# Interdisciplinary Learning and Teaching

*Practice and Pedagogies*

By

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Interdisciplinary Learning and Teaching: Practice and Pedagogies

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Simon Scott

# Contents

**Part 3: Pedagogies in Practice**



**Part 4: Assessment, Reflection, and Impact**

**Part 5: Reflections on Hosting an Interdisciplinary Conference**

# List of Figures

# List of Tables

# Preface

**Ida Kemp**

> "Academics should develop teaching experience in both core and interdisciplinary areas." – British Academy, 2016.

This book aims to provide some practical guidance, underpinned by educational research and actual experience, of interdisciplinary learning and teaching activities, opportunities and challenges. If you have already had the good fortune to teach in interdisciplinary environments, it is likely that you have already 'solved' many of the issues related in the following pages, but I hope that you'll be able to identify some of the reasons 'why' your methods have been successful and to provide you with some ideas on how to further improve your interdisciplinary teaching approaches. If you are new to interdisciplinary teaching, this text is designed to provide some guidance as you develop your own programmes. It focusses primarily on the undergraduate curriculum, rather than postgraduate research or practice, as it is concerned with trying to develop interdisciplinary thinking at a point where disciplinary knowledge is not as refined and embedded in students.

The chapters in the book are based on presentations delivered at the series of interdisciplinary learning and teaching conferences. These conferences are designed to explore and describe practical experience of interdisciplinary learning and teaching activities, sharing knowledge of what has worked and what hasn't worked as well. As at publication, there have been nine conferences held in the UK at various higher education institutions, attracting presenters and delegates from around the world.

There is no intention to dilute or threaten the importance of disciplinary knowledge and experience in the following pages. Indeed, there is good evidence to suggest that a strong disciplinary understanding is essential in order to develop interdisciplinary thinking and understanding. However, as interdisciplinarity continues to influence higher education discourse, this text aims to provide a starting or continuing point for your own interdisciplinary teaching development, with a view to sharing some tested practice and some theoretical teaching tools, that will enhance the experience for your students.

We have included an Index and References/Additional Resources list at the end of the publication, as one of the challenges in working across disciplines is that it is not easy or straightforward to find materials that provide guidance for developing successful interdisciplinary learning and teaching activities. Things are improving, however, and there is more literature to draw on than there was even 10 years ago. Much of the interdisciplinary literature at the outset was focused on justifying the need for interdisciplinary research and articulating the opportunities and challenges that this approach required. The discussion of disciplinary knowledge, discipline epistemology and the difficulties in communicating across 'boundaries' is as relevant in the teaching context as it is in the research context. The work which surrounds interdisciplinary research provides a rich and important platform for discussion of how interdisciplinarity can be addressed in the classroom and provides a solid basis for understanding the interdisciplinary landscape.

If you are interested in developing 'interdisciplinary' activities, it is likely that you have been asked to do this in response to someone else's agenda, or in response to an outside influence, as it is rare to have 'interdisciplinary' activities simply emerge unbidden. Luttuca, et al (2002) reports that in the US, almost 40% of HE professionals

have been asked to teach on an interdisciplinary course or module.[1] Current educational structures at many levels do not support the notion that interdisciplinary learning is important or valued. Interdisciplinary activities do not sit comfortably within faculty or knowledge structures. To start, there is usually a funding problem, in deciding who will pay for staff and resources required. There are also problems in accurately assessing interdisciplinary work, as disciplinary practices tend to value and produce work in specific ways, particularly at undergraduate level, in order to achieve accepted academic standards and benchmarking criteria, as well as ensure it is fair, equitable and transparent to students. And, finally, but most importantly, there is the additional resource in terms of time and energy required to deliver interdisciplinary learning and teaching activities, which is often unappreciated or unrewarded. Current academic promotion structures do not reward staff who work, publish or teach in interdisciplinary ways because it is difficult to measure the 'value' of the contribution, which usually takes more time and resource than 'disciplinary' activities. It is harder to measure any impacts, to put against ledger accounts and to manage staff who are working outside faculty structures. These are all key elements in a modern university environment.

In addition to these issues, if you are working on an interdisciplinary project, you are likely to be working on your own or in a small team, with conflicting and various commitments elsewhere. If you feel isolated, alone or that you must do battle at each step of the way, please try and remember that it is like this pretty much everywhere. The discipline/faculty structure supports colleagues within and across institutions, as they provide communities that offer not only intellectual cohesion but practice-based agreement. Interdisciplinarity

[1] Does Interdisciplinarity Promote Learning? Theoretical Support and Researchable Questions Lattuca, Lisa R; Voight, Lois J; Fath, Kimberly Q., Review of Higher Education; Baltimore Vol. 28, Iss. 1, (Fall 2004): 23-C.

does not benefit from this yet. I think there are two main reasons for this: 1. Academic structures do not support interdisciplinarity, so if staff wish to gain promotion or become fatigued, they revert to the traditional disciplinary support structures and 2. By their very nature, interdisciplinarians want to avoid creating a 'disciplinary practice' of interdisciplinarity. Those who engage in interdisciplinary activities want to ensure that there are not set 'rules' for interdisciplinarity and that all views are valid in order to avoid a limited approach. This is laudable, and I think very important, but it doesn't facilitate the creation of a 'community' that is sustainable and identifiable.

The chapters in this book are designed to provide some thoughts, which are hopefully useful, on how you might implement your interdisciplinary activities, as well as provide a range of the issues that you will need to consider. Much of this is designed to be focused on the student perspective, rather than the staff/academic perspective, so there will be overlapping features, just as a student isn't divided into discrete areas of 'assessment', 'knowledge', 'identity'. All these elements converge in students and it is important to consider them continuously, as they are fluid and vary between students, especially for undergraduate students. Indeed, depending on what you are teaching, you may have a wide range of engagement from students, from those who take the course/module because of an academic requirement to those who are taking it for intellectual reasons alone, and for all the students in between.

We hope you find this publication useful and thought-provoking, as well as applicable to your own interdisciplinary context – or the context you are planning for the future.

# Introduction: The Ethics of Interdisciplinary Learning and Teaching

**Simon Scott**

## 1 Complexity and the New

Interdisciplinarity begins with complexity (Newell, 2001). Many issues we study today, like climate change, global migration, food insecurity, and the social effects of AI, cannot be understood by isolating only a few factors. Economic forces, cultural meanings, technology, political decisions, and historical patterns all interact in ways that are mutually shaping and difficult to disentangle. These issues are complex not simply because they have many parts, but because those parts continually affect each other, so that a change in one element alters the behaviour of the others. Complexity names this deep interdependence of phenomena.

No single discipline can capture this dynamic interplay. In a multidisciplinary approach, each discipline frames a complex topic from its own perspective, asking and answering questions within its scope. Although these questions can be difficult and challenging, the topic does not appear as complex when disciplinary lenses are applied in isolation. What remains absent is any account of how different disciplinary insights relate. It is this relational challenge that interdisciplinarity addresses, drawing on multiple disciplines in an integrative way. While the process of interdisciplinarity is complicated, it is not complex.

When we combine these concepts, for example, by referring to complex issues as "interdisciplinary problems", we make a conceptual mistake. We confuse the nature of the problem with its study. This happens

because the topic is encountered from many different disciplinary perspectives, and so interdisciplinarity is thought to belong to the topic itself. However, this leads to poorly designed 'interdisciplinary' modules that are actually multidisciplinary because they simply offer breadth across disciplines and overlook integration altogether**.** But the distinction between complexity and interdisciplinarity is categorical: complexity is a feature of the object of study; integration is a feature of the study of the object.

If interdisciplinarity is not itself a feature of complexity but a way of studying it, a further question arises: what is its purpose? Integration is the defining concept in interdisciplinarity, but it cannot be the purpose as it is always a means to some other end. Some in the scholarly community identify that end as a "more comprehensive understanding" (Newell, 2001, p.2; also, Klein and Newell, 1998), while others describe it as a "more holistic understanding" (Szostak, 2015, p.96). These terms, which are often used interchangeably, have led to the widespread view that interdisciplinarity aims for a particular type of breadth. Yet this belief is difficult to maintain once we examine the purpose of multidisciplinarity.

In multidisciplinarity, when different disciplinary approaches are placed side-by-side, each reveals a distinct set of phenomena because of its unique assumptions and epistemic priorities. By coordinating these views, we broaden the range of phenomena for analysis, which improves our understanding of a topic by covering more aspects than is possible within any single discipline. This means our understanding is more comprehensive, but this expansion happens through juxtaposition. The representations of the phenomena remain unconnected, with no relational account of how they shape one another. Even if a multidisciplinary project were to coordinate its disciplinary insights more coherently so that it could describe connections between them, it would still offer a descriptive arrangement rather than a

relational synthesis. Our understanding remains fundamentally unchanged, with only the number of phenomena revealed by different disciplinary framings increasing. This comprehensiveness depends upon accumulation rather than integration.

Because breadth can feel like depth, the accumulation of perspectives is often mistaken for integrative work. But without relationality, this essentially quantitative process stays within the logic of multidisciplinarity. If comprehensiveness can be achieved without integration then it cannot be the defining purpose of interdisciplinarity. Whatever the purpose of interdisciplinarity is, it must be something that multidisciplinarity cannot produce even in principle; otherwise the distinction between them collapses into a mere difference of degree.

Interdisciplinarity can indeed provide a more comprehensive understanding, but this outcome should not be mistaken for its purpose. In fact, it is because interdisciplinarity begins from the differentiated insights of multiple disciplinary approaches that it is capable of generating breadth. Yet what distinguishes interdisciplinarity from multidisciplinarity is not the scope of coverage but the kind of understanding that integration makes possible. Integration is not an incremental expansion of insight but a qualitatively different epistemic act: it reconfigures the relations between disciplinary insights to produce a new understanding. Whether interdisciplinarity is used to solve problems, generate insights, or critique inherited framings, the plurality of purposes rests upon a single epistemic requirement: the production of new understanding.

Of course, disciplines also produce new knowledge, which benefits both disciplinary and multidisciplinary work. Novelty, therefore, is not unique to interdisciplinarity, but it differs in kind from that produced within disciplines. Disciplinary novelty extends knowledge within an existing framework. Interdisciplinary novelty, by contrast, arises only when the learner steps outside those frameworks to reconfigure

the relations between them. It is not simply a fresh perspective but a different mode of understanding altogether. It reconfigures relations to produce new ways of understanding phenomena, new conceptual syntheses that no single discipline is designed to produce, and a new coherence between previously incommensurate elements. Because this kind of novelty changes what can be thought, its significance is not only epistemic but ethical. Interdisciplinarity makes possible new questions, new understandings, new objects of inquiry, and new solutions. The ethics of interdisciplinarity is the creation of the new[1].

The new should not be understood only in terms of groundbreaking contributions, and certainly not in an educational context. Even at an introductory level, a learner creates new understanding when they bring disciplinary insights into relations that had not previously been formed within their inquiry, whether in an essay or in any other integrative task.

If this is interdisciplinarity's ethical imperative, then we must ask what it demands of those who practise it. What kind of learner must the interdisciplinarian become in order to generate the new? Only then can we turn to the question of how the new is created in practice. Yet teaching interdisciplinarity often assumes we already know what it means to

[1] Step 9 of Allen Repko and Rick Szostak's research process is 'Construct a more comprehensive understanding' (Repko and Szostak, 2025). Part of their explanation includes producing "a new and more complete, and perhaps more nuanced, understanding" (Repko and Szostak, 2025, p.277). In this respect, the new is already central to their account of interdisciplinarity's purpose. Although much of my account aligns with theirs, I take novelty to arise when the learner moves into a liminal position between disciplinary framings, where the relations they create can be reconfigured. This results in a qualitative transformation rather than an enhanced breadth: disciplinary insights are brought into relations that alter their meaning. Because integration transforms the interpretative frame itself, the continuum can no longer function as a scale of comparison, for continua presuppose a stable underlying frame in which what increases remains the same kind of thing. Moreover, because the continuum model provides no clear boundary between multidisciplinarity and interdisciplinarity, it risks encouraging poor practice in which essentially multidisciplinary work is presented as interdisciplinary.

learn it. In truth, the scholarly community knows far less about the experience of interdisciplinary learning than it does about teaching. This exposes a central absence in Interdisciplinary Studies: while theories of interdisciplinary teaching have flourished, theories of interdisciplinary learning remain remarkably underdeveloped. This is understandable because teaching is intentional and public, whereas learning is an internal, emergent, and often tacit process. If we want to understand how the new is created, we must first understand what it looks and feels like for students to become the kind of learners capable of creating it.

Student feedback, interviews, and focus groups offer valuable insights into how learners describe their interdisciplinary experience. However, there is a limit to self-reported data, as we tend to be poor judges of ourselves (Schön, 2016). Recollections often fit a narrative that was not written at the time students faced challenges, and are also subject to recall bias. This bias may be influenced by assessments, grades, and the fact that reflections are provided for assessors; that is, students may tell us what they think we want to hear. Because we often fail to understand what interdisciplinary learning is, we tend to confuse it with interdisciplinary teaching and risk over-attributing outcomes to pedagogy by arguing that on the basis of using *this* method, *this* learning happened. Which is to say that interdisciplinary learning is often theorised from the outside. If we want to understand how the new is created, we must examine interdisciplinary learning from within – through the internal tensions, confusions, breakthroughs, and movements that constitute the learner's becoming.

## 2 The Paradoxes of Interdisciplinary Learning

### 2.1 The First Paradox

In what follows, I argue that the creation of the new is not experienced as a linear or straightforward process, but rather one that

unfolds through two paradoxes. These paradoxes structure the lived experience of interdisciplinary learning and shape how learners become capable of generating new knowledge.

According to the first paradox, students must analyse disciplinary approaches critically before they possess the disciplinary grounding to do so, yet that grounding can only emerge through precisely this critical analysis.

To understand why this paradox arises, we need to clarify what it means to be "adequate" in a discipline, because the paradox rests on a mistaken assumption: that adequacy must precede critical analysis when, in fact, it can only emerge through it. Interdisciplinarians are not, nor should they be, experts in each of the disciplines they use. However, they have a responsibility to use disciplines accurately; otherwise, the new knowledge they create risks becoming arbitrary rather than meaningful. This requires an awareness of key features of disciplinary approaches (such as assumptions, methodologies, epistemologies, and criteria for validation), even though these features do not define adequacy. Students often ask "how much is enough?" to demonstrate their understanding of a disciplinary approach and are often disappointed to find there is no clear metric. But we mislead students if we answer that question in disciplinary terms, because adequacy cannot be assessed by the standards of a discipline. Those standards measure how well someone reasons within a framework, whereas interdisciplinary adequacy concerns how well one can use that framework in relation to others.

For the interdisciplinarian, there are three modes of understanding disciplinary approaches that amount to adequacy. First, adequacy is contextual, meaning it involves recognising how a disciplinary approach maps onto the wider complexity of the problem. This requires understanding how a disciplinary approach frames a topic and includes, for example, what it reveals, what it obscures, and how

its assumptions shape the analysis. To use the disciplinary approach responsibly and in dialogue with others, the interdisciplinarian must recognise its strengths and limitations. Contextual adequacy therefore requires the learner to see the disciplinary approach not as something to be mastered on its own terms, but as a particular way of structuring the world that can be brought into dialogue with others.

Secondly, adequacy is relational, as it involves understanding how insights from different disciplinary approaches could relate to each other. This relational awareness is crucial because interdisciplinary work views disciplinary insights not as isolated claims, but as positions within a broader conversation. To recognise the possibilities for integration, one must understand not only what a disciplinary approach says, but also where it comes from and how its assumptions and priorities shape its insights in ways that are distinct from, and potentially resonant with, other approaches. Relational adequacy cannot be judged by a discipline's own criteria, because it is part of a wider ecology of knowledge. Rather, it is assessed by the learner's ability to keep disciplinary approaches open to connection. Relational adequacy therefore demands a stance that no discipline can cultivate from within: a capacity to hold insights in a condition of openness, in which potential relations can be perceived but are not yet enacted.

Finally, adequacy is performative: it is the ability to enact the relations that relational adequacy only makes possible. Whereas relational adequacy concerns recognising how insights might connect and holding disciplinary approaches open to transformation, performative adequacy concerns the activity of bringing those insights into relation and working with the effects. It develops through the practice of moving between frameworks, testing how insights behave when placed in dialogue, and adjusting the relations as new meanings begin to take shape. Adequacy is realised not in prior knowledge but in this ongoing activity of making and remaking the relations themselves.

These three modes of understanding disciplinary approaches describe the conditions for full adequacy, and they are discrete and cumulative. Relational adequacy presupposes contextual adequacy, because we cannot perceive how disciplinary insights might relate if we do not first understand each in its own framing. Performative adequacy presupposes relational adequacy, because we cannot enact relations intelligibly without first recognising how disciplinary insights may connect. Adequacy is not a measure of expertise but rather a way of working with partial knowledge in relation to other frameworks. It is a capacity that develops as learners engage with disciplinary approaches, rather than a prerequisite for interdisciplinary work.

In practice, adequacy begins to take shape through a movement between immersion and reflection. On the one hand, students must immerse themselves in texts, reading them from within a disciplinary approach. This means engaging with them as practitioners do: they follow the development of arguments, note what questions are pursued, observe what is treated as evidence, and see how data is organised and interpreted. Although I refer here to "reading texts", immersion and reflection take discipline-specific forms: in laboratory sciences and quantitative fields, students immerse themselves in methods and modelling practices just as they do in arguments and textual reasoning.

For students on a monodisciplinary programme, this immanent mode of reading (that is, immanent to the assumptions that inform the disciplinary approach) is often enough. However, for the interdisciplinarian, it is only the first step. They must also study the disciplinary approach from outside the text, making the approach itself an object of inquiry. For instance, they might attend to its assumptions, the ways it evaluates claims, typical forms of evidence, and the criteria that determine what it treats as significant. In other disciplines, reflective questions may take a different form: students

might ask why a particular model, experimental design, or analytical procedure was chosen, and what alternatives have been bracketed. These features cannot be grasped simply by following a text from the inside; they require a deliberate, meta-level analysis of how each disciplinary approach constructs knowledge.

The movement that enables students to inhabit this paradox is not linear, but dialectical; not the Aristotelian dialectic of logical opposition but rather, in the Hegelian sense, a productive contradiction. As soon as students attempt to read a disciplinary text immanently, they encounter pressures that cannot be resolved from within this immersion alone. They can follow the argument, but questions arise that the text itself cannot answer: 'why this method?', 'why this form of evidence?', 'why this assumption about what counts as significant or rigorous?' These questions mark the limits of immersion. The more closely students try to inhabit the discipline's internal norms, the more they encounter what those norms cannot account for or must implicitly bracket. The immanent reading therefore produces an epistemic pressure that forces the learner into a reflective stance before they feel ready for it. Reflection appears not because students have mastered enough to step back from the text, but because the internal logic of the discipline generates questions that require stepping back.

Yet when students shift into reflection, they immediately encounter a different kind of pressure. From the reflective position, they can see assumptions and scaffolding, but they cannot fully understand how these operate without returning to the text. Reflection exposes gaps that only renewed immersion can address: the student must return to the text in order to understand how the disciplinary approach influences the construction of argument and produces meaning. Reflection therefore sends the student back into the immanent reading of the text, but now with altered awareness. What once appeared as 'content' is now seen as the product of the disciplinary framing that organises it.

It is in this continual movement across the limits of one's own understanding that adequacy begins to form. Even within a single disciplinary approach, the movement between immersive and reflective readings deepens understanding. For interdisciplinarians, however, this movement is intensified because they never work with a single disciplinary approach but with several held in relation to one another. Each additional disciplinary vantage point enables students to study the other approaches from outside their own assumptions, making their strengths and limits more visible. This comparative posture repositions what is learned in immersion: knowledge is no longer contained within the discipline's internal logic, but held open to other frameworks. This double hermeneutic reveals a mode of understanding in which knowledge is something constituted through relation. It is in the reflexive movement between immanence and reflective distance that the learner acquires not only content but a way of holding relations among different types of knowledge.

## 2.2 The Second Paradox

A second paradox emerges from the first: integrated claims require authorisation, yet the only available sources of authority are the disciplines themselves; but integration becomes possible only when the learner moves beyond those disciplines into a space where they can no longer authorise the relations that must be constructed.

This paradox creates a tension between recognition and autonomy. On the one hand, the interdisciplinarian works across multiple disciplines, each with its own conventions and traditions that confer authority on the claims made within each disciplinary approach. This recognition reassures students that their claims are intelligible and legitimate. On the other hand, as the interdisciplinarian always looks to open up these claims and create new relations, they must go beyond disciplinary frameworks. Since these frameworks cannot authorise integrative

reasoning, recognition is always partial and ultimately withheld[2]. Strategies that create a common ground, such as those suggested by Repko and Szostak (2025), help to organise relations between insights and are recognised within the interdisciplinary community, but this recognition does not extend to the singularity of each integration. This is a central concern in scholarship on assessing interdisciplinary work: how can genuinely new knowledge be evaluated? The interdisciplinary learner therefore finds themselves having to speak without the security of an established and recognised framework.

This withholding of authority proves productive because it forces the student to shift the ground of validation. Authority is established through the quality of the reasoning that constructs the relation between disciplinary insights. As a result, the interdisciplinarian becomes the source of authority rather than its recipient, and legitimacy is performed rather than conferred. In this context, autonomy does not simply mean the freedom to choose one's topic or disciplines; rather, it requires justifying the epistemic logic of those choices once they are made. Since no discipline can legitimise the relations the interdisciplinarian creates, the learner must provide the standards by which their claims are judged. This involves explaining why particular insights are used, how they are brought into relation, the nature of this relation, and what new understanding emerges from their integration. By constituting authority performatively, the learner gains greater control; they become an active contributor to knowledge production rather than simply reproducing disciplinary content. This

[2] Some interdisciplinary fields in the sciences eventually develop shared standards, but these do not resolve the paradox: they represent new disciplinary frameworks rather than disciplines authorising integrative relations. Once integration stabilises into a field with its own norms, it ceases to be interdisciplinary in the strict sense. The paradox applies to all integrative work carried out before such stabilisation, which is where interdisciplinary reasoning properly occurs.

experience grants students an earned, though always provisional, right to speak.

This is not a one-way progression from dependence to self-authorisation; as with the first paradox, the movement generated by this tension is dialectical. Once students authorise their integrative claims through the quality of their reasoning, they do not abandon the internal norms of the disciplinary approaches used. Although these standards cannot confer authority on new knowledge, they remain useful resources against which to test integrative claims for intelligibility, persuasiveness, and coherence. Because new claims retain elements of the disciplinary approaches used, returning to their norms helps determine both whether the student has drawn sufficiently from them and whether the integrative claim is merely a disguised disciplinary one. This return both tests and refines their self-authorisation. The movement is recursive: dependence becomes self-authorisation, which is then deepened through a renewed, critical return to disciplinary norms.

## 2.3 The Lived Experience of the Paradoxes

These two paradoxes, and the dialectical relations they give rise to, provide the epistemic structure of interdisciplinary learning. But what about the lived experience? To understand how the new is created, we need to consider the affective movements that accompany the cognitive ones. This helps us, when designing modules, to decide which tensions we want students to experience and which we want to protect them from. These paradoxes are not experienced simultaneously but sequentially and unevenly. Interdisciplinary learning consists in moving between these different tensions, and it is this continual repositioning that gives rise to both lived instability and eventual agency.

The first pressure comes from the shift between immersion and reflection. Students begin with the immanent reading of a text; as readers of content they aim to work within the discipline's own patterns of reasoning and its characteristic ways of presenting and justifying claims.

In disciplinary approaches familiar to the learner, this immersion can feel comfortable because the conventions are recognisable and students sense that they 'belong' to the conversation. In approaches that are unfamiliar, immersion produces a different emotional response in which the student feels confusion and hesitation; they have the uncomfortable sense of being a beginner again and not knowing where to place themselves.

The shift to the reflective stance is therefore experienced differently depending on the learner's familiarity with the discipline. It is more likely welcomed with unfamiliar disciplinary approaches than familiar ones. Because students do not have an intuitive grasp of what they are reading, reflection becomes a useful means to orient themselves. With familiar disciplinary approaches, reflection can be experienced more as destabilising because it asks students to critique the framework they have learned to operate within. In both cases, it is a dislocating experience because of the demand to reflect before one feels ready, which can leave students feeling frustrated and unsure of where they stand.

As students move backwards and forwards between the immanent and reflective readings of a text, they rarely feel settled in either position. Immersion is disrupted by reflective questions, and reflection is disrupted by the need to return to the text for grounding. Of course, this movement between two cognitive positions happens not only in regard to a single text, but multiple texts in multiple disciplinary approaches. Reflective questions raised about one disciplinary framework reverberate into the next, forcing students to revisit texts with a new awareness.

When done well, this discomfort becomes a generative part of the learning process. Because students are continually pushed to the limits of their understanding, and are asked to reflect even while still forming their grasp of a disciplinary approach, the experience is rarely comfortable. Yet it is precisely this ongoing exposure to partial knowledge that allows new relations to begin to form. Each return to a text is refracted by what has been learned elsewhere, and students begin to sense that their understanding is actually expanding, not collapsing. Small breakthroughs allow new relations to emerge across disciplinary approaches, and new relational possibilities come into view. Disorientation does not disappear, but it is gradually transformed into a sense of capability. The very movements that unsettle students become the movements through which agency is formed.

As this emergent agency takes shape, a different kind of pressure appears: a growing sense of epistemic solitude. The learner begins to realise that the perspective forming through their relational activity is not one the disciplinary approaches have mapped out. As they move across different disciplinary frameworks and create new connections, they become increasingly aware that their developing way of holding these relations is, in an important sense, theirs alone. This is the early form of the interdisciplinarian's solitude: the experience of inhabiting a perspective that no established community has yet recognised or authorised. It is a solitude that is not merely affective but signals the first appearance of a perspective the learner must shape for themselves.

This solitude generates a need for recognition, though the nature of that need changes as learners develop. Early in the process, students seek recognition as reassurance; that is, confirmation that they are not "doing it wrongly" as they navigate unfamiliar disciplinary framings. Later, as confidence grows, recognition becomes a way of testing whether others can understand the new relations they have created. In both cases, recognition provides emotional stability: not by

conferring disciplinary authority on their claims, which is unavailable, but by confirming that their emerging reasoning can nonetheless be communicated.

Yet this stability does not remove the demand to articulate their emerging perspective: despite the ambiguity and uncertainty of the research process, the risk of error, and the fear of being seen as an imposter, the interdisciplinarian must still speak. This necessity strengthens their desire for recognition, not only as personal validation but as a way of situating their reasoning in relation to others engaged in inquiry. As they return to disciplinary texts, their reading becomes less immersive; instead, they read with a reflective awareness of the disciplinary structures that shape the argument. Although the text still provides a temporary foundation, this shift introduces a new tension: the text no longer offers the same sense of belonging it once did.

But recognition does not resolve the deeper affective difficulty of interdisciplinary learning: the experience of being structurally "out of place". Interdisciplinarians borrow, translate, and cross disciplinary boundaries, sometimes committing creative acts of conceptual violence, yet they never fully belong to the frameworks from which they draw. Even students with a home discipline often find that integrative work unsettles the sense of belonging they once had. This loss of epistemic security can produce feelings of disorientation and alienation. The continual switching of perspectives, and the way each perspective destabilises the insights of another, makes learning feel turbulent rather than cumulative. Interdisciplinary understanding is not only built step by step, but through the lived experience of holding disciplinary framings in tension and making meaning across them.

Students are often given significant autonomy from the outset. This autonomy is not simply a pedagogical preference designed to appeal to students, but follows from the nature of interdisciplinary work itself: because there is no fixed body of content (Klein, 1990), students

must make substantive choices about what to study, which disciplinary approaches to apply, how to construct claims, and how those claims relate. Autonomy is therefore structurally tied to the learning goals of interdisciplinary education; without it, students would be reproducing ready-made examples of integration rather than creating their own. Early in a module this freedom can feel light and expansive; but when students must articulate their integrative reasoning, that same freedom can be experienced as a weight. Every earlier research decision returns as a site of responsibility ("did I choose the right disciplines?", "has my use of them held together?"). Interdisciplinarity is a decision-based, rather than a content-based, education and without the implicit protection of disciplinary traditions, students may feel they are overstepping by making claims they have no inherited right to make. It is this experience of speaking without established authority that makes integration the most affectively charged moment because there is no pre-existing authority to support it.

This heightened affect is not a psychological accident, nor a result of inexperience, nor is it due to poor pedagogy; it is structurally inherent to interdisciplinary learning. To become an interdisciplinarian, one must learn to accept this risk rather than try to eliminate it: students must speak even when they do not feel entitled to do so.

## 3 The Interdisciplinarian's Perspective

### 3.1 Interdisciplinary Becoming

The epistemic paradoxes describe the tensions that interdisciplinary learners must negotiate, and the way in which they unsettle the learner's inherited ways of knowing. Yet the experience they generate cannot be accounted for in epistemic terms alone. What begins as a cognitive disruption develops into a deeper ontological change, a shift in the learner's mode of being in relation to knowledge.

As we have seen, navigating the epistemic paradoxes requires continually shifting positions, both within a disciplinary approach (between its immanent and reflective readings) and between multiple disciplinary approaches. At the experiential level, these movements generate the instability characteristic of interdisciplinary learning. At an ontological level, however, they have a different significance: they mark the absence of any fixed perspective from which interdisciplinary understanding can begin. Because no single disciplinary framework can hold the relations that integration requires, understanding arises only through these continual shifts, each of which reconfigures the position from which meaning is made.

But integration becomes possible only when the interdisciplinarian occupies a position from which the relations between disciplinary insights can be grasped. Since no disciplinary approach provides this position, it does not exist before the interdisciplinarian begins their work. This creates the ontological paradox at the heart of interdisciplinary integration: the learner must begin to construct relations before they have a position from which those relations can be seen, even though it is only through this relational activity that the position emerges.

In establishing relations, what counts as relevant, as a point of contact, what is foregrounded or bracketed, is not determined by the disciplinary approaches themselves because they cannot prescribe the relational logic that integration requires. This logic is constructed through the interdisciplinarian's movements between disciplinary insights: the sequence of crossings, returns, comparisons, and interpretations through which performative adequacy develops. These iterative movements are ways of experimenting with and exploring these new relations.

Through these relational movements, a liminal state begins to emerge, though only tentatively. The learner is no longer anchored in inherited