

## Revisoning Student Learning: Applying Disciplinary Literacy to Curricula Design

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**Abstract:** Why do students succeed? More poignantly, why do students fail? This article offers a series of scaffolded models to render disciplinary literacy overt, explicit and clear. We show how ‘disciplinary literacy’ is a phrase, trope, and concept that underpins theoretical models to enable student success, while respecting the diversity of student backgrounds and pathways into formal learning. Most importantly, this article reveals the value of reconciling the relationship between the research and teaching functions of academic life. We present models that operate in the spaces between research and teaching, success and failure, form and content, content and context. Our goal is to transcend the labelling of learners, such as ‘at risk’ or ‘high achievers.’ Instead, our models occupy the spaces of learning, rendering them granular, customised and transformative, and ready for deployment in curricula design.

**Keywords:** Disciplinary Literacy, Curricula Design, STEM Education, Student Success, Multimodality

### 1. Introduction

Too often in contemporary academic life, scholarly functions are separated, sifted, and differentiated. Consider the phrases Teaching Specialist, Research-only Academic, and Academic Manager. As metrics manifest, this differentiation has limited the capacity to build a dialogue between teaching and learning functions, and thus reduces the ability for research to be disseminated through teaching, and teaching to be informed by the daily innovations of research. These relationships matter. Currently the separation of scholarly functions is creating unproductive silos that limit a reflection on insiders and outsiders, the strange and familiar, the taken-for-granted and the innovative. Gillian Tett warned of the “silo effect,” where the separation of expertise blocks consideration and awareness of alternatives (2015). The innovative potentials of the Scholarship of Teaching and Learning (SoTL) and the Scholarship of Supervision (SoS) to reveal alternatives and enable learning in difficult times, such as during the pandemic, have been revealed and demonstrated (Maurer, 2022; Manokore, 2022; Simpson, 2020). Indeed, SoTL and SoS provide pathways to “navigate the chaos” (Gansemer-Topf, Webb, Kensington-Miller, Maheux-Pelletier, Lewis, Luu, Hofmann, 2021).

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While these innovative options and case studies exist, based on building powerful relationships between teaching and research, the neoliberal simplification and restriction of academic functions – justified on the basis of cost saving and economic efficiency - has built silos. These silos have decentred, demeaned and silenced the capacity to enliven teaching and learning through the infusion of profound and potent international research.

This reification harms and hurts both teaching and research. This article creates an alignment between disciplinary literacy and curricula design, with the goal of revisioning student learning. This article develops a model for teaching and learning, emerging from the functions of research and researcher. Building these relationships is crucial to the development of a model for learning that is transferable, repeatable and translatable through multiple subjects, contexts and nations. Only by participating in the learning process and analysing the similarities between students and academic teachers can the patterns and pathways be revealed. The models presented have been developed through many years of observation of students and reflection of teaching practices, to ensure that e-learning modules are inclusive of the necessary elements that are needed to support the development of disciplinary literacy.

Disciplinary literacy – as a phrase, theory and trope – describes the specific modes of teaching, learning and thinking that are framed by an academic discipline (Shanahan and Shanahan, 2008). Each academic discipline has a distinctive history and trajectory, configuring a bespoke relationship with disciplinary literacy development (Hunter, Brabazon, Quinton, 2022; Brabazon, Hunter, Quinton, 2023). Variable proxies configure the ‘inside’ and ‘outside’ of disciplines, including specific referencing styles, vocabulary, methodology, epistemology and ontology. How teaching and research is framed in physics is distinct from teaching and research in cultural studies. The role of theory or theories, laws or hypotheses, is specifically constituted in each discipline. Assumptions about the generalizability and mobility of terms, concepts and foundational principles mislead students and staff alike. Indeed, they block effective interdisciplinarity, transdisciplinarity and multidisciplinary interactions. Without mastery of disciplinary literacies, it is difficult to transpose and transcend one cluster of expertise and build a pathway to another knowledge system. It is dangerous to assume that a teacher has been successful unless disciplinary literacy has been explicitly and carefully enmeshed into the curriculum. Therefore, this article builds a frame – a meaningful frame – around a discipline to allow student learning to resonate for curricula designers.

## **2. A Theoretical Model of the Learning Process**

Developing literacy amongst science students involves a combination of factors including ample opportunities to practise reading and writing. Significantly, these activities are not developed in isolation of other experiences. Lab and fieldwork experience, coding and the development of proofs, shape and texture the genres and modalities of reading and writing. Thus, it is important to ensure that any theoretical model that attempts to explain the processes involved in learning scientific literacy addresses the student holistically and in context. A student’s learning experience comprises three elements: Context, Expectations and Engagement. These three elements are captured and represented in Figure 1. Only when all three aspects are considered during curriculum design can the student’s learning experience be transformative, resulting in the development of disciplinary literacy. The context is critical in this model, as it describes the element over which educators have the most influence and determines the relationship between both other elements. Therefore – because it is the lens of the learning relationship, it is positioned

at the top of the model. By designing the context with past experiences and expectations in mind, educators can provide opportunities to align both the learning environment and student expectations. A student's expectations of a task include not only what achieving the task might look like but also evaluating whether they are confident in their ability to do so.

Confidence is a predictor of success. This directly impacts the student's ability to complete the task. If the student has experience of a similar task, then confidence in achieving the new task will be greater. However, unless students are also engaged in the learning process, then neither positive expectations nor context alone are sufficient for learning to occur. In this model, experience is defined as both prior experiences of learning and the learning context to which students are exposed. Thus, confidence can be viewed as the sum of elements that have contributed towards learning as well as what should be considered in curricula design. The term 'experience' is important, as it encompasses both past and future learning environments and thus enables this model to be used by both educators and learners.

By applying a disciplinary literacy-centred approach to curricula design, these elements provide alignment to student's expectations and engagement through authenticity in context. This results in a model where Context + Expectations + Engagement = Experience. This is where learning occurs.

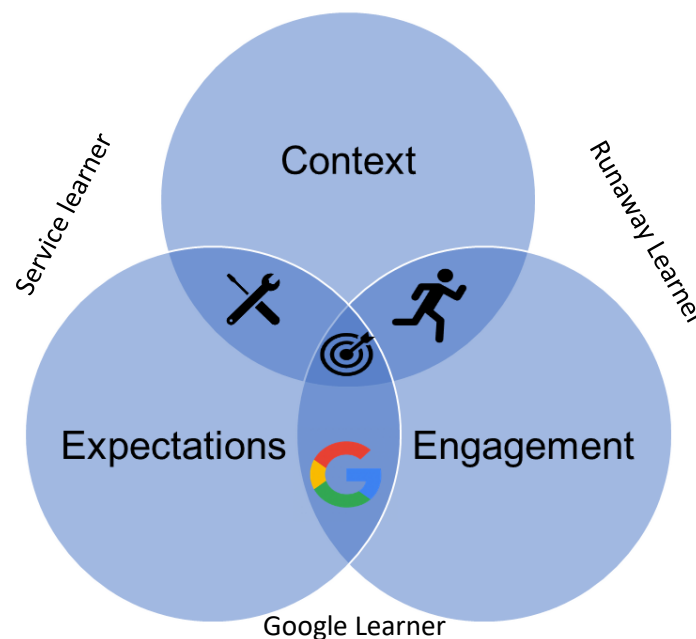


Figure 1: The relationship between the three central elements of effective student learning. The transformative learning experience is represented by the central target.

Learners move between the elements, resulting in varying levels of learning. The service learner has clear expectations and context for their learning, however, lacks engagement. This type of learner is unlikely to see the relevance of the learning to their long-term learning goals, such as a biologist undertaking organic chemistry: the links between the subject areas being viewed as only notional rather than providing a source of engagement and interest. The runaway learner understands the context of their learning and is engaged but lacks clearly defined and reasonable expectations, and thus finds it difficult to determine the boundaries

of their discipline. The Google learner has clear expectations and engagement, but this is not tied to a purposeful context. Their learning behaviours are characterised by their own interests rather than guided by context. The Google learner is more likely to rely on non-academic sources of information for learning. This model suggests that students may shift between learning elements over time and with discipline. Thus, educators must enact their educational design with opportunities to direct students to maintain all three elements to ensure that their experience is tempered by transformative learning.

Shanahan and Shanahan (2008) described a model for disciplinary literacy development (Figure 2) in which they describe how disciplinary literacy can be scaffolded, based on basic and intermediate literacies. We have adapted this model to consider the effects of student expectations of a discipline as well as their engagement in learning within a discipline area. A student is unlikely to engage with a task if they have feelings of discomfort (Efklides, 2006), which may include a lack of confidence in achieving a task, inexperience or having previously experienced failure. Thus, engagement is a crucial indicator of whether a student will experience learning and must be monitored in an ongoing fashion. In both cases, authenticity provides the landscape for engagement and learning to occur, with experience and expectations being embedded in authentic examples in the learning environment.

Providing opportunities for students to develop clear expectations of assessment tasks that align with previous experience of the learning environment results in increased engagement and confidence in task performance (Hunter, 2022). By modelling task expectations, students can be guided through the development of skills while developing confidence in performance. Using this model will result in higher student engagement and learning without sacrificing content.

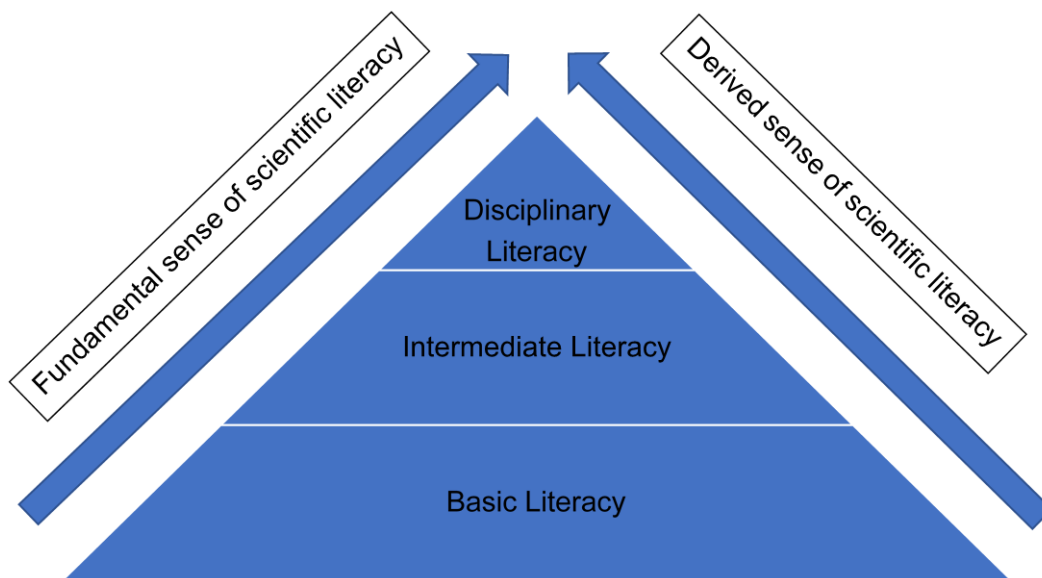


Figure 2: The increasing specialization that accompanies literacy development.

This structure, depicted in Figure 2, is modified from Shanahan and Shanahan (2008), where narrowing of the pyramid occurs as a learner moves through the stages of literacy, indicating increasing specialisation

alongside decreasing instructional support provided/needed. The fundamental sense of scientific literacy is regarded as reading and writing when the content and focus of these behaviours is science. Additionally, the transposed configuration of scientific literacy is being knowledgeable, learned, and educated in science. Basic literacy skills are traditionally developed early in life and relate to the decoding and understanding of high frequency words found in virtually all reading tasks, while intermediate literacy refers to fluency and generic comprehension found in many reading tasks and results in the understanding of common texts in everyday life.

While fundamental and derived literacies are represented as separate skills in our model, it is unlikely that they develop independently. In developing foundational disciplinary literacy, students develop the core knowledge they need to become a prolific learner in their discipline. As they progress higher up the pyramid, they learn more specialised and less generalisable skills in reading and writing. This is authentic expertise within the disciplinary genre, where developing derived disciplinary literacy involves gaining subtler conceptual understanding and knowledge of the discipline that may be beyond most learners, or inconsistent with previous experiences. These skills must be developed simultaneously in order to result in disciplinary literacy, as they provide the foundational structure to move towards increasingly complex disciplinary content. Most teaching and learning in reading and writing instruction are forgotten, embedded or marginalized by the time a learner has achieved an intermediate level of literacy. Especially in higher education, where we see highly specialised and compartmentalised curricula, learners are left to manage this obstacle themselves.

All literacies are based on previous literacies. All literacies are resurfaced by new skills, masking the layers of meaning that preceded it. Therefore, how can a teacher create a learning environment that fosters development in the student, so that they can progress up the pyramid? This theoretical model describes the elements that educators must consider when enabling learners to make the leap in their expertise from intermediate to disciplinary literacy. The combination of these elements results in the model presented in Figure 3 that describes the development of disciplinary literacy in a stepwise fashion. Each step can be considered an integral aspect of the discipline. Progression up the steps towards disciplinary expertise involves learner engagement in a variety of authentic disciplinary activities, which in turn results in a strong disciplinary identity based on knowledge and experience for the learner.

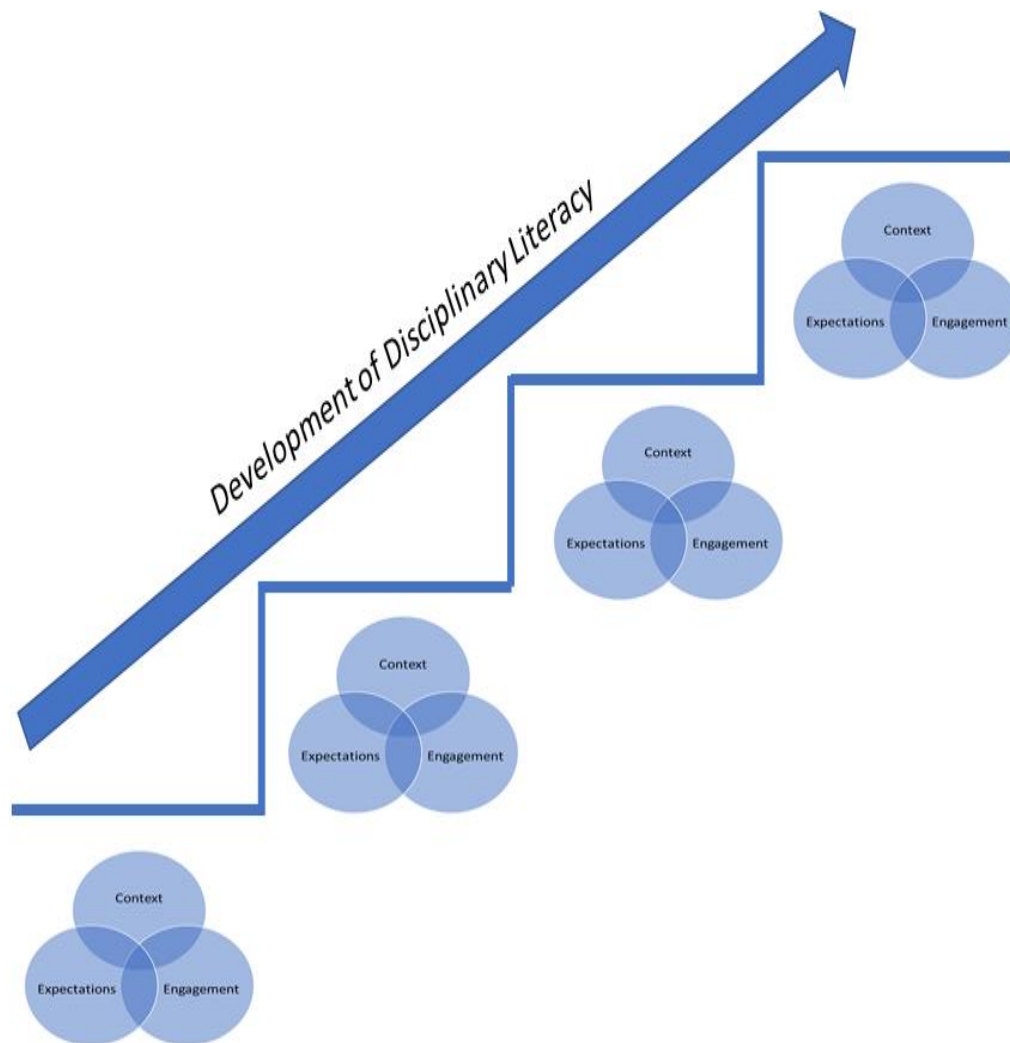


Figure 3: Theoretical model of disciplinary literacy development.

Gunther Kress (2003, 2009) was instrumental in understanding the importance and value of multimodality to language and education. The relationship between form and content, and platform and information, requires reflection, attention and application for learning to emerge amongst diverse learning cohorts. When activating Kress's theories, there is power in applying his research to disciplinary literacy development in teaching and learning. The model proposed so far in this paper reveals stepwise learning, addressing individual academic challenges. With the use of multimodal theories in teaching and learning, it is possible to reduce the size or even flatten the steps. As shown in Figure 4, it is possible to summon a learning environment that is increasingly accessible to learners. Our models show that moving towards

disciplinary literacy is no-longer a series of large leaps or analytical jumps represented by potentially unattainable objectives or achievements.

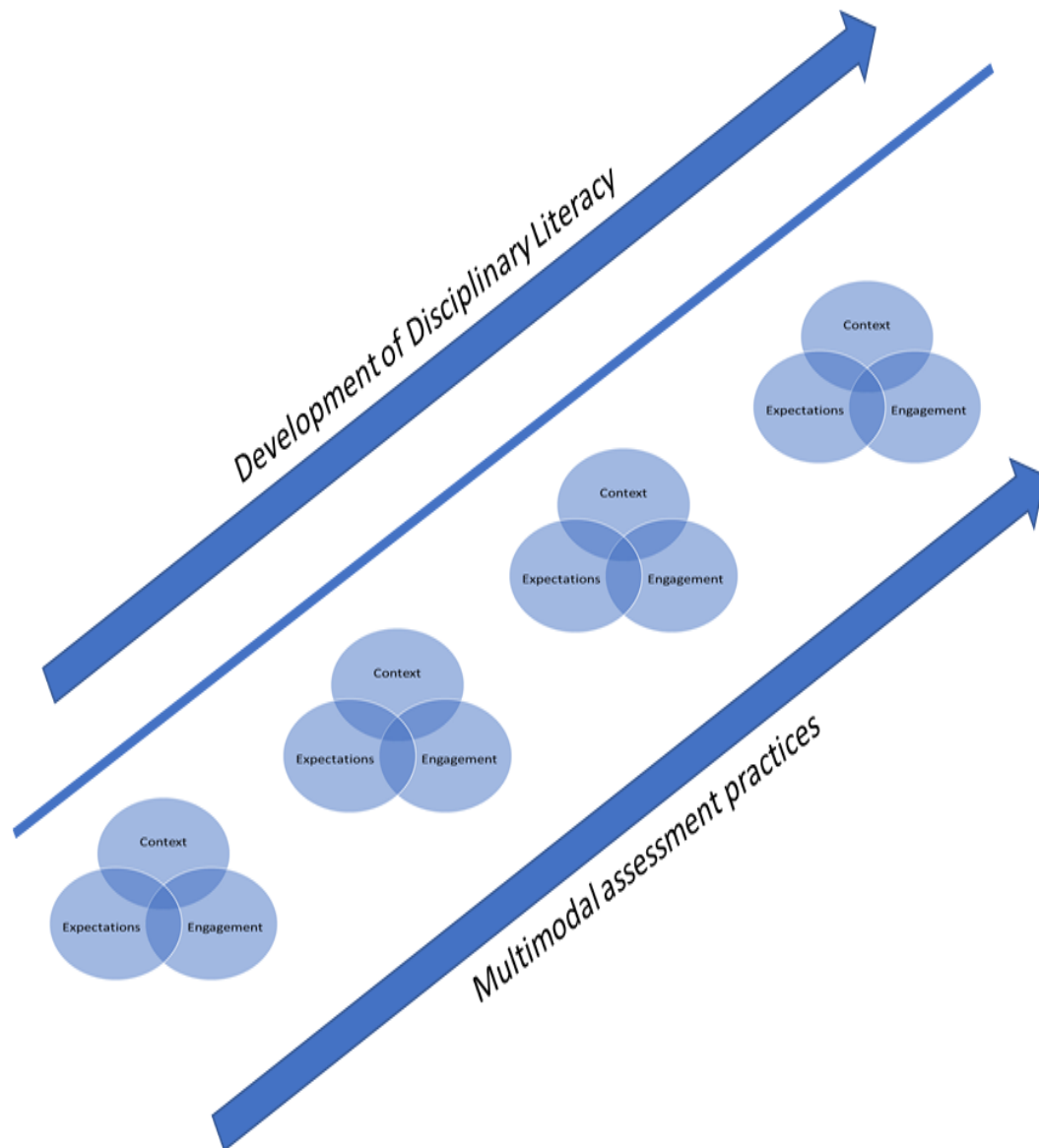


Figure 4: Model of student learning with the inclusion of multimodal assessment practices.

In her paper discussing the doctoral learning space, Tara Brabazon (2018, p. 64) describes multimodality as “the capacity to select, interpret and manage diverse platforms. The many platforms and channels that are now the nature of our reality, a way of experiencing information, ideas and life.” We provide authentic



environments and experiences for students by incorporating a multitude of platforms, media and modes in the learning environment. By recognising the educational importance of non-traditional modes of assessment (such as video, audio, blogs, Facebook, Twitter), not only do teachers enable learners to engage with material that has meaning for them, but also students are invited into academic conversations based in familiar modes that they understand and in which they maintain expertise. Put another way, if students have existing literacy in the use of a platform, such as playing videos housed in YouTube or following hashtags on Twitter, the content can be filtered to specifically focus on science-based materials. Expertise in form can be mobilized to develop new knowledge, experience and expertise in content.

In this model, multimodality provides a context that enables learners to access academic content that would otherwise be unavailable to them. Multimodality takes existing knowledge in one mode and uses that expertise to improve it in other modes (Brabazon, 2018). Thus, learners that engage with a wider range of modalities within a discipline will be more easily able to transfer their knowledge to another discipline. In deploying a focus on multimodality in this disciplinary literacy project and revealing its impact on building productive matrixes between form and content, curricula design and educational delivery becomes dynamic, customized, bespoke and agile. For university teachers in the sciences, this is a confronting practice. Most science academics hold no qualifications in education. Even fewer hold qualifications in media, communication or cultural studies. Yet with multimodality as the incisive trope straddling three disciplinary expertise, opportunities for subtlety, reflection and intentionality emerge within the creation of a learning environment.

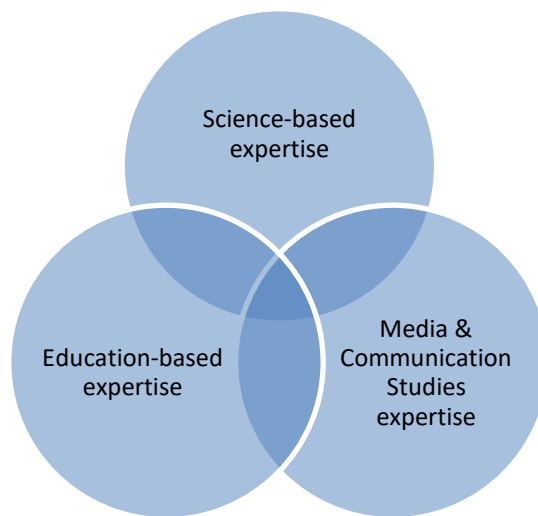


Figure 5: Building disciplinary literacy through multimodality

For many university academics in the sciences, this is an uncomfortable intellectual space. It offers an intellectual reminder that expertise in science-based content is not sufficient to enable disciplinary literacy. It is certainly not a sufficient qualification to teach that expertise to others. By disrupting homology – the way in which teaching and learning has always taken place in higher education – a recognition of the changing sociological configuration of students can emerge, and the diverse backgrounds and experiences



that brought them to university respected. Standards of quality teaching and learning can be maintained, without standardization.

By disrupting the way that scholars read and write within a discipline, educators can reflect and transform how disciplinary knowledge functions. Once this overtness and explicitness emerges, new relationships can be built between teaching and learning, teaching and research, form and content, platform and knowledge. From this matrix of literacy, it is then it is possible to move between disciplines and activate these skills in new contexts. Interdisciplinarity is based on disciplinarity. This clarity, precision and reflection are key to effective science communication. Learners make connections with a wider variety of modes and contexts. They develop understanding and interpretative capacities from multiple perspectives, thus encompassing a wider community voice. Curricula design – and in particular, assessment tasks - must motivate students to build upon previous experiences, scaffolded by clear expectations, and produce textual material that is appropriate for the relevant context. These texts vary from laboratory notebooks to essays, from fieldwork observations to photography, from blogs that communicate science to new audiences through to experimental design. The goal is to understand the sensory environment, build the relationships between signifiers and signifieds, and communicate these results with an awareness of diverse audiences.

Such a multimodal curriculum is designed to be accessible and appropriate to cater for pathways required by a diverse range of students. Customization is possible. Recognizing David Howes and his research into the “Empire of the Senses” (2021), visual literacy is the most dominant. Written texts dominate formal education, and visual literacy is our most advanced mode of interpretation. We are taught to read print, and then read text on a screen. Increasing the interplay between different modalities of text – including written text and images – and moving between diverse platforms from paper to screens, from hypertext to PowerPoint, increases the reflection on how the form of information changes the meaning from it. Noting the diverse sensory experiences required of scientists, particularly through multi-sensory observation, requires carefully planned experiments. These experiments not only deliver knowledge through results, but by constructing overt assessment scaffolds through labs and fieldwork means that students reflect on the senses they require to gain information and the interpretive skills necessary to manage that information with dexterity. The Empire of the Senses means that scholars – and citizens – revert to the literacy in which they hold most experience and skills. Visuality dominates the sonic, olfactory and tactile capacities to gather information and interpret it with precision. Therefore, curricula design elements can model such information seeking behaviours, defamiliarize the dominance of visuality, and create a much subtler and dextrous observational capacity for students.

### **3. Situated Literacies**

Fine scholars have developed a shape and frame for the development of diverse spaces in curriculum for the activation of diverse literacies. Amongst the most well-known are Barton, Hamilton and Ivanic’s *Situated Literacies* (2000). The alignments between situated literacies and disciplinary literacy are not well theorized or developed at this point. However, our article attempts to formulate these first integral connections. Literacy learning and literacy developmental events emerge within a context provided by the teacher. They are situated. Textual environments to decode these events emerge within the family home, or on the football field, or during an early morning walk. Multiple contexts for literacy learning

emerges in formal education. The difference between effective and poor online teaching is due to how well this situatedness of the tasks is met. These literacies are labelled within subjects and disciplines. Hamilton describes situated literacies as a “time-bounded interaction between people and texts or other literacy-related artifacts is taking place.” (2000, 28). Our model expands on this definition by focusing the interaction within disciplines.

The key design elements for this multimodal literacy were described in Figure 1 in this article. However, to expand on this model, allowing it to move into diverse communities and audiences, requires new characteristics and attributes. This is revealed in Figure 6, activating the student learning elements of Context, Expectations and Engagement of Situated Practice, Modelling and Community. Situated disciplinary practice provides the environment which enables learners to connect their experiences of the discipline with how experts function within the discipline. This modelling provides clear examples of expectations of the discipline, including the type of writing that is commonly used to communicate within and between other disciplines. By incorporating authentic aspects of the discipline in terms of communication styles and events, learners are encouraged to engage with that community, performing the tasks that will be expected of them within the discipline.

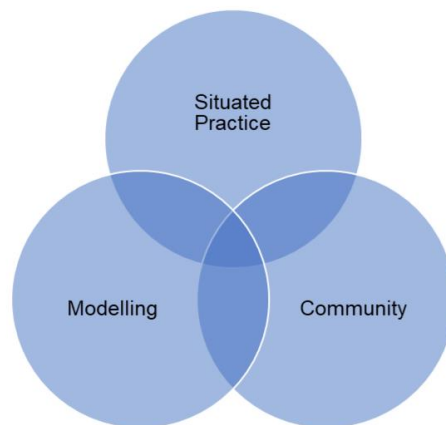


Figure 6: The relationship between the three central elements employed in the artefacts that promote student learning.

The elements of Situating Practice, Modelling and Community adhere to each of the elements necessary for learning to occur, namely Context, Expectations and Engagement respectively. Building these alignments also reveals the value of connecting situated literacies with disciplinary literacies.

Human cognition is situated. All learning emerges within a context. Further, learning is enhanced and intensified if the context in which learning takes place is familiar and known (Gee, 2004). If learners attempt to assimilate new knowledge without a familiar context, the outcomes will not be as successful as learning new knowledge within a comfortable and known context. Therefore, when creating a literacy development opportunity, it is important to monitor the relationship between form and content. Situated

practice focuses on how the learner develops meaning in ways that are relevant to them in their own lives (Cope & Kalantzis, 2015). The key educational technique is to provide an information scaffold between new disciplinary knowledge and the already existing experiences of a learner. Within a learning environment, this can mean tailoring assessment and scaffolding activities to make these links clear, in turn valuing both existing knowledge and experience of the learner.

Student success is linked to learner engagement (Groccia, 2018) and aligns directly with student effort in meaningful educational tasks (Kuh, 2001). Educators have long understood the importance of engagement in higher education, and the elements proposed by Chickering and Gamson (1987) are particularly relevant the characteristics of the learning environment and the educator interactions with students. Through the model described in Figure 1, it can be seen that the combination of these elements is critical, demonstrating that engagement alone will not result in learning. While these factors emphasise the learning environment, they exclude the internal factors such as learner disposition. Here we can learn from alternate theoretical models of human behaviour, including the model of critical thinking disposition developed by Peter Facione (1990, p. 11) where “there are dispositional components to critical thinking..... each cognitive skill, if it is to be exercised appropriately, can be correlated with the cognitive disposition to do so.” Similarly, there are dispositional components to engaging in any kind of learning. As Facione confirmed, “In each case a person who is proficient in a given skill can be said to have the aptitude to execute that skill, even if at a given moment the person is not using the skill” (Facione, 1990, p. 11). Literacy learning is hooked into daily experiences and is available to deploy, practice and improve as required.

Learner disposition is enhanced and enabled by an explicit, careful, compassionate and rigorous context for educational events. In the model presented here, disposition is defined as the combination of a learners’ confidence and willingness to attempt a task. Baird and Dilger (2018, p. 21) suggest that “in the case of writing transfer, [disposition] shape[s] decisions writers make regarding prior skills, experience, and knowledge as they move between contexts”. Disposition and therefore engagement can be influenced by the expectations and context of the learner. The more closely aligned the expectations and context, the more confident and willing a learner is to attempt a task. In the model of the learners’ experience, disposition can be described as factors acting to increase learner engagement and is influenced by the alignment of expectations and context of the learner.

Engagement Theory was developed by Kearsley and Shneiderman (1998) to understand and provide a framework for teaching and learning using technology. However, the concepts are applicable to teaching and learning beyond digital environments and can be used to understand how collaborative and interactive teaching promotes learning engagement, with a focus on worthwhile tasks. Depicted in Figure 7 is the situation where an inelegant alignment of factors contributes to poor engagement. A student who is underprepared in terms of learner disposition - meaning that their previous experiences of formal education had not connected form and content, content and context with clarity – will reveal a misalignment with the discipline, resulting in poor engagement with literacy events and learning processes. By addressing the issue of engagement and alignment between form and content, content and context, a learner’s disposition can also be improved. They can enhance their opportunities for success, as determined by learning outcomes. This can be related to the model described in Figure 1. By realigning the context of learning so that the student can see how it relates to long term learning goals, increased engagement can be

achieved. In this example, the learner disposition works to distance the expectations and context of the learner, resulting in a lack of confidence and willingness to undertake tasks, which translates to a poor learning experience. However, by providing opportunities for engagement in authentic contexts, confidence and willingness to undertake tasks also develop. This stage of learner disposition represents students who are in the early stages of developing their disciplinary literacy skills. At this stage, an educator must provide ample opportunities for students to easily access the disciplinary environment to help them align their context and expectations and therefore engagement, resulting in a more positive learning experience. By incorporating meaningful and relevant authentic tasks educators can promote learner engagement.

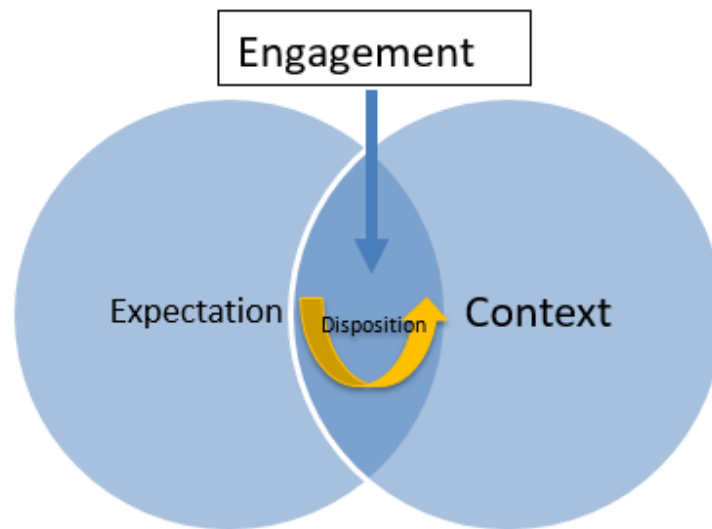


Figure 7: Representation of the engagement of a student whose expectations and context are not closely aligned.

By providing supportive curricula where expectations are overt and are situated into a well framed context, learners can be supported in the movement towards the model described in Figure 7, actualizing high engagement. This support is founded on clear guidelines and ample opportunities for practise and feedback in a low-risk setting.

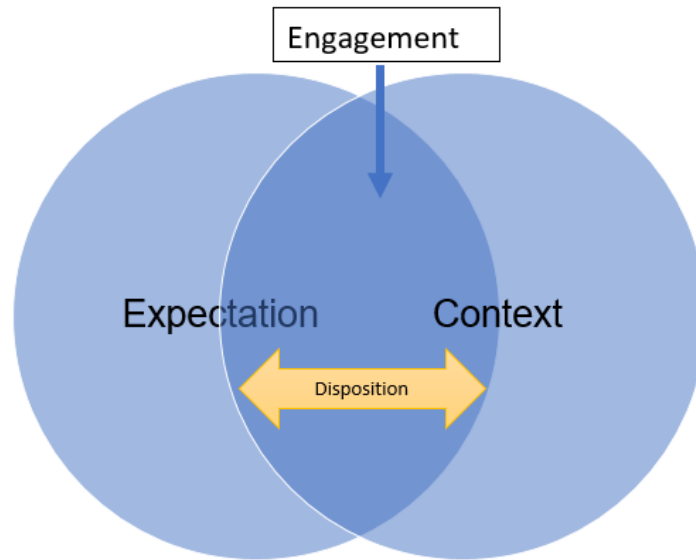


Figure 8: Representation of the opportunity for engagement of a student whose expectations and context are closely aligned.

A student who is likely to have a high level of engagement in their own learning and who has a well-developed learner disposition will further benefit, as these traits align both expectations and context. This shift in alignment is representative for students who are developing their disciplinary literacy skill set.

#### 4. Conclusion

Attrition rates remain of great concern in universities around the world. Yet while success is celebrated, failure is individualized. While communities of learners gain degrees and graduate, the reasons for students to leave higher education and – indeed – to withdraw from the learning experience through a lack of attendance or disconnection from learning materials is rarely understood. With careful attention on disciplinary literacy development, ‘failures’ and ‘attrition’ gain new meaning and interpretations. This article has brought together science, education and multimodal theories from media and communication studies. The goal of this unusual intellectual cluster is to render the toolbox of teaching and learning overt, clear, mobile and dynamic. Understanding the relationship between disciplinary literacy and situated literacy – content and context – offers a much more granular and customized strategy for teaching and learning. And further, this differentiation of learning enables a diversity of learners. Such a project offers value for many sociological groups, particularly the neurodiverse (Bailey, 2022). Academic standards can be maintained without standardization.

Academic failure is not an individual concern. It emerges within contexts. It is hooked into a curriculum. Therefore, by framing a curriculum in the already existing experiences of students, scaffolded success is possible. But such decisions require a change in academics. We cannot sit in homological complacency. We cannot separate teaching and research, learning and literacy. Teaching in higher education has never been more difficult than in our present. The cuts in funding and the damage created through the pandemic

means that the academic workforce is battered by disengagement, disrespect and disconnection. However, by building meaningful relationships between disciplinary literacy and multimodality, science can transcend its elitist past, address its battered present, and formulate a plan for collaboration and dissemination in the future. This project has already proven successful in mathematics (Weinberg, Wiesner and Fulmer, 2022), revealing how situated literacies can support students engaging with semiotic systems such as textbooks. Therefore, with a diversity of platforms and interfaces available, the capacity for meaningful learning events to emerge is only limited by our commitment, clarity of purpose and desire to build new relationships between our disciplines.

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