Universalizing science literacy:
How to transcend deficit models of teaching and learning

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Abstract

Student attrition figures are a hidden metric in universities. They signify institutional failure, inhibit branding and marketing campaigns, and displace blame onto individual students. Behind the thousands of cases of attrition are individual stories of shame, guilt, failure, confusion, and lost future hopes and aspirations. This article explores how students – in and through their diversity - can be supported to succeed. Critiquing the deficit model of teaching and learning and deploying both universal design and the abundance model of teaching and learning, this article provides new strategies for student success. We offer innovative methodologies to understand and enable productive pathways for students through a curriculum. The goal is to enhance and enliven science education and demonstrate the gift and power of well qualified university academics aligning innovative research and teaching.

Keywords: Disciplinary literacy, universal design, deficit model of teaching and learning, abundance model of teaching and learning, STEM education, student success

Biographies

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1. Introduction

It is a tough time to work in higher education. The bleeding of funding from public universities, record student debt, and the disrespect of expertise (Nichols, 2017) presents debilitating challenges for teachers and researchers. This is only one part of the suite of institutional problems. There is the all-too-frequent public ridicule of university leadership, spanning from un (der)qualified Vice Chancellors and Presidents without PhDs and/or expertise in teaching or research (Fatunde, 2015; O'Brien, 2021), to sexually exploitative Vice Chancellors and Presidents (ICAC, 2020), and even a Vice

Chancellor who – allegedly – spat on a 16 year old girl on International Women's Day at an event hosted by a regional council (Burge, 2022).

University leadership in this state cannot address the deep challenges and opportunities in teaching and learning cultures (Brabazon, 2021). The sector is confronting not only critique, but apathy. Rarely valued, mentioned, or measured are the gifts and opportunities that universities grant to local, state, regional, provincial and national governments, including the capacity to develop evidence-led policies, assisting research and development for private and public enterprises, alongside enriching and enlivening culture and the arts, and professional development programmes through nano or micro credentials. In this space of apathy and silence sits 'experts' – or more accurately 'education consultants' - who explain the failings of the current system and – for a fee – reveal the alternate models that are available. These alternatives do not focus on the public good, information literacy, student diversity, or lifting the standards of reading, writing and thinking. An example of this genre is Martin Betts and Michael Rosemann's *The New Learning Economy: Thriving beyond higher education* (2023). They propose that the 'new university' should learn the entrepreneurial lessons of Tesla, Spotify, YouTube and Apple, with Elon Musk being the model of leadership for higher education. Considering the chaos and populism emerging from his 'leadership' of Twitter, the efficacy of this model is questionable at best.

This article refocuses Higher Education Studies away from the flaws of leadership and onto the key issues that require what Gillian Tett described as the "worm-eye view," rather than a bird's eye view of the institution (2021). This article does not focus on top-down imposed initiatives. Instead, three university educators summon both experience and expertise to question and probe taken-for-granted assumptions about curricula design and disciplinary literacy. Using Tett's *Anthro-Vision* (2021), it is possible to see – clearly – the costs and consequences of neoliberalism on universities. Tett described her strategy as offering a "new way to see business and life" (2021). We extend her argument, to reveal an innovative vista for teaching and learning in universities, in tough times. To paraphrase Stanley Aronowitz, *The Knowledge Factory* is not our future (2000). Neoliberalism revealed its failures and errors

through the Global Financial Crisis. It is a zombie ideology, yet it keeps walking (Brabazon, 2016). Instead, our research critiques the deficit mode of education. We propose the power of universal design and the abundant model of teaching and learning to transcend theories of the deficit in learning, reading, writing and the preparation of students.   Further, we log innovative methodologies to monitor, track, assess and improve understandings of student progress in higher education. Our article commences with Literacy Studies and then opens out the potential for universal design and the abundance model of teaching and learning. We also confirm a series of evaluative methodologies for university educators, to ensure efficacy, reflection and quality through these learning innovations. STEM (Science, Technology, Engineering and Mathematics) teaching and learning are of a particular focus, as student numbers are declining and an array of strategies have not been successful reversing this trend.

Our article respects these initiatives and demonstrates the gift and capacity of universal design to ensure that all students and citizens – including those with an impairment and/or disability – can not only gain 'access' to higher education but can thrive.

2. Literacy Studies

Written texts are central to how scholars communicate. Literacy in both reading and writing is aligned, and research indicates that by teaching writing skills, reading ability is also enhanced (Graham, 2000; Graham & Hebert, 2011). Galbraith (1999) describes writing as 'discovery' and as a process of constructing knowledge.   Writing enables a learner to explore their understanding of a concept and link it to existing content. Expertise in content can be developed by writing in conjunction with reading. The act of writing is thinking. As Hand confirmed,

> By having to construct text, a learner is required to connect to existing knowledge in ways that he/she had not previously done, and thus knowledge is constituted in a new way. Writing could be viewed as a process by which knowledge is engaged with in a way that was much more than replication of existing ideas given to students, but rather as

a process by which students themselves could construct their own understanding of these ideas (2017, p. 17).

Conversely, traditional science educational pedagogy has emphasised the importance of writing to communicate scientific understanding to a narrow and highly specialised group of similarly literate individuals (Stevens et al., 2019). This focus ignores the varied forms of communication that scientists may practice, and also the diversity of scientists and potential science students. In order to promote scientific literacy more widely throughout society, our science graduates must learn how to communicate with family, friends, children, teachers, policy makers, and industry in a way that is sensitive to their audiences' background and understanding. These experiences must be authentic and meaningful, preparing our graduates to perform these activities throughout their careers. Our graduates can only hope to succeed if educators have a theoretical framework from which to base science communication education. This theory requires attention to language, interface and audience.

Science education will continue to exclude minorities from participating in science if scholars do not transform and translate the notion of scientific literacy. Norris and Phillips (2003, p. 224) argue "that nothing resembling what we know as western science would be possible without text … because of the dependence of western science upon text, a person who cannot read and write is severely limited in the depth of scientific knowledge, learning, and education he or she can acquire." They go on to confirm, "reading and writing when the content is science is the *fundamental* sense of scientific literacy, and being knowledgeable, learned, and educated in science as the *derived* sense." While so much of science education focuses on the *derived* sense of scientific literacy (Kohen et al., 2020; Roth & Lee, 2016), exclusion and marginalization will continue. Science and scientific knowledge can and should be used to tackle real world problems and issues, and if higher education science graduates cannot communicate their knowledge in a way that has value, purpose and momentum for citizens, then we have failed as science educators. Therefore, there must be a recognition of the assumptions about written text that undergird the foundational expectations of science.

Through the science education literature, scientific literacy is defined as "being constructed from the following components: (1) understanding the core concepts of the natural sciences, (2) the ability to understand and critically evaluate scientific content, and (3) enabling members of society to cope with situations they are likely to encounter in real-life scientific and technological contexts" (Kohen et al., 2020, p. 250). Therefore, this definition focuses on the knowledge held by an individual about scientific concepts, rather than the ability to construct knowledge based on reading and writing of scientific content. Therefore how this knowledge is developed, and how it is translated to the next generation of scientists is unclear. As Hand (2017, p. 20) confirmed,

> While students are perceived as being active in doing science, there is a need to address the question of doing what? Replication of the structures of argument is different from requiring involvement in the justification of claims as a critical element of learning the big ideas of the topic. It is at the intersection of these three acts – learning about language, using the language and living the language of science – that students are required to fully engage with the epistemic nature of language.

In the current context of climate change denial, where scientific language is used against scientific arguments and promotes political inaction with respect to the environmental and social impacts of the science (Herrando-Pérez et al., 2019), it is critical that scholars have an understanding of how to engage and develop *fundamental* scientific literacy in our students and beyond into the wider community. Assumptions about language – about the textualizations of science – must be expressed.

The research in this area is expanding, with Michela Massimi and Casey McCoy's edited collection, *Understanding Perspectivism: scientific challenges and methodological prospects* (2020). That is why our research in this article probes the scientific challenges of increasing diversity and student success, while also diversifying the methodological capacities of science. In asking the difficult ontological questions about the nature of reliability,

coherence, dissemination and impact, new relationships are built between perspectivism and pragmatism, perspectivism and pluralism, and perspectivism and realism (Massimi and McCoy, 2020, 1). Epistemological knowing is always historical and contextual, requiring a diversity of explanations and approaches. In many ways, all science must enfold the history and philosophy of science. Therefore, activating this diversity of views, lenses and approaches, we argue that this project and initiative is best summoned and actioned through universal design.

3. Universal design

Providing digital access to learning material is not sufficient to produce a multimodal curriculum, nor is it a well-supported scaffold to sustain an ageing and exclusionary institutional infrastructure. Many students think and act as if access to Google – or ChatGPT - is enough to tackle any problem they encounter. In our digitally transformed educational landscape, simply digitising material without considering the educational reasoning behind doing so and incorporating this reflection into the design brings with it a wide range of exclusions and marginalization. As Douse and Uys (2018, p. 8) describe, "the young inhabit – indeed own – a digital world embracing social interaction, entertainment, gaming, music, pictures, information gathering and friendships." We are surrounded by digital platforms. Learners are familiar with rudimentary digital platforms, often conflating with social media. Our article therefore – in summoning Tett's *Anthro-Vision* (2021) – asks that we render the familiar strange and consider the assumptions that are part of 'normal' teaching and learning.

There remains a problem with the accessibility of science to minority groups. The 'problem' is not located, formed or formulated in the groups that remain excluded. Instead, the scientific disciplines remain exclusionary. Encouraging and enabling wider participation will ensure that more people from a variety of backgrounds are able to contribute to scientific solutions as well as feel as though they are part of the scientific community. To actively encourage and enable widening participation within science disciplines, educators may find

solutions in the concept of universal design described by Ronald Mace (1998). Initially based on housing accessibility, the notion of universal design recognises that "because most of the features needed by people with disabilities were useful to others, there was justification to make their inclusion common practice" (Mace, 1998, p. 22). These design choices resulted in services and products that are usable by all. By designing curricula with universal design at the forefront – the first lens - it becomes accessible to all because the focus is shifted from the syllabus content to the learner. Once the learner becomes the centre of the learning experience, then access is not limited by the parameters of portals or platforms. Educators must address the ongoing issues that impact the accessibility of science to minority communities, enabling learner agency (Segura & Mohorn-Mintah, 2019) over their contributions to the broad discipline of science. The following model of the learning and teaching processes has been conceived by investigating, observing and recording how learners proceed through structured learning activities specifically designed to provide universal access. Whilst presented here within the context of scientific literacy, these theoretical models are not limited to this specific discipline and may be explored in other disciplinary spaces.

The International Convention on the Rights of Persons with Disabilities was ratified by more than 100 nations (Convention on the Rights of Persons with Disabilities, 2006). Inclusive education was the imperative of this document, and this mandate included Universities. Indeed, Justin Powell described this movement as the "Universal Design University" (2013, 33-44). This is a foundational commitment, with the goal to create open and accessible learning architecture (Barnes, 2007:135-145). The challenge is that a student with a disability must manage a double oppression. They are bullied and discriminated against in primary school and high school. Their capacity to attend university is truncated by 'standardized tests.' Their capacity to achieve is inhibited through this systematic discrimination. Therefore, because of the oppressions in schools, in higher education, students are less likely to progress. Invisibility and marginalization intensify. The word 'enabling' is incredibly important to this discussion (Brabazon, 2015). It is used throughout this article because it signifies the recognition and location of limiting and disabling

structures, rather than a labelling of 'disabled people.' Discrimination creates disability through learning. Universal design enables all scholars to learn through access to and management of multimodal platforms.

The challenge is how best to respect the diversity of impairments and how to ensure that this plurality is recognized and acknowledged. This can be configured through educational architecture, with the equivalent of 'automated doors' and 'curb cuts' as the standard configuration of the building in which learning takes place. But further, a cultural mapping of campuses can recognize disabling architectures. Simple interventions such as the availability of benches for sitting within green spaces, and the diversified presentation of pathways to buildings, are incredibly important. Ben-Moshe, Cory, Feldbaum and Sagendorf termed this process "building pedagogical curb cuts" (2005). At its most basic, a series of initiatives confirm both universal design and an enabling university

- Ensure multiple pathways into and out of lectures, seminars and tutorial rooms.
- Ensure hardware – such as computers – is configured at a height for multiple users, including those in wheelchairs.
- Guarantee disabled toilet facilities in each building
- Create quiet rooms for staff and students
- Use braille on signage
- Ensure that social and educational events are planned – from the start – with multiple users in mind (Brabazon, 2015).

The impact of not respecting differences and implementing these simple andragogical 'curb cuts' is obvious, but remain typical in many institutional cases. We are living in these disabling environments in our current university system. As Michael Oliver, one of the founders of Disability Studies, confirmed, "poor access to educational buildings coupled with the disablist attitudes of many educators meant that a thick skin was a necessary prerequisite for kicking open the doors of educational opportunity" (2009, p18). This marginalization through analogue space is only intensified through

the institutional push to digitization. Because online learning has been framed throughout its twenty-year history as a way to reduce costs and create efficiencies (Brabazon, 2002; Brabazon, 2008; Brabazon, 2013), the principles of universal design are becoming increasingly lost in the 'rush' to digitization. Online learning portals increase the disablement of some students. Universal design is not a short-term strategy for economic efficiency. It is a long-term movement to transform learning, teaching, research, and higher education.

Universities have failed to create the deep and wide structural changes required to enable the educational opportunities of all members of the population. With twenty percent of most nation's citizens possessing an impairment or disability, the lack of visibility and recognition of staff and students with an impairment in higher education is telling and chilling.. Oliver argues that disabling educational services have four characteristics: dependency, reactive policies, fixed options, and few opportunities (2009). To establish a foundation of independence, flexibility, choices, rights, careful planning and diverse pathways requires a three-stage process.

Promote and validate an array of options, features and pathways as a standard practice for all students

Instigate principles of universal design

Remove analogue and digital barriers to participation in higher education
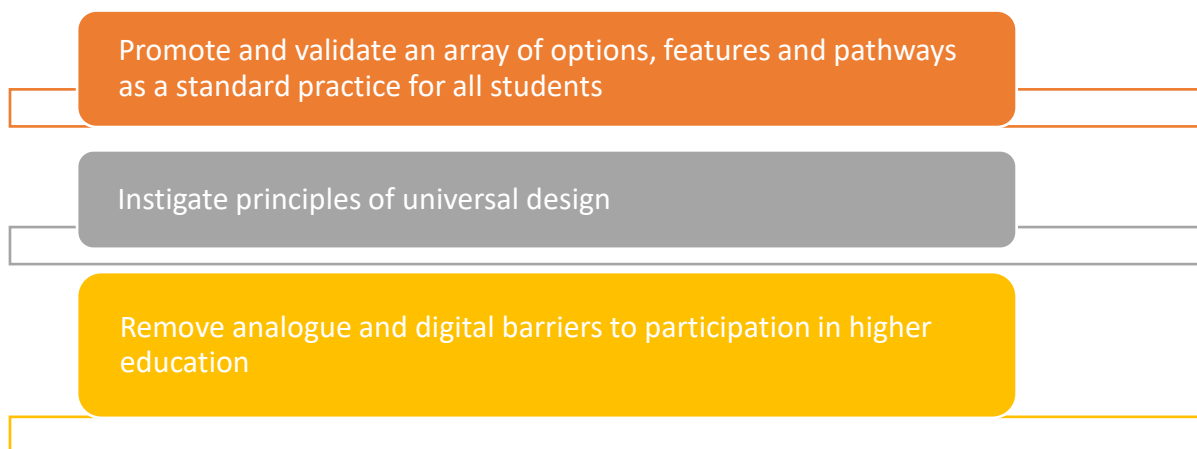
Figure 1 – The three tier strategy for creating an enabling university
(Brabazon, 2015)

All interventions must commence with accessibility – to classrooms, toilets and learning management systems. If this first stage is not reached, then all other interventions are irrelevant. From this point – that requires retrofitting of historical and legacy architecture - universal design can be implemented.

Building from this strategy, in higher education, universal design has four components.

- The capacity to develop a curriculum, product, artefact, policy or procedure that recognizes a diversity of users, from the moment of its inception.
- A movement beyond modifications and accommodations to allow students to cater for their individual needs. Accessibility capacities are available from the point of release.
- The development of a curriculum, products, artefacts, policies or procedures that widens the diversity of possible users and participants
- The removal of platforms and interfaces that differentially empower some users over others and replace them where appropriate with universally accessible alternatives.

Universal design necessitates a deep reconciliation between exclusionary historical legacies of higher education and the present capacities for injustice and discrimination triggered through neoliberalism. Offline oppressions manifest online, and often in different ways. The gift in considering impairment and disability at the moment of curricula design and the selection of online and offline architecture is that university academics see our landscape, our classrooms, our screens, and our communication strategies in new ways. New relationships emerge between form and function, platforms and knowledge.. Therefore, the next section of our article builds this relationship through a new theoretical model to reveal the assumptions that undergird learning in science education.

4.   A theoretical model of the teaching process

Just as learners cannot be considered in isolation from their lived experiences, so too must science education researchers examine the teaching process within the context of their discipline. We must also acknowledge how the teaching process is impacted by intrinsic problems that exist in current higher education institutions, where the separation of teaching and research is increasing. Higher education teachers often have individual discretionary control over the communication skills that are included in a particular unit of study (Bath et al., 2004), and these skills may not be clearly mapped throughout an undergraduate degree program. Consequently, skills develop haphazardly with conflicting evidence that educators feel confident in teaching students written communication skills in an undergraduate classroom (De la Harpe & David, 2012; Ferns, 2012). Therefore, it is crucial that Science Educators grow our understanding of *how* and *why* educators teach in the way that they do. Support needs to be provided in the most beneficial way to improve outcomes, both for teachers and learners. As shown in our last section, universal design necessitates a transformation of each stage of andragogical preparation, from curriculum through to assessment, from classroom architecture to interface management.

There are a variety of ways that higher education institutions have addressed the need to improve the teaching of communication skills within the sciences. These include compulsory communication units, elective communication units or postgraduate programs, and strategies to embed communication skills into disciplinary units of study (Stevens et al., 2019). However, whilst strategies to embed communication skills within a discipline appear to be most effective for student learning (Harris, 2016; Jaidev & Chan, 2018), educators may not themselves be confident of how to do so in the context of their discipline. Understanding the relationship between an educator's own disciplinary literacy and their confidence in teaching within the discipline is integral to developing a model that explains teaching practices and provides a framework that enables educators to move beyond their own experiences of teaching and learning.

5. Practice-based teaching

Educators undertaking practice-based teaching focus the pathway experience of the learner on authentic experiences, encouraging the learner to form ideas and understanding from real-world situations and context. Practice-based teaching ranges from short exposure through to realistic contexts and scenarios through to immersive experiences, where the learner systematically develops an in-depth understanding of the complexity of real-world situations and is involved in intricate s and experience that is valued in practice-based teaching. The key limitation of practice-based teaching is that it allows little room for alternate views and experiences, potentially leading to situations of othering where the students' sense of understanding (personal/cultural/family experiences) are not aligned with experiences in the classroom. In the frame of disciplinary literacy, this means that educators base the curriculum and practice around the disciplinary norms that they have experienced themselves and assume that there is nothing lost in translation. Thus, the range of experiences available to students is limited. Practice-based teaching is not an example of universal design. However, the practice-led experiences, when scaffolded carefully and constructively aligned with the principles of universal design, can be retrofitted to provide extra contexts that enhance the development of disciplinary literacy in the learner.

Practice-based teaching relies on an immersive environment enabling the learner to experience a range of real-world challenges within their discipline. Practice-based teaching ranges from providing learners with modified examples of authentic experiences through to genuine field or industry experiences. If implemented to its full extent, Greece et al. (2019) suggest that practice-based teaching can provide an educational environment with equivalences to the real world. However, this relies on developing relationships with industry stakeholders, which in many circumstances is not feasible. Practice-based teaching is common amongst professional disciplines including health and education where clinical training experiences are more easily situated, being closely linked to professional practice and competencies (Koo & Miner, 2010; Wrenn & Wrenn, 2009). In the sciences, practice-based teaching is also a deeply embedded practice, especially in disciplines that

involve laboratory based techniques and applications (O'Neill & Polman, 2004). Greece et al. (2019) propose the following relationships and outcomes of practice-based teaching experiences, noting the significant emphasis of technical and professional skills developed through the learning process. It is also important to note that these 'real world' experiences are punctuated by the oppressions, discrimination and marginalization that continue to restrict, demean and undermine students and citizens with a disability.

School/University
- Reputational capital
- Institutional collaboration
- Civic responsibility
- Potential funding streams

Alumni

Students
Technical knowledge
Professional skills
Workplace skills
Professional portfolio

Alumni

Enhanced learning experience

Opportunities:
- Job
- Volunteer
- Practicum

Faculty
Enhanced expertise
Professional development opportunities
Research/practice opportunities

Practice-Based Teaching

Collaborations:
- New
- Continuing

Agency
High-quality deliverables
Professional development opportunities
Targeted community programs
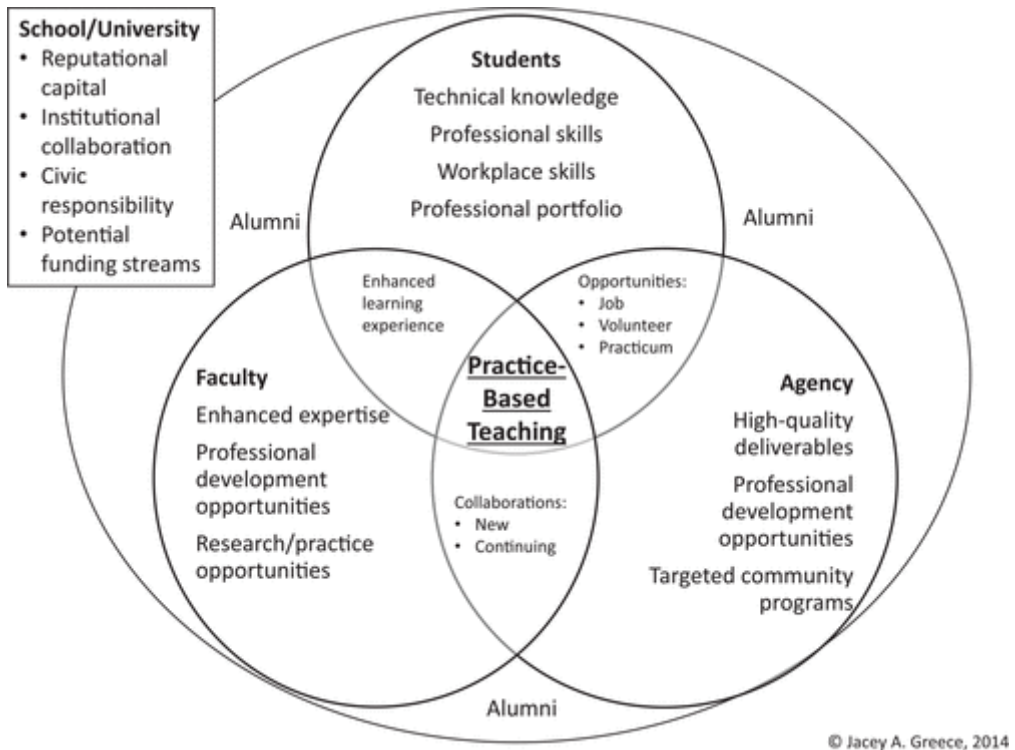
Alumni

© Jacey A. Greece, 2014

Figure 2 - Relationships and outcomes of practice-based teaching experiences. Modified from Greece et al. (2019)

Practice-based teaching can be used to align the disciplinary needs of students, faculty, and industry by considering the needs of these groups, and design assessment tasks that are authentic. Assessment artefacts – such as preparing a blog, writing a piece of journalism or writing an article abstract – bring authentic examples of writing into the classroom and making them accessible by unpacking the structure of various genres, linking the writing to the intended

audience. In this way, the traditional goals of higher education and the needs of industry can be brought together while improving the student experience and engagement with learning. Using the disciplinary lens in the context of the sciences, limitations of practice-based teaching emerge. Specifically, practice-based teaching has great potential to develop disciplinary literacy in learners as it is based on a disciplinary-specific immersive experience. However, providing an experience that is an accurate representation is challenging and even if attempted, will still be framed by the educator's own professional and personal career and life.

6. Practice-led teaching

Throughout the process of teaching and learning, experienced educators regularly identify problems and challenges associated with their practice. In the higher education context, this can be a significant challenge in that many educators are not well-equipped to recognise and respond to these issues as there are no expectations of formal education qualifications being held by academics (Harland, 2017; Mcnamee et al., 2004). This is an important limiting factor in that it leaves many higher education teachers without the disciplinary literacy needed to observe, understand and respond to their own teaching practices. University educators are particularly vulnerable in this circumstance as they are likely to have a good understanding of the content and context of their discipline yet are unable to articulate perceived problems in andragogy. The capacity to implement universal design is not possible, as it requires expertise in Disability Studies and Media Studies, alongside specialist knowledge in the science-based disciplines.

Practice-led research involves the conceptualisation of how we understand our experiences in the world (Hawkins & Wilson, 2017). In the same way that practice-led teaching involves understanding how students make meaning from their learning experiences, it demands reflection of the role the educator holds in the learning process. Practice-led research is becoming increasingly common in scientific research (Main et al., 2017; van Dijk et al., 2017) with increasing recognition of the importance of involving industry stakeholders

that have a wealth of knowledge about practice and context. The "practice-led collaborative learning processes, which involve but are not led by scientists" (Main et al., 2017, p. 1) can provide an excellent example of how the process can be adapted to the formal education experience. Practice-led teaching centres on the collaboration of teachers and learners in exploring the learning experience, valuing both perspectives and knowledges that they bring. Personal knowledge and lived experiences inform the teaching practices of educators and in the context of practice-led teaching become the basis for reflective practices that inform pedagogy. Practice-led teaching holds opportunities to address the limitations described in practice-based teaching, by examining the relationship of practice and learning we can develop an understanding of the interplay and address the narrow lens individual educator experience provides. It widens the capacity for universal design as it requires reflection on foundational principles. However, it is not student-led or formed.

7. Learning-led teaching

Learning-led teaching differs from other teaching practices, as the educator becomes the learner in a position of power over their own learning. By re-positioning the educator as a learner, their context is reframed enabling them to have a more meaningful understanding of the learning process. Learning-led teaching incorporates reflective practice by the educator/learner to explore and understand the process of learning. Learning-led teaching involves the educator developing an identity as a learner, allowing them to understand the learning process by performing it (Brabazon et al., 2020).

Learning-led teaching offers something that no other mode of education can provide: the opportunity to experience the process from the learners' perspective. It is only from this perspective that educators can learn with authenticity about the learning process and therefore truly focus on the learner. To begin with the potential of the learner is to welcome universal design. University teachers have a far deeper appreciation of the experience from the learner's perspective and have therefore been able to offer a unique

understanding of the learning process. Open andragogical spaces for diverse learning choices are available.

8. Theory in Teaching Practice

In practice, during curriculum design and in reflecting on teaching experiences, educators engage in practice-based, practice-led and learning-led teaching, and not in a discreet manner but rather in combination. However, all these teaching modes are necessary to develop andragogical practice that provides a dynamic, accessible and transformative curriculum. Examples of good teaching practices can be found in each of the modes discussed in this article. However, the strength in curriculum design lies in their combination. Bringing these modes together is a complex task and requires ongoing commitment from teaching faculty. Understanding how and why educators engage in each mode of teaching will build knowledge and support educators in developing their practice. Through reflection, educators can identify which aspects of their teaching can be described by each component and therefore ensure a cohesive and complimentary curriculum designed to support a wide range of learners. The element that transforms practice-based, practice-led and learning-led teaching practices into high quality learning experiences is multimodality, which summons multiple platforms, alongside modes of synchronous and asynchronous delivery and interaction to provide a range of learning environments and thus experiences for the learner. Multimodality acts in several ways to make knowledge more accessible. Multimodality places value on multiple forms of knowledge. No-longer is knowledge bound in a single mode or form, thus enabling wider access. Transdisciplinary literacy is made possible by the application of multimodality. Universal design is activated when commencing the creation of all learning events by welcoming multimodality.

Learning is challenging and uncomfortable (Bheekie & van Huyssteen, 2015; Brown, 2016). Pushing the boundaries of the learner's expectations and experiences is likely to lead to unpleasant feelings, making tasks seem more difficult and less satisfying (Efklides, 2006) and less likely to be sustained. At worst, these learning experiences can be discriminatory, blocking educational events and processes. The proposed model of learning and teaching presented

here suggests that expectations and environment are aligned to establish an experience where learners are less likely to feel overwhelmed, uncomfortable and incapable of achieving. However, there is an element of productivity to struggling with a challenging concept where a learner is supported and encouraged to "figure something out that is not immediately obvious" and this "can help… in their thoughts and play an important role in deepening the student's understanding" (Permatasari, 2016, p. 95) This is a 'productive-struggle', and 'supported-failure'. It is critical that educators strike a good balance between supporting and challenging students to ensure that capacity development is optimal. Support must link the environment and expectations to develop engagement in students and challenge must be authentic and multimodal ensuring real connections form within the discipline.

While the models presented here have been based on science literacy, they have potential for more far-reaching impact. Whether a student is learning about biology, law or history, the importance of aligning expectations, context and engagement remain . To become an effective learner and gain as much as possible from their education, students must have a well-developed disposition to learning within their discipline. By providing clearly scaffolded opportunities for students to succeed within their disciplinary context teachers can enable all students to make meaningful connections and contributions.

9.   From a deficit past to an abundant future

The deficit model of teaching and learning is based on an ideology that a human being is incomplete when they enter formal education. They exist in lack. They require a teacher to bring them to knowledge. This model is activated on those students who differ from the normative history of education. There are two modes of deficit: deficit theories and deficit ideologies. Deficit theories emerge from 'minority education' and 'multicultural education,' exploring how diverse languages operate in a classroom (Collins, 1998; Dudley-Marling, 2007; Gorski, 2009).   The deficit ideology operates in educational policy, with 'context-blind' standards enfolded into quality assurance protocols (Sleeter, 2004). Such deficit modelling displaces blames

on the disempowered or marginalized individual for the structural injustices that remain in educational institutions, including universities.

Deficit models focus on individuals, not systems and structures. Therefore, they are antithetical to universal design. They reinforce the power and expertise of the teacher, rather than valuing and validating the pathway and experience of learners. There are many proxies for the deficit model of teaching and learning, with attrition rates being an effective guide to 'something' not working in a course, degree or discipline. This 'something' often confirms that a social, cultural, economic, religious, political, bodily or neurodiverse difference has been labelled and judged as in deficit. This demeaning of difference may not be intentional on behalf of the teacher. But when teachers continue to teach as they were taught, without educational theory, educational qualifications or professional development providing a node of critique and reflection, legacy architecture – including intellectual architecture – can proliferate. Paul Gorski described this process as, "recycling … misperceptions, all of which justify inequalities" (2010, 6). Therefore, the interventions of universal design can freshen thinking, interrupt legacy intellectual architecture and transform each moment of a teaching and learning experience. They also shred neoliberal ideologies. Universal design policies and procedures value a diversity of learners and citizens to find a pathway through education. The choices of a few do not signify success. Certainly, the disempowered in neoliberal educational systems are vulnerable (Chandler and Reid, 2016). Access and equal opportunities are not the goal. Access to a programme without rendering the form and content, the interfaces and assessment, appropriate for diverse students perpetuates historic injustices. Instead, equality of outcomes must remain the focus. If particular groups continue to attrit from a degree or course, then access was not sufficient to address the legacies of inequality.

Such an initiative and transformation can be implemented and has been presented in the educational literature. Janice Lombardi's research (2016) does not blame the student for failure. Instead, she focuses attention on teachers

and our expectations. If a teacher has a low expectation for a particular student based on specific sociological criteria, then they are less likely to be successful. Put another way, teachers are complicit in the deficit model for teaching and learning. This complicity is performed through our language, like 'minority,' 'disadvantaged,' 'remedial,' or 'at risk'. Lombardi provides five strategies to prevent – or at least manage – the deficit model.

- Show students they can reach high levels of achievement
- Generate intermediate goals to accelerate success
- Assist students in managing their fear of failure
- Create data-let short-term successes
- Produce scaffolded instruction (2016)

Low stakes assessment, diversifying the selection of medium and mode in assessment tasks, and providing different models and modelling for academic success are all clear options to activate her strategies. Teachers can recognize the gifts and abilities that students bring to knowledge. We teach the whole person. We listen. We reflect. We create spaces for silence, learning and thinking.

Rebecca Alber describes this andragogical imperative as the "abundance model" of teaching and learning (2013). She offers four characteristics of this paradigm.

- Every student possesses skills and abilities
- A bespoke and customized model of instruction
- Recognize standards are different from standardization
- Confirm that all learning builds on already existing strengths and interests (Alber, 2013).

Applying these four principles activates an intervention in teaching and learning. Subjectivities and biases are questioned, as is what Beth Harry and Janette Klingner described as "the social/cultural deficit lens" (2007). When displacing the deficit model, abundance in learning potentials emerge. As universal design and the abundance model of teaching and learning dialogue and dance, our disciplines and our disciplinary literacies transform.

10. Conclusion

Expertise in the higher education sector is increasingly difficult to determine. The academic functions for teaching, research and leadership are siloed. The capacity to demonstrate how teaching is a mode of research dissemination or how leadership must be built on excellence and qualifications in research and teaching, is waning. Outside of universities, the role of knowledge, experience, expertise, opinion and commentary are even more confused. Indeed, as Tom Nichols confirmed, "to reject the advice of experts is to assert autonomy," with "every opinion on any subject … as good as any other" (2017, p1). This article proposes systems and structures, policies and procedures that build compatibility between social and academic goals and make the case for the careful alignment between education, health and technology (Szostak, 2022). By reducing short termism and re-establishing trust, honesty and compassion in teaching and learning, academics can confirm the value of universities, enhancing and enabling the capacity to make rational, evidence-driven decisions, both inside and outside higher education.

Expertise is not only 'about' knowledge. It captures the knowledge teachers, researchers, students and citizens gain through metacognition. At its most basic, metacognition enables us to recognize errors, missteps, confusions and problems, and then step back and reflect, realizing the challenges. From this pause and moment of reflection emerges strategies to gather new information. Once this new information is gathered and interpreted, the project, process or strategy is to recalibrate and then commence the experiment, process or argument again. Peer review is the greatest strategy to overcome confirmation bias, alongside the external examination of courses and thesis. Universities actually have strong strategies in place to validate expertise and validate the metrics as this expertise moves to different audiences through consultancy, citizen science, altmetics, research ethics and other impact and engagement strategies and protocols. A tweet is not subjected to peer review, despite the argumentative thread of opinions that might ensue. Instead, tweets come and go as is convenient to the tweeter's confirmation bias. The key to expertise is the capacity to seek out, examine and analyse new information, disconnect

emotion or personal engagements, and re-evaluate a view, hypothesis or argument.

The challenge to this argument that values reading, thinking, education and learning is that our universities have changed. Nichols (2017) argues that our degrees now affirm attendance not education. Consider the *Rate My Professor* website. Not only does it rank the' hotness' of an academic teacher, but the easiness of the course. Is an easy course of value? A university degree is meant to be challenging. If it is not, then it is not a university degree that has provided a genuine transformative educational experience, which has stretched the mind of the learner. Populism has had such an impact on education, and students are no longer 'students'. They are clients or customers. If they are paying for a university education, then should they all pass? We have the recent case of New York University validating the student petition about Professor Maitland Jones Jr's organic chemistry class. The tabloid headlines told a particular story. To cite *The Guardian*, "New York University professor fired after student says his class was too hard" (Marcos, 2022). That tabloidized language was deployed in *The Guardian*. The *New York Times* asked an interesting question: "who is responsible if students fail a university course?" (Mcmillan, 2022). Eighty out of the 350 students in the organic chemistry course signed a petition, complaining about the grades, teaching and assistance delivered through a pandemic. The students complained that the course was too hard, and they lacked resources. To confirm: organic chemistry is difficult. University is difficult. Metrics do not capture how to evaluate the role of student reviews as in understanding the quality of education. Populism is not quality, and these metrics gathered using student reviews and pass rates means that academics – and academic leaders - have prioritized an economic imperative, displacing an intricate learning culture. In this situation, the students have inadvertently and implicitly redefined academic and educational standards.

When democratizing who attends university, teachers must transform andragogical design, and refocus on effective learning models. The imperative is to maintain standards without standardization.   Education is not a client

service. Students are not customers, ranking a professor like they would rate a purchase from Amazon. Currently, it is easier to validate personal control, choice and individualism, rather than information literacy, preventative health and increasing education spending. However, the last decade has been punctuated by short termism, poor decision making, and the overvaluing of personal experience rather than policy instruments incorporating expert advice. For those of us working in universities, we can throw up our hands or complain about the state of the world. As shown in this article, this is not a productive strategy. Instead, it is time to return to fundamentals, such as high standards for curricula development, universal design, building strong relationships between research and teaching, maintaining the highest standards of research ethics and rigour, and ensuring not only 'access' to education from diverse groups, but success and achievement for diverse learners. Education always matters. It is transformative for individuals and our society. When we commit to learning, we commit to improving our way of living.

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Conflict of Interest

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