containing all boys had the greatest difficulty staying on task. Shocker.

The challenge here is to create opportunities for classroom discussions centered on the learning. Four boys or girls in the same group presented challenges given that they often inhibited collaboration and engagement in the learning process far more than it helped. It was evident that students were lacking intentionally curated classroom discussions. Not having structured opportunities for conversations such as those created in DL #12 (Socratic seminar) prevents students from being able to investigate a topic together, learn from others' expressed thinking, and develop and practice social and literacy skills. The following exit-ticket sums up how one particular student felt about how often they engaged in similar strategies and perhaps some insight into their perspective.

Figure 16

Anonymous exit-ticket (DL #12 Socratic seminar)

Name:	Date:	Class:
Exit Ticket- Do you feel that students get the opportunity to express themselves (like we did in class today) enough in school?		
<i>No not we do it's work</i>		

The Teacher in a Social Context

To be certain, the role of the teacher is that of instructional guide and disciplinarian. A large portion of the responsibility of a teacher is to teach content, challenge students intellectually, and manage the learning environment. But to truly improve how students engage in reflective literacy practices, positive relationships with students must be developed. I often reflected during class on how I was interacting with students socially in the learning environment. In DL #3&4 (read aloud/close read) I considered my interaction with students.

- One thing I am really liking are the **types** of conversations that I can have with students. I am finding that I am getting to know my students much better and building relationships with a larger percentage of my classes. Surprisingly enough, they seem to be enjoying it too.

This was interesting to me because I did not anticipate that reading to students and showing them how to break down a piece of academic text would spur so many opportunities for meaningful conversations. Most of these occurred one-on-one as I was helping to explain to a student why I was doing something or helping them to understand a strategy. I found that they were sharing with me their approach, reflecting on what worked for them and why, and we were having quality exchanges regarding strategies for literary analysis.

I had on the other hand anticipated lessons such as Socratic seminars and PBL groups creating opportunities for meaningful conversations. What I found especially confounding was that very often, for the most part I would say, students who were working together in groups were engaged in social conversations that had *nothing to do with the learning taking place*, rather than academic conversations. During DL #6 (PBL) I recorded this observation pertaining to the nature of student conversations.

- There was less collaboration amongst the whole groups then I thought there might be. Students seemed focused and engaged, however I noticed in many of the groups that there were only single comments here or there relating to the “work” of learning. Students would say things like “So this one goes here, right?” to a group member, and once they verified they were on the right track, *talk would divert from the learning process* and move to other things as they worked.

Developing relationships often comes from sharing your personal experiences, in life and in learning, with students. During this study, I noticed it was often the small, micro-interactions that take place with a student that help amplify trust and provide

opportunities to support their development of literacy skill. This brief exchange took place following DL #5 (learning logs), as the bell was ringing to change classes.

Lilly: “I really like the idea of the strategy. I just wonder if I will use it for a week and drop it or actually develop a bit.”

Instructor: “I use this strategy to reflect and plan for my classes in college. It is great. I’m not very good at it yet, but I am enjoying it and finding it really useful.”

Lilly: “I really like it. I think I’m gonna try it out and see where it goes.”

Lilly is a delightful student with a wonderful personality. She is the type of kid that teachers refer to when they say, “I’d like to have ten more just like so-and-so”. As it turns out, Lilly did sustain that practice. Her learning log rivaled the top of the grade-level in sophistication and depth of reflection. And the fact that she had more entries than any other student, and across a broader array of subject areas showed how she truly embraced the strategy. I was able to view her reflective journal, however I did not obtain samples of her work, as she wanted to keep her journal and continue to develop using that strategy. I can tell you that she absolutely loves what reflective journaling did for her school experience, and it makes the whole process worth it when you can empower a brilliant young student with one lesson.

Here is conversation I had with Catherine around DL Lesson #5 (learning logs).

Catherine can come across as opinionated and a “straight-shooter”. As I was going around the room seeking feedback from individual students, she had this to say:

Catherine: “One of the things I learned today was that Coach Beaver cared. Otherwise, we wouldn’t be doing this. Also, I hated this assignment.”

Instructor: “Aww, thanks. Why the hate?”

Catherine: “I don’t need to *reflect* to remember or develop my thinking. I just do it. To me this is just busy work, but I will do it because I want the grade.”

Instructor: “Ok, but surely there has to be some value you can find in testing your mind in this way, right?”

Catherine: “Not really. Not to me.”

The funny thing is that knowing Catherine, her perspective may have been right. Catherine is the quintessential “Straight-A” student; the classroom leader, who has amazing, supportive parents; who plays golf and mothers everyone. She most likely really did not need to use this strategy to produce this level of work. On a positive note, she did feel comfortable enough with me to express her objections. Every student is unlikely to receive the same level of benefit for every strategy and in this case she was. What I missed out on as it happened was the opportunity to refocus Catherine on the *process* and not the *result*. If I could go back in time, I would have helped her consider how useful this activity could be with much more difficult material.

Another innocuous interaction with a student named Donovan provided a deeper level of understanding and trust in our relationship. A highly intelligent and creative student, Donovan was identified as being on the Autism spectrum, likely with high functioning Asperger's Syndrome. Donovan and I had developed a great relationship throughout the

year. Earlier in the school year, Donovan was struggling with fixating on his phone and not engaging in learning. He would often simply not attempt assignments in class. I began working with him, speaking with him daily and helping him manage his behavior, which had laid the foundation of our relationship.

Often, he would seek me out before, during, and out of class just to visit or share something he was interested in. Following the squid dissection conducted in DL #9 (PBL) I found Donovan at the other end of the classroom as students were cleaning up their lab tables. He was crouched behind the Chromebook cart, clearly upset, and crying.

Instructor: “Donovan, what’s wrong? Are you ok?”

Donovan: [through tears] “I’m ok.”

Instructor: “Are you hurt? Did something happen?”

Donovan: “It’s just... I really like Mollusks.” [Squid are members of the Phylum Mollusca]

Instructor: “I’m so sorry, I had no idea that...”

Donovan: “It’s ok, why would you.”

Instructor: “If I had known this might affect you this way, I would’ve maybe set up an alternate assignment for you... Would you like to take a few minutes outside of class to cool off?”

Donovan: “Yes.”

After class he explained that he had an attachment with certain types of animals. Knowing that individuals with Asperger's can often fixate on certain things, I reaffirmed that he could always come to me with any concerns he had beforehand, and that I would be more than willing to do what I could to help. I told him not to worry about completing the post-dissection reflection that day, that he could complete it another time. He told me he appreciated that I never made fun of him and always tried to help. He shook my hand and told me I was his favorite teacher. This gesture was especially substantial because Donovan was normally averse to physical contact.

Literary Support

Students engaging in collaborative learning such as Socratic seminars, inquiry circles, or partner-sharing, opens the door to the construction of meaning by communicating ideas to one another respectfully (Lent, 2014). In addition to simply participating, Lent (2014) suggested that Socratic seminars required students to think and engage using literacy through which students obtained repetitive practice using disciplinary language, memory recall, and listening to other's perspectives. Many of those student perspectives revealed a desire to share emotional hurts they were or had gone through in their lives.

In argument for the usefulness of Socratic seminars and more socio-emotional support in schools, Hammond (2014) mentions socio-emotional support in the classroom has causal to the shift students from being dependent learners to independent learners. This change in thinking allows students to transition into an independent learner through creating partnerships with the teacher and students in their learning environment (Hammond, 2014). According to Hammond, (2014) building rapport and trust combined with the co-construction of a learning partnership results in validation and a shift towards an

academic mindset that promotes progress feedback, engagement, and increased effort and cognitive insight.

Worsley et al., (2021) present that the establishment of collaboration as a form of literacy frames the discussion for how people of all ages interact in collaborative experiences.

Smith Davis (2013) recommend that educators can and should structure student classroom conversations to demonstrate goal-oriented and participation focused use of discipline-specific vocabulary. While reflecting on their own research, Worsley et al., (2021) recorded that many various dimensions of participation within the student collaborative environment can often be stimulated with a single well-designed lesson.

Atun, (2021) in a study found that student creativity and collaboration increased when presented with group interactive science activities involving their decision-making in response to a potential earthquake disaster. Atun (2021) further references the student interactive experience within the tactile nature of the task and proposes that there is a correlation between intentionally creating opportunities for students to collaborate and discuss their experiences, one of the key findings in this research. In the arena of visual literacy, Gaudelli (2009) noted that visual texts, such as those used in this research during DL #2 and #10, improved collaboration and discussion through creating a basis for discourse and the development and enrichment of that discourse, a finding echoed by this research. The author goes on to argue the benefit of visual texts being impactful and having immediacy for today's youths, and thereby increasing engagement and interest.

Burder et al., (2014) showed that students who engaged in Socratic seminars showed higher thresholds of critical thinking, specifically how they expressed their perspective

and justified their positions. Ariffin (2021) found in a study of EL learners' vocabulary development that many preferred participating in group work rather than individual work, citing the benefits of group thinking, help identifying mistakes or misconceptions, and help completing the final product as reasons for working in social groups. The author continued to place an emphasis on how simply engaging in the process of collaborating on literacy tasks improves listening, spelling, speaking, and all other practices related to discourse. Student evaluation of evidence and construction of explanations within discussions helped demonstrate thinking skills needed by scientists in their field (Bati, 2019).

Maeda (2017) in a study of international students determined that skilled educators could assist students in speaking up in discussion through providing additional discussion opportunities and increased positive feedback. Zhang et al., (2017) exhorted the release of the responsibility of learning from the teacher to the students, where the instructor helped facilitate vibrant discussions and students reframed and challenged one another's thinking. Seechaliao (2017) found that the best discussions formed creatively as students shared knowledge in groups and came to a consensus regarding their thought processes.

Scalise (2016) in her research saw groups collaborate to effectively fit scientific data and mathematics to their use of digital technologies in an interactive lesson. Disciplinary skills in the field of technology could prove exceptionally valuable when student future work environments are seeking employees able to synthesize work alongside other employees, digitally collaborate, and others (Scalise, 2016). Atun (2021) and Scalise (2016) both found creating additional opportunities for group collaboration to have positive effects on performance by bringing in skills of their respective disciplines.

Focusing on educators collaborating with DL strategies, Lent (2016) found that teachers became highly motivated, intellectually engaged, and intentional about sharing the effectiveness of these strategies with their students. Lent and Voight (2019) showed teachers “trying out” DL strategies ended up collaborating with each other via a video log sharing new strategies to try out and how they worked. Dewitt (2017) further suggests that teachers who feel more connected, both to their peers and to their craft, builds collective teacher efficacy

Following analysis of social interactions in the classroom, here are some key takeaways to consider when attempting to curate social interactions with Disciplinary Literacy strategies:

1. ***Authentic collaboration does not plan itself.*** Begin the process a month in advance. Give yourself time to imagine and reimagine what a lesson might look like.
2. ***Get ready to manage the conversations.*** Think about how you might redirect two students who are talking over each other. What about if they are arguing? Establishing clear guidelines for effective communication was critical to the success of Socratic seminars.
3. ***Lead with relationships, not teaching.*** If students know that you care about them, they will give you everything they have got.

Writing-to-Think and the Role of Metacognition

“The world is full of obvious things which nobody by any chance ever observes.”

-Sir Arthur Conan Doyle, *The Hound of Baskervilles*

“Oh, what's so great about discovery? It is a violent, penetrative act that scars what it explores. What you call discovery, I call the rape of the natural world.”

-Dr. Ian Malcolm, *Jurassic Park* (1993)

“I wrote my way out...

Wrote everything down far as I could see...

I wrote my way out...

Looked up and the town had its eyes on me.”

-Alexander Hamilton, “Hurricane”, *Hamilton Soundtrack* (Manuel-Miranda, 2015)

Writing-to-Think

The emergent and surprising importance of creating rough drafts to develop my thinking and teaching practice would fall squarely in the “unintended data” section of this paper.

Once I began to truly engage in metacognitively reflecting on my practice, I found myself *constantly* writing. Even more impressive, I found myself returning to that writing; annotating, highlighting, doodling, and refining my thinking.

I grew up in the “underline something if it was important” age of textual interaction. Books were a source of interest for me, and I read often in class, only I did very little reading of school texts. If I was reading, I was reading a five-hundred-page fantasy fiction novel and certainly did not have the desire or time for the textual analysis of documents. The process of highlighting and reflecting on my reading was as far away from me as my understanding of a prepositional phrase.

When it came to writing, I was and have always been a G/T student who simply began putting down whatever came to mind. I turned it in and usually received a good grade, so I thought I understood how to write. I loathed grammar and detested any practice that would prevent me from finishing my writing as quickly as possible. This was, of course, to return me to the writings of Michael Crichton or Stephen King more expeditiously. I was bored with school and chose to escape into novels instead.

I would have never identified myself as someone who would write down my thoughts in preparation for a task either, let alone organize, color code, and order the steps of my process. And yet, I did. Below is an example of a simple “intermediary” text that I created during the research:

Teacher strategy hit list

-Identify and effectively convey the task at hand

-Shift roles as necessary (guide, taskmaster, idea-generator)

-gather initial engagement data (classroom feedback) and adjust

-Reflect and improve instructor delivery with each class

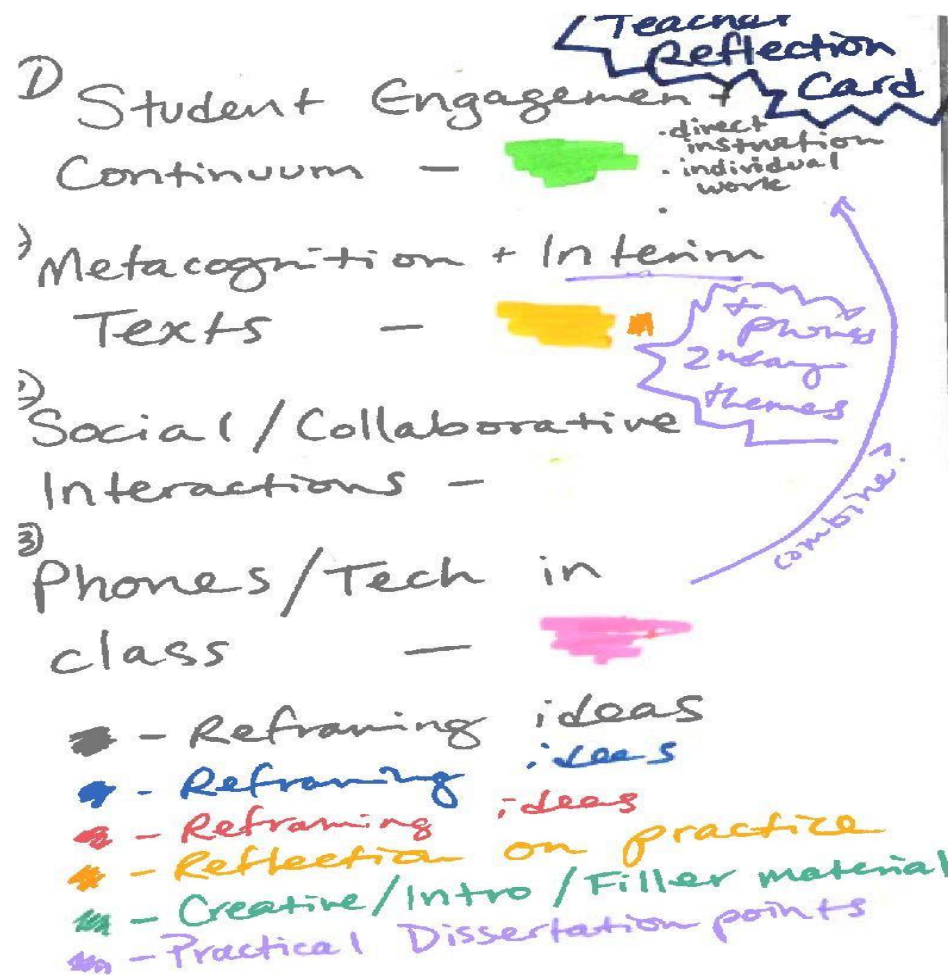
-Exercise restraint in communication (do not over-inform, prematurely provide answers, or connect the dots for them)

The creation of this intermediary text took me approximately two minutes to complete.

The benefit of such a document is that while I was planning, refining, or organizing resources for my lesson, I was able to refer to this text to inform my approach. Even if I did not actively use it during lesson planning, the act of simply creating it helped me retain that information in the forefront of my mind. I was surprised at how natural and useful the creation of these texts were in supporting my teaching practice. The following are some examples.

Figure 17

Instructor's "Intermediary" text #1



This was written down on a nearby scrap of paper. There was something very organic about my transition into using color and reflection as a tool, in the same way a hammer and level are used for hanging a picture. Often, I would be walking around, and a “flash of inspiration” would occur. I would begin metacognitively reflecting on something from the research and need to get that thought on paper (intermediary text) as soon as possible to avoid losing it. My initial attempts were usually broad in scope.

Figure 18

Instructor's "Intermediary" text #2

Due Jun 12th (12 days) / **Current LIST**

- Write Metacog Section using crunched data.
- Crunch DL RJ data using color key
- Complete 1st theme S-T Continuum
- Write 2nd theme - Tech in the classroom
 - easy on teacher side (intentional student opp. / data collection)
 - pull "examples + gty!" (maintenance / dictation)
 - sources
- Write 3rd theme - Social Interactions
 - S - highs + lows, sources, social awkwardness, ^{how they engage} as antisocial
- The role of Metacognition / Interim texts

Socratic Seminar

Metacog -

- crunched data
- student examples
- resistance / challenges
- role as pre-req to DL

Interim texts -

- emergence in Teacher ^(ex.) practice
- failure to move to student practice
- lessons learned
- student examples

Due Jun 20th (8 days)

- Complete descriptions of all 12 lessons

* Write Conclusion ^{rough paper} (outline ~~outline~~ ^{from each} section listed, easy follow)

In the following example, the sophistication of my writing-to-think is improving. I am changing colors to represent new ideas and my writing is more focused on the task of outlining my information.

Figure 19

Instructor's "Intermediary" text #3



What I found especially interesting in developing my use of these texts was how easy it was to organize my thoughts. I was writing-to-think, organizing and connecting my ideas on paper. Again, and again, I found myself returning to using colored pens to write out and jumpstart my creative process if I hit a rut. During the research period, I created roughly fifteen or so rough drafts both in planning for DL lessons and in writing up my

findings. When I read disciplinary texts, I would close-read my pages so that they were littered with commentary, ideas, and connections.

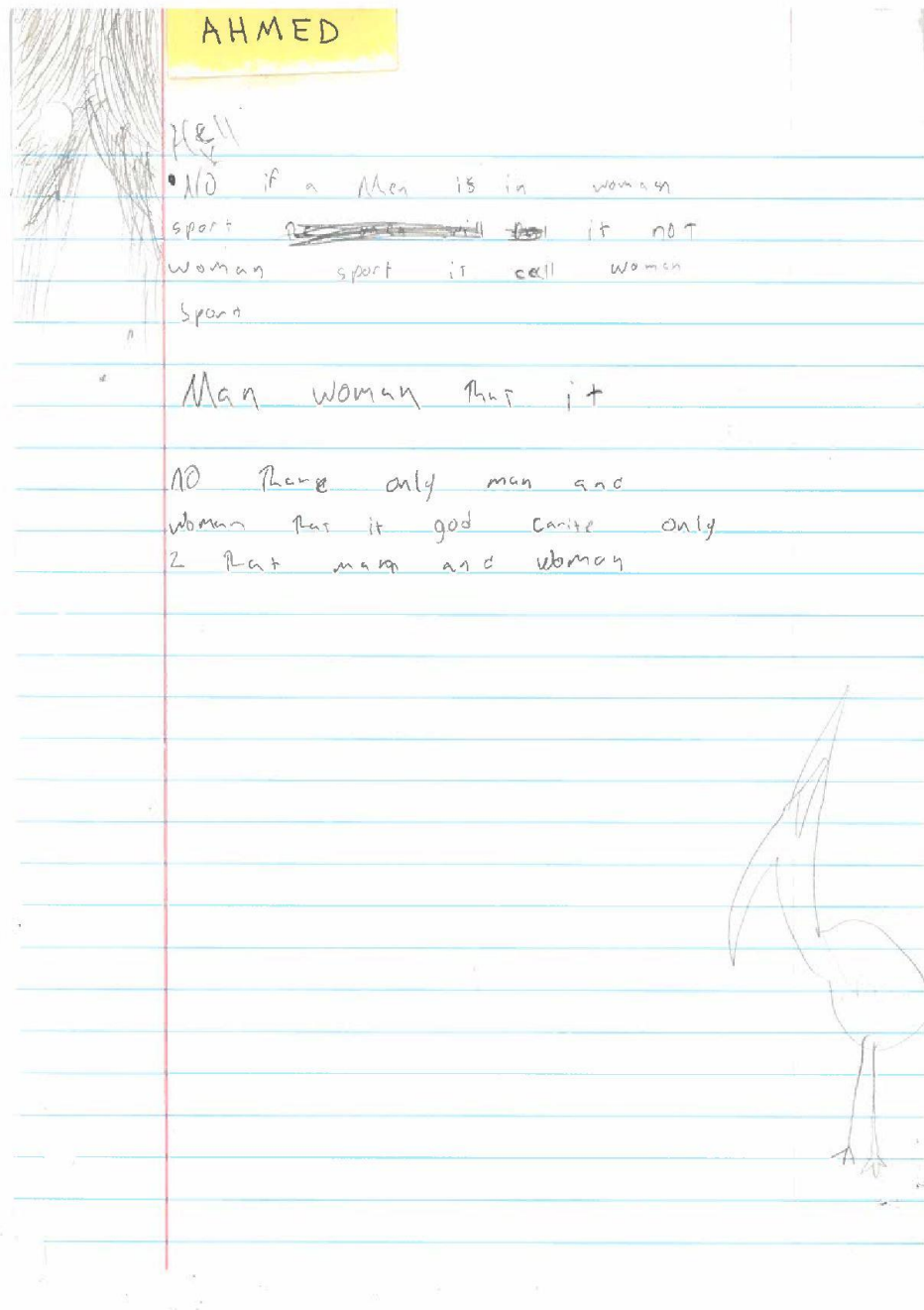
I also did not anticipate I would be able to oscillate from topic-to-topic so easily, or that I would be able to maintain so many streams of data simultaneously. After all, I am a male, and multi-tasking is not exactly our forte. When I began to begin a planning task, I would write out my thoughts in a rough outline or list. I would then revise and develop that list. This provided a jumping off point for the creation of another intermediary text. From that point, I might transition to a computer to write, or begin using my phone to dictate my thoughts regarding a lesson, and so forth. Even my finalized lesson plans were interim in nature because I was constantly adjusting my plan.

Student Rough Drafts

To a lesser extent, students created and used neophyte intermediary texts during the research period with varying levels of sophistication and success. During DL Lesson #7 (Socratic seminar) students were encouraged to use a sheet of paper to write out their thoughts on the topic. In doing so, students were creating rough drafts that they could refer to when participating in class discussion. Students were asked to consider whether transgendered athletes should be allowed to compete in women's sports. Here are two examples of students writing out their thinking.

Figure 20

Ahmed's "Intermediary" text (DL #7 Socratic seminar)



Ahmed, perhaps more than any other research participant, struggles with writing in English. An immigrant from Saudi Arabia, Ahmed's level of comprehension, sentence

structure, and handwriting were all poor. One student told me that the reason his handwriting was so poor is that for the first year he got to Pine Tree he pretended to not be able to read or write. His level of demonstrated thinking is difficult to follow, linear and basic, and includes a drawing of a bird.

Figure 21

Erica's "Intermediary" text (DL #7 Socratic seminar)

Anonymous / ERICA

Should Transgender athletes be allowed to compete in womens sports?

• personally I disagree. they would have a higher advantage b/c mens strengths are greater than womens. Nothing against them but it would not be equal. God created every human being the way he wanted them. Nothing wrong with a little change. But also their strengths would be greater than a female.

• size
• age

Gender identity

• being forced to change your gender should not be aloud.

My mind hasnt changed about whether it should be allowed or not

Erica demonstrates much more sophistication in the development of her thinking through the creation of her text. She brings in the concept of religion while countering with a necessity for some change to take place. Ultimately, she decides that her opinion has not changed although I do not know at what point in the lesson she wrote that portion. She separated key information and thoughts to help her maintain clarity throughout the reflective writing process.

Students also began to create rough drafts for assignments. During DL lesson #10 (Visual Text), students were tasked with creating their own dichotomous key. These disciplinary tools, they were told, are used by Biologists to name and classify organisms. Creating one involved identifying increasingly inclusive paired statements that helped categorize organisms based on traits that they have in common. Below is an example of how a simple dichotomous key might separate different species of dogs.

Figure 22

Dichotomous Key Exemplar

Dichotomous Key for various species of *Canis lupus familiaris*

- 1a. Weighs over 50 lbs.....go to 2
- 1b. Weighs under 50 lbs.....go to 3
- 2a. Has short, straight hair.....Doberman Pinscher
- 2b. Has curly hair.....American Poodle
- 3a. Torso is longer than it is tall.....Dachshund
- 3b. Torso is shorter than it is tall.....Chihuahua

“Dichotomous” means “divided into two parts”. Depending on the number of organisms in the key, each contrasting characteristic should provide two options to further pursue until you arrive at that particular organism. Correctly reading this disciplinary visual text can be difficult for some students, and more difficult for them to create.

Figure 23

Shantrelle’s “Intermediary” text (DL #10 visual texts)

SHANTRELLE

Dichotomous Key:

1. a. is it sweet ... go to 2
b. if not ... go to 4
2. a. has caramel ... twix
b. if no caramel ... go to 3
3. a. if it's hard ... jolly rancher
b.
4. a. if it's salty ... pretzels
b.
5. a. is it cold ... ice cream
b.
6. a. is it taffy-like ... airhead
b.
- 7 a. is it minty ... gum
b.
- 8 a. is it triangle shaped ... doritos
b.
- 9 a. if it has nuts ... snickers
b.
- 10 a. if it's sour ... warheads
b.

Snacks

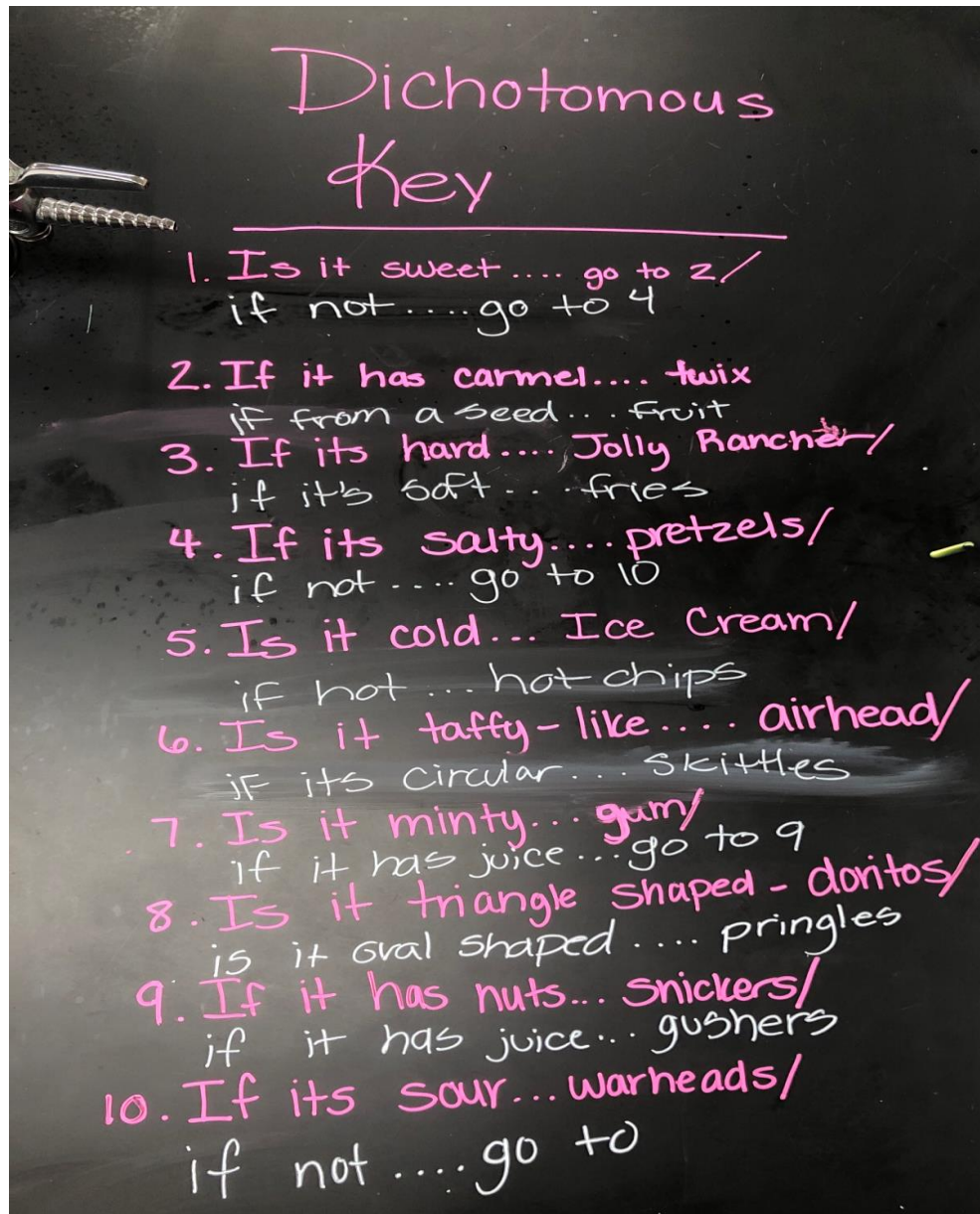
- Skittles
- Sour patch Kids
- ~~Snickers~~
- Starburst
- ~~gum~~
- ~~warheads~~
- gushers
- ~~twix~~
- Jolly ranchers
- ~~airheads~~
- ~~pretzels~~
- ~~doritos~~
- ~~hot chips~~
- fruit
- ~~pringles~~
- ~~Ice Cream~~
- ~~Fries~~

Shantrelle constructed a list of snacks and sorted them by traits into the dichotomous key on the left. It was clear that she had a very limited understanding of how a dichotomous

key works. For her to properly differentiate her snacks, she would need to break down items starting with *the most inclusive* criteria.

Figure 24

Shantrelle's submission (DL #10 visual texts)



Her final product is improved; however, it is evident that she still does not fully grasp the concept of how to correctly create a dichotomous key. Her first misconception was that

there is no way for the person using the key to get to step 3. Or any of the steps past step 5. This is an example of the instructor trying to do too many things at once during the lesson. If I had truly analyzed it instead of walking around and thinking it looked good I would have quickly caught and been able to correct her misconceptions.

The Role of Metacognition

Let us return to the examination of the process of Metacognition, that is, thinking about your thinking as you engage in a learning task. Metacognition proved to be essential in connecting all the inputs required to practice disciplinary literacy. According to Lent and Voight (2019) the changing of *learning behaviors* for students based on the examination of their metacognitively monitored thinking is really the goal. Our typical classroom behaviors changed as we used DL lessons to navigate the knowledge acquisition process.

The Classroom Observation Form

This classroom observation form was derived from a pre-instruction checklist created by Dr. Timothy Shanahan, which identified the alignment of a proposed lesson with major tenets of disciplinary literacy instruction. Throughout instruction, I would monitor and rate the levels of student performance in each of the domains. The observation form is located as a stand-alone document the *Appendices* section.

The evaluation and analysis of disciplinary literacy strategies in the classroom was its aim, as well as to determine effectiveness the level of student participation and how they are participating. These forms were completed only once per DL lesson within twenty-four hours or so from the last lesson being taught. The following figure shows the scores of the lessons from their Classroom Observation form.

Figure 25*Classroom Observation Form Scores*

<u>DL Lessons</u>	<u>Total Points</u>
<u>DL# 1:</u> PBL	20
<u>DL #2:</u> visual texts	24
<u>DL #3&4:</u> read aloud/close read	48
<u>DL #5:</u> learning logs	<i>did not record</i>
<u>DL # 6:</u> PBL	27
<u>DL #7:</u> Socratic seminar	39
<u>DL #8</u> concept web	30
<u>DL #9:</u> PBL	<i>did not record</i>
<u>DL #10:</u> visual texts	26
<u>DL #11:</u> close-read	31
<u>DL #12:</u> Socratic seminar	44

The data collection and analysis of classroom observations was minimal in the sense that the scope of the instrument was too broad for the purposes of this study. I do want to note that the least favorite/highest scoring disciplinary literacy lesson DL #3&4 (read aloud/close read) truly defined DL, as students were interacting directly with expert texts. The lowest overall score belonged to DL#1 (PBL) and was unsurprising in that the instructor was still developing understanding of the implementation of DL lessons.

Unfortunately, I did not give this data set enough attention following completion of the research for a variety of reasons. The first was that collecting this data was always meant to be a supporting form of data, rather than a stand-alone focus of this research. The

second was that I felt it was a bit over my level. I created something more logically suited for research with a much narrower focus, though the process of completing it did fuel my metacognitive thinking towards other areas of the research. Finally, I simply ran out of time. I made the priority of the research the analysis of the teacher reflective journal, student exit-tickets, instructional experiences, and the metacognitive awareness inventories. This merits consideration for future research.

The Metacognitive Awareness Inventory

Participants were presented with the Metacognitive Awareness Inventory, or MAI, prior to all DL lessons and following completion of the last DL lesson. The purpose of this was to determine what relationship, if any, that Metacognition had with Disciplinary Literacy. The full document and scoring guide are located in the *Appendices* section.

Of the twenty-nine research participants, two did not complete an initial inventory, one did not complete a final inventory, and one had identical results on both pre- and post-intervention inventories. Seven participants scored *lower* in metacognitive awareness on their second attempt following the research timeline. Of those, two showed a loss of more than five points. Eighteen participants scored *higher* in metacognitive awareness the second time, and of those eight showed an increase of more than five points. Over two-and-a-half times the number of students demonstrated metacognitive awareness growth compared to those who regressed.

One student recorded a twenty-point positive jump in metacognitive awareness based on the inventories. Was this student an outlier that needs to be disregarded? Statisticians certainly would say so. Within the realm of qualitative research there must be at least

some intrigue surrounding a strategy that has shown to help a student think critically and in an interdisciplinary manner *because of* literacy strategy usage.

Perhaps there is a definitive benefit, but there are other factors to consider as well.

Roughly one-fourth of the participants did score negatively, a question that surely needs answering. What could the factors be that influenced this outcome? Additionally, over half of the research participants (15) scored less than a 5-point swing positively or negatively, indicating that many did not experience much change in metacognition because of the DL lessons.

Experiences in Metacognitive reflection

Early on, I failed to remember to pass out exit-tickets to collect data during PBL lessons. I kept trying to understand why I forgot during each of the three attempts in the research. It was because I was trying these strategies for the first time and struggled with maintaining consistency in a chaotic project-based environment. I was trying so hard to focus on the interactions taking place in the classroom and metacognitively reflect on them simultaneously. Here is an example of one such reflection.

- There was less collaboration amongst the whole groups then I thought there might be. Students seemed focused and engaged, however I noticed in many of the groups that there were only single comments here or there relating to the “work” of learning. Students would say things like “So this one goes here, right?” to a group member, and once they verified they were on the right track, talk would divert from the learning process and move to group conversation of other things *as they worked*. I wonder how to move the needle more towards academic conversations...

When I did record and correctly analyze their responses my reflections looked more like this example.

- After reviewing the questions related to how to read their visual text, I was struck by the amount of surface level responses that I received. The three groups that provided the most correct and specific feedback relative to the discipline were minority male students, which leads me to believe that this activity was exceptional for allowing them to understand the content. These three groups all presented their visual texts with appropriate depth and provided specific dialogue as to how to read their visual text, utilizing disciplinary vocabulary.

Later, when I was able to review my reflections with a fresh perspective, I sought to improve my practice by reflecting on larger amounts of information. During DL #2 (visual texts), I recognized how poor the quality of student exit-ticket responses was. I was reminded of my military service and how we would conclude each mission. We always conducted an AAR, or After-action report, which basically had all parties involved metacognitively reflect on the event that had just taken place and evaluate how things went. We would give three positive things and three negative things about the mission. It did not matter how tired a soldier was, they could at least come up with three ups and downs. I recorded that I needed to try this strategy for an exit-ticket, which I did on assignments 3&4. During Assignments 3&4 (read aloud and close-reading of text), I reflected in my journal after my first day implementing the lesson using the “3-up, 3-down” model I used during my military service.

“3 Up”

- 1. My overall conceptualization of the lesson was sound.

- 2. I was responsive to all the feedback I received from my students and adapted well.
- 3. I did an excellent job of sharing how and why I used certain strategies to make meaning from the text.

“3 Down”

- 1. I still need to include more support. I should have made multiple copies of my example so that more students that needed an example would have had one.
- 2. The assignment was long. In the future I would need to break it up into two class periods.
- 3. I feel that providing students with a physical set of instructions would have been a better choice instead of verbal instructions.

The following “3-up, 3-down” exit ticket was created for student responses following DL lessons 3&4. Compare the last two “cons” from the student’s reflection with my last two “downs”.

Figure 26

Cadence's exit-ticket (DL #3&4 read aloud/close-read)

Name: **CADENCE** Date: 3/3/21 Class: Bio #4

Exit Ticket- Think about the literacy strategies of reading aloud and close reading we just completed. Try and come up with three (3) positive benefits you received from these strategies AND three (3) weaknesses or areas that could be improved.

3 pro	3 con
<ul style="list-style-type: none"> • amazing strategy b.c. it helped me think through • the difficult paper helped better than an easy one would • helped simplify the normal strategy immediately 	<ul style="list-style-type: none"> • many kids get bored of reading • Some people had no idea what was going on • took a long time to complete

The example above shows that Cadence and I were on the same page as to the weaknesses of the DL lesson. The benefit of metacognitively reflecting on how my students thought the lesson went allowed me to incorporate their feedback into the instructional process. Through the use of metacognition, I had accessed my prior knowledge and retrieved a strategy that had worked for me years earlier and was using it effectively to inform my practice.

Occasionally, rather than asking students to complete formal exit-tickets I would take a quick poll and ask students what their initial thoughts or feelings were following the strategy. I would write out their responses on the whiteboard, making occasional comments or rewording their suggestions slightly. I then typed them into my reflective journal. Here is the format I used.

- 0 out of 16 raised their hand when asked if they hated the assignment. Some said they were neutral about it. Here are the responses we wrote on the board when asked how they felt about the assignment:
- Boring, easy, made you think, didn't hate it, personally easier for the teacher to explain than teach myself, hard to focus on reading and reflecting at the same time, content was interesting, breaking the text down helped, strategies were useful to learn.

These were invaluable for adjusting prior to the next class and seeking out student stumbling blocks. I was able to consider each student's perspective, ask a clarifying question, or take the conversation back to content based on their reply. It was through the examination of student experiences attempting DL lessons that helped me understand the big picture of their role in the classroom.

Student Examples

One student I wanted to be sure to include regarding her metacognitive practices is Alicia, a G/T female student. During DL #5 (learning logs), mere seconds into presenting the concept Alicia blurted out, "OMG this would be so easy for Geometry." She had immediately come to understand the strategy and had identified uses for it in another subject. This student likely has one of the highest I.Q. scores of all my students and comes across as if she has had three espresso shots when her interest is piqued in class. Here is her completed first log for DL lesson #5.

Figure 27

Alicia's submission (DL #5 learning logs)

Thursday
March 11, 20, 21
Biology

ALICIA

LEARNING JOURNAL

space for students to record their thoughts, feelings, and questions about what they are learning.

levels

- Beginner (3-2-1 chart)
- Intermediate (experience/T-chart)
- Advanced (Reflective Journal/self-formatted)

A Learning log consists of 3 levels. The **beginner level** is a simple 3-2-1 chart. It is easy a preformatted to help the student create a helpful Learning log. The **Intermediate level** is a T-chart that is formatted for effective use. The **Advanced level** is a reflective Journal that is self formatted. It commonly contains a metacognitive paragraph.

FEELINGS

I think that this journal could be helpful in certain circumstances. Overall, I do not think that I would use this all the time, but I would be helpful to use once a week or two and at the end of every month to sum up what I've learned and what I think I could work on more. I don't think I would create a journal for each class, but I would create an overall school journal.

- once every one or two weeks
- Overall school journal rather than by class

OUTCOME

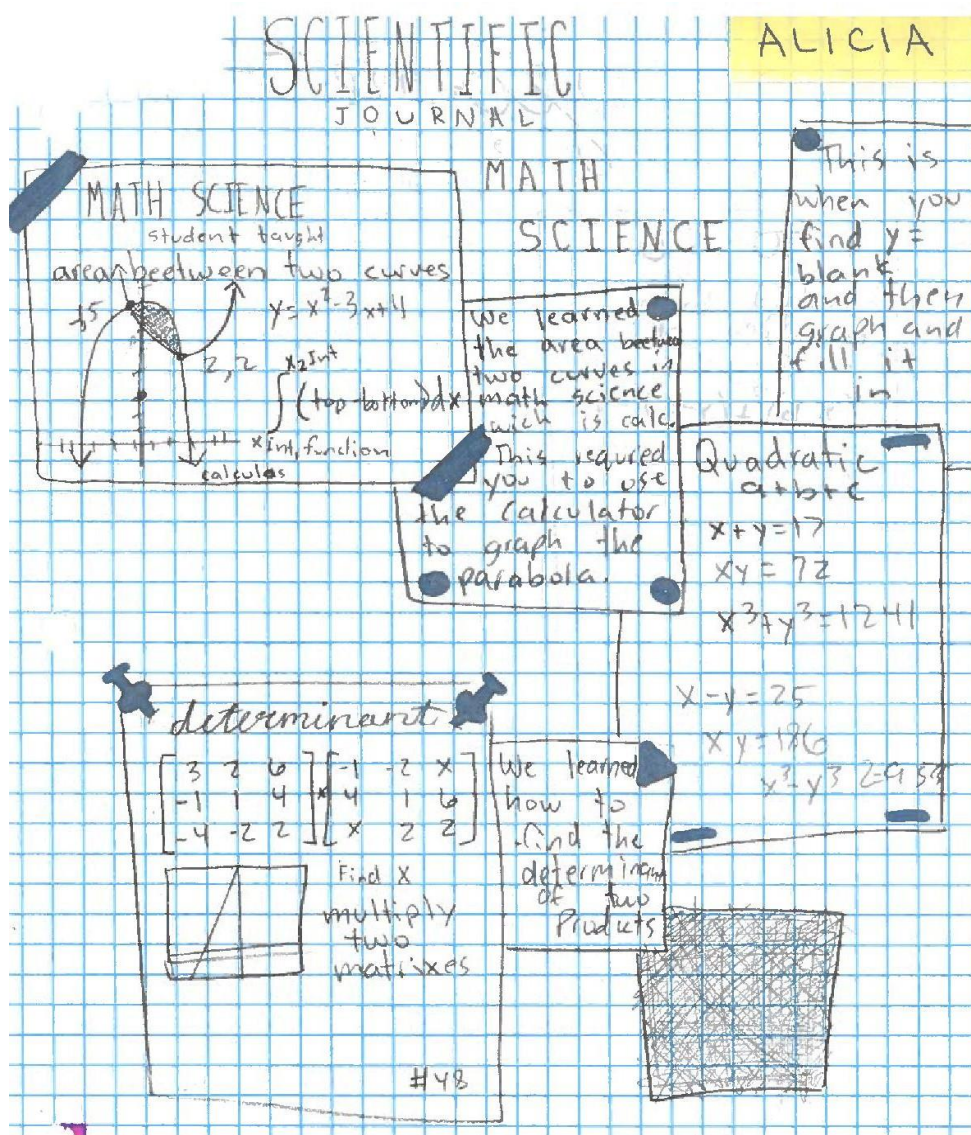
I will try this Learning log. By the time I finish the year, I will **reflect** on the log and **routinely look at** and **evaluate** my Learning log so I can try to learn more and use this information to help me learn and contain this information in my memory.

- ▷ reflect and evaluate logs
- ▷ retain info
- ▷ what do I know
- ▷ what did I forget

As it turned out, she did complete another learning log several weeks later that was related to Geometry from Math/Science Club, just like she said she would. Note that she was able to translate the strategy with ease.

Figure 28

Alicia's submission (DL #5 learning logs)



During a different DL lesson, Alicia related what we were doing in our lesson to a concept she had uncovered during research at home called “spaced repetition”, developed

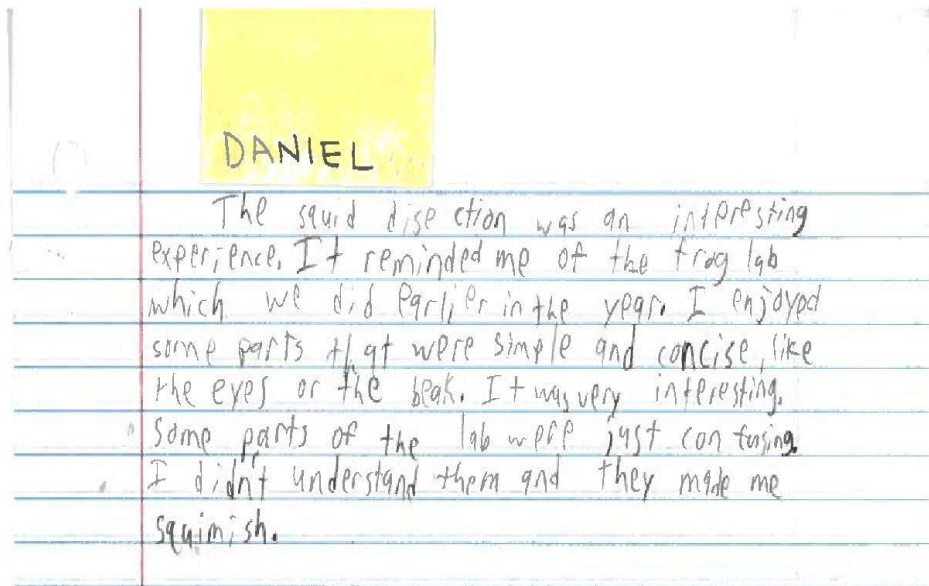
by German psychologist Hermann Ebbinghaus. She shared that she had read about him while trying to research how to better learn a new language and suggested I consider his work for my own study. That three-or-so minute conversation told me everything I needed to know about just how gifted Alicia already was in her. Her functional cognitive skill was high enough to be able to; a.) research language acquisition strategies effectively, b.) store them in her working memory, c.) reflect on the task being attempted in class, d.) identify the usefulness and connection between the two, and d.) retrieve the strategy *and* its source. Having taught her for a year I know that at times this type of thing seems effortless for her and she tends to show off her intellect in class as a result.

Later, I decided to research Ebbinghaus. As it turns out *spaced repetition*, or the reviewing of material at optimal intervals to maximize the brain's ability to increase long-term memory recall, does in fact dove-tail with my research. I had in fact designed intervals of review throughout the research period and created opportunities to spiral in prior knowledge from throughout the year. Alicia had recognized this. I was unaware of Ebbinghaus' research before she brought it to my attention and made note that it might serve to inform my future research.

Daniel was another one of my students with above-average metacognitive ability. His capacity for reflection and insight was very high for a student his age, often effectively challenging my own thinking during instruction, lecture, or discussion. If he has a defining characteristic it is that he loves to debate an issue. However, that did not translate into his written metacognitive reflections. The following is a submission from his learning log.

Figure 29

Daniel's submission (DL #5 learning logs)



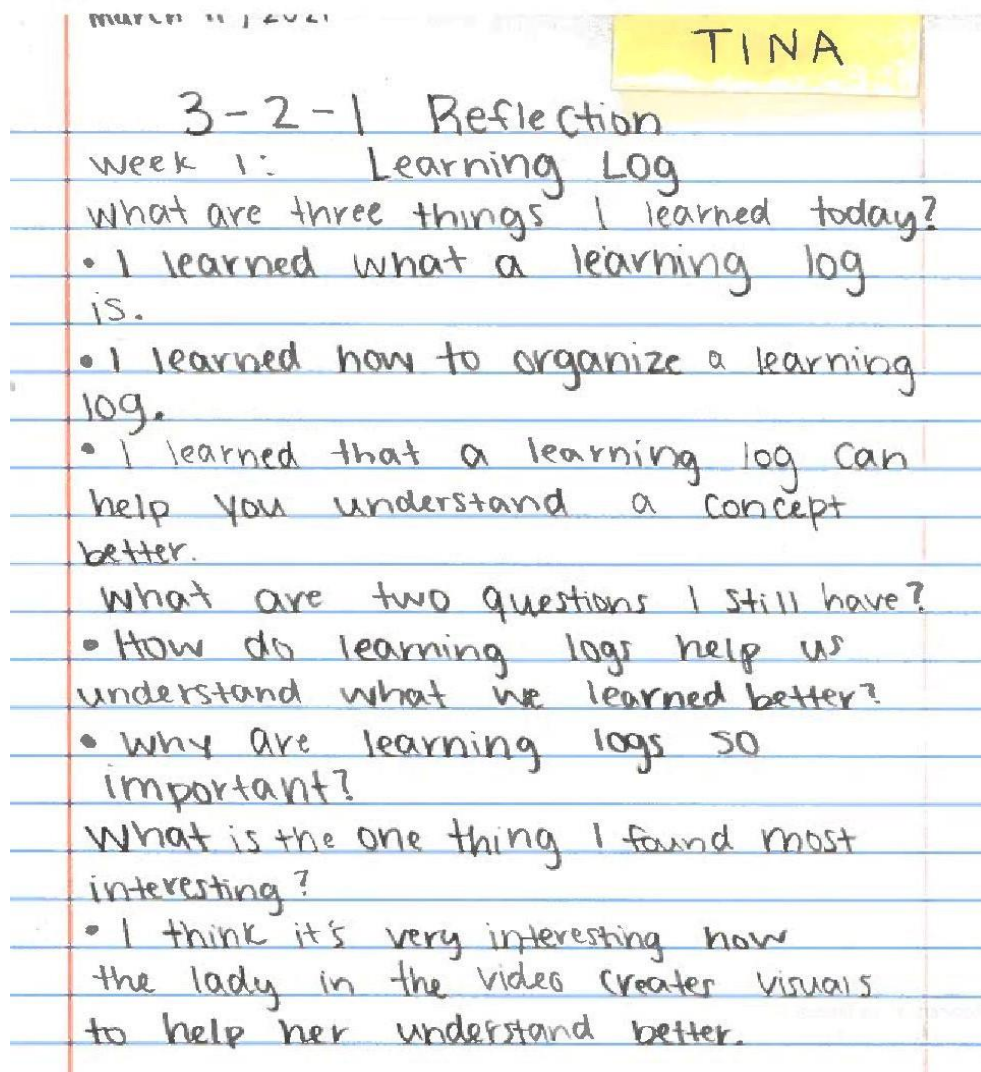
This student was one of the more frustrating cases from the research in that he is very bright and consistently demonstrated the ability to metacognitively reflect at a high level and yet did not successfully translate that into writing during the research, least of all for the purpose of metacognitively reflecting on a task. His normal written coursework consisted of very high levels of insight and was filled with connections to several relevant interdisciplinary concepts. When I asked him about how writing learning logs was going in class he simply scoffed, clearly not a fan of the strategy. Daniel may have simply struggled as a writer, rather than being opposed to the strategy.

Tina struggled with getting down more than one or two simple ideas when attempting to metacognitively reflect on a task. During DL lesson #5 (learning logs) she raised her hand several times to ask for help. After reframing the task expectations and a brief discussion, I recommended that she try to use the “level one” version of the learning log.

This strategy asks the student to respond to three questions; 1.) What are three things I learned today? 2.) What are two questions I still have?, and 3.) What is the one thing I found most interesting? Here is her first learning log below.

Figure 30

Tina's submission (DL #5 learning logs)



Tina's responses are very linear and basic, but she is clearly reflecting on the task in some fashion. Her questions are quite good. It was also rare that a student would reflect on the thing they found most interesting as being something related to the process of

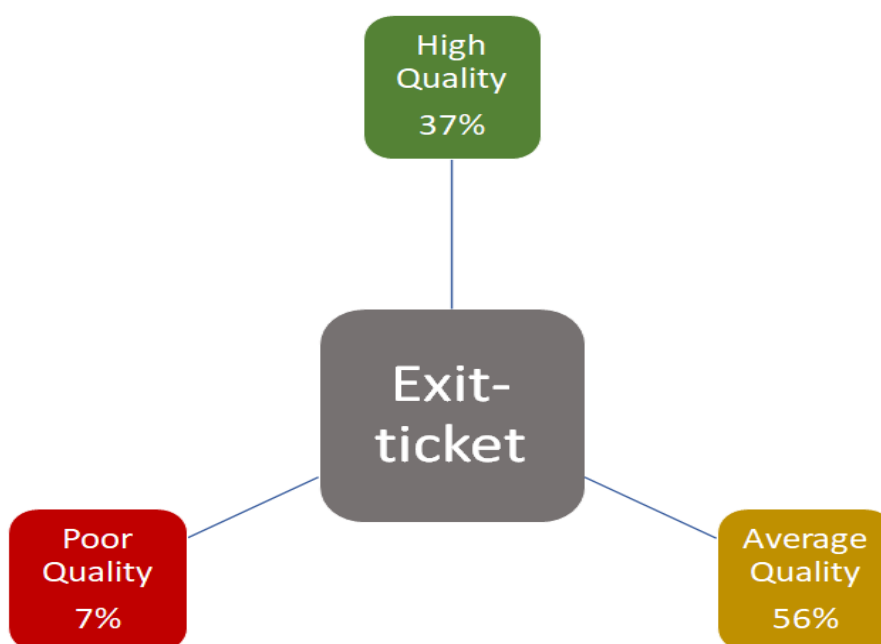
learning. This was an instance where a DL strategy provided a framework for a student to achieve literary reflection on an experience.

DL Lesson Exit-Tickets

The following figure shows how student exit tickets were categorized based on the quality of response.

Figure 31

Student Exit-ticket Data

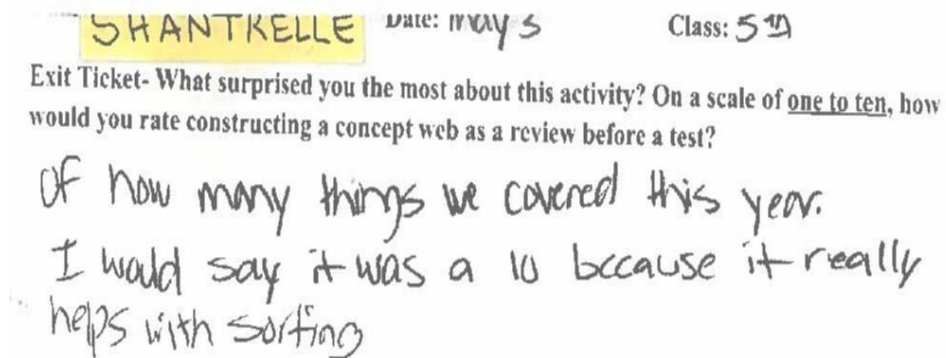


Exit-tickets completed following disciplinary literacy lessons presented an opportunity for students to critically think about the task they just completed. Collection and review of student responses gave insight and informed teaching practices. Analysis of student response quality was conducted by collecting all student written responses and sorting them into the three categories shown above. I relied upon my knowledge of what each of

my students' best work looks like and a brief description of what qualified each type of response. In this study, over half of student responses were of “average quality”, meaning that they responded correctly to the prompt and demonstrated at least some level of metacognitive reflection. Among those, most exit-ticket responses were on topic and positive. The following are examples of average quality metacognitive responses.

Figure 32

Shantrelle's exit-ticket (DL #8 concept web)



This response by Shantrelle epitomizes the level of reflection that most students provided. She reflected on the question correctly, however that level of reflection was very minimal and linear in thinking. Many students exit-ticket responses provided feedback that were at a similar level as her response.

More than one-third of submitted responses that revealed a much higher level of reflective thinking and were placed in the “High Quality” stack. Here is an example of such a response.

Figure 33

Sonja's exit-ticket (DL #8 concept web)

Name: **SONJA** Date: 5-3-21 Class: P3

Exit Ticket- What surprised you the most about this activity? On a scale of one to ten, how would you rate constructing a concept web as a review before a test?

I would rate this web (that we made) a 4.5/10
 Our ideas weren't solid & I wouldn't have sorted
 the web the way that we did if I were to do it alone.
 I probably would've written facts about each topic that I
 could remember & then written separate sentences/bullet
 points of how two concepts were connected or similar.
 My group & I were just doing an unorganized brain
 dump on the table. 10/10 experience, though.

Sonja's reflection here is one of the top examples of metacognitive reflection from this study. She does not actually answer the first question from the exit ticket which was designed to draw students into the act of metacognitively reflecting with an easy "softball" question. She immediately jumped to the second question and began rating *the performance of her group*, a much better reflective practice than what the question asked and one that I will use in the future. She is not only aware of the deficiencies in her group's method, but also considers how she might have improved upon their procedure if performing this task by herself.

The following sentence informed my instructional approach in using concept webs in two ways. *"I probably would've written facts about each topic that I could remember & then written separate sentences/bullet points of how two concepts were connected or similar."*

The first part of her reflection where she says that she would have written facts about each topic was part of the task. It became apparent to me that my directions were not clear, and I needed to provide some clarity through structuring the process more as one of my most intelligent and successful students did not fully understand all the steps involved. After reviewing student work from DL #8 I noticed that many of the webs simply were not very good, and many of them did not include supporting evidence or facts.

In the second part of her reflection, Sonja writes that she would have included *separate sentences/bullet points of how the two concepts were connected or similar*, an improvement on my original lesson design. I agreed with her analysis that a linking statement between two concepts was needed to boost rigor. Every student might not make it to that level of reflection on how topics connected, but this certainly was an excellent extension of the lesson for higher-end learners.

As I examined her suggestions I was reminded of another “web” that we had done earlier in the school year. In our unit on human body systems, students explored the connection between each system by linking body system posters spread around the room with long strings of yarn. Students then created statements that connected the two body systems based on how they interacted together and stapled them on the string. I began to reimagine the concept web lesson as an actual physical web that interconnected with supporting concepts, important intra- and extra-curricular connections, and relevant visual representations.

Allowing the whole class to work together in concert on one massive web has multiple benefits, chief among them being that it is likely more appropriate given the task students are being asked to complete. Connecting all the content students have learned in Biology throughout the year and edifying those connections with supporting evidence is a big ask. Additionally, the one or two students in every group that had difficulty conceptualizing this task would have the benefit of seeing others who would feel confident enough to start the web and would be able to build from theirs. Also, rather than having students examine each other's webs for ideas on how to improve their own, classmates can co-construct one web that will contain all the strengths and less of the weaknesses.

Less than 8% of the time student exit-ticket responses were characterized as being “poor quality”. This meant either a student did not respond to the prompt correctly or their response was insufficient to show the student was engaged in the practice of effectively using DL strategies or metacognitive reflection. The following examples are representative of poor metacognitive responses.

Figure 34

Leigh's exit-ticket (DL #8 concept web)

Name: LEIGH Date: Class:

Exit Ticket- What surprised you the most about this activity? On a scale of one to ten, how would you rate constructing a concept web as a review before a test?

What surprised me is how slow I am

:)

Technically Leigh did answer the first question. However, this response demonstrated no tangible reflection in terms of the strategy being implemented and did not show that she took the response seriously. Another example of a poor response comes from Rachel during her reflection on DL #1 (PBL).

Figure 35

Rachel's exit-ticket (DL #1 PBL)

Name: RACHEL Date: Class:

Exit Ticket- Think about how you approached writing like a Scientist. What did you do that worked well? Describe what happened.

I think I did well but my grade says otherwise.

This DL lesson was the only instance in which students received their grade before completing their exit-ticket as it was submitted online with a deadline at the end of the weekend and student reflection took place the next time their class met. Her response was considered “poor” because it did not successfully address the prompt. Rachel was clearly frustrated by receiving a “70” for her submission, a grade warranted by the rubric. I took time to visit with her and provide rationale for her score once I read her reflection and afterward she did admit that her submission, while entertaining, was much too informal and verbose to be considered a quality representation of scientific writing.

Occasionally, there would be some exit tickets that proved difficult to place between “Quality” and “Poor”. Either the student’s response was difficult to understand or their attempt to answer the prompt was confusing. Here is an example.

Figure 36*Ahmed's exit-ticket (DL #1 PBL)*

Name: **AHMED** Date: 24, 2021 Class:

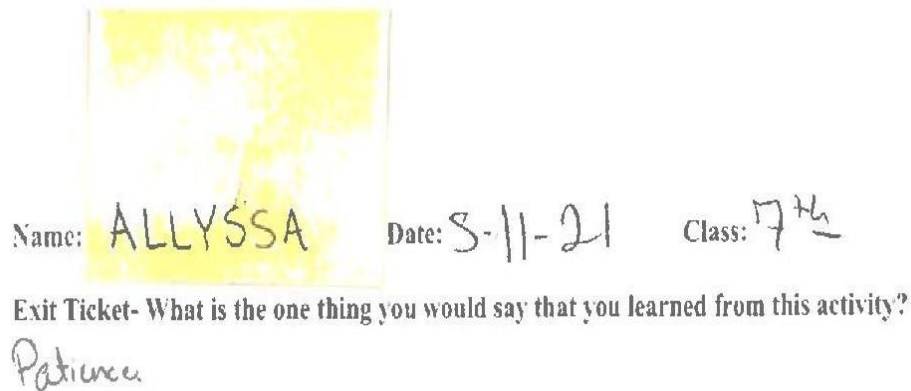
Exit Ticket- Think about how you approached writing like a Scientist. What did you do that worked well? Describe what happened.

using ~~the~~ Big words and Learning
a lot in 2-3 hours

On one hand, Ahmed thought about how he approached writing like a scientist and described what happened. This illustrated for me the depth of his experience and showed that he did not truly understand the task, qualifying the process of writing as a scientist as simply “using big words”. It is also clear from his response that rather than working on this assignment asynchronously for weeks he crammed it all in a very short amount of time (2-3 hours). I felt that this was very useful feedback and provided insight into how lower-level learners viewed this assignment. Other examples included extremely short responses as shown below.

Figure 37

/Allyssa's exit-ticket (DL #10 visual texts)



Name: ALLYSSA Date: 8-11-21 Class: 7th

Exit Ticket- What is the one thing you would say that you learned from this activity?

Patience

Perhaps Allyssa did learn patience. After I reflected on the question I recognized that it was very closed-ended and not as good as I should have made it to inspire quality metacognition. Allyssa very well may have reflected deeply and come up with learning patience as a member of her group as the “one thing” she learned. However, I suspect that this was most likely a sarcastic response.

It is important to mention here that completion of exit-tickets following a lesson was not mandatory. I purposefully chose to do this as I wanted to allow students to choose if they wanted to reflect following the DL lesson. I did not want students to respond through the lens of having another task to complete. Most students elected to consider the quality of their approach to the lessons and provide feedback.

One interesting connection between exit-ticket quality and metacognition developed when I analyzed the change in student metacognitive awareness scores. A student named Tommy recorded an increase on the Final MAI of +10, good for third highest amongst all

participants. Analysis of his exit-tickets nonetheless showed that Tommy exhibited little to no change in the depth and quality of his reflections over the course of the research period. Here are some of Tommy's responses from the study.

Figure 38

Tommy's exit-ticket (DL #1 PBL)

Name: TOMMY Date: feb 24 Class: 5th

Exit Ticket- Think about how you approached writing like a Scientist. What did you do that worked well? Describe what happened.

what I did good on was describing

Figure 39

Tommy's exit-ticket (DL #12 Socratic seminar)

Name: TOMMY Date: today Class: 5th

Exit Ticket- Do you feel that students get the opportunity to express themselves (like we did in class today) enough in school?

NO

Figure 40

Tommy's exit-ticket (DL #8 concept web)

Name: TOMMY Date: today Class: 5th

Exit Ticket- What surprised you the most about this activity? On a scale of one to ten, how would you rate constructing a concept web as a review before a test?

how much I remember

7

Figure 41

Tommy's exit-ticket (DL #10 visual texts)

Name: TOMMY Date: Class: 5th

Exit Ticket- What is the one thing you would say that you learned from this activity?

how simple it is to make a diagram

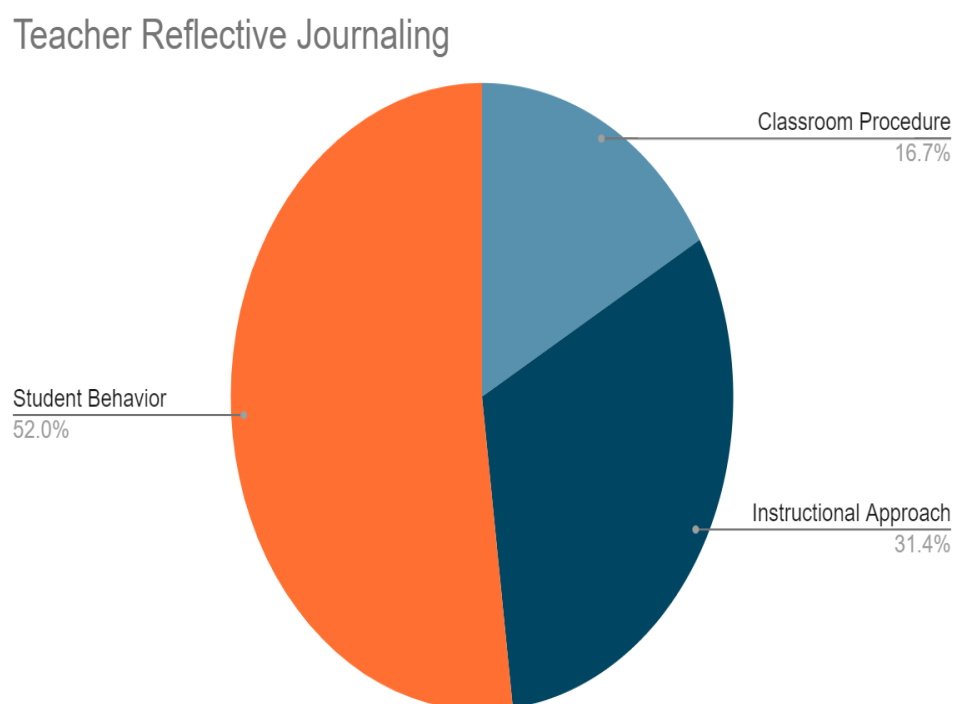
Tommy's contributions to this research were minimal in the sense that his participation up to this point had not provided much relevant data. This made it even more surprising that his second MAI score increased to the degree that it did. Perhaps rather than showing a dramatic increase in the quality of his reflections, simply being engaged in the act of routinely evaluating his approach and performance during a given task was significant enough for him to feel more aware of his metacognitive abilities.

Teacher Reflective Journaling

The following data set breaks down the nature of my reflective journaling practices throughout the research period. I carefully examined all my reflective journals both in text, online, and on my phone. Many of my reflections were in a “bulleted” format. Each of the “bullets” or comments were placed in one of three categories based on if they were pertaining to classroom procedures, my instructional approach, or student behaviors.

Figure 42

Breakdown of Teacher Reflective Journal Entries



Over half of all reflective bullets were focused on student behavior, both positive and negative towards a given task. It is important to note that the sheer volume of reflection

on student behavior is impressive, as it provided multiple data points from within the classroom to observe and evaluate how to improve their learning experience. Capturing these behaviors in class and metacognitively reflecting on them contributed greatly to the creation of the other two sections.

Overall, the number of student behaviors reflected on was clearly larger than the number of instructional approach reflections, however reflecting on how to improve my instructional practices had a significant impact. Doing so led to the reimagining of DL strategies, the creation of new ones, edifying transitions between tasks, and generally being engaged in the tangible practice of being an educational practitioner.

Procedural reflections, although mentioned less often, were identified as being critically important to the quality of DL instruction. Not only do they help improve management of the classroom, but they provide a framework by which students can conduct their learner experience. This helped regulate their behavior, logically order their tasks, and provided them with the knowledge and resources they needed to successfully engage in developing their literacy skill through DL lessons.

Teacher Metacognitive Reflection

The following visual text represents the process by which metacognitive reflection occurred during the research period. Surrounding the core of the metacognitive process are the steps that were typically involved in DL lesson planning and evaluation afterwards. They are shown in a clockwise progression and are numbered and multi-colored to increase visual interest.

Figure 43*Instructor DL Implementation Process*

I would begin very early on with little more than a strategy and over time complete step one. Where the act of teaching transitioned to research was in step two, colored gray for its clinical nature. For step three, I chose yellow to symbolize inspiration occurring during the act of analyzing data. Step four, reflecting in writing, occurred spontaneously and took up large portions of time. I chose a shade of blue to speak to the importance it has in the metacognitive reflection process. Steps three through five represented the bulk of the time spent in the instructor metacognitive reflection process. Step five was given

green to denote it as a creative instructional practice. I would often go back and forth from five and six as well, writing out new ideas and then refining and annotating them to further develop my understanding.

I would ask myself questions like these during the act of teaching a lesson and record the answers in my metacognitive journal:

Are students interested?

Are they engaged?

Are they learning what I intended them to learn?

If so, how are they demonstrating their learning?

If not, what is preventing them from understanding?

Is the lesson structured logically?

What are the various forms of feedback students are providing me?

How does that inform my practice?

The reasons that I might consider changing my approach to instruction during a lesson were varied. I tried my best to view every potential change to a DL lesson through the lens of whether it helped students access and learn both content and literacy strategies more effectively. Generally, I adjusted my instructional plan of attack depending on how the first attempt went. I found that many of the changes I made during the first few attempts teaching a lesson revealed ideas that I likely should have implemented in the first place. Oftentimes, I modified a lesson after having taught it to my first class, then again with the next class, tweaking my approach, student questioning, and formative assessments until satisfied with the student experience.

These modifications ranged from minor and procedural changes to a total reimagination of how students interacted with and demonstrated competency. Instructional adjustments were often related to how students first engaged with new material, whether presenting the topic from a different angle, approaching a topic using a different line of questioning, or providing an opportunity to access background knowledge prior to the lesson. Many adjustments in implementation resulted from strategies or activities that were simply ineffective or inefficient.

Students often lamented that they did not understand the process or were struggling far more than I felt they should in attempting a given task. I would often ask myself if the entire strategy needed to be scrapped, or if there were methods of supporting them that could assist them in being successful. An example of such an adjustment would be breaking a complex activity into smaller, easier to understand stages so that students could progress through a lesson using a scaffolded approach, allowing them to understand the task more clearly and giving me as the instructor the ability to easily identify where students might encounter difficulty.

Often, I stayed on the “train track” of my plan, however in almost every lesson I made multiple small adjustments. I viewed the instruction of DL lessons as something very dynamic and malleable and I allowed myself the flexibility to try new things until I settled on what I believed was the most effective version of my lesson. Decisions to change lessons occasionally were unsuccessful, or at least less successful than intended.

At times, I bounced around in the process and asynchronously moved throughout the sphere rather than in step-by-step progression. I spent long periods of time considering each aspect without concern for where I was going next, allowing myself to follow

whatever inspiration struck now. I used orange to signify the connection between newly envisioned DL lessons and the iterative and cyclical nature of the planning process.

Often I returned to my created interim texts later, cleaning up the grammar and checking for reader comprehension. I was also sorting reflections into categories. This I believe was a critical part of the metacognitive process. Get the idea out, refine the idea by returning to it again and again until satisfied. Once sufficiently revised, I moved to the computer writing out my ideas into a format that would be usable in the future.

The following example of metacognitive reflection helps to fully explain how pervasive the impact this practice has in my day-to-day life. While watching a kid's show with my son, I noticed that they were using paper plates and painting assorted letters on them as a way of teaching the alphabet. I paused the television and stopped to reflect for a moment on this strategy and its usefulness in my classroom.

I envisioned students colorfully writing out a process or concept from within any subject. I recognized the cost effectiveness of paper plates and the ability to stack completed student samples in the corner of the room as a resource center throughout the year. In ten to fifteen minutes, students could illustrate thinking while the instructor simultaneously examined products for deficiency, connections, and excellence. I saw how teacher metacognition might translate into student literacy growth and inform teacher practice.

Literary Support

Lent and Voigt (2019) relate teachers need to be flexible and allow students to participate in learning from inside the discipline by allocating student time and resources into developing literacy thinking, a goal of this research. In doing so, the combination of

disciplinary literacy strategies and emphasis on student metacognitive reflection appeared to shift some participant's demonstrated levels of thinking as evidenced by the observed MAI growth. These shifts in observed thinking, depth, and habits provided testimonials towards creating a growth mindset in participants.

Individuals either have a *fixed mindset*, in which the student perceives intelligence is static, or a *growth mindset*, in where the person believes that intelligence can be developed (Dweck, 2007). Dweck (2007) touts a growth mindset as critical in helping students achieve a sense of free will, inspiration in other's successes, and increasing levels of academic achievement. Participants in this research indeed became more willing to embrace the unique challenges they encountered although most exhibited very little in the way of perseverance in the face of adversity.

Hammond (2014) also recognizes the importance of a growth mindset to aiding culturally and linguistically diverse learners in developing cognitive capacities so critical in helping them avoid funneling into the school-to-prison pipeline. The focus of reflection on identifying the instructional tasks provided in DL lessons gave both teacher and students practice in developing such competencies. Helping dependent learners develop their skills of cognition and using their mind allows them to internalize and accelerate their own thinking, which further allows them to find the areas they struggle in, access new learning, and improve classroom skills (Hammond, 2014). Bantis (2010) when conducting a study of EL learners engaged in disciplinary writing, found group revision and instructor feedback to be significant pedagogical techniques, as well as identifying and catering to the range of student literacy skill within the class.

Teacher use of DL strategies led to an increase in collective teacher efficacy, the *most statistically significant* out of 252 studied factors related to student achievement (Hattie, 2019). Teaching using DL strategies and metacognitive reflection during this research resulted in a significant but hard to quantify increase in my perceived teacher efficacy. Regarding teacher metacognitive development, Lent and Voight (2019) recorded that teaching with Disciplinary Literacy strategies led to some teachers being so inspired in their instruction that they began presenting at conferences, writing journal articles, and creating literacy initiatives.

Critical to this growth was the process of reflective journaling or writing-to-think. In their research on the cognitive processes involved in writing to learn, Çetinkaya (2020) proposes the necessity of students reading silently for comprehension, a DL technique utilized during close read activities. Through comprehending the text, students wrote rough drafts demonstrative of high levels of cognitive reflection (Çetinkaya, 2020). Denke et al., (2020) found that students presented with reflective writing and peer-to-peer opportunities demonstrated increased literacy perspective, comprehension, evaluation, and reflection.

Denke et al., (2020) found students showed evidence of metacognitive regulation by evaluating their own work and critiquing the article evaluations of their peers. Çetinkaya (2020) acknowledges the difficulty in evaluating one's own text compared to someone else's work. This reminded me of DL #2 and #10, where students revolved around the room to view each other's work for inspiration and to critique their approach. Such actions are relevant according to Lubis, (2018) because most texts reference other texts,

giving way the development of understanding through the layering of various texts and meanings.

Didis et al., (2014) found in their study of student metacognitive practices that those who exhibited more metacognitive behaviors during research were able to create and use science knowledge structures more skillfully than those with fewer recorded behaviors. Cencelj et al., (2020) identifies the usefulness of metacognitive modeling for developing excellence reading the types of explanatory and explicatory texts found in science, technology, and engineering, as well as in cultivating the skills of those literacies, such as creatively designing instructions for a product. In a discipline-specific example, Cohen and Zion (2020) observed a significant increase in the nutritional literacy of students who received metacognitive guidance regarding drinking practices and nutrition labels versus the control group. Students even demonstrated examples of mindset shift regarding the importance of metacognition related to their task (Cohen and Zion, 2020).

van Aswegen et al., (2019) in a comparative study of young learners engaged in metacognitive practices while reading found that both writing out mental images and summarizing material received the highest response frequencies out of learners queried. As their experiences with metacognitive reflection increased, so did the number of analytical high-level responses, with an expressed trend of connecting prior knowledge and breaking down the task at hand (van Aswegen et al., 2019). The researchers reported an increase in improvement in low-level metacognitive performers and a broad development of literacy strategies used, a finding mostly mirrored by this research. In this research Tommy's case stands out as showing a lack of visible progression to back up the recorded metacognitive gains from his MAI scores.

Following an investigation of teacher and student metacognitive practices, here are a few suggestions for practical use:

1. ***Make time for Metacognition.*** It does not happen if you do not introduce, explain, and support it. Students are willing to learn if the conditions are right.
2. ***Intentionally think outside-the-box.*** Be planned and purposeful in continuously re-imagining lessons. My first idea was usually my worst.
3. ***Rough drafts and “interim” texts promote iterative growth in idea development.***

Provide opportunities for students to write out their thinking before being asked to express it.

Conclusion

Regardless of how interesting or challenging a lesson, chances are that each student has seen it at least once before. Today’s students are faced with, (their words, not mine) “seemingly endless daily learning tasks”, miring today’s students in creative lethargy.

From class-to-class, students may be asked to participate individually, in partners, in groups, and in whole class discussions. They might need to read a paper, take a test, write a reflection, participate in a rotational science lab, watch a video, create a slideshow, start a project, finish a project, and the list goes on and on.

Simultaneously, students are being funneled through schedules of formative and summative assessments. Many of these tests are upwards of fifty questions, and students are provided an hour and a half to complete them. Imagine how sympathetic you might be toward a kid who has two such tests in back-to-back periods, starts a new unit in

Algebra class the very next period, and then arrives in your class mentally exhausted.

How might you meet the needs of that student to be successful?

It was the stories of the students that proved most valuable to me as a researcher. They informed my practice. I had never previously studied student interactions in class with this level of focus. Careful evaluation of class participation, behavior, and work examples during these DL lessons provided me as the researcher the knowledge needed to improve instruction *for the students*. Disciplinary literacy transformed my classroom in the sense that how I approached instruction and how students accessed their learning transformed. Their approach and positionality towards the subject of science transformed as well in organically taking the role of apprentice learner.

Undoubtedly the essence of this research was the role metacognition played in my research process. I feel that it was the most impactful finding for me overall, with the surprising effectiveness Socratic seminars being a close second. The creativity I gained through using color and reflection to magnify the resources I had was inspiring. Moreover, I am focused in my thinking towards the goal of improving student literacy growth with every revision to a lesson. The creation of new texts to develop my thinking has a multitude of instructional and personal applications.

This research was always meant to be for the average teacher. It was approached from the perspective of a novice trying new instructional strategies. The question of what kind of impact these disciplinary literacy strategies would have on my practices as an educator was answered because many of them changed. From the instructor perspective, teaching DL lessons, gathering student feedback, and analyzing their work to improve my practice

was frankly exhausting. I would think, write, and reflect 4-6 hours daily... finding the process much too strenuous to do much more than that in a day. At times I would have to run to my desk, muttering the key to an idea or a connection I made over and over, so that I would not forget.

I will say that I did improve along the way, recording at one point during my data analysis that I was aware of the increasing speed, efficiency, and quality of my reflective process. I think there was a natural temptation to run or hold back from fully committing to DL lessons and metacognitive analysis. Instead, I, and many students and participants chose to *lean into it*. It was hard and required perseverance and grit. Being engaged in a productive struggle with the task of trying something new. What I found most interesting, and did not expect, was that together we endeavored to better understand how science worked through literacy. In doing so, it was only through literacy could we express that understanding.

Chapter V

Future Research

This was an exploratory study designed to provide insight for the educational community as to the performance of disciplinary literacy lessons in increasing student literacy growth and effective teacher practices within pre-advanced placement Biology classes. In that aim it was a success. The question posed now is “Where do we go from here?”

The potential applications for the use and subsequent research of disciplinary literacy strategies outside of the field of Biology are as expansive as the number of unique disciplines students endeavor to learn, both in school and throughout their lives. From a research standpoint the logical progression would be to integrate DL lessons across multiple subject areas to confirm the findings of this research. Campus or district-wide programs advocating the use of DL strategies would inform the educational community as to the usefulness of these strategies within those disciplines and the challenges educators and students may face when attempting to implement them.

Such an endeavor would require the apprenticeship of teachers in the use of DL strategies. This raises some intriguing possibilities regarding disciplinary literacy professional development for pre- and in-service teachers. Presenting these strategies (and perhaps findings from this research) in an interactive workshop style professional development would allow teachers to view samples, analyze data, and make and integrate their own DL lessons in a planning session with the members of their department and choice administrators. Research observing and evaluating the productive struggle of

teachers as they implement DL strategies would inform their large-scale transferability and teacher resiliency. Mentoring teachers in the practical use of DL strategies would facilitate attaining volumes of data through interviews and reflective notes from within their disciplines. Individualized monthly follow up consultations and future PD sessions expanding their understanding and use of multiple DL strategies would significantly increase the expertise level of teachers when creating DL lessons based on the experience of the researcher in this study.

DL lessons impacted my practice as an educator tremendously. The process of researching DL strategies, creating lessons around said strategies, implementing them, collecting data, analyzing that data, and reflecting on my practice helped me to establish a newfound understanding as to my responsibility as a classroom teacher. Most importantly and surprisingly, I found myself energized and invigorated, thoroughly enjoying the discovery of a new way of not only teaching but interacting with my students. Research aimed at realizing how DL instruction increases the cultivation of a growth mindset in teachers, teacher metacognitive reflection, the development of critical teaching skills, and even teacher job satisfaction would enlighten both teachers and administrators as to how DL strategies can create a culture of lifelong learners within a school system.

The data obtained through this research speaks volumes regarding the capacity DL strategies have in both targeting language deficiencies and developing mastery for a variety of sub populations. Focused studies on how DL strategies support culturally and linguistically diverse students could have massive implications on student language intervention and assessment. Specific strategies that maximize group participation and engagement, such as PBL and the creation of visual texts, align strongly with best

practices for English learners. The value of the opportunities found in these lessons for educator monitoring and evaluation of reading, writing, and speaking skill while students are engaged in the active learning of content cannot be understated. In addition, the byproduct of learning and using literacy structures and processes in class develops student awareness and promotes self-reflection as to a student's effectiveness while attempting these tasks.

Research emphasizing the scaffolding of DL strategies can provide data beneficial for all students, but especially those classified as Special Education or low performing.

Consistent practice metacognitively reflecting following DL lessons would also provide these students with the opportunity to develop interest and ownership of their learning.

Highlighting differentiation and the extension of DL lessons would elucidate the advantages of DL instruction for gifted students. The caliber and expertise found in expert usage of literacy within a given discipline provides an extremely "high ceiling" for these students to strive for in across a variety of lessons and disciplines. Deeper and more targeted examinations of relevant literature are needed to inform all these areas of research.

Several recommendations can be made to focus future research of individual DL strategies. The study of Socratic seminars and student social interactions in the classroom would provide grounds for several research applications such as socio-emotional learning, behavioral management, and speech development. The examination of observed behaviors, both from the teacher and students, would reveal the appropriateness and frequency of differentiation and scaffolding in response to student difficulty in each task.

Examining student samples of DL writing from learning logs after a full year would provide a lengthy and progression-laden map of how a teacher's students are developing as writers. Student reflective journaling in all content areas, coupled with conference check-ins, could be used by teachers to provide meaningful, relevant feedback for students and allow for interdisciplinary connections to be made. These types of connections (and others) made by the students and teachers while reflectively writing provide fodder for the diversity and enrichment of learning in the classroom.

Using apps, such as Flipgrid, would allow students to video record their reflections and interactions in class educates those interested in the use of technology in the classroom and experiential learning. Tracking the number of rounds of "metacognitive revisions" that teachers and students used to fully develop their thinking during instruction would relate the importance and frequency of having time-on-task and writing-to-think while reflecting.

Evaluating the ability to dictate every thought as you are thinking it into a program such as Google Docs could provide grounds for research. Instructor dictation increased creativity and idea generation during this study. Allocation of time for teacher reflection regarding instruction helped organize the lesson planning process, similar to the benefits found in writing out my thoughts. Creating opportunities for student dictation using their cell phones might inform transdisciplinary applications. Measuring the impact metacognitive reflection has on the sophistication of teacher's lessons would inform teacher professional development and efficacy.

There were some deficiencies that became evident during this research. Data collection as a whole pertaining to student literacy growth needs to be more consistent and tangible. A repetitive data collection strategy may more clearly demonstrate improved mastery for instructors and students, potentially leading to higher levels of engagement. Hard data would assist in determining how often certain positive and negative interactions arose and when and how certain types of improvement occurred.

The overall scale of the research was quite small given the immense potential disciplinary literacy has for impacting education. One researcher and twenty-nine participants located in one school provided a tightly bound case to study, however future researchers must enlist more practitioners and students. An annual conference dedicated specifically to the advocacy of disciplinary literacy strategies in education is a personal goal of mine and one that I hope would draw attention to the validity of DL practices, thereby increasing research interest.

Throughout this research my teacher practices have been informed. And being informed, the instruction I provided students naturally aligned toward creating opportunities that I felt increased student literacy growth in the classroom. Students learned valuable skills in self-reflection and process analysis that transcend disciplines. The applicability of disciplinary literacy strategies equips students with life skills that can strengthen the quality of their lives and help them develop into competent global citizens.

In closing, I am not an expert. I had an experience. An amazing, eye-opening, career informing experience. Through that research experience I came to better understand how to use literacy skills to develop my thinking and illuminate said path for others. Imagine a

world in which the metacognitive and literacy skills I developed over the course of this research were able to be incrementally transferred to students on a massive scale, empowering them to read, write, and communicate as an expert within any discipline? The impact of such a study would certainly be difficult to measure.

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Appendix A

Description of DL Lessons

Initial-Metacognitive Awareness Inventory (MAI):

Impact of Metacognitive Awareness on DL Strategies

Timeframe: 20-30 minutes.

Description: Students were given an inventory designed to measure an individual's metacognitive awareness.

Implementation: Participants answer questions in an inventory that is used to gauge their metacognitive awareness. Students then score themselves. The instructor verified their scores. Inventories were sealed by class.

Purpose: To establish a baseline of student participant metacognitive awareness. To determine to what extent participants demonstrate growth in metacognitive awareness resulting from DL strategies.

Lesson 1: Project-based Learning-Scientific Journal Article

DL Thinking (Inquiry), DL Writing

Timeframe: Four weeks (some time weekly in class)

Description: Students were introduced to the concept of Disciplinary Literacy. Students examined mentor texts and were tasked with emulating scientific writing.

Implementation: Participants created their best version of a scientific journal article explaining the key components of cellular transport and homeostasis. Students were aided in the examination of mentor texts, or current examples of disciplinary writing in the field of Biology. Students co-created specific criteria that represented good writing in science. Students were provided approximately four weeks to complete their project

asynchronously. During that time, the researcher conducted weekly conference check-ins.

Purpose: To inform participants of the scope of DL writing and to establish a baseline for participant DL writing in the field of Biology. To allow students to provide initial feedback regarding their successes/struggles with Project-based Learning, Disciplinary Writing, and asynchronous assignments.

Exit-ticket question(s): *Think about how you approached writing like a Scientist.*

What did you do that worked well? Describe what happened.

Lesson 2: Interpreting Visual Texts-Protein Synthesis

DL Reading, DL Communicating (Collaboration)

Timeframe: One block (90 min)

Description: Students were introduced to the concept of Visual literacy. Students were tasked with creating a visual representation of one of the processes of Protein Synthesis.

Implementation: Participants were introduced to the concept of visual literacy through analysis of visual models related to the processes of DNA transcription and translation. Participants formed groups and were asked to create their own visual representations (text) of the DNA transcription, translation, or a mRNA codon chart using unique representative forms (shapes, colors, symbols, cartoon animals, etc.). Participants accomplished this by using chalk markers to draw on lab tables and were asked to succinctly explain how their created visual text depicts DNA transcription/translation. A photo was taken of the completed diagram and uploaded into Google classroom.

Purpose: To provide students practice both decoding a visual text and creating their own. To determine mastery of the processes of transcription and translation through the examination of visual texts.

Exit-ticket question(s): *What would you do differently next time? How might you go about doing that?*

Lessons 3&4: Read Aloud & Close Reading-Taxonomy

DL Reading, DL Communicating (Collaboration)

Timeframe: One block (90 minutes)

Description: Instructor modeled disciplinary reading while detailing approach as an expert in that discipline. Instructor provided an example of close reading a document, illuminating specific interactions with the text and why these were made. Students attempted to close-read the text.

Implementation: #3 (Read-Aloud): The instructor read a high-level current events article, modeled his own intellectual processes as he read for understanding. The instructor explained how he approached reading, verbalized for the class certain thoughts that came to mind, how he accessed background knowledge while reading, etc. A series of images were presented in a slideshow for students to view as the instructor read, along with a copy of the article for students to read and follow along with. Upon completion of the teacher example article, the teacher placed his completed “close read” on the article on the overhead projector and explained how he “close read” the article to prepare for instructing students on this strategy.

#4 (Close Reading): Students first briefly read the article. Then, students read a second time much more slowly, annotating the article, writing down questions or comments they had while reading in the margins, identifying unfamiliar vocabulary, and writing out their

thinking as they read the article. Once the time limit was reached (20-30 minutes) students were then placed into groups. They took turns sharing their annotations, explaining their thinking as they read, and their reasoning behind what questions and comments they made. Students then answered reflective questions collaboratively as a group regarding the article content.

Purpose: Model for students disciplinary reading and thinking. Provide students with opportunities to engage with high level texts.

Exit-ticket question(s): *Think about the literacy strategies of reading aloud and close reading we just completed. Try and come up with three (3) positive benefits you received from these strategies AND three (3) weaknesses or areas that could be improved.*

Lesson 5: Differentiated Learning Log-Various Topics

DL Thinking, DL Writing

Timeframe: 30 minutes initially, 15-20 minutes weekly

Description: Students created a written log or “learning journal” of experiences in their classes. Students independently reflect and develop their understanding of their experiences through ongoing reflection, analysis, evaluation, and application of new information

Implementation: Students viewed a video of a college student breaking down what learning logs were and how to use them. Following the video, students were provided with an overview of this assignment and the resources available to help them in Google classroom. Students then created their own learning log and wrote their first entry while reflecting on the learning log video. The instructor circulated through the room, providing

guidance and feedback. Students then reflected on the strategy at the end of the research study with an exit ticket.

Purpose: Provide students with a reflective tool that is useful in all disciplines and is individualized for the student. Promote student reflection and writing within the disciplines.

Exit-ticket question(s): *Please circle the most appropriate response.*

I found this strategy to be useful and will continue to use it in the future.

I did not find this strategy to be useful and will not use it in the future.

Lesson 6: Project-based Learning-Genetics

DL Thinking (Inquiry), DL Communicating (Collaboration)

Time frame: One block (90 minutes) initially, then two more 30-45 min blocks weekly.

Description: Students engaged in a multi-week project examining and breeding fruit flies to observe principles of genetics in action.

Implementation-Lesson One: Students received an introduction of the entire process of the fly lab, orientation of lab stations, and lab safety overview. Students began the lab by creating their own vials filled with media, labeling their group, and receiving an assigned cross. Each group collaborated to figure out the process of “napping” flies and viewing them for expressed traits together. Students then received an overview on the handling and sexing of flies. Students anesthetized flies and separated them into male and female groups by examining their sex organs under a stereoscope. Students also examined and recorded eye color and wing shape. They then placed their males and females into their vials, secured their properly labeled vials into their storage areas, and reflected on their experience in their reflective journal.

Lesson Two: Students retrieved their vials and anesthetized the Parental (P1) generation, disposing of all adult flies into a morgue. Students viewed and identified the number of larvae in their vials. Classroom discussion regarding modes of inheritance took place, and groups created a hypothesis regarding expected phenotypes in their crosses.

Lesson Three: Students retrieved their vials and anesthetized the Filial (F1) generation, viewing each under the stereoscope and scoring them. Students created a chart and compared and contrasted modes of inheritance. Classroom discussion regarding expected outcomes of their F2 generation, and groups created a hypothesis regarding expected phenotypes in their crosses.

Purpose: Allow students the opportunity to develop understanding of genetics from inside the disciplinary perspective.

Exit-ticket question(s): *Describe your favorite and least favorite portions of this lab?*

How did it help you grow as a scientist? Take a moment and reflect your thoughts in your journal.

Lesson 7: Socratic Seminar-Transgendered Athletes in Women's' Sports

DL Thinking, DL Communicating (Collaboration)

Timeframe: One block (90 minutes), longer as needed.

Description: Students engaged in classroom discussion during the unit on genetics.

Implementation: The instructor wrote on the board, "Should transgender athletes be allowed to compete in women's sports?" Students received a short think-time and quick-write time to formulate their thoughts and opinions related to the topic. Students were

asked to share their stance on this issue. Instructor assisted in moderating the discussion by presenting and maintaining seminar expectations and helping students clarify or reframe their opinions, as necessary.

Video one: Evidence **for** topic. Following the video students were asked “Does this person deserve the opportunity to compete as the sex they identify as, rather than their biological sex?” Students quick-wrote their responses in their reflective journals. Students briefly discussed their thoughts/opinions after the video.

Video two: Evidence **against** topic. Following the video, students were asked “What percentage of the female population do you feel could match this particular male in physicality and athleticism?” Students quick-wrote their responses in their reflective journals. Students briefly discussed their thoughts/opinions after the video.

Video three: Discussion by experts regarding the appropriateness of transgendered athletes competing in women’s sports. Following the video students quick-wrote and chose a side of the argument. Students were allowed to use their writing to strengthen their arguments. Students discussed in groups first, and then as a class. The instructor assisted students in recapping key points of both sides of the argument, and metacognitive reflection afterward. Students then reflected in their journal.

Purpose: Provide students a forum to practice analyzing a topic and formulating an argument. Additionally, practice engaging in academic discussion and supporting claims with evidence.

Exit-ticket question(s): *What are three positive and three negative comments that you*

have regarding classroom debate around transgender athletes? Take a moment and reflect your thoughts in your journal.

Lesson 8: Concept Web-End of Year Review

DL Thinking (Inquiry), DL Writing

Timeframe: 20-30 minutes

Description: Students created a concept map linking all the information they learned throughout the year.

Implementation: Students constructed a concept map linking all the topics they have learned throughout the year. Students created an initial “iteration” in which they wrote all the topics they could think of in a web (5-10 minutes). Students then conducted a gallery walk of their peers’ concept webs, looking for ideas to improve their web. Students then embellished their webs in a second “iteration”, going back and annotating their web, searching for areas of strength/weakness, questions, connections, supporting facts, or further remembrances.

Purpose: Provide students with a tool to help organize their thinking and reveal their background knowledge in a particular discipline.

Exit-ticket question(s): *What is another subject you could see this strategy being useful in? Why? Take a moment and reflect your thoughts in your journal.*

Lesson 9: Project-based Learning- Invertebrate Organisms

DL Reading, DL Communicating (Collaboration)

Timeframe: Three (90 min) block classes

Description: Students selected an invertebrate organism to research and created an infographic through which they shared key taxonomic, anatomical, and physiological information regarding their organism. They then created a dichotomous key (DL #10) and close read an article on invertebrates (DL#11). The project culminated in a dissection of an invertebrate organism (squid).

Implementation: Instructor allowed students to select an invertebrate organism from a list of potential organisms. Students conducted research over their selected organism, recording as much taxonomic, anatomical, and physiological information as possible. Students then created an attractive infographic sharing their research with others.

Purpose: Allow students to conduct scientific research culminating in the creation of a visual text.

Exit-ticket question(s): N/A

Lesson 10: Interpreting Visual Texts- Dichotomous Keys

DL Reading, DL Communicating (Collaboration)

Timeframe: 30-40 min

Description: Students attempted to create another visual text, this time constructing a dichotomous key.

Implementation: Students continued in developing their understanding of interpreting visual texts through analysis of a dichotomous key showing evolutionary relationships of

invertebrate species. Students formed groups and were asked to create their own visual representation (dichotomous key) using the same rules but using content from within present-day culture. Participants accomplished this by using chalk markers to draw on lab tables and were able to succinctly explain how their created visual text reflected the core concepts of an accurate dichotomous key. A photo was taken of the completed diagram and uploaded into Google classroom to complete the treatment.

Purpose: Introduce the concept of visual literacy to students. Provide students with practice in both decoding a visual text and creating their own.

Exit-ticket question(s): *What is the one thing you would say that you learned from this activity?*

Lesson 11: Close Read-Invertebrate Organisms

DL Reading, DL Communicating (Collaboration)

Timeframe: 35 minutes

Description: Students attempted to close-read a disciplinary text over invertebrate organisms.

Implementation: Instructor briefly overviewed close reading annotation strategies and modeled his thinking. Following this, students briefly read the article over invertebrate organisms being impacted by their environment. Then, students read a second time much more slowly, annotating the article, writing down questions or comments they had while reading in the margins, identifying unfamiliar vocabulary, and writing out their thinking

as they are reading the article (20 minutes).

Purpose: Model for students disciplinary reading and to provide them with opportunities to practice engaging with high level texts.

Exit-ticket question(s): *What do you feel is the most difficult part of this activity for you personally? What comes most naturally or is easiest?*

Lesson 12: Socratic Seminar- The Millennial Problem

DL Thinking, DL Communicating (Collaboration)

Timeframe: One block (90 minutes)

Description: Students engaged in classroom discussion designed to help them metacognitively reflect.

Implementation: Students engaged in classroom discussion. The instructor wrote on the board the question “Does your generation face insurmountable obstacles that prevent you from being successful/ happy?” Students received a short think-time and quick-write time to formulate their thoughts and opinions related to the topic. Instructor asked for students to share their stance on this issue. Instructor assisted in moderating the discussion by presenting and maintaining seminar expectations and helping students clarify or reframe their opinions, as necessary.

Students then engaged in watching a thought-provoking video on how young adults are struggling to assimilate into the workplace due to various factors. Students watched the first half of the video and were given time to think and reflect in writing their thoughts

from that portion of the video. The instructor facilitated another round of classroom discussion. Students then finished the video and were given time to think and reflect in writing their thoughts from that portion of the video. The instructor then facilitated another round of classroom discussion. Following the discussion, students completed the exit-ticket.

Purpose: Provide students a forum to practice analyzing a topic and formulating an argument. Additionally, practice engaging in academic discussion and supporting claims with evidence.

Exit-ticket question(s): *Do you feel that students get the opportunity to express themselves (like we did in class today) enough in school?*

Final- Metacognitive Awareness Inventory (MAI):

Timeframe: 20-30 minutes.

Description: Students were given a second inventory designed to measure an individual's metacognitive awareness.

Implementation: Participants answered inventory questions a second time to gauge their final metacognitive awareness. Students then scored themselves. The instructor verified their scores. Inventories were sealed by class.

Purpose: To determine growth in individual student metacognitive awareness after all DL strategies were implemented. To provide students with the opportunity to examine their own metacognitive development throughout the research.

Appendix B

Research/Reflective Metacognitive Journal

Week of 2/1-2/5

- Provided time for students to work on their journal article projects again following the test. Many students were unproductive, and others seemingly stuck at step one. So many questions emerge for me from this...Are they novices at writing papers in general? This seems logical as there are not many classes that implement writing assignments outside of English (excluding TELPAS). Are they procrastinating because they don't understand the assignment, fear writing, or are just lazy? I believe the last two are most likely as I have provided overview, one-on-one conferences, detailed instructions, a rubric, and some pointers.
- Students had very little difficulty understanding the direction a paper should be outlined and presented in once explained to them, however there were very few students able to conceptualize a quality approach to writing this paper without at least some assistance. I wonder how to help students' quality writing in some scaffolded manner.
- Cell Respiration Lab: Students simply love being crazy exercising and raising their heart rate. Energy and engagement was high during the first half of class in which we were doing the lab. Behavior and focus was fantastic in the second half. There really is something to be learned from brain-based research regarding the importance of exercise.
- Another graph, another problem.
- I have to remind myself that these are Pre-AP students sometimes. Several students failed to read instructions, trying to conduct the experiment in the graduated cylinder used for measuring instead of the test tubes, putting in the wrong amount of BB, and failing to logically plan out their experiment. I believe that is really the issue, there is NO THOUGHT taking place prior to action!! How can I integrate the modeling of scientific thought processes that need to be happening in every assignment? Should I be taking 3-4 minutes before every assignment to model that? Will they pay attention and try it?
- **Teacher strategy hit list:**
 - -Identify and effectively convey the task at hand
 - -Shift roles as necessary (guide, task-master, idea-generator)
 - -gather initial engagement data (classroom feedback) and adjust
 - -Reflect and improve instructor delivery with each class
 - -Exercise restraint in communication (don't over-inform, prematurely provide answers, or connect the dots for them)

- -I'm noticing an element of randomness to the level of engagement from the instructor's side of things. Are there outside influencing factors?

ASSIGNMENT #2 START HERE

Week of 2/22-2/26

- This week we will be conducting Treatment #2 Visual Literacy. I believe that I have a solid foundation for how I want to achieve this. My plan is to begin with a brief modeling session on the board, demonstrating how to interpret the visual texts I am creating with models of DNA transcription, translation, and a Codon Chart. I then will introduce the concept of visual literacy, inviting one or two students to come up to the board and "explain and interpret" the visual text to the class. Emphasized how each student was able to do this for the class at varying levels. I then placed participants in groups to isolate them to one or two lab tables so that I can stay near that side of the room and glean from their conversations as much as possible. Each group will choose from either DNA Transcription, DNA Translation, or an amino acid codon chart. Using their visual they will create one group answer for the following questions:
 1. How do you "read" this text"
 2. What is the purpose of the visual?
 3. Who would be most interested in the information presented in the text? Why?

The assignment will then be given for them to create a visual using shapes, symbols, candy types, etc. Observations/note taking/questioning or student rationale during. Remember to use the whole class experience to gather research data, but only specifics from participants. Completion attained by uploading photos to google classroom, and explaining how their visual correlates to their created one. Exit ticket to complete. Practitioner reflective journaling, analysis of exit tickets, and summative bullet points taken down.

- **2ND PERIOD**-Rough start. I was super ambitious... Students did not address the questions from the board well so I quickly typed and printed them out on a paper for next class. Students all chose the easiest option (transcription). I will try and "sell" the other options next period a bit more.
- Took a long time to get going. A lot of excitement, engagement, and energy.
 - "Adenine has to be -insert this character's name- because they were involved in a love triangle with T-character and U-character." Directly correlates with the fact that Adenine

pairs with Thymine in DNA and Uracil in RNA. Student is a white male with very high intelligence.

- “Aurora represents death, (in the vampire diaries) so she is the RNA Polymerase that separates the DNA strand.

A group creating a visual with football players (Qb’s and WR’s for various bases) passed the football between them. The group said that the football was the hydrogen bond. Check plus.

Overall, more table talk about how to create it than use of the vocabulary. However students overall seemed very positive about the activity.

-” I like the visual learning much better”

-” I actually understood it better because it was something that I knew well”

4TH PERIOD- need to reframe the questions on the planning sheet

Two student groups did the codon chart this time. Perhaps I did a better job explaining the concept this time. The other three did transcription.

- D* It is going to be very difficult for me to explain these science concepts to lay people in my dissertation. Explaining the concepts of DNA transcription and translation thoroughly enough for the reader to understand the significance of the task students are being presented with will be challenging. How will I go about bringing them into the fold so that they can understand what is happening in the classroom? How deep do I need to go to accomplish this? Do I need to explain entire concepts and include appendices for them? All of the time? Some of the time? Skirt the depth issue altogether and report more broadly? Need to ask
- This class had two “lower” groups, both which struggled to get started. One group got going about (5-10 minutes) in, while the second took much longer (15-20 minutes), despite multiple helps and checks.
- Both of these lower groups happen to be comprised of all males, mostly Hispanic and African-American. In one group it was obvious that they felt socially uncomfortable with the task presented to them and then having to discuss how to approach it. I need to look into specific strategies to support conversation and provide them with helps that they can use when I’m not there at the table getting them directly.
- Taylor Swift group were struggling a bit with their ambitious Taylor swift codon chart. I suggested they go look at the fruit codon chart group, whose idea was more simplistic and well executed. Go me for being the “guide on the side”.
- Ultimately the low groups turned out decent quality work, with one group somewhat surprising with their quality and simplicity.

- - She emerged as the natural leader of the group. Carried the other three members, and was responsible for much of the vision and execution. Other members were seemingly in awe of her. – “wow, you are really good at this”. Another student- “yeah, you really are.”
- Juggling all tasks is exhausting! Need to think of how to streamline data collection and/or process for the next treatment.
- There was less collaboration amongst the whole groups then I thought there might be. Students seemed focused and engaged, however I noticed in many of the groups that there were only single comments here or there relating to the “work” of learning. Students would say things like “So this one goes here, right?” to a group member, and once they verified they were on the right track, talk would divert from the learning process and move to group conversation of other things *as they worked*. I wonder how to move the needle more towards academic conversations.
- Students aren’t really discussing their work very effectively. I am going to try presenting the questions class wide at the end so they can discuss more... I’m also going to try to have students stop work after 15 minutes or so and go around and look at other groups’ tables to glean ideas from other groups’ visual texts. My hope is that walking from table to table together while discussing and looking at other people’s visual texts will give them ideas and improve the quality of the overall finished product.
- I need to do a better job of coming up with an assessment schedule that allows me to show growth within each individual unit before any treatments or after certain treatments.
-
- Upon a cursory review of my exit tickets, I may want to reframe them. I am reminded of an after action review for my time in the military, three up three down. Three things that went positively and three things that went negatively or could be improved upon. Metacognition definitely in play there.
- I’m noticing that being able to use Google docs app on my phone and use voice to text is very helpful in taking down my reflections. It allows me to reflect in the car on the ride home at my home first thing in the morning if I have an idea I am able to get it down into word form very easily.
- **3rd Period:** One group of four had two students say, ‘this doesn’t make sense). The other half of the group was doing anime characters so they took the initiative split the group up and made their own group.
- Top group seems to be overthinking it, I spent time with them helping them frame their thinking. They are choosing to do DNA translation, which is the most difficult of the three options. They are using animals to symbolize the codon and anti-codon’s, and products made from animals to represent the amino acids. Very creative, additionally they researched on their phone to find out the name of a slaughterhouse employee so that they could properly name what is happening. An Abattoir.
- Despite all that creativity, upon returning 10 to 15 minutes later what they had created was surprisingly unpolished for them and used mostly words instead of images. I may have shocked them by telling them it wasn’t very good, and encouraged them to use images rather than words for their “visual text”. They really took it to heart, restarting their process, reflecting, and finding other misconceptions that people could have given their initial design. They are currently revamping their visual text.

- I'm hearing a lot of reflective thinking, student saying things like "is this what you meant when you said..." Also, I think it would've been better if we had done this another way, students are asking questions and relating the content to their visual
- Suggested leaving the visuals from the previous class for the next class to see examples of. I agreed
- I asked group how they thought they did. Said that she thought that they completed a better project than they had initially planned. Mentioned that he felt that they adapted well and that's why they ultimately ended up with a quality product.
- **5th Period:**
- This class probably will struggle the most, mostly boys and very little initiative or creativity usually demonstrated and activities.
- Two of the groups used the exact example that I provided. Rather than refocus them and have them do something new, I'm going to allow them to continue in order to see how low they are willing to take the project. One group is comprised of two minority female students, the other group four minority male students.
- I wanted to make sure to have this group walk around, and look at other peoples because they were struggling.
- A group of two girls doing cheerleaders left their table and came up to the board and started walking through the process of trying to make meaning of the model of DNA transcription. One was explaining to the other how they should approach it, and the other was beginning to understand based on their partner's instructions.
- Cheerleader group decided that "drama" made sense to be RNA polymerase, because it would break up the cheerleaders i.e. the DNA strand. So far several classes have made excellent connections with RNA polymerase and an appropriate variable that represents that concept. Group
- The group of two minority female students that were attempting my example have now shifted to a different model, so it is a positive that they were able to think outside the box and come up with a new idea. However, they are now 15 to 20 minutes later, and still attempting to use just the letters for u, a, c, and g. they are suffering from paralysis by analysis, and I believe that they're not really understanding the concept at all.
- The group of boys before minority boys that chose to do my example have diversified at some, and made it their own and I believe that their use of a template actually really helped them. Given the group I believe that they were fairly successful with their final product.
- Another group was struggling to get started until two of the three members both felt inspired to make it about an anime show that they were familiar with.
- The third member has no knowledge of the show, and so I tried to use it as a positive to encourage them to share why these things are good fits for the variables. However in the end, that student simply stood as a bystander for the most part although they did help where they could.
- Personal note: I feel that this method of teaching is really good. I have absolutely been a guide on the side, after a short 15 minute refresher lecture/modeling session of these concepts. I was able to introduce the activity and most groups were able to successfully get started on their own.
- All Boy groups definitely had the greatest difficulty staying on task. Shocker.
- **7th Period**

- **This class is filled with students that have a lot less structure than most of my classes.** This period has taken a little bit longer to get going than other periods, and I think that they are getting the concept a little less effectively.
 - I don't think there's anything different from this class that hasn't been covered in the other periods.
 - **AFTER ACTION REVIEW:**
 - If I want to consider having my students do this perhaps I should...
 - 3 Up: Innovative assignment selection, good adaptations of my instructional approach as the classes' progressed, good amount/quality of data being collected using talk-to-text on my phone.
 - 3 Down: Lack of supports for struggling groups, Lesson not planned out well enough, struggling to collect data "correctly".
-
- **Classroom observation form score is 24.**
 - After reviewing the questions related to how to read their visual text, I was struck by the amount of surface level responses that I received. Interestingly enough the three groups that provided the most correct and specific feedback relative to the discipline were minority male students, which leads me to believe that this activity was exceptional for allowing them to understand the content. These three groups all presented their visual texts with appropriate depth and provided specific dialogue as to how to read their visual text, utilizing disciplinary vocabulary. Most of my high end intellectual groups took the questions much less seriously. I wonder if this has to do with boredom or feeling that they completed the assignment and therefore not really needing to respond, whereas the other groups recognized the importance of the visual text and being able to help them access their learning of the material.
 - **Exit ticket responses:**
 - Many of the first few exit tickets expressed that they need to take more time to plan initially before beginning construction of a visual text so that they better understand what they are doing. Excellent metacognitive reflection.
 - Many of the responses convey a need to take more time in the process.
 - Overwhelmingly the need for clarity and having time to explain is showing up. Some of the students mentioned managing their time better as well.
 - Another theme emerging is that several students wanted to allow for planning on what individual members would do so that all are involved.
 - Several students have expressed pride in the product that they produced. Phrases like I am honestly proud of what we did and I think we did very well.
 - One African-American male said that he would try to find something that almost everyone would know about so they could connect better with it. I think this is an outstanding reflection
 - Several of the students commented that they would do something easier. However I think easier may not be correct. Perhaps the students just struggle with the assignment overall.
 - Overall I feel that most of the responses detailed and need to plan more effectively, to be more creative, and to involve more group members in the planning process. I feel that approximately 20% of responses did not take the prompt seriously, whereas approximately 20% of the responses seemed very focused in their reflection. I would be

interested to see how this mirrors or does not mirror the initial metacognitive awareness instrument scores that I received from all student

- Emotional words to describe this strategy in action and the classroom environment; energetic, even frenetic at times, positive, lighthearted, creative, colorful.

ASSIGNMENT 2 ends HERE

ASSIGNMENTS 3&4 START HERE

- **ASSIGNMENTS 3&4 Read aloud and close reading**
- Lesson planning reflection. As I went through this process initially I was only going to do the read aloud portion by itself. However, considering the brevity of my timeline and the desire to make as much impact in the classroom towards developing a culture of disciplinary literacy as possible, I decided to pair the reading aloud of a short scientific article with students following up my example and close reading a text that somewhat mirrors my example. I felt this would lend emphasis to the read aloud and allow students the opportunity to practice skills that they have just seen an “expert” demonstrate.
- I created a simple slide presentation for total slide, two images per brief article, just to provide students with visuals during the read aloud (per Lent).
- I feel that modeling is especially important during the read aloud to provide a quality example for students to see how I engage with the text. I need to be sure that I slow that process down so that students can follow my reasoning and explanations of what I am thinking about.
- Each week of doing this is eye opening, and it makes me feel like I am not as good of a teacher as I thought I was. Having a microscope on everything you do (and don’t do) is a little nerve wracking. I would characterize myself as a good but not great teacher, and I am seeing many areas of improvement that I will not have the opportunity to fully commit to (as I am moving into administration and out of the classroom). That being said, I will have the experience of conducting this research to fall back on as I mentor others.
- Should I make a formalized lesson plan form? I feel like it could help, but at the same time I feel that if I provide step-by-step implementation it should be unnecessary.
- As I am finalizing my lesson plan, smoothing it out and creating my step-by-step order of operations if you will, I am noticing that as I am trying these new disciplinary literacy strategies I am much less sure of myself, second guessing how and why I am choosing to do things. It provides anticipation of the upcoming lesson, knowing that I will have to adjust on the fly potentially. Also, failure when trying new things is always a possibility, so I have to be able to pivot to another approach. It makes me very much teach in the moment, think more than I ever have about teaching, and really consider what I am doing and what I know about learning.

- I think it is important to show students what success in a task might look like, referring to it as (success criteria). Additionally, students who are used to direct instruction will likely need encouragement and modeling on how to conduct collaborative conversations.
- 2ND PERIOD:
- While sharing during the read aloud, many students were on their phones. I believe it may have been due to anxiety regarding the activities during the class. Students flat out do not like to read/write/annotate/interact with text. I observed many examples of student “classically” avoiding an assignment: moving to looking at their phones, zoning out, “falling asleep” etc. I have got to find a way to do better.
- Several class members do however enjoy commenting on the text as I was reading and explaining my thought processes. We had some good dialogue going and overall class interest spiked. Approximately 5 out of 16 were on their phones the entire time.
- Four students seem to be really embracing the activity. They are locked in and engaged in the discussion of the text. Is one of them, less so?
- One student was actually watching anime on his phone with earphones in. When I walked by, he did not respond at all.
- Another student asked for my example that I shared with them 15 minutes in....
- After 15 minutes, conversations opening up throughout the room. I am not making an effort to curb behavior, because I want to study it.
- One student asked “why are all the people talking about this not actually involved in it?” Great question. I told her as much and prompted her to write it down in the margins. “Maybe it’s just me, but this is hard”.
- On a scale of 1-5 with 1 being minimal effort and 5 being maximum effort on the assignment, I would say that 6 of 16 would be a “1”, 6 would be a “3” and 4 would be a “5”
- Students still trying to work after time called.
- The time frame to complete the task is too tight. I need to make sure that I am very focused on timeline in my next classes and need to try to adjust to produce better conversations. Conversations did pick up once the close reading handout was introduced. For the sake of time I am going to make that the only conversation piece, because I want them to discuss deeply. Most in 2nd did not share their strategies and greatest questions in the 5-10 minutes I gave them so I am scrapping it. I do feel that with more experience they would be fine. I am DEFINITELY doing this again by the end of the research to show growth and increased understanding.
- 4TH PERIOD:
- Students asked to put phones away. I provided rationale by reading my notes from the prior class. All complied. Some students were visibly annoyed/bored with being asked that, and also at the intensity of what we were doing in general.
- All students are reading, with most very focused on their task. This is a difficult reading assignment, and I am sure not very enjoyable for most students.
- I also made a point this period of offering my close read of the original article as an example they could view if they needed some more guidance (a support, yay). Multiple students wanted to view it throughout the first 10 minutes of the close read time.
- ***Female students are emerging as MUCH more consistently successful in this task. I would be interested in a comparison, not only of the amount and quality of reflection (circled number of comments/questions, analysis of comment bloom’ level) but also***

color, total actions on the page, time on task, and other things that would be difficult for me to measure during this research.

- Are all successful in this task. Now twenty minutes in, they are still on task, reading, writing, and thinking. Are not present today.
- A few phones started popping out during the last 10 minutes of instructional time, however this represents a significant improvement as every student kept their phone away and was for the most part focused on the assignment for the duration of the lesson..
- This class is longer, so I am going to give them a 5-10 min break for the announcements video between the close read and group discussion to allow them to “come up for air” since I have the flexibility to do so.
- From outward appearance has been so diligent and focused. I feel that she will produce some excellent reflection and thinking.
- Following their close reading, I asked them for their initial thoughts about this strategy.
- In an informal survey 8 out of 15 students raise their hand when asked if they would raise their hand if they hated this assignment.
- -It was really draining mentally. I feel like I understand it, but I feel that I am missing something.
- Another student said that she was surprised by how much she wrote, and all the questions she had. She noticed that many of them were answered by the end of the activity.
- - I found it really interesting (the article), and I found that the process of writing my comments made me much more engaged mentally in what was happening.
- - asked to write it down but the facilitator did not give her the pencil so she managed to formulate her question again and use appropriate discipline in her vocabulary.
- - I really would like to know what happened to the brittle stars. Maybe the mining company was Exxon, we could “cancel” them on social media. “Save the brittle stars”
- During this research I find myself feeling bad for asking them to remain engaged and think critically for so long. Students mentioned things being too long, or too hard. I wonder if it is best used in smaller doses, or if it’s just hard at the beginning until they get a handle on how to do it. I would assume a bit of both.
- One thing I am liking are the types of conversations that I am able to have with students. I’m finding that I’m getting to know my students better, building relationships, and they are enjoying having these conversations as well.
- 3rd PERIOD:
- Much more talkative during read aloud. I feel like I am doing a better job of breaking down my thinking in a manner that they can understand. I related a vocab term to my love of dinosaurs as a kid, explained how my own military career gave me insight into his, etc.
- One student clearly has disdain for this type of work. 3 students are staring off into space only 3 minutes into their reading time.
- 10 minutes in. One student is highlighting some torn pieces of paper. Three students are actively avoiding the assignment. One staring off into space still. Female Hispanic student. African American male and White male are the other two. The female and the white male have done the least amount on this in the class by far.
- Student work varies considerably in all classes. Half-way through, three students are absolutely done working. First phone came out. Four students appear to be still diligently working at a high level. Four students appear to be diligently working using what I would

describe as minimal skills (highlighting things here and there with no comments or reflections). 16 in class today.

- I am noticing a lack of resiliency and a superficial understanding of depth in approaching text. I am going to describe the continuum from emergent reader to expert, reflective leader before my read aloud in order to try to move them along that.
- With 5 minutes left. Only five students out of 16 appear to still be engaged with the assignment. Seven people were on their phones, one person had highlighters stuck to their fingers, one had their head on the desk, and one had wandered to the back of the lab to play with water from the sink, one had a different book out reading (10 off task).
- Trying something different: I am going to ask them right after this assignment how they felt about the assignment, and dictate it on my phone. I will not give the exit ticket to account for the time.
- 0 out of 16 raised their hand when asked if they hated the assignment. Some said they were pretty neutral about it. Here are the responses we wrote on the board when asked how they felt about the assignment:
- Boring, easy, made you think, didn't hate it, personally easier for the teacher to explain than teach myself, hard to focus on reading and reflecting at the same time, content was interesting, breaking the text down helped, strategies were useful to learn.
-
- One student asked what mining had to do with the brittle stars at all. Student was done with 15 min remaining.
- -when I walked up to observe their group said, "Can we help you?!" Obviously not wanting me to be attentive to their conversation. I slowly walked away.
- One of the groups has two of the low performing members, and are not taking the assignment seriously. – asked them to stay on task. In response to having questions for the author, two are saying things like, "Why is the author's name so I? Where does she sleep? What does she eat for breakfast?"
- Main instigator for staying off task when pressed by – to stay on task exclaimed, "I am at a loss for words... I I KNOW WHAT TO SAY!" (Emphatically and slightly louder, but not yelling.
- When asked what the hardest paragraph was to read he replied "the letter A". General attitude has been to annoy the group, particularly -, who is doggedly trying to facilitate the group. Responses came across as skillfully intentional in derailing the activity. I have noticed this behavior from this student before on less intensive activities, so I am not surprised at his approach to avoidance.
- 5th PERIOD:
- I am going to ask the questions right away again as a class rather than the exit ticket. I feel that these responses might say more than the tickets. How did this assignment make you feel? What were some positive reflections? Negative reflections?
- This class is made up of all males and only three females. This should be interesting to compare my "Boys struggle with this assignment" theory.
- This class I felt that I nailed the presentation. I led with the human component of helping them to be successful in life, I broke down my thinking personably and carefully. It takes me approximately 25-30 minutes to read the article, express my thoughts, questions, and comments, to transition to close read, to present my exemplar close read on the board and to get them started on their 30 close read.

- This class is normally my lowest energy class. This is also the first class to mostly follow the instructions of reading though once without writing or coloring anything. Most classes up until this point have been highlighting and marking things on the first read through.
- 10 minutes in Jasmine leans to another student and starts asking questions to another student. She then came to my desk and asked how to tell the difference between “key locations and public sources”. I helped explain to her that all articles were different, and that some things might not apply here, such as the sources because this was an original article. [I should have asked her if SHE could figure out what wouldn’t apply in this article from the last article]. Missed an opportunity there.
- 10 minutes in only 1-2 students appear off task. YES! 16 students present in this class as well! So strange!
- Three students sitting/laying on the ground in this one. One keeps getting up and walking across the room to his friend to check something on the example.
- Right at having 10 minutes left, two white male students attempted to turn theirs in. One minute later a third followed. 20 minutes in 0 out of 16 are on their phones.
- This class has by far had the best class wide effort, and for the longest period of time. This also was the first class in which I explained that they would need to turn their brain on, and that the task would be difficult. I told them that they would have to fight against distractions, and that they would want to quit and give up on it early. Seeing some great resilience here.
- 5 minutes remaining: 4 have demonstrated overtly that they are done, two are standing markers up vertically in a circle shape, four have started putting away markers and cleaning up their work area. Four appear to still be on task. I would estimate that the successful work time that students can participate in this assignment for the FIRST time, having not built up resiliency to it would be 25 minutes.
- How did this assignment make you feel?
- Curious, braindead, intrigued by content, tired, foggy in the head, clueless, different & confused, bored, interested in how the story was explained, not just dumb, informative, the date the article was published was the day before my birthday, I read this article like 5 different times.
- Next class I need to draw attention to this instant questioning after the close read as “Metacognitive” in approach.
- Two students asked to complete the close reading handout individually including -. I agreed.
- Raise your hand if you were surprised at how much this strategy helped you understand this article. 10 out of 16. Need to make this question a closer for every treatment?
- 7TH PERIOD:
- Toughest class to control. Most energetic, and most high end intelligence class wide.
- Latest class period in the day to try this 1:25-2:55pm. 21 in this class.
- Class wide they started to break down about 15 minutes into the assignment multiple people talking, more so than any other class, and had to be politely redirected twice before returning to silence for work...
- I was more clear in this class about the fact that the information I got for my “read aloud” of the text came from my “close read” of the text that I showed them. I think these two strategies work very well in tandem.

- 6 only still engaged at time.
- How did this assignment make you feel?
- Pain, I don't want to do this again, boring, confused, distracted, should not exist, flashbacks of reading, uncertain, time consuming, absorbed more, remember it better, made my ADD worse, forced you to think, intriguing subject, provided awareness of a new topic, made you pay a little more attention.
- **AFTER ACTION REVIEW:**
- Emotional words to describe these strategies in action: uninspired, overwhelmed, avoidance/ intense focus, creation, thoughtfulness/ social navigation
- 3 up: overall conceptualization of lesson was sound, responsive to all of the input I received from my students and adapted well to it, excellent job of sharing my strategies for making meaning from text.
- 3 down: still need more supports (should have made multiple copies of my exemplar), treatment was very long (in the future I would break it up into two class periods), needed physical instructions I believe instead of verbal (provide them).
- **Exit Ticket Responses** 😊 2nd and 4th only) (other classes provided verbal feedback)
- Increased understanding and being too time consuming were the top positive and negative response.
- Overall, most of the benefits have to do with depth, clarity, and the ability to persevere through challenging text. A vast majority of responses were solely focused on the close reading activity and not on benefits of the read aloud.
- Negative comments ran the gamut from falling asleep, too hard to focus, to too boring.
- **Review of student close reads:**
- Question/Comment counts by sex, averaged per class and by total participation.
- Females studied 34. Total comments 478. Average 14.06.
- Males studied 46. Total comments 467. Average 10.15.
- I thought this was going to be a larger discrepancy...I will conduct a deeper dive (closer look into the above numbers) on this referring to quality of response, i.e. not just the key, questions vs. comments, sophistication, etc.
- I also think it would be useful to provide basis for imagining the continuum of student work (worst attempt → best attempt) perhaps by sex as well, and description of where the majority of work falls on that continuum.
- By the way, student count of comments is virtually useless. They cannot be trusted to count their own comments, as multiple were wrong and one was off by over 15.
- **Review of group responses to close reading handout: (have not reflected on these yet)**
- **Disciplinary Literacy Observation form score: 44**

ASSIGNMENTS 3&4 END HERE

ASSIGNMENT #5 STARTS HERE

ASSIGNMENT #5 Differentiated Learning Log

- Lesson planning reflections: This treatment was hard for me to figure out how to integrate into a particular lesson, because I feel that the strategy works with any subject matter. I wanted to find a good video that explained the concept and showed examples because I felt that this would be a good opportunity to take the focus away from me as the teacher and place control of their learning on them as individuals. My goal is to help them make sense of the video by making a learning log about the learning log video (next level)!
- As their guide on the side, I will assist them in understanding the process, help them make sense of what learning logs are and what they look like after they attempt their own, and model/show them what mine looks like.
- I want to provide students with as much choice as possible, and reward any and all efforts to move in this direction (I'm thinking of my low effort/low writing skill students) so one-on-one assistance and scaffolding will be used here. I am thinking about having three tiers of options for students to choose from: (low-level a 3-2-1 reflection, Mid-level a T-chart with experience/sense making, and high-level fully student independent version). I will allow them to choose whichever level they want, however, after two weeks on a level they must progress to the next level.
- I want to allow them to choose their own format, digital or paper. I also want to allow them to determine their frequency of use, challenging them to use them as much or as little (in this class and others) as they choose (minimum once a week).
- I want to use this strategy for the rest of the semester (*so, I need to plan out at least 1-2 opportunities per week to do so!*), and believe that it will help my students to process information and formalize their questioning for upcoming class discussions.
- Perhaps I can post top examples in the classroom or on google classroom or I can allow peers a chance to review each other's work and provide feedback.
- I anticipate running into resistance from about half of each class based on what I have seen so far. Early on I will be intentional about how I am moving students through this process and what specifically I am saying that might elicit a negative reaction from students.
- I created a breakdown of this assignment in google classroom so that students can review when necessary. I felt this would help those students who were struggling to start/complete the assignments. I also posted the video in that same week so that they can go back and rewatch it as necessary.
- Additionally, I created beginner 3-2-1 and intermediate T-Chart templates in google classroom for students who are just stuck in getting started. They can easily have a starting point (scaffolding) and not allow themselves to use that as a crutch in delaying the assignment. I want this to be as seamless as possible to get students started down the path. I also made it so that students can only stay at a level (beginner or intermediate) for two weeks until they move to the next level. This will allow them process differentiation to their level of comfort, but ensure that they are being scaffolded toward more difficult tasks and not just choosing the easiest option.
- 2ND PERIOD
- This class takes these literacy strategies hard. Visible irritation/annoyance in most student's voices/actions. Vast majority of off-task behaviors during the video. Once they

realized what we were doing, two very persuasive (and intelligent) students began arguing for reasons that it did not make sense to do this assignment today.

-
- Others began chiming in, and still other students had already checked out mentally once they figured out what was coming. You can see it almost in an instant... The slouch in their desk, the headphone being popped into one ear away from the teacher, or just the open looks of frustration, shaking of heads, and the all too familiar air of resignation that comes over many of the students when faced either with a writing/reading task, or a difficult one. Approximately half of students (so far) often demonstrate a lack of grit, perseverance, or tolerance. Compliance yes, but lacking in effort. I need to remember to ask more questions as to why they are feeling this way when I see these behaviors. (Note, make a note on computer with questions.)_
- This class has a “bare minimum” club. Approximately half the class has demonstrated that they will choose the easiest option every time. They are also the most phone addicted class that I have.
- I decided not to do an exit ticket because I feel that the best demonstration of how they feel about the learning journal will occur over the next several weeks. I will do a final exit ticket on the last time we do this as a class.
-

4TH PERIOD:

Students seem visibly annoyed when I introduce reading or writing into their classes. They seem very confused as to why I am teaching them these strategies (even though I have talked at length about my research and some of them have signed participation forms). Generally speaking, this class is on topic, with the vast majority of students choosing the digital version.

I feel that showing them my research journal helped some, but I may need to be more intentional of how I show examples for future classes. Mine was pretty boring. I told them why, but it was still boring.

-: OMG this would be so easy for Geometry.

-: I don't think this is going to be that bad actually...

Two students did the 3-2-1 in about 5 minutes.

This class generally tries to do what I am asking them to, however there is not much excitement or buy in. The room is completely quiet 15 minutes in, and if I remember correctly last week it was the same. Most are diligently working with only a couple off-task at a time.

-: one of the things she learned today was that “Coach Beaver cared”...aww she also said that she hated this assignment. When I probed her and asked why, she said that she doesn’t need to reflect to remember and develop her thinking. She just does it. To her she said that it is just busy work, but that she is going to try it because she wants the grade. (I definitely needed to challenge her on that, but I will be following up to see if her perspective changes for sure.)

-: I really like the idea of the strategy, I just wonder if I will use it for a week and drop it or actually use and develop it. We talked a bit about how I use mine as a combo reflective journal/personal organizer for work/college. I provided her with some examples of how she might use it.

-: We talked about how she might use one journal for all classes, and not one per class. “I think it would just be too much, and not time efficient.” “I am definitely going to try it”.

Other students ranged from wonderings about Leonardo di Vinci, to trying to envision using this in non-core classes or outside of school. One student said they would like to see more examples from other students. I need to show one or two additional examples I think. 4 students seemed very positive about the strategy, with most others nonchalant. Maybe 2-3 showed open frustration/annoyance.

One student wrote a very quality reflection about the fact that “if they were just now learning this, then it couldn’t be very important, and that they didn’t need to “document” everything. Also later on in her entry she begrudgingly acknowledged some potential benefits. (I need to follow up with her as well.)

Overall, I introduced the concept, showed the video, showed my example, showed them where to find in google classroom, and allowed them to choose/get started. The class got going fairly quickly and quietly, with a few questions and little resistance. The overall quality was good, with about half of the students demonstrating quality reflection and connection. The other half was nascent in understanding of strategy use and/or little effort.

3RD PERIOD:

- Granted, it was the Friday before spring break, but this class has several students that are not interested in doing this assignment. One said, “Why do I need to do this and write down stuff if my teacher is just going to make me write down stuff. That’s like trying to teach myself and that makes no sense.”
- I was very open with this class in that my goal was to put them in a situation where they were required to attempt this strategy for several weeks. The classroom atmosphere was....interesting. I feel as though they respected me for coming right out and saying it, but also they did not like it much. Might not do that again.

- 2 students flat refused to do the assignment. One sleeping in the back, the other on their phone.
-

5TH PERIOD:

- During the video, 8 students were on their phones at one time or another, and 5 had their heads on their desks at some point.
-
- Why do you think that students (in general) have these reactions to videos, strategies, or journaling?
- I asked the class and many did not respond. However, some remarked that they were dealing with issues outside of school and that they really don't always have a problem with the learning necessarily, but just a problem in their life.
-
- Others marked that the video was not attention getting, too long
- Another said that they were simply "overwhelmed". Leads to lack of perseverance and grit.
- When asked, 8 out of 16 students said that they had decided that the video was boring and not worth their time within the first minute of viewing it.
-
- No one has asked for assistance 5 minutes in. Only 1 student chose paper in this class (as opposed to digital).
- **ASSIGNMENT #5 ENDS HERE**

Metacog: "If we are informing towards DL strategies, what are we "informing" away from?" -possibly in results/conclusion section instead?

Dissertation: Use colorful, stepped, visually appealing models to show various student and teacher changes

Metacog: About week five, recharging with spring break, I realized that I needed to give this 100% the best I could do. If I'm conducting research then I should conduct research that makes a difference and impact student learning. Noticing that it's not rocket science to improve my practice, just simply writing down thoughts when I have them and following ideas to see the practicality, additionally I will be able to at least

know. Achieving a sense of knowing whether or not the strategies work will impact me personally as an educator, and give me an instructional framework from which to learn other instructional strategies

Dissertation: Level 1: lesson planning attempts with new strategies. Level 2: instructor familiarization period with new strategies. Level 3: Analysis/reflection of results. Level 4: risk-taking level 5: recognizing the need for more. (Resources, instructional tools, time)Level 6: considering other disciplines within my planning.

Dissertation: Structure my paper so that I begin inwardly as an isolated practitioner, and begin working outward, logically moving to identifying students as co-partners in the process of learning

Dissertation: Outline process-skills specifically, not necessarily disciplinary specific ones although link those skills with the usefulness within the subject.

Dissertation: Detail progression of instructional practice from basic–advanced and the increase in width and depth of a lesson, moving much more into connecting concepts i.e. integrating new subjects, development of all changes create a concept map with different color zones that show growth.

Dissertation: Map the entire study as a whole out by creating a visual text. Perhaps a Concept web so that I can tie this in with DL strategies to show them in action. (The fact that I can do this is great DL strat bonus) Colors for different time periods in the web, to show how the DL culture emerged over time (low, spike, gradual curve, etc.) Four quadrants (if you will) that allows the reader to get a sense for the impact of the research timeline.

Dissertation: identify key points of change (wasn't doing too well at the beginning, improved in the middle) Identify where the level of complexity gets stronger and stronger throughout the study from basic to moderate skill to advance skill disciplinary literacy. Juxtapose that step to progression of easy to difficult with the steady improvement of the reflective journaling specifically.

Metacog: Note that often the pieces of information that belong in my lesson planning folder occur and perhaps only occur during my reflective journaling time. The increasing depth of the thought processes regarding what lessons to plan (who what when where why) Maslow? Some other source?

Metacog: Explain a halfway mark checkpoint in which I decided to review my progress and process for the first six lessons. Although it is a bit early with the timing of spring break it makes sense to do it now.

Dissertation: Moving from becoming aware of deficiencies and strategies, to implementing and addressing them, to developing and then finally mastering them.

Dissertation: Go back and rewrite the entire lit review with the knowledge that you've gained from conducting the study. Logical progression, detailed, providing the setting for the research specifically.

Dissertation: Future research chapter 5: continue research throughout career. At each level conduct the type of research I am doing here as a template and continue to further publicate after moving on to administration. If I can accomplish this in one area, why not attempt it long-term?

Dissertation: Future Research (CHP. 5): create an action list, a series of bulleted points that will guide me through each lesson. I also need to color-code potential things such as transitions, cleared delineations on time blocks, scaffolding measures.

Metacog: Timeline was slow for like the first half of the research, a quantum leap why I finally started really reflecting/doing/using DL strategies well. I have been doing this for a month and a half but it feels like I have improved my process as an educator more than I have in six years of teaching. Important question- I am seeing a quantum leap in my process, but Do I see a level of a (quantum leap) in my students work? In any of the four domains? In all of the four domains?!

Dissertation: I am approaching a lesson from so many angles. Delivery (Or medium of conveying knowledge), progression through content, classroom location, action of student, Available supports, Student actions throughout lesson, teacher actions throughout lesson, classroom aesthetic, student initial perception of lesson.

Metacog: Comment on how halfway through my research I gave up on or felt like I wanted to give up on the notion of writing a purpose for each lesson. There is a melding of discipline, a blur between the lines dividing the process of teaching and the purpose for teaching.

Dissertation: Discuss how self-reflection is improving my creativity level. By leaning into it, I am able to imagine how I might like to see information presented and see the path for me as a researcher to present it to them.

Metacog/Dissertation: As the year goes on, the amount of reading, writing, thinking, and speaking in my lessons is greatly increasing. I need to look for and address specific examples of the expansion of these student tasks in a lesson, preferably participants.

Dissertation: Is lesson creation on one end of a spectrum and student work at another end of a spectrum? Am I extending the length of the spectrum by adding in self-reflection and post-lesson metacognitive activities?

Metacog: process of metacognitive reflection: Express the usefulness of dictation on a phone, and compare that with educational practitioner options throughout history.

Detail how I am going back-and-forth between Google docs for my instructional document and notes for my reflection. Express awareness that I will need to always ensure that I am taking notes in the appropriate place.

Dissertation: I need to make sure I address student-focused and teacher-focused aspects from small individual assignments to entire themes of my research cascade off each other throughout the duration of the paper. Make sure to highlight and express the human component in relationships here.

Dissertation: IN DATA ANALYSIS: Explain the process of data analysis: Sifting through the reflections of my data, rewriting it for clarification, cutting it into strips and placing it in them into categories (emergent themes), analyzing and structuring those strips into a format that will help explain the results (pre-rough draft), comparison The collection of student data sources and how I broke them down, my observations in real time during teaching.

Dissertation: Speak to the process of lesson planning intermingling with reflective journaling and intermingling with writing. All three happening simultaneously and bouncing off of one another, fueling growth in one another. Like a trophic cascade.

Metacog: Perhaps this is one of my emergent themes. Speak to the process of emailing myself videos I found on YouTube, ease of that activity, and dictating. Outlining the steps as the process gives my study perspective and clarity.

Dissertation: Open each new section with a quote a.k.a. Eisner. " Process, student work, dissertation (or writing of findings). How does writing up my findings help me though the reflective process? How can I strengthen my arguments with sources?

Metacog: Highlight the importance of an overall study of criticism. Having that perspective really helped me to analyze my research.

Metacog: Learning to reflect like this is going to be great for my career, life in general, etc.

Metacog: Be sure to compare the impact that treatments are having on other (normal) lessons. Look for ways that student behavior is changing and presented with a typical lesson.

Metacog: Impact of metacognition and disciplinary literacy reflection. By reflecting on the process of the lesson, the process slowly comes into to view. We can then examine that process ourselves to see how well we attempted an assignment, and by being critical of ourselves, then naturally move more towards doing it better.

Dissertation: Engagement: Students first apprehend the basis for what we are doing, then engage in an exploratory phase, and then begin to recognize and internalize some of the rudimentary framework of the process" continue to develop

Metacog: Self-reflection: What I really needed to help process all this was some time to get away from all of my normal responsibilities and focus intently, purposefully, and

solely on the process of conducting the research, planning the lessons, and what was actually happening in the classroom.

Metacog: This journey is really a process and self-discovery as an educator.

Dissertation: I'm going to present everything I did as appendices. All my journals, observations, etc

Dissertation: No one else is going to do it for them. Some of the students did buy into strategies. Share examples of how students did. Compare to how I myself improved as well.

Dissertation: Construct a neat timeline of lessons administered with number and description, brief.

Metacog: Is there a change in behavior? If so, what specifically caused that change?

In what ways? Contextual factors. Do you have to have context, as a prerequisite and understanding how to present a lesson. Interestingly enough, the development of the ability to see the context in my experience only occurred after I simply began trying strategies and then the context revealed itself iteratively.

Dissertation: try looking at the problem from a different angle. The way we do things here.

Dissertation: Define key words iteration, self-reflection vs. metacognition, more

Metacog: What I'm finding out is that going through the process of trying to work the strategies in everything starts to become connected. It's a very fluid and easy process once you get into it. Initially scary, but later enjoyable.

Metacog/self-reflection: I also am finding that it is easier for me to get started in the process of thinking and planning if I start with pen and paper and get ideas out fast.

Then when I've got some going in a certain direction I move to the computer.

Dissertation: Highlight in the findings section that it would be entirely possible for me to break down several "instances" of student literacy development throughout the school year that I did not include as (disciplinary literacy strategy lessons) that were actually on par with DL strategies.

Dissertation: Explain different student participation bracket i.e. the student will follow along and try to hang with the pack but will not. Provide specific examples from observations

Metacog: I find myself vacillating from one process/project, and when I run out of inspiration, I go back to pen and paper to restart my creative process.

Dissertation: Use a quote about going down different paths when talking about how to bind the study.

Dissertation: Creation is risky and difficult.

Dissertation: Get outline into text form. Process goes from looking at expert text, exemplars, hand writing an outline and annotating it, creation of initial textual outline

*Dissertation: Chapter 5: Chp. 5 * I would be interested in creating follow up research in the future where different strategies are practiced by willing educators within the same environment and results compared i.e. (PBL, DL, Inquiry).*

ASSIGNMENT #6 STARTS HERE

Assignment #6 Flies

Students were crazy hard to focus initially. The excitement for what they were doing was palpable, even though none of them came out and admitted it. Several students investigating, moving from station to station, inspecting the flies, playing with the stereoscope. The room was abuzz with energy, and I had the task of harnessing it into a smooth and measured lab.

Some students would stay back until welcomed into the fold “hey, can you hold this, or get this, or do this?”

Careless with technique, while others are very exacting.

I need to take my time and set this up much more.

Why do you think fruit flies are a good choice?

Get them to genotype/phenotype & dominant/recessive (it’s their background knowledge)

3rd Period:

Look at all these big words!

- Slowly progressed today. Not the best with the physical sorting of the flies.

Most students did not seem overly excited. Phenotype/Genotype much more prominent in discussion this time.

ASSIGNMENT #6 ENDS HERE

ASSIGNMENT #7 STARTS HERE

3rd: Excellent discussion, primarily due to having both points of view represented in class. Respectful and eager to discuss. Students were surprisingly mature and sophisticated in their responses, and participated well. Entire class on topic. Vocabulary needed to be addressed such as “cis-gendered”.

5th: Much less successful due to all of the students being anti-trans athletes competing. Some variation on the argument was present, however most of the framing of the pro-trans side of the argument came from me.

I had a student that said nothing in class at the end explain to me that they were a member of the LGBTQT community and had considered transitioning, but they did not feel comfortable discussing this in front of the class.

ASSIGNMENT #7 ENDS HERE

ASSIGNMENT #8 STARTS HERE

Assignment 8: Concept Map

2nd period- Student initially struggling with the concept, and some groups needing several “redefinitions” of what the assignment is.

“Coach Beaver, what would Osmosis go into? What would ____ go into (on repeat from students?)

-incredibly creative, instantly included pictures and logically connected concepts into a true web (grab her picture off go)

4th Period:

Some groups are breaking out work from the school year (-) to help them remember topics.

-very structured in detailing headings with subheadings of things that fall into major concepts, going very heavy on the “pre-work” of collecting information before attempting to write the web.

Conversely, group of Hispanic males went straight to creating the web and stalled out after writing three major topics with a couple underscoring ideas. I provided them with feedback to write all the topics first.

After 10 minutes stopped them and had them go around the room and look at other groups’ prep.

- I don’t remember this at all. After mentioning one or two components, OH!!! She started to bring information back to the forefront quickly.

What is Cellular transport? Students are explaining to each other concepts, how to spell them, how they connect to other topics, correcting and refining each other’s thinking and understanding.

Hispanic group added some, but still did not try my strategies. Essentially they had failure to launch. I did get them to admit that if I offered them an “A” in the course and allowed them to do whatever they wanted in class for the rest of the year that they could at a minimum double the size of their web. What is the limiting factor? Buy-in? Trying new strategies? Looking too dumb/too smart in front of peer group?

- related what we were doing to the concept of “spaced repetition” by HERMAN EBINGHAUS that she was researching because she wanted to learn a new language. May actually dovetail into my research and support the “iterative” nature of learning

ASSIGNMENT #8 Concept Map

3rd Period- Students struggling... Can’t be trusted with chalk markers to not doodle. THE MORE PROCEDURES YOU PUT IN PLACE THE BETTER THE PROCESS WORKS

Students not understanding the concept. Webbing outward from main ideas to smaller tough. Can't remember small detailed parts but remembered the main topics easy enough. I am going to try to format them Step-by-step next class and not overwhelm them with all the instructions. Step 1: tell-model-?'s-do, Step 2: tell-model-?'s-do,

Surprised at how poorly the students did. What are some questions/strategies they can use to pull information from...

I'm going to let 5th period pull out their notes if they need to.

I need to be intentional about the TOTALITY of the assignment while at the same time not overwhelming students all at once with info. Finding the logical/least intrusive places to introduce procedures and outline expectations and model practices requires FINESSE.

5th Period-

Working MUCH better going step by step. Focus is better, Product/Progress is significantly better. The amount of student engagement is better. The vocabulary usage, the collaboration, all significance improved.

COMMON THEME: student lack of desire, engagement, effort, perseverance, grit, focus, and general incapability for engaging in SUSTAINED learning. **Perhaps this is why chunking the activity to Step-by-step is showing positive results. **

Provided an opportunity for students to observe their peers tables a second time (when productivity started dipping class-wide) in order to glean observations from 80-90% complete webs. I should have done this just a bit sooner I think.

When given time to finish following 2nd observation students pushing each other, writing (so and so sucks on the table), and generally quitting on the activity. Reinforces lack of sustained learning.

Each group has roughly one leader that emerges and is trying to pull the weight of the other non-participating students. Some group leaders simply gave up, unwilling to continue to drag students who don't want to engage. I don't blame them.

*** MAKE sure to look at how many students did not even respond to exit tickets correctly. Further proof of lack of sustain/not reading/not completing assignments.

7th period-

** DATA ANALYSIS_ I need to compare student responses (exit tickets) and their "perception" of the lesson with my "perception" of the lesson success in my reflective journal. Disparity between the two could be an emergent theme.

9 students on phone, 6 completely off-task, and 1 hiding under a desk out of 23 students (20 minutes in).

Intermittent would be the word I would choose that most describes student focus on this (and, most other) assignments. Between phone interruptions, sidebar conversations, restroom requests, phone breaks, etc.

I asked one group of students as to why students often completed the absolute minimum on an assignment and went right back to their phones. Stephanie responded that students are just lazy, perhaps phone addiction. They did not feel it was specifically to avoid doing the assignment itself.

So what else could it be? Fear of failure? Fear of looking smart or being a “try-hard” or “sweat”? Chronic Apathy?

ASSIGNMENT #8 ENDS HERE

ASSIGNMENT #9 BEGINS HERE

Overall, PBL is working much better with a created “thematic unit” of sorts with invertebrates. Having research combined with the creation of an infographic and the dissection of the squid is really pulling the students interest in and improving engagement and quality of work versus what I might normally see.

I am noticing that I am not needing to metacognitively reflect nearly as much on lessons prior to teaching them. Am I being lazy, or am I simply getting better at teaching?

Most of my reflection prior to lessons is moving to “informal interim texts”. Scraps of paper, randomly writing down ideas rather than entire plans...

ASSIGNMENT #9 ENDS HERE

ASSIGNMENT #10 STARTS HERE

ASSIGNMENT #10 Interpreting Visual Text- Dichotomous Keys

3rd Period:

Group jumped into D key fairly easily.. Seeing some creativity and enthusiasm. One student who is typically disinterested in class got excited when she could use Pokémon to make her key (-

Some students are struggling to get started, and need additional examples/instructions. Unsurprisingly, almost half of the groups chose candy for their key, which was the primary example I gave. Granted, it is an excellent example, but students consistently choosing the easiest option is often the case.

- When creating hers stated “Can Gengar use stealth?” Shows complex breakdown of the defining traits that signify how Dkeys work.

- Dude! I did not know that crabs and lobsters are related to insects!

- completed everything as quickly as possible to get on her phone. The work was correct and met the assignment criteria, however it was the bare minimum level needed to successfully “complete”. This is a typical pattern for this student who is very intelligent, a natural leader in group work, and capable. Other students often demonstrate this behavior. An example of which is choosing an admittedly less interesting option when given choice over content/process..etc. if it is perceived to be an easier avenue toward completion.

PBL note: out of 18 students, 6 continuously worked on their project until the bell. Jasleen stopped 35 minutes before the end of class, having done the required portion for today as quickly as possible. Other students stopped once their research was done, however, that basically included googling the answers to the questions. I am going to incorporate a website requirement for the next classes.

5th Period:

I came up with the idea to have students create a “rough draft” of their key on the paper before writing it on the table. This will likely increase end result quality.

*** Note to self, check to see how the creation of “interim texts” impacts student engagement, work quality, and student thinking/communication. Logical theme that is emerging***

This is a really interesting development for this exercise in that many of these students are creating interim texts in this class (list of “organisms” or items for their keys, lists of items that fit a certain criteria, etc.) Granted, these are simple texts, but I need to look for other examples throughout the research and the school year where they have done this.

One group that is behind.. When I came over to check on them they said, “we are making a rough draft.” This is a lower group, and when considering the usefulness of interim texts, it would behoove me to include the impact and how it relates to culturally responsive pedagogy.

- was working by himself and was really struggling with this concept. I tried to have him use an interim text to help move it along, but it didn't help much. What helped the most was taking the time to walk him through the process, explaining how to construct it, and helping him have success in a couple of steps before letting him work on his own. Ultimately, his work was half of what the others in class completed, but it was a success for him.

7th Period: none

2nd: One student is just not doing it.

Groups seem very engaged in this period. One group was struggling, so I suggested an interim text of a list. Students will try that.

4th Period: One thing that stands out across all classes is **INCREASED ENGAGEMENT**. Students having the gift of choice (content differentiation) takes some students from barely there to **VERY** excited. All levels of students seem to experience at least some of this.

Students having discussion about their traits, equal collaboration **BETWEEN** students much more evident during this activity than many others throughout the year. Usually multiple partner groups will be unequally engaged, with one student doing most/all of the assignment. I am seeing more collaboration than normal.

ASSIGNMENT #10 ENDS HERE

ASSIGNMENT #11 STARTS HERE

ASSIGNMENT # 11 CLOSE READ

4th: -She loved this idea...not to mention her work was very impressive. She said, "I like the idea of this concept, because rather than just having information thrown at me, it's like I am taking control of it and making it my own".

Amazing analysis.

3rd: Students working diligently and quietly for the most part. Teacher example provided for reference has been utilized by two minority male students.

7th: Coach can I be honest? I don't get how to do this... I spend all my time thinking about what I need to write that the text doesn't make sense.

- 5 minutes on his phone before reading through one paragraph and highlighting a few lines. Then another 3-5 minutes on his phone..now back to the paper...now phone...ad

nauseum. When I stopped counting he had gone back and forth 14 times. However on the backside of the paper, he dedicated himself much more to the task, going texting in “his conversation” only 4 more times. When I asked him if it was his convo ending or being more focused, he said... “a bit of both. Once I got into it a certain amount I needed to focus and finish it.”

- First 10 minutes on his phone and quietly talking to a student who was initially on topic, however now he is no longer focused

After 10 minutes, 7 on phones, one head on desk. Lack of grit, avoidance....

Students seem to be constantly distracted, and vascillating between phones and the assignment, noticeably more than with other assignments?

ASSIGNMENT #11 ENDS HERE

ASSIGNMENT #12 STARTS HERE

ASSIGNMENT #12 SOCRATIC SEMINAR

****In this section, provide additional reflections on themes developed following data analysis****

Remember, looking at how ***DL IMPACTS STUDENT GROWTH*** and ***INFORMS TEACHER PRACTICES***

STUDENT GROWTH THEMES

--Avoidance of engagement/ Increased student engagement

-specific tidbits “conglomerate” section? Very niche and pointed?

CLASSROOM OBSERVATION FORMS: Identify my strengths and weaknesses based on the scores for each of the lessons, and provide specific examples. Identify and outline opportunities/strategies to improve my areas of weakness.

Dissertation: TEACHER PRACTICE THEMES

-Use more interim texts

-Increase in my own Metacognition and use of strategies outside of instruction

-completed the nascent shift from sage on the stage to guide on the side

Metacog: It was hard to quantify how important this classroom discussion was to some students. The emotions that were coming forward were very real and very almost uncontrollable. It was as if these students were unable to stop themselves from doing so. Some teared up but didn't quite cry, others you could see the stress of the end of school almost melt away from their shoulders, the emphatic look of happiness and satisfaction from actually "being heard". Most students that I spoke with said that they did not have the opportunity to share their opinions or have deep, meaningful conversations very often, least of all with adults who they felt were TRULY listening to them.

-Great participation, students really impacted. Interestingly enough, they REALLY appreciated the opportunity to have real, deep, meaningful conversations. Students are clearly missing that interaction in general and with their peers.

Some students were still talking in small groups about parenting, and or their lives ten minutes after the end of the discussion.

Students engaged at the levels they chose and/or were able to. I feel they enjoyed the OPPORTUNITY TO EXPRESS THEMSELVES. I feel that they truly do not get to do that nearly enough in an educational setting.

Students exhibited HOSTILE, addict behavior when discussing the upcoming year's cell phone policy. Became angry, started yelling, hyper-aggressive. Started saying things like they hate this school or they were going to move, kill themselves, etc.

Student participation was usually confined to 5-6 people talking, 5-6 people actively listening and responding non-verbally, and 5-6 people not really paying attention/looking

at phones, etc. Some students were actively trying to avoid this strategy, not wanting to consider the topic. Every student doesn't actually have to speak. They are getting the learning, the experience, they are SEEING AND HEARING THESE PROCESSES MODELED BY THEIR "MORE SUCCESSFUL" peers in this area. The beauty of this is that they desperately want and need help in communicating with people face-to-face in a way that is not socially awkward and helps them build confidence, and this strategy allows them to participate and/or experience it first hand in the classroom.

2nd Period: Class got very personal, students were letting their emotions out, sharing very personal stories. What I found interesting is how much I enjoyed it. And also how much some students enjoyed it. Not all, but some. It was surprising to me how much they yearned to share their opinions, to speak on a deep and meaningful topic TO THEM. There has to be a way to manufacture opportunities like this regularly throughout the year and

Dissertation: **This socratic seminar method may be why I am teaching next year. It is the one strategy that I feel truly passionate about, would want to develop and implement, and want to pursue for future research. There is not nearly enough of these opportunities being provided to our students in education today (this concept of integrating socratic seminars into all disciplines vs. standardized testing culture)

Dissertation: Socratic Seminar, of all the strategies presented, elicited the most positive response, the highest focus and engagement *for certain students*.

**** Not all of these strategies hit students the same way**** But I think that the vast majority of students were **HIGHLY** engaged and/or enthusiastic about at least **ONE** of these strategies throughout the year.

Settled on the topic question “Is it hard for your generation to be happy/successful in life?”

4th Period: This class by far was the most mature. Finally they began to speak directly to each other, asking questions and clarifying **EACHOTHER**’s statements, not mine. – all major participants today.

ASSIGNMENT #12 ends here

Appendix C

Disciplinary Literacy Classroom Observation Form

During the implementation of lessons featuring Disciplinary Literacy strategies, using the scale below, rate the level of student performance observed in each of the following domains.

Rating Scale:

- 0**-(not observed/no proficiency)
- 1**-(observed only once/ very limited proficiency)
- 2**-(observed more than once/ limited proficiency)
- 3**-(observed in roughly half of the students/ limited proficiency)
- 4**-(observed in roughly half of the students/ proficient)
- 5**-(class-wide implementation/ proficient)
- 6**-(class-wide implementation/expert level proficiency)

Domain 1: Texts

___ Students are reading text to understand, thinking about, and discussing the content.

___ Students are using text content as a basis for writing.

___ Students are using text content as a basis for other activities (e.g., problem-solving, labs, debate).

___ Students are engaging with the kinds of texts that are typically used by experts within the

Discipline.

Circle textual documents observed being used- textbooks, lab reports, research proposals scientific papers, Popular-science articles and brochures, graphics (including smart graphics)

___ Students demonstrate confidence in their ability to read various disciplinary texts.

Domain 2: Reading Closely

___ Students are using context/morphology to determine the meaning and/or tone of the terms found in the text.

___ Students are successfully answering disciplinary questions about information found in text.

___ Students are able to distinguish and identify an author's claims, reasoning, and evidence.

___ Students can critically respond to a text, judging its value or quality.

___ Students demonstrate knowledge of how to use textual evidence to support their conclusions

(To include quoting and citing).

Domain 3: Expert Processes/ Strategies

___ Students are able to recognize the essential information (e.g., for disciplinary purposes) and to disregard non-essential information.

___ Students receive instruction on the processes of interpretation used by disciplinary experts.

Circle all observed instruction of interpretation techniques- modeling, discussing, collaborative interpretation, practice opportunities, feedback of student's interpretation.

Circle all Science-specific interpretation techniques observed- transformation; categorization; reciprocal reading; reading for processes, products, features, use of morphology to interpret word meanings/models.

___ Instructor models their own processes as they read for understanding, sharing these with student learners and helping them to do the same.

___ Instructor demonstrates how content, texts, disciplinary knowledge, and strategies interconnect within the discipline.

Domain 4: Disciplinary Communication/ Problem Solving

___ Students to see the “big picture” of the discipline in which they are reading.

Circle all student recognitions observed- scientific methods of experimentation and systematic observation; cross-cutting concepts such as: cause and effect, scale, proportion, and quantity, systems and system models, energy and matter, structure and function, stability and change.

___ Students are posing questions that are representative of experts within that discipline.

Circle all student questioning observed- What is the process/phenomenon involved? How can this be visualized, graphed, described? How do we know this is the process/phenomenon? What do we still not know? How was this measured or observed? How does this process/phenomenon interact with others?

___ Students use the “jargon” or technical language of the discipline when speaking or writing.

Domain 5: Identification, Analysis, Critique, Evaluation and Formation of**Arguments**

___ Students understand the nature of the claims or arguments made in a disciplinary text and can analyze them.

___ Students can evaluate the effectiveness or quality of the argument in a disciplinary text.

___ Students make their own claims or arguments about disciplinary content.

Circle all observed- putting forth their own claims, providing evidence, anticipating and responding to potential counterarguments, using appropriate evidence and hedges).

___ Students identify criteria for the evaluation of disciplinary texts.

Circle all criteria considered- How well were scientific methods followed, what measurement techniques and instrumentation were used, how replicable is the information? Is the explanation coherent and complete?

___ Students evaluate the quality of evidence as well as the quality of the claim that the evidence supports.

Appendix D

Metacognitive Awareness Inventory (MAI)

Check True or False as appropriate. Use the Scoring Guide after completing the inventory.

	True	False
1. I ask myself periodically if I am meeting my goals.		
2. I consider several alternatives to a problem before I answer.		
3. I try to use strategies that have worked in the past.		
4. I pace myself while learning in order to have enough time.		
5. I understand my intellectual strengths and weaknesses.		
6. I think about what I really need to learn before I begin a task		
7. I know how well I did once I finish a test.		
8. I set specific goals before I begin a task.		
9. I slow down when I encounter important information.		
10. I know what kind of information is most important to learn.		
11. I ask myself if I have considered all options when solving a problem.		
12. I am good at organizing information.		
13. I consciously focus my attention on important information.		
14. I have a specific purpose for each strategy I use.		
15. I learn best when I know something about the topic.		
16. I know what the teacher expects me to learn.		
17. I am good at remembering information.		
18. I use different learning strategies depending on the situation.		
19. I ask myself if there was an easier way to do things after I finish a task.		
20. I have control over how well I learn.		
21. I periodically review to help me understand important relationships.		
22. I ask myself questions about the material before I begin.		
23. I think of several ways to solve a problem and choose the best one.		
24. I summarize what I've learned after I finish.		
25. I ask others for help when I don't understand something.		
26. I can motivate myself to learn when I need to		
27. I am aware of what strategies I use when I study.		
28. I find myself analyzing the usefulness of strategies while I study.		

29. I use my intellectual strengths to compensate for my weaknesses.		
30. I focus on the meaning and significance of new information.		
31. I create my own examples to make information more meaningful.		
32. I am a good judge of how well I understand something.		
33. I find myself using helpful learning strategies automatically.		
34. I find myself pausing regularly to check my comprehension.		
	True	False
35. I know when each strategy I use will be most effective.		
36. I ask myself how well I accomplish my goals once I'm finished.		
37. I draw pictures or diagrams to help me understand while learning.		
38. I ask myself if I have considered all options after I solve a problem.		
39. I try to translate new information into my own words.		
40. I change strategies when I fail to understand.		
41. I use the organizational structure of the text to help me learn.		
42. I read instructions carefully before I begin a task.		
43. I ask myself if what I'm reading is related to what I already know.		
44. I reevaluate my assumptions when I get confused.		
45. I organize my time to best accomplish my goals.		
46. I learn more when I am interested in the topic.		
47. I try to break studying down into smaller steps.		
48. I focus on overall meaning rather than specifics.		
49. I ask myself questions about how well I am doing while I am learning something new.		
50. I ask myself if I learned as much as I could have once I finish a task.		
51. I stop and go back over new information that is not clear.		
52. I stop and reread when I get confused.		

Schraw, G. & Dennison, R.S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*, 19, 460-475.