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Learning to think together: Creativity, interdisciplinary collaboration and epistemic control

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1. Introduction

As I write this, the world is experiencing a one in 100-year pandemic, with a great many people in lockdown, aiming to ‘flatten the curve’ and save lives. The current loss of life and threats to wellbeing caused by the virus and enforced social isolation, as well as the potentially catastrophic long term impact on social structures, economic stability and political systems caused by our response to the virus, highlight the complex and intractable problems we face in our interconnected global society. More precisely for me, Australia has just experienced the summer from hell. Intense bushfire activity that destroyed countless native animals and razed millions of hectares of bushland has underlined that – despite the dragging of feet by government - a comprehensive and coordinated response to the problem of climate change has long been personally, culturally, economically, nationally and internationally urgent.

These intense experiences reflect that we indeed live in post normal times (Sardar, 2010, 2015) – a world characterised by chaos, complexity and contradiction. The threats to our wellbeing in our ‘new’ everchanging normality require us to build new understandings. Horney, Pasmore, & O’Shea (2010) elaborate on what they call the VUCA world – one not unlike a battlefield, full of complexity, uncertainty, volatility and ambiguity. Our world is interconnected and interdependent, comprised of complex systems with complex problems.

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1.1. Creativity, complex problems and education

The challenges we face can be described as complex problems. As Vandenbroeck (2012) argues, complex or ‘wicked’ problems have unclear boundaries and multiple stakeholders, making them difficult to negotiate. As Goodyear and Ellis (2007) remind us, complex problems are qualitatively different from other serious problems we have faced. There is often a scarcity and low quality of data and a constant need to reframe and renegotiate the problem, making them difficult to understand (Vandenbroeck, 2012). Unlike tame problems (Goodyear & Markauskaite, 2019, p. 47; Vandenbroeck, 2012) complex problems are non-linear and unstable, with the problem needing to be defined and redefined throughout the process, often as a result of actions taken to address them.

Rittel and Webber (1973) argue that solutions to complex problems are not true or false but better or worse and there is an ‘inability to know beforehand what constitutes a good answer’ (Horney et al., 2010). As they can ‘rarely be fully resolved’ (Goodyear & Markauskaite, 2019, p. 42), instead of solutions, complex problems invite strategies to address or minimise their negative impact. Horney et al. (2010) conclude that in this context ‘people connections matter as much or more than solid structure’. The people working on the wicked problem and their viewpoints form part of its formulation – that the way the problem is framed is a product of who is framing it (Coyne, 2005) creating a state of ambiguity often uncommon in fields and disciplines charged with taking on these challenges.

Ambiguity is a fundamental condition in complex problems – they are contextual and support, if not require, multiple interpretations. What does this mean for our young people in institutions of learning (secondary and tertiary/higher) that often emphasise certainty and linearity through high stakes testing, accountability based on success metrics and silos of disciplinary knowledge? How are our institutions preparing our young people for the future when they are still focussed on individual competitiveness and success based on assessment of certain known problems and solutions through tests and essay questions? The students of today will graduate into a world where interdisciplinary, multicultural and international teams will be likely, if not the norm. Learning that does not encourage a willingness to work with ambiguity, to recognise the specific strengths and limits of a single epistemic/disciplinary approach and does not encourage collaboration will not honour our duty to prepare our students for their future. These ‘knotty, confusing, and contested problematic situations’ (Vandenbroeck, 2012, p. 6) will challenge our students creative capacities as well as their discipline knowledge and collaborative skills. A core conceptual strength of a creative disposition is the ability to deal with ambiguity (Sternberg, 2010). Tan (2015) suggests that the ability to cope well with novelty and ambiguity, the ability to break away from set ways of thinking, and the ability to think metaphorically are all ways to be more creative.

The complexity of the problems our young people will face (and we continue to face) can be overwhelming. We need to provide students with the skills to know ‘what to do when they do not know what to do’ (McWilliam, 2008, p. 266). Dealing with wicked problems requires collaborative and cooperative future making (Goodyear & Markauskaite, 2019, p. 42). Certain problems cannot be effectively met when approached from one discipline and complex problems require collaborative, creative solutions. This paper encourages educators to embrace creative collaboration to prepare young people for the epistemic challenge posed by these learning and working contexts. There is an urgent need to scaffold and structure creative and collaborative learning and strengthen interdisciplinary communication.

1.2. Creativity and collaboration

If complex problems require creative solutions, we need to consider what we mean by creativity. The standard definition of creativity is that creative products are novel and of value or appropriate to the context (Sternberg, Kaufman, & Pretz, 2002) or worthwhile, original and appropriate (Starko, 2005). These products are conceptual as well as tangible – approaches and theories as well as innovative tools and commodities. Creativity is acting on the world in a new and significant way (Glaveanu, 2010, p. 148). It is the fashioning of imaginative activity to produce an original and novel outcome (NACCCE, 1999, p. 30). However, as the complex problems we are discussing need to be addressed rather than solved, the concept of creativity I will consider here is both a disposition

Creativity is a social rather than individual phenomenon (Csikszentmihalyi, 1996; Ingold & Hallam, 2007; Sawyer, 2012). As Csikszentmihalyi argues, ‘creativity doesn’t happen inside people’s head but in the interaction between an individual’s thoughts and a sociocultural context’ (1996, p. 23). Csikszentmihalyi suggests that creativity benefits from the interplay of diverse ideas, that it thrives at the ‘intersection of different cultures, where beliefs, lifestyles and knowledge mingle and allow individuals to see new combinations of ideas with greater ease’ (1996, p. 8). Creative ideas are formed and reformed in relationships and in a context (Ingold & Hallam, 2007). Creativity is ‘deeply rooted in “connections” between person and the environment, self and others, creator and culture’ (Glaveanu, 2010, p. 147). As creativity occurs in a system, then what we do to increase the value and expectation of creativity within that system will work to generate the conditions in which creativity can thrive.

Vygotsky (2004) suggested that creativity was a combinatorial activity. It is about reconstruction – about combining and imaginatively reworking ‘elements of past experience ... to generate new propositions and new behaviour’ (2004, p. 9). The richer an individual’s experience, the more the imagination has to play with and the more creative they will be. As a child’s experience is less rich than that of an adult, Vygotsky reminds us that creativity is neither fixed nor to be idealised as existing more purely in childhood. Vygotsky’s insights also focus our attention on everyday creativity – the incremental development of ideas and practices. He argues:
...creativity is present, not only when great historical works are born but also whenever a person imagines, combines, alters and creates something new, no matter how small a drop in the bucket this new thing appears compared to the work of geniuses. When we combine the phenomenon of collective creativity...we readily understand what an enormous percentage of what has been created by humanity is a product of the anonymous collective creative work of unknown inventors. (2004, p. 11)

This focus on the incremental, collaborative, combinatorial nature of creativity reinforces the importance of equipping all our students with the skills to contribute their ‘drop in the bucket’.

1.3. Group creativity

Creativity is enhanced by collaboration. As Sawyer (2012) argues, when asked to devise creative solutions to real world complex problems, groups outperform individuals (p. 234). Further, diverse groups are more creative than homogenous teams (Sawyer, 2012, p. 234). Consistent with Vygotsky’s observations regarding richness of experience and Csikszentmihalyi’s recommendation to increase the possibility of the intermingling of diverse ideas and practices, diversity in group participants would more likely lead to more innovative ideas. However, Sawyer also indicated that if measures to regulate interpersonal conflict were not in place, then the benefits of diversity might be offset (Sawyer, 2012, p. 246). Therefore, when scaffolding and teaching collaboration, we need to explore how to regulate interpersonal relations in diverse groups to facilitate their generation of creative products. Sawyer details the importance of and ideal conditions for creative diversity:

‘groups are more creative than individuals when they’ve worked together for a while, when they share a common set of conventions and knowledge and yet have complementary sets of expertise, and when the organisation rewards collaboration. Groups are more creative than individuals when the amount of shared knowledge corresponds to how well the problem is understood. If the group has to find a new problem, it’s better that they don’t share the same background and expertise...’ (p. 246).

Sawyer suggests that groups who all think the same will not be as creative as those who contain differing viewpoints and experiences, but those differences need to be managed. Almajed, Skinner, Petersen, and Winning (2016) found that diverse groups, consisting of different perspectives, opinions and inputs, increased the experience and likelihood of positive learning outcomes. Researching dental students’ experience of collaborative learning, they found that learning was enhanced when it was focused on an ‘authentic complex context that involve[d] realistic use of ...knowledge’. Almajed et al. (2016) study suggested that diversity leads to knowledge conflicts, but these were ‘opportunities for further learning by exposing [students] to different opinions and aspects of knowledge’. This ‘conceptual conflict’, where students original ideas are challenged, created a sense of ambiguity that developed into ‘epistemic curiosity’. However, they also found that, for the benefits of this diversity to emerge, group members needed to share a common disposition to learning and needed to learn how to manage these knowledge conflicts.

Group diversity is often characterised as a ‘double-edged sword’ (Srikanth, Harvey, & Peterson, 2016). Despite its perceived benefits, diverse groups ‘often have less cohesion, less information sharing, less motivation to engage with other’s ideas, more coordination problems, and more interpersonal conflict’ (Hawlina, Gillespie, & Zittoun, 2017, p. 134). However, as Srikanth et al. (2016) concluded, rather than categorisation issues (such as demographic differences), problems in groups emerged from coordination failures – that is, failure to manage different perspectives (2016, p. 455). They conclude that ‘preventing coordination problems early in group development is likely to enable a group to capitalise on the positive aspects of social categorisation while avoiding the negative effects’ (Srikanth et al., 2016, p. 44). Further they argue that trying to diminish categorisation differences can also reduce the benefits of group members ‘sharing unique information’ (p10). Hawlina et al.’s research supported the observation that ‘unfavourable social outcomes do not stem from a priori intergroup biases but from the failure to coordinate different perspectives’ (Hawlina et al., 2017, p. 134). Adopting Torrance’s creativity indices of fluency, flexibility, originality and quality for measurement, Hawlina et al. (2017) concluded that perspective taking increased the creativity of the interactions between dyads working in non-real world non-domain-based discussions. Their research found that participants’ perspective taking allowed them to quickly understand each other and develop a sense of mutual recognition, where ‘gaps did not need to be bridged’ as there was ‘acceptance and enthusiasm for the partner’s perspective’ (p. 143). Further, mutual recognition also allowed the climate for creativity to emerge – one of tolerance (withholding judgment), playfulness and mutual understanding. The findings of Hawlina et al. and Srikanth et al. demonstrate the benefits to group creativity of enabling individuals to quickly understand the perspective of others.

1.4. Knowledge, collaboration and dealing with ambiguity

As a social, systemic (Csikszentmihalyi, 1996) phenomenon, domain knowledge is essential to creative thought. Csikszentmihalyi went as far as to say that ‘no one can be creative in a domain to which he or she is not exposed’ (1996, p. 29). Yet the complex world requires interdisciplinary collaboration, the integration of different disciplinary ways of knowing. Creative collaboration needs to integrate substantial domain and disciplinary knowledge to generate rigorous and creative responses to complex problems. Creativity
benefits from epistemic diversity. Interdisciplinary groups working together, rather than in parallel (such as multidisciplinary groups) require collaboration based upon, not in spite of, disciplinary strength (Greef, Post, Vink, & Wenting, 2017). As Lyall, Bruce, Tait, and Meagher (2011) suggest, interdisciplinarity ‘approaches an issue from a range of disciplinary perspectives, and the contributions of the various disciplines are acknowledged and integrated to provide a holistic or systemic outcome: good interdisciplinary research is much more than the sum of its parts’ (p. 14). Integration creates a more comprehensive perspective (Greef et al., 2017). The interdisciplinary approach also:

...enables students to demonstrate higher order thinking skills of creativity and integration, strong-sense critical thinking, balanced thinking or judgment, tolerance of ambiguity and diversity, ability to demystify expertise and challenge power structures, and ability to address real world problems. In terms of motivation, students see real world relevance to their education, get to think about the “big picture” context of the problem, and with their more comprehensive understanding are enabled to move from talk to informed action. (Repko, Szostak, & Buchberger, 2016, p. 256)

Interdisciplinarity, while valuing disciplinary knowledge, does not privilege disciplinary solutions. It discourages students from providing stock responses from their individual disciplinary perspectives that are then collated, evaluated, weighted or ranked and then discussed until a compromise is reached. Pre-prepared and pre-conceived responses are discouraged to allow creative ideas to emerge from collaborative and interdisciplinary discussion (Sawyer, 2015).

Like collaboration itself, integrating different ways of knowing will benefit from scaffolds and structures, meta discussion and skills development. Without them, interdisciplinary discussion has the potential to be adversarial at worst and parallel at best, with each way of knowing adding their ideas without integration and thus not accessing the subsequent benefits of an interdisciplinary perspective.

The ambiguity and complexity of problems in the 21st century require flexibility and control in the way people think and apply knowledge. Approaching problems from different perspectives increases our likelihood of moving forward. Adaptability is key to creative development and creative problem solving. Metacognitive structures can address intellectual rigidity, a fixed approach to problem solving which makes it difficult for individuals to take on new ideas and change the way they approach problems, challenges and situations. Working with others on wicked problems necessitates rapid reconfiguration of methods and tools for inquiry (Goodyear & Markauskaite, 2019, p. 44). Goodyear and Markauskaite argue that students working on complex problems need to develop a range of epistemic, reflexive, pragmatic and interpersonal tools and to transform these tools into useful instruments (p. 49).

Yet, as Wiltshire, Rosch, Fiorella, and Fiore, 2014, p. 1154) found,

...there has been little work describing how to train for collaborative problem solving. ...Solving complex problems requires the collaborative efforts of teams who are able to monitor and regulate their collective problem solving performance as they work to integrate complementary perspectives. ... Without effective training to help teams monitor their collaborative processes, they are likely to fail when complex problems arise. (p. 1154)

Their research found that enhanced metacognition, the ‘awareness of one’s own cognitive processes and the ability to consciously monitor and control these processes... [was shown to] increase participants’ ability to apply new knowledge to solve novel problems’ (p. 1154). Specifically relevant to this argument was their finding that metacognitive prompts during collaboration improved the participants’ ability to communicate their knowledge and the underlying assumptions of that knowledge, enabling them to overcome possible coordination problems (Srikankan et al., 2016).

2. Epistemic cognition - understanding how we know

The following metacognitive framework provides a scaffold for collaboration and knowledge integration for individuals working on complex real-world problems in diverse collaborative groups. It provides a practical range of tools and instruments for collaborative problem solving. This scaffold begins by focussing students on understanding how they make sense of the world and what forms of knowledge they value. A summary of the framework is provided at Fig. 1.

2.1. Epistemic awareness

To develop an awareness of their own perspective and to understand how they make meaning, their own ‘way of knowing’, students need to actively reflect on their own knowledge tradition. This requires critical and meta-analysis of, and reflection on, their disciplinary practices, on the strengths and limits of both discipline knowledge and discipline methods - the products and the processes. It

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1 For a description of the differences between inter-, multi-, and transdisciplinary groups see Lyall, C., Bruce, A., Tait, J., & Meagher, L. (2011). Departure point: Our approach to interdisciplinarity. In C. Lyall, A. Bruce, J. Tait, & L. Meagher (Eds.), Interdisciplinary research journeys: Practical strategies for capturing creativity (pp. 7–24). Bloomsbury Academic.

2 The concept of interdisciplinarity differs with context. In certain disciplines, interdisciplinary groups consist of sub-categories within their way of knowing – such as the sciences. In other contexts, interdisciplinary collaboration might occur across faculties, such as across subjects within the faculty of Arts or Social sciences. In other contexts, it could refer to collaborations across the whole institution. In this way, diversity is not a fixed variable. Further, many undergraduate and postgraduate courses of study are, by design, interdisciplinary. This is a strength, as many (most?) students are already juggling multiple ways of knowing and recalibrating how the approach their studies in each context. For a discussion of interdisciplinarity in the sciences see Smith-Doerr et al. (2017). Epistemic cultures of collaboration: Coherence and ambiguity. In S. Frickel, M. Albert, & B. Prainsack (Eds.), Investigating interdisciplinary collaboration: Theory and practice across disciplines (pp. 65–83). Rutgers University Press.
involves understanding what they know, how they know it and the assumptions these reflect. They ask, ‘What does knowledge mean in my discipline? How do we decide what is authentic knowledge?’

Each discipline ‘dictate[s] what you can know and what you can do with that knowledge…[and] limit[s] what questions you can ask’ (Lyall et al., 2011, p. 19). Smith-Doerr, Croissant, Vardi, and Sacco (2017) explain disciplines as ‘epistemic cultures’ that consist of ‘interiorised processes of knowledge creation…practices, arrangements, and mechanisms…[that] make up how we know what we know’ (p. 71). Each discipline culture has a set of rules and strategies, called epistemic games, that constrain inquiry and target structures (Collins & Ferguson, 1993, p. 25). Like all games, disciplines have moves that need to be learned to succeed and progress (Perkins, 1997) and are the mental processes that make knowledge (Collins & Ferguson, 1993). Each discipline gives a different structure to their inquiries. The means of communicating and representing the findings of that inquiry are the epistemic forms. Put simply, for students to understand their discipline’s games and forms they are asked ‘what do you do in your discipline?’ And ‘What does that action produce?’

Mastering these games and forms grants the learner access to the discipline’s ‘community of practice’ (Markauskaite & Goodyear, 2017, p. 5). It is this membership that tempts disciplines to develop tribalism (Lyall et al., 2011). The more disciplines evolve, the more complex and more constrained the games and forms become (Collins & Ferguson, 1993, p. 40). In systems theory, a discipline’s culture is the domain (Csikszentmihalyi, 1996). To be creative in a domain you need to understand and appreciate its limits. By understanding their domain as away of knowing, students develop domain meta-knowledge which forms part of understanding how to be creative. In the systems approach, the domain is guarded by the field – a community of gatekeepers that regulates the rules and acceptable ‘moves’ and acceptable forms or products. Thus, understanding the epistemic games and products will help students be more creative in their own discipline and domain.

A deep understanding of their discipline as a series of games and forms will supplement students’ understanding of being ‘within’ their knowledge culture with an understanding positioned ‘above’ or from outside the culture. Recognising that knowledge is constructed by a set of constraining rules generates an awareness of the strengths and limits of their way of knowing. Metacognition,

| Framework for effective collaboration and creative problem solving |
|---------------------------------------------------------------|
| **Epistemic awareness** | Understanding our way of knowing |
| What do we know? | How do we know it? |
| What are the games and forms that characterise my way of knowing? |
| **Epistemic humility** | Understanding it is not the whole story |
| What are the limitations of my way of knowing? | What part of the picture do I have? |
| What other perspectives would illuminate the problem? Challenge? |
| **Epistemic empathy** | Understanding other ways of knowing |
| How can other perspectives help me understand the problem? | What insights do they bring? |
| How do others use different ways of knowing to approach the same problem? | How does that help me understand my way of knowing? |
| **Epistemic control** | Understanding and practicing multiple ways of knowing |
| with How can I adopt different ways of knowing to approach complex problems from a range of perspectives? | How can I move from one way of knowing to another when required? |
| How can I combine multiple ways of knowing? | How can I adopt the games and forms of these other ways of knowing |
| **A collaborative creativity way of knowing** | The multiple perspectives and ways of knowing can be exercised in collaboration and/or within the individual. The students have developed an interdisciplinary understanding that generates collaborative creativity |

Fig. 1. Framework for epistemic control.
thinking about what we know and how we know it, is an essential skill for interdisciplinary integration (Keestra, 2017). Cultivating this awareness is especially important for disciplinary experts, as their assumptions and ‘representations’ are often so well integrated into their thinking that they perceive their way of knowing as the way rather than a way. Making known the processes and assumptions in students’ ways of knowing is a positive factor for countering intellectual fixedness or rigidity. Epistemic fixedness prevents students from working together especially when any change of position is framed as a compromise, a small loss. Metacognition is needed to counter the disadvantages of expertise (Keestra, 2017, p. 124). Keestra (2017) suggests that disciplinary experts develop complex knowledge structures that can lead to inflexibility in interdisciplinary contexts. Disciplinary expertise and over confidence can hinder students from recognising the ‘insights that other members bring to the table’ (p. 124). Interdisciplinary integration challenges intellectual rigidity, showing that to hold on to your position without understanding the benefits of humility or recognising the strengths of other disciplines is a disadvantage.

However, this does not devalue domain knowledge, skills or understanding. Interdisciplinary integration needs rigour and substance, but within scaffolded processes to enable the ideas to mix and generate novelty and using a common language for effective communication. Epistemic awareness means a strong understanding of the games, moves and forms of their discipline and occurs from within a strong understanding of the domain.

Epistemic awareness begins for members of a collaborative diverse research team when they first understand their own games and forms and when they reflect on their approach to knowledge and problem solving. This will focus them on seeing both strengths and limits. Asking ‘What ideas are foregrounded and what ideas are ignored by my way of knowing? An interdisciplinary team needs to be aware their individual disciplines are important, but incomplete. Our discipline games, moves and forms create certain types of knowledge and other games, moves and forms create different equally relevant knowledge. This underlines the need for epistemic humility.

2.2. Epistemic humility

Epistemic humility is the understanding that what you know and how you know it, your way of thinking, is not the whole story. Epistemic humility is the awareness that while your discipline has insights that others do not, solving complex problems necessitates that these insights be complemented by the perspectives of others. Collaboration between disciplines allows insights to emerge that are greater than the sum of the individual disciplinary parts. Humility encourages students’ acceptance of multiple ways of knowing. It stresses that we don’t and can’t know everything, thus preparing students for the reality of complex problems in our volatile, ambiguous, chaotic world. This teaches students that a level of uncertainty is unavoidable and should be acknowledged and not to be raised against.

Epistemic humility based on epistemic meta-knowledge encourages students to recognise that their perspective is a peculiar lens for looking at the world. As this lens obscures some ideas by focussing on others, students, rather than fearing or diminishing alternate ideas, will be positioned to pursue other perspectives. Epistemic humility opens students to the frames of reference of others and the need to work together, encouraging an understanding that addressing complex problems means completing an epistemic jigsaw. Creative collaboration needs a polyvocal dialogue, not a monologue.

Creative climates (Isaksen & Ekvall, 2010) are supported by epistemic humility. The willingness to pursue and embrace multiple perspectives gives the space for ideas to circulate freely before they are evaluated or dismissed. This dynamic will support risk taking and divergent novel combinations. It will also encourage an acceptance that ideas that are generated, but not accepted, still contribute to the problem-solving process as they illuminate aspects of the complex problem (Tahiryslfaj, 2012). By encouraging risk and embracing mistakes as information, epistemic humility keeps the collaboration focused on the complex problem and not on disciplinary tribalism.

But understanding the limits of our own discipline is not enough. Students need to value and seek out the input from other disciplines to solve the problem they are working on. For many students, this will not require a great shift in perspective. For Arts students, for example, epistemic shifting is already part of their academic identity, as they navigate and reconcile approaches to knowledge under the broad umbrella of their faculty. To be able to value the contributions and validity of other ways of knowing, students must also choose to understand the games and forms of other disciplines. This process is epistemic empathy.

2.3. Epistemic empathy

Understanding the perspectives of their own discipline increases student’s ability to see what their discipline brings to the table - and what it doesn’t. Understanding what their discipline highlights and ignores will encourage them to understand that other ways of knowing complement their own and will increase their awareness of other possible perspectives. For this, students need to develop epistemic empathy.

As a relatively new concept (Horsthemke, 2015), epistemic empathy can be understood as the opposite of epistemic closure, i.e. a choice or inability to understand others (p. 64). Further, unlike some approaches to empathy, the empathetic shift is prompted not be imagining ‘What would I do in this situation?’, but by actively trying to understand ‘What do they do?’. Epistemic empathy recognises that to understand others we need to know how they think (Jaber, Southerland, & Dake, 2018). Jaber et al. define epistemic empathy as ‘the act of understanding and appreciating someone’s cognitive and emotional experience within an epistemic activity—i.e., activity aimed at the construction, communication, and critique of knowledge’ (2018, p. 14). Focusing on epistemic empathy in pre-service teachers’ and its benefits to the teacher-student dynamic, they explored the benefits of understanding their students’ ‘sense making experience’ and actively tried to see the merits of their reasoning and emotions (Jaber et al., 2018, p. 14). Applying this concept to
collaborative creativity with diverse groups will illuminate how to encourage students to understand the perspectives of others and to identify the merits of their reasoning from their perspective (Jaber et al., 2018, p. 14).

Epistemic empathy highlights the need to understand how others make meaning – both in how they understand and how the communicate that understanding. The strength of epistemic empathy is that it predisposes students to value other group members and equates to a ‘decentering’ from our own way of knowing, encouraging a collaboration of equals, rather than an adversarial compromise of ideas. Epistemic empathy requires more than understanding how it would feel to be that person (an excellent goal in itself) and even more than how I would feel in that situation. The real benefit of epistemic empathy is understanding how another thinks in that situation, how they arrive at their knowledge and appreciate that their approach as valid. Epistemic empathy is about actively seeing the merits of the games and forms of other disciplines, the knowledge that is created and the ways it is communicated. It requires students to understand and value how others think and work, and to make space for those perspectives in the process.

It goes beyond mutual recognition. To be effective, epistemic empathy will need to come from knowledge of other ways of knowing, both to provide insights into how they can complement their own way of knowing, and to empower the mix of perspectives to generate emergent creative ideas and processes. Epistemic empathy will lead to a sharing of games and processes, finding what is common and what is unique. It will enable the group to access benefits of complementarity and the generating of new concepts from mixing divergent and disparate ideas. Without knowledge of each other’s way of knowing, the ideas and processes will co-exist in parallel but will not integrate. In this way, a diversity of games will be more likely to lead to a diversity of products and forms.

Jaber et al. (2018) encourage educators to consider the importance of balancing epistemic agency and epistemic safety. Epistemic agency requires students to ‘work through frustration and to struggle’ (p.16). Epistemic empathy engages with epistemic conflict. It is about facing the challenges to our understanding posed by other perspectives and changing our minds when that is required. Jaber et al. argue that concerns with student emotional wellbeing and the desire to avoid the discomfort of epistemic challenges can adversely affect student epistemic agency. Intellectual struggle and the ‘burdens of uncertainty and frustration’ (Jaber et al., p. 16) are to be understood as part of the intellectual landscape and not to be avoided or denied by clinging to misguided discipline certainty. Epistemic empathy asks students not to unlearn their domain knowledge, but to unlearn their fixed position. Students are to be willing and eager to face uncertainty and persevere. Educators must also be prepared to allow students to sit in discomfort and ambiguity. However, educators also need to maintain a safe learning environment - where students are free to make mistakes and have their perspective valued and incorporated. Educators manage student collaboration to ensure the discomfort is intellectual rather than personal and/or social. While the scaffold structures collaboration, educators still need to create an environment where the risks associated with integrating and possibly changing perspectives occur within an environment of ‘trust, openness’ and minimal ‘emotional, relational or affective conflict’ (Søksen & Ekvall, 2010, p. 74).

In a collaborative creative situation, the ability to understand and appreciate the cognitive experience of others will facilitate group cohesion, allowing the benefits of diversity to emerge. The group will be able to work as equals in a creative process, rather than adversaries in a critical rivalry, and will therefore generate creative responses based on unusual and new combinations of thoughts and thought processes.

As they encounter new ideas for the first time, students bring an ‘outsider mindset’ (Syed, 2019, p. 141) to practices within another’s discipline or way of knowing. Epistemic empathy offers students the benefits of a traveller. Cultural mixing improves creativity (Sawyer, 2012) and exposure to another culture increases the creativity of an individual in the way that increased experience offers more for the creative mind to reconstitute (Vygotsky, 2004). Epistemic empathy is epistemic holidaying. Students are relative experts in their nominated domain. They are not experts in others. But exposure both to the concepts (content) of other fields and to other ways of knowing (processes) will increase students’ creativity by broadening their experience and understanding of what is possible. Naïve first responses, products of fresh divergent thinking, will then be evaluated by the convergent thinking of a domain expert. The places of creativity are places where diverse ideas can mingle.

Further, when explaining their ‘way of knowing’ to outsiders, students can anticipate ideas that may need further context or explanation so as to be understood and valued by others (Keestra, 2017). By adopting an outsider mindset for our own way of knowing we can understand that not only are our games and forms specific, some may need a rethink. By adopting an outsider mentality, a critical stance, for our own discipline, we can further develop our meta-knowledge of our own position. Epistemic empathy allows us to balance the tension between domain knowledge (Csikszentmihalyi, 1996) and mental flexibility (Syed, 2019, p. 142). Epistemic empathy encourages ‘conceptual distance’, so important for reimagining the known:

In a world where recombination is becoming the principal engine of growth…[t]he growth of the future will be catalysed by those who can transcend the categories we impose on the world: who have the mental flexibility to bridge between disciplines and thought silos and regard them not as immutable but moveable, even breakable. (Syed, 2019, p. 142)

At this point the three previous stages begin to converge. Epistemic awareness, epistemic humility and epistemic empathy allow us to value our knowledge and understanding, but be ready to accept that others can offer insights that complement or surpass our thinking, and that certain aspects within our deep knowledge may be flawed, anachronistic or even a liability in the context of complex problems.

This awareness develops into epistemic control, the final stage of the framework.

2.4. Epistemic control

The final stage develops the humility and empathy to a state of epistemic control - where students in group (and individual) research contexts can mobilise and adopt a range of ways of knowing to address complex problems. It represents a synthesising and
The metaphors associated with interdisciplinarity are relevant here. Repko et al. (2016) describes the process of integrating disciplines as being able to cross boundaries, build bridges and speak many languages (pp. 80–86). While not without their limitations, these metaphors capture the need to think metaphorically across disciplines to allow communication between and across different ways of knowing. The metaphor of boundary crossing, for instance, reminds us of the outsider mindset, that group creativity places students in the role of travellers, moving from country (discipline) to country (discipline) ‘in search of knowledge relevant to the problem’ (Repko et al., 2016, p. 81) and that each traveller must learn some of the language of each culture but will rely on the knowledge of the native experts.

Using the metaphor of language, epistemic control involves the ability to speak many languages:

Working on real world problems usually requires the combination of different kinds of specialised and content-dependent knowledge, as well as different ways of knowing. People who are adept with respect to different ways of knowing about the world can be said to possess epistemic fluency. (Markauskaite & Goodyear, 2017, p. 1)

The idea of fluency also suggests a flexibility and lack of rigidity that makes collaborative creativity successful. The metaphor of control takes these ideas further, emphasising that this is a deliberate capacity, generating agency for groups and individuals.

Epistemic control means that students will be flexible and creative in their thinking and mobilisation of knowledge. Understanding what knowledge and perspectives are privileged in and across a range of perspectives will help groups and individuals employ the epistemic games and forms, the ways of knowing, most appropriate to addressing the particulars of the complex problem and will bring a broad perspective to their imagined strategies and responses. They will employ different kinds of ‘thinking’ and ‘doing’ to answer different kinds of problems within larger complex challenges. This control allows students to identify which discipline perspectives are more suited to aspects of the problem. It also allows for the possibility that sometimes the most appropriate disciplines are not made clear until the problem is defined, and that groups can trust emergent creativity and not be too quick to limit which ways of knowing are relevant or appropriate.

Epistemic control allows initial collaborative discussion to begin from an open position that embraces diversity and positions the group to resist initial limiting assumptions about what the problem is, and what forms of knowledge will be needed to address it. This avoids what Syed (2019) calls perspective blindness. Diversity of perspectives is significant as it broadens what key questions are asked at the outset, who is involved and whose opinions and data are sought etc. Epistemic control prevents the group from locking into an epistemic track too early that may exclude a range of understandings that could possibly benefit the group (Repko et al., 2016, p. 81) and that each traveller must learn some of the language of each culture but will rely on the knowledge of the native experts.

Epistemic control can be conceptualised through the phrase ‘think like a …’. There will be phases of the problem-solving process when the group will need to think like an economist, for instance, and integrate other ways of knowing to respond to and mitigate the impact of these ideas. Other times they will need to think like an artist, to find the metaphors that will make the problem clearer across disciplines and ways of knowing. Educators are adept at this process, having to move from thinking like a lawyer (What legal problems would we face? What are the policies that impact this decision?) to thinking like an accountant (What will it cost and how can we pay for it?) to thinking like a student (What mischief can students get up to?) to thinking like a parent (What benefits to their child’s education will parents recognise? Or can they afford it?). These perspectives demonstrate that the limits of a perspective are the strengths of collaboration. Further, students can be encouraged to adopt different perspectives. Thinking like an expert, thinking like a novice, or thinking like a competitor, will focus on aspects of a problem other than their default domain of problem-solving perspective. Kelley and Kelley (2015) describe a human centred approach to design thinking, which calls for creators to shift their perspectives and understand the needs of the end users of the product and adopt an anthropological or ethnographic position in their design process.

The affordances of hybridity are underlined here as new and innovative ideas and processes will be generated through collaboration of individuals, ideas and epistemic games and forms. Sawyer (2015) discusses the importance of the ‘emergent idea’ in creativity. He argues that complex interactions create something novel and unpredictable: ‘you could not have known empirically beforehand that a discussion of x would lead to y’ (2015, p.19). Complexity and diversity increase the possibility and probability of this happening; emergent ideas are observed in many complex systems – systems with many components that interact in complex system configurations’ (2015, p.16) (Fig. 1).

3. Discussion of future research opportunities

In our 21st century interdependent world, knowledge needs not to be acquired, but to be navigated. Dinham (2011, p. 12) argues that knowledge is so prolific that the future will involve students ‘seeking out and assembling information around a particular need’ (Knowledge needs to be understood in terms of its nuances, its limitations and benefits. Further research into how groups collaborate to problem-find and problem-solve around complex problems will need to understand the dynamics around perspective taking, epistemic negotiation and creative processes in a range of contexts. Examining the benefits of this framework for individual openness to perspective taking and position shifting will reap benefits for all educational settings, for both disciplinary and interdisciplinary learning.)
Research into real world applications of collaborative problem solving will illuminate the processes that are currently being employed and their level of effectiveness and efficiency. With the focus on collaborative creativity, measures that evaluate the creativity of processes, experiences and responses provided by groups, diverse and otherwise, could explore the extent to which the conceptual shifts outlined in the framework are occurring and to what extent engaging (or not) in epistemic empathy and/or developing epistemic control impacts a groups creativity and cohesion. Further, research that examines the experience of students employing the frameworks as they approach complex problems, both inquiry learning and real-world case studies, will allow the framework to be explored to determine its impact on collaboration, creativity and epistemic control.

In a higher education context, with significant variety and definitions of interdisciplinary research, there are rich opportunities to apply the framework to gather data on its impact on creative collaboration across the faculties, in a range of contexts, including research, professional education and teaching and learning for innovation.

The framework scaffolds thinking to allow true collaboration and to develop epistemic control. Research that explores a group’s ability to adopt and employ the perspectives of other disciplines in collaborative research situations and its impact both on the creativity of the processes and responses, as well as the emergent ideas and innovative interdisciplinary knowledge created, would also develop greater understanding of how to change the culture of critical thought from an adversarial compromise to one of equality and integration of ways of knowing. The possibility of developing these ideas beyond the specific context and developing epistemic control as a truly transferable skill offers an exciting research potential.

4. Conclusion

The world our students will graduate into will be one of normalised change. There is a need to attend to the vast amounts of information confronting our students and the attendant impact on their well-being. As such the education they receive must incorporate, account for and generate the skills of flexibility, resilience and creativity.

By asking students to develop an understanding of the strengths and weaknesses of their discipline, they can address epistemic rigidity in their own thinking and way of knowing. Focussing on the knowledge and processes that their perspective highlights or obscures, students recognise the need for epistemic humility, that their ideas are (more than likely) incomplete and that there is more than ‘what they know’. This awareness will develop students’ willingness to exercise epistemic empathy, an ability to understand how others make meaning, and a readiness to listen and look for how others can add to their understanding of a complex problem. This reorienting of the knowledge discussion, from adversarial to collaborative, will develop the skills necessary for a world full of complex, intractable problems. As students develop this empathy, understanding becomes control and students are able to employ a range of ways of knowing, either in group situations or facing problems as individuals. The ability to think in a range of ways, to understand the importance of a diversity of thinking, will provide them with the awareness and skills to be able to mobilise their specific disciplinary understanding when appropriate and to seek out and employ other ways of knowing when it is not. They will activate a fundamentally interdisciplinary perspective, based on strong disciplinary skill, with a willingness to ‘travel’.

As Goodyear and Markauskaite (2019) suggest,

...educational design aimed at helping students to learn to tackle wicked problems needs to consider how students will come to recognise the range of potentially useful instruments and what is involved in jointly configuring those instruments to create a productive working environment. (p. 50)

This framework is a move in that direction.

If the global crisis has any silver lining, it will be that we do not return to the negative and adversarial ways of our past. The bipartisan interdisciplinary response to the global pandemic should not be the last resort but the default position. The need to understand others must trump the need to be right and the need for dominance. Measures and processes that normalise collaborative decision making and collaborative meaning making should become part of all upper secondary, undergraduate and postgraduate learning across the globe. This will mean our students are prepared as creative agents willing to work together and address the inevitable complex problems that they will encounter in their world.

Author statement

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