

Title:

Teaching collaborative dexterity in higher education: Threshold concepts for educators

Author 1

Name: Nicholas Rowe

Institutional affiliation: Faculty of Creative Arts and Industries, University of Auckland

Email: n.rowe@auckland.ac.nz

Physical address: Room 122, level 1, building 113, 5 Symonds Street, University of
Auckland, Auckland CBD 1010, New Zealand

Author 2

Name: Rose Martin

Institutional affiliation: Department for Teacher Education, Norwegian University of
Science and Technology

Email: rosemary.k.martin@ntnu.no

Physical address: Department for Teacher Education, NTNU Norwegian University of
Science and Technology, N-7491 Trondheim, Norway

Author 3

Name: Ralph Buck

Institutional affiliation: Faculty of Creative Arts and Industries, University of Auckland

Email: r.buck@auckland.ac.nz

Physical address: Room 102, level 1, building 113, 5 Symonds Street, University of
Auckland, Auckland CBD 1010, New Zealand

Author 4

Name: Alfdaniels Mabingo

Institutional affiliation: Faculty of Creative Arts and Industries, University of Auckland

Email: amab260@aucklanduni.ac.nz

Physical address: Level 1, building 113, 5 Symonds Street, University of Auckland,
Auckland CBD 1010, New Zealand

Abstract

This article draws on a multi-phase study of collaboration in tertiary education programmes. This commenced with a survey of 111 students in Engineering and Creative Arts, contrasting their experiences of the teaching of collaboration in different faculties. This led to an iterative action research cycle, in which the conceptual boundaries that surrounded teachers' approaches to teaching collaboration were explored through qualitative interviews with teachers and observations of teaching practices. Within this article we discuss five specific threshold concepts that subsequently informed the design of the SALAM professional development programme for tertiary educators: enhancing explicit metacognition, scaffolding socialization, animating symmetry, animating pluralism, and embedding values. By bringing greater clarity to the graduate attribute of "collaborative dexterity" (Schupp 2015, p154), we argue how these five threshold concepts present pedagogic responsibilities to teachers in Higher Education who are seeking to constructively align the teaching of collaborative dexterity with assessment procedures, teaching activities and course content.

Keywords: collaboration; constructive alignment; teaching; threshold concepts

To, not through

What are the responsibilities of tertiary educators to actually teach collaboration?

An ability to effectively collaborate is a key employment competence in 21st century workplaces (Robles, 2012). As a result, collaboration has become a ubiquitous graduate attribute across tertiary education programmes (Burbach, Matkin, Gambrell & Harding, 2010), largely qualified through the assessment of small-group tasks (Griffin & Care, 2014). Given that cooperative learning has been prevalent for several decades (Slavin, 1995), the integration of small-group tasks into the curriculum might seem fairly straightforward. There is a significant difference however, between learning *through* collaboration and learning *to* collaborate. The instrumental use of collaboration to assist learning is not the same as actually gaining an advanced capability as a collaborator within a discipline (Hennessy & Murphy, 1999). Approaches to the teaching of collaboration nevertheless often extend upon a tacit-learning approach, following the maxim that “the best way to learn about working together is by doing it” (Horder, 1995, p. 158). While such experiential learning is deeply valuable, just ‘doing it’ should not be the *only* way to learn about collaboration. For students to gain a sophisticated competence in a phenomenon as complex as collaboration, teachers need to undertake a pedagogic responsibility that extends beyond simply assigning and assessing a group task in their coursework. Within this article, we argue that if collaboration is being promoted as a graduate attribute within tertiary institutions, then this attribute needs to be constructively aligned (Biggs, 1996) with *what* is taught and assessed about collaboration, and *how* it is taught and assessed.

This teaching and assessing of collaboration can be a very new experience for teachers in many disciplines, presenting challenging transformations away from previous modes of

classroom management and course design. To explore how tertiary educators might effectively transition into new ways of teaching collaboration, our research has sought to identify key threshold concepts (Meyer & Land, 2005) for educators related to collaborative coursework. As transformative ways of understanding *the teaching of collaboration*, these threshold concepts can open new possibilities for a teaching practice.

To explore the demands of teaching-and-learning about collaboration, we first examine the complexity of what we call ‘collaborative dexterity’: a disposition and ability that allows an individual to nimbly respond to the complex demands of a collaborative process. We then outline our research into the pedagogy of collaboration, which involved a three-year cross-faculty project investigating student and teacher perceptions of collaborative tasks, and responses to teaching interventions. This reveals five key threshold concepts associated with the teaching of collaborative dexterity: enhancing explicit cognition, scaffolding socialization, animating symmetry, animating pluralism and embedding value. These threshold concepts provide a point of reference for professional development interventions that seek to enhance the teaching of collaboration within Higher Education.

Collaborative dexterity: Meanings and motives

Collaboration requires promotive relationships in which individuals behave interdependently (Johnson & Johnson, 2009) in order to collectively innovate and problem-solve (Mattessich & Monsey, 1992). To engage in such promotive relationships, collaborators need to acknowledge that social interdependence exists, and to disassemble any competitive behavior that may impede the shared accomplishment of their creative goal (Johnson & Johnson, 2005). Conceptualizing such a shared, creative goal can involve intricate processes of communication and persuasion, that take account of the perspective, knowledge and

intentions of others (Frith 2018). These communication cycles expand the collaborators' collective understanding, allowing collaborators to work together in ways that are new and emerge from the process of collaborating, leading to outcomes that are not always predetermined (Raelin, 2006). It is this emergent, collective creativity that makes collaboration a distinctive graduate attribute; valued by employers as an effective means of generating multi-faceted, innovative ideas and new solutions.

While collaboration has often been assumed by teachers to be an innate behavior or characteristic, research has evidenced that it is a competence that can be acquired (Hesse et al., 2015). Often referred to as a 'soft skill', this ability and inclination to collaborate can be as valuable as the mastery of domain-relevant knowledge (Morgeson, Reider & Campion, 2005). Such collaborative relationships are outside the norm of student interactions in tertiary education however, where independence is encouraged and accomplishment is rewarded individually (Biesta, 2006). The effective teaching of collaboration therefore requires that teachers actively transition students towards an enthusiasm for social capital: an inclination towards joint effort in order to grow shared values and ideals (Hung, Durcikova, Lai & Lin, 2011). Ultimately, the development of a "proactive disposition" (Perkins, 2008, p. 9) towards collaboration requires students to enjoy collaboration and experience a desire to grow their collaborative practice. An intrinsic motivation to collaborate can lead to more valuable contributions to the collaboration (Kankanhalli et al., 2005), and is considered essential within unmonitored, collaborative professional environments (Vlaanderen, Jansen, Brinkkemper & Jaspers, 2011). If a student comes away from a group-task in Higher Education with a disinclination to engage in collaboration in the future, or only responds to extrinsic motivations to collaborate, it is hard to claim that a professional collaborative competence has been effectively fostered within the course of study. How tertiary educators

conceive of the teaching of collaboration within their own discipline is therefore an urgent concern.

Investigating threshold concepts of collaboration: epiphanies in slow motion

Our cross-faculty research project has investigated how teaching practices can affect student experiences of collaborative group tasks. We undertook a survey of 111 students from two faculties with distinctly different pedagogic practices: Creative Arts and Engineering. Our mixed methods approach gathered quantitative data and qualitative commentary (Johnson & Onwuebuze, 2004) on students' experiences of small-group projects within their coursework. This led us to investigate teaching practices, through classroom observations and semi-structured qualitative interviews (Dingwall, 1997) with 12 teachers in both disciplines. These observations and interviews revealed a clear sense of what was being taught, what was not being taught, and what needed to be taught to address student concerns regarding preparation for professional collaboration. This analysis led us into action research (Stringer 2008) and the design of a transdisciplinary framework for teaching collaboration. Further qualitative interviews with 14 teachers undergoing this professional development programme helped us understand their current conceptualizations of how to teach collaboration. This process of data gathering (under the auspices of our university's Human Participation Ethics Committee) helped us identify important threshold concepts (Land, Meyer & Smith, 2008) associated with teaching collaboration. Within this article, we address these through the guiding question: What are key conceptual thresholds that can facilitate the teachers of collaboration in Higher Education?

Following educational theorists Meyer and Land (2005), we recognize that threshold concepts can create borders around our understandings of a subject like collaboration. From

this standpoint, crossing a threshold concept is like moving through “a portal, opening up a new and previously inaccessible way of thinking about something” (Meyer & Land, 2005, p. 373). By presenting “troublesome knowledge” (Meyer & Land, 2005, p. 373) a threshold concept can contrast sharply with an individual’s assumptions about a phenomenon. While traversing a conceptual threshold can be akin to experiencing an epiphany in slow motion, recognizing the barriers to such realizations is not always straightforward. The process of identifying where this “ontological and epistemological shift in thinking” takes place amongst learners can be quite complex (Nicola-Richmond, Pepil, Larkin & Taylor, 2018, p.102), requiring iterative processes of qualitative investigation by teachers (Rowe & Martin, 2014).

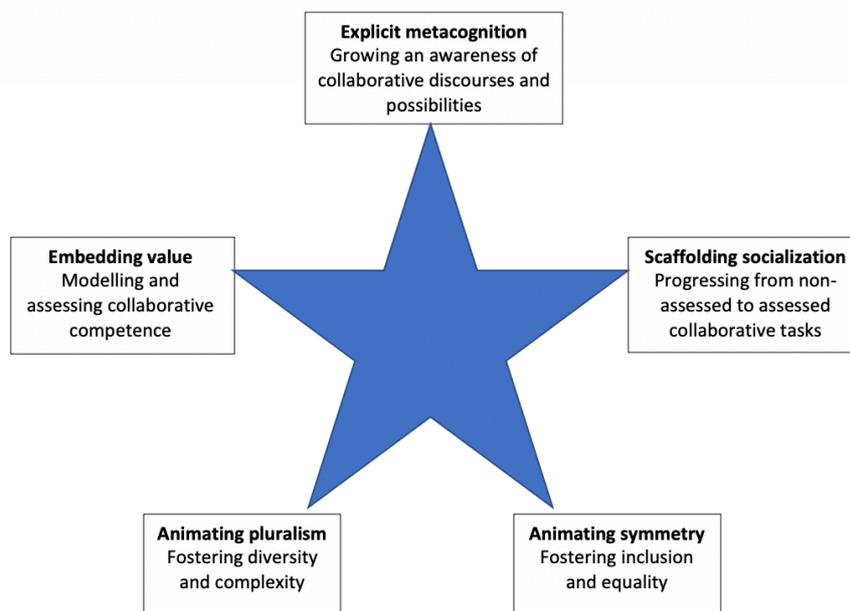
While much research has been undertaken on threshold concepts within Higher Education (Nicola-Richmond et al., 2018), this scholarship has predominantly examined the threshold concepts of students within tertiary degrees. We seek to extend threshold concept theory into the sometimes challenging pedagogic domain of professional development training for tertiary educators. Within Higher Education, such professional development can require experienced practitioners to question their habitual approaches to teaching (McCulloch & Loerser, 2016). As collaboration has rapidly increased across the curricula of HE, educational practices have required revision in order to accommodate this new graduate attribute. Our interviews, observations and interventions sought to understand the threshold concepts that tertiary educators were experiencing in relation to the teaching of collaboration. These threshold concepts revealed a boundary around how teachers approached collaborative tasks within their courses. Once reflected upon, teachers could traverse these threshold concepts and transform their teaching practice, more confidently integrating small-group tasks throughout their courses. Based on this analysis we devised the SALAM (Socialised,

Animated Learning to Activate and Motivate) micro-credential in teaching collaboration, which has been delivered as a professional development programme for tertiary educators.

In other publications we have analysed the literature on collaboration in higher education (Rowe, 2019) and examined the student experience of learning collaboration in higher education (Rowe, Martin & Giacaman, in press). Within the following discussion, we draw on qualitative interviews with teachers that were seeking to enhance their teaching of collaboration, to understand the threshold concepts that stood between them and a more complex understanding of the phenomenon. We identify five of these threshold concepts as key pedagogic responsibilities: enhancing explicit metacognition, scaffolding socialization, animating symmetry, animating pluralism and embedding value.

Figure 1.

The SALAM framework for teaching collaborative dexterity



Within the following discussion we explore how these concepts appeared to be threshold concepts to our interviewees, requiring an ontological and epistemological shift in what it meant to be a tertiary educator within their particular discipline.

Enhancing Explicit metacognition: “*I don’t tell them how to do it*”?

Collaborating is not as simple as sharing toys in a sandbox (Bruffee, 1995). Collaboration is a term that is often used loosely and confused with other forms of social enterprise, like cooperation. Cooperation also emerges from promotive social interdependence (Johnson & Johnson, 2009), but is a less complex social process: a predetermined and agreed division-of-labour to achieve a shared goal (Dillenbourg, Baker, Blaye & O’Malley, 1996). Cooperative models of professional activity streamline group productivity and product quality and are pervasive within service and assembly line contexts (Wysocki, 2002). By contrast, collaboration is valued as a means of generating complex, innovative ideas that respond to diverse perspectives. While collaborative endeavours inevitably involve phases of cooperation (teams working separately and in parallel), collaboration also requires cycles of discussion and decision-making amongst collaborators. This tension between the productivity of cooperation and the creativity of collaboration can present a challenging polemic within group tasks; particularly when collaborators maintain competitive interdependence.

Our research into student experiences of collaboration in Higher Education revealed a predominant interest in being taught effective collaboration processes, particularly within the context of their disciplinary and particular course. They recognized that their peers came into small group tasks with very diverse and often contrasting expectations of how groups might interact on a project (Rowe, Martin & Giacaman, in press). This need was generally not

shared amongst the teachers we interviewed, with comments like *“I give them information about content, but I don’t teach them how to work together explicitly.”* A recurring theme emerged, in which they felt the management of collaboration was under the domain of student responsibilities, *“They have a project briefing, but as a group they have to develop a plan how they want to implement the task at a hand, I don’t tell them how to do it.”* For some teachers, the idea of how the collaboration might function was novel, *“I didn’t really think about any differences about how groups might work together.”* For others, the processes of students interacting remained unfathomable, *“For me it is hard to see the difference sometimes in how they work together.”* For these interviewees, the idea that collaboration was a complex phenomenon that might need to be unambiguously taught presented a threshold concept.

This teaching of the meanings and expectations of collaboration might, however, be understood as a critical first step in the teaching of collaboration: when students have an explicit metacognition of a subject, they can better manage their cognitive processes associated with it (Brown, Bransford, Ferrara & Campione, 1983). The process of making understandings of collaboration *explicit* allows collaborators to clearly articulate their intentions and uncertainties within the shared process, as *“...explicit metacognition allows us to discuss aspects of our perceptual and decision-making processes with others and thereby improve our decisions”* (Frith, 2012, p. 2220). By moving from a tacit understanding of collaboration to a more explicit metacognition of collaboration, collaborators can achieve a greater awareness of each other’s intentions and knowledge, and engage in constructive discussions to resolve collaborative issues (Hesse et al., 2015). This explicit metacognition is particularly important as professional contexts increasingly become *“adhocracies”* (Lindkvist, 2005, p. 1197), in which collaborators are temporarily gathered ad hoc from diverse

backgrounds in order to address the needs of a particular project. Such transient projects rely upon collaborators to explicitly express their disciplinary knowledge, ideas and ways of working collectively, rather than simply relying on tacit understandings shared within an established community of practice (Lindkvist, 2005).

To achieve such an explicit metacognition of collaboration, students need both theoretical guidance and practical, social activity (Goos, Galbraith & Renshaw, 2002). Through guided learning (Mosston & Ashworth, 1994), students can develop a shared conceptual vocabulary that allows them to effectively discuss the collaborative process and to adapt their collaborative approach to suit different contexts. As we argue in the following sections, the students' explicit metacognition of collaboration is enhanced by how collaborative tasks are scaffolded, animated and valued by the teacher.

Scaffolding socialization: “only for assessments”?

When small group tasks arise in a curriculum, students are suddenly jolted from an independent, privatized education experience to an interdependent, publicized education experience. Within a tertiary education system that conditions students to behave in a peculiarly self-serving manner (Biesta, 2006) being collaborative can feel counter-intuitive, or even transgressive. Our research into student experiences of collaboration suggests that students would like their collaborative learning activities to be progressive; allowing them to recognize, realize and reflect on collaboration within their discipline before being assessed on their ability to collaborate (Rowe, Martin & Giacaman, in press). The teaching and learning of collaboration can therefore require teachers to do more than distribution; or as one teacher reflects “*I just say ‘now get in groups and work together!’*” Navigating this radical shift

within peer relationships can necessitate a scaffolded transformation of the social climate of a lecture hall (Rowe, 2019).

Amongst the teachers we interviewed, collaboration was generally only considered within the context of a group-work assessment, “*They do group collaboration, but only for assessments.*” This was generally rationalized within the demands of the existing curriculum, in which group work was seen as a burden rather than a tool “*There’s no time to do group activities that are not leading to a grade.*” Moreover, the teacher’s rationale for engagement with groups tended to be focused on managing disputes, rather than enhancing collaborative practices “*I think it’s fair to say that I don’t really follow the groups closely unless there are really serious concerns.*” The idea that a tertiary educator might be responsible for scaffolding this socialization appeared to be a threshold concept. While the process of scaffolding learning (Vygotsky, 1978) has become established as mainstream within educational reform, our interviewees repeatedly expressed a reticence about getting involved in growing peer-to-peer relationships amongst students. Traversing this conceptual threshold can therefore involve understanding how non-assessed, socializing tasks that are relevant to the discipline can be tools that grow from the first lesson, and become progressively challenging as students build towards an assessed group-task outcome. This integration of small, non-assessed collaborative tasks can also require teachers to move away from a more autocratic teaching style (Mosston & Ashworth, 1994), in order to foster autonomous interactions amongst students.

This is not a shift to a more passive teaching process, but can require very active *animation*; “encouraging, motivating, involving, empowering, engaging real human beings” (Foth, 2006, p. 640). Drawn from pedagogical histories in community development, animation literally

means enlivening the collaborative relationships between people (Thapalia, 1996). Such animation involves teaching strategies that actively facilitate equitable social interactions in the classroom, animating symmetry and pluralism so that students do not revert to competitive or cooperative mindsets. By valuing egalitarian and pluralistic student perspectives and a movement away from the teacher as the sole authority, this concept of actively *redistributing* knowledge-construction sits conceptually beyond the process of simply *distributing* learners into groups.

Animating symmetry: “*the strong ones pull them through*”?

Collaboration functions when the individuals involved deeply want to work with each other, in ways that might be transformative for all, rather than simply leading or being led.

Transitioning students into such egalitarian and inclusive collaborative relationships can therefore require that the teacher animates symmetries of *actions*, *status* and *knowledge* (Dillenbourg, 1999). The symmetry of *actions* requires collaborators to maintain equal access to the deliberations; engaging in collaboration at times and locations, and using languages and technologies, that allow all collaborators to participate. The symmetry of *status* recognizes that leadership can be flexible and distributed; the collectivization of a group’s critical and creative efforts is optimized when decision-making does not always follow a rigid hierarchy (Wysocki, 2002). The symmetry of *knowledge* values the different cultural, social, political and educational backgrounds of the collaborators; recognizing that a collaborative effort is strengthened by the complexity, rather than the conformity (and hierarchy), of its shared knowledge. The symmetries of action, value and knowledge allow collaboration to serve as both a means of generating new, unique ideas and products, and as an affirmation of the value of developing social networks.

Amongst our teacher interviewees, the idea that such egalitarian approaches to group work might be fostered presented a threshold concept. Central to these teachers' concerns were assumptions about the inherent hierarchies-of-ability that underpinned the culture of the student cohort. As one teacher reflected, "*Weak students could surf through the course with group work, because sometimes the strong ones pull them through.*" Even in contexts where all the students were seen as 'strong', this strength was attributed to their competitive relationships, "*There are very few weak students, they all have very high GPAs, so there's a lot of competition.*" So long as a teacher generalizes students into categories of 'strong' and 'weak' (and maintains the belief that 'strong' students will inevitably engage in competitive relationships), it will be hard for that teacher to credibly guide the class into symmetrical, promotive relationships. The teaching of collaboration can therefore require more than just expressions valuing collaboration; it can also require a restraining of comments that promote a competitive and hierarchical learning environment.

This view that student groups are comprised of strong and weak students can be a legacy of the asymmetrical relationships established by the instrumental use of cooperation to enhance learning. Throughout the 1980s and 1990s cooperative learning largely involved the placing of more advanced learners with struggling learners, so that the more advanced learners could help the others to 'catch up' (Bruner, 1985). While we recognize the value of such peer-learning practices, it is important to emphasize that this is distinct from the process of actually collaborating, and actually learning about collaboration.

From our research, this asymmetrical mindset amongst students within collaborative course work remains a pervasive attitude; students often enter into a collaborative project with a sense of academic hierarchy, and little belief that all involved might have valuable

contributions to make. This asymmetrical standpoint can be a central cause of student disputes, resulting in domination, alienation and non-participation. The pedagogic effort put into animating a sense of symmetry between collaborating students might be seen as a useful means of offsetting the time-consuming and tedious mediation of student conflicts (Arggawal & O'Brien, 2008) and the ambiguous grading of individuals within group-devised outcomes (Rosen, 2018). Previous educational research predominantly sought to address these dilemmas through the development and implementation of digital tools that help teachers and students monitor and measure individual student contributions in collaboration (Jermann & Dillenbourg, 2008). The managing of disputes and policing of free-riders should, however, be recognized as remedial actions. To achieve more inclusive and egalitarian cultures within collaborations, it can be important for the teacher to undertake a proactive role in animating symmetry.

Achieving a sense of symmetry in a class can occur through how teachers express themselves and relate to everyone in the cohort, and how they design non-assessed small-group tasks that emphasize the symmetry of the group. Establishing symmetry can ultimately require that the teacher animates the ideal of pluralism within a collaborative endeavour.

Animating pluralism: “often just one right answer”?

Distinct from other forms of collective endeavor, collaboration ultimately strives to achieve an outcome that could not emerge from a singular perspective. Through encountering such differences, students become prepared for the professional contexts that they subsequently find themselves in (Crookall, Jacobs, Hussein & Ismail, 2001). Such pluralism does not always emerge instinctively however, within an assessed learning environment. From our observations of classes, students generally gather amongst the familiar, rather than the

strange, when forming themselves into collaborative groups for assessments. Their subsequent collective decision-making processes often seek compliance, rather than complexity. For these reasons, the maintenance of pluralism in assessed group tasks can require pedagogic animation, in the process of gathering collaborators, in the valuing of difference amongst collaborators, and in the fostering of collaborative decision-making processes.

Our interviews with teachers suggested that such a purposeful mixing of differences in order to arrive at diverse outcomes through collaboration may be a threshold concept, through comments like “*The groups that take the task seriously often have likeminded individuals together.*” For this teacher, the idea that a collaborative task involves accommodating divergent perspectives, and is therefore strengthened by the differences within the group, appears to be a threshold concept.

So how might teachers actively animate pluralism through collaboration? The development of collaborative dexterity involves extending the students’ spheres of inclusion, by providing opportunities to collaborate with a wide diversity of partners. That teachers should be responsible for fostering this diversity in assessed and non-assessed tasks by purposefully gathering groups comprised of differences age, gender, ethnicity, cultural identity, political ideation, appeared to be a threshold concept, through teacher’s reflections on typical practices like, “*When they switch into the teamwork aspect, they get told ‘get into pairs’ and they decide who they want to work with.*” While this might placate student unease with engaging with strangers, it does little to extend their collaborative dexterity.

The threshold concept of animating pluralism extends beyond just group selection. To facilitate a pluralistic mindset within group activities, teachers have to provide learning tasks that prompt students to seek and value these differences. Rather than bonding collaborators with a sense of commonality, a teacher can promote pluralism by animating the differences between members; helping preserve their “distance and strangeness” (Biesta, 2012, p. 690). This can also stop students from returning to a hierarchical mindset, in which they assume groups have been mixed in order to allow ‘stronger’ students to guide ‘weaker’ students.

Ultimately this move away from hierarchies will require students to engage in complex and challenging processes of collective decision-making; the key feature that distinguishes collaboration from other forms of socialized endeavour (Järvelä, Volet & Järvenoja, 2010). Collective deliberations can require a nonjudgmental approach to inquiry-based dialogue, a willingness to share ideas and have those ideas scrutinized, and an openness to the possibility “that something new or unique might arise from a mutual inquiry that could reconstruct the participants’ view of reality” (Raelin, 2006, p. 155). This can lead into collective decision-making criteria based on *truth*, *majority* or *pluralism* (Laughlin & Ellis, 1986). Through a *truth*-based criterion, there is one correct answer; peer learners can critically review each other’s logic to help refine their knowledge and skills. Through a *majority*-based criterion, consensus is based on the amount of support that an idea has amongst individuals within a group. While popular within team-building activities, this consensus-building process can inhibit creativity and the incorporation of divergent perspectives (Biesta, 2012). Through a *pluralism*-based criterion, decision making in the group seeks to include diverse responses to a question; recognizing that the phenomenon is complex and that solutions need to be multifaceted and fluid. This aggregation of disparate ideas through pluralism encourages the generation of new ideas to be further explored, unfettered by the previous experiences and

logistical assumptions of the group (Owen, 2015). To generate ideas, establish goals and workplans, review outcomes, and redesign goals and workplans, effective collaborators will vary their decision-making criteria, shifting between collective decisions based on truth, majority or pluralist criteria. Effective collaborators will also recognize how to shift between decision-making phases in a project, identifying which decisions might be determined collectively or individually.

This might appear as a threshold concept to teachers who use collaborative tasks as a means of simply affirming existing ideas and solutions. As one teacher reflects, “*We’re asking the students to do the same task, and there is often just one right answer to the problem, but how each group gets there could be different.*” When group tasks in higher education are actually designed to reinforce existing knowledge, the pluralist generation of new ideas and solutions can actually be inhibited. For some teachers, a key threshold concept can be their responsibility to design discipline-specific tasks that require shifts between different collective decision-making approaches, and to provide students with un-assessed space to practice making these decisions autonomously. Such well-designed tasks can grow a student’s collaborative dexterity, as they can learn to recognize the needs of each distinct, collective decision-making moment, and fluidly adapt their decision-making approach as needed.

Embedding values: “*we’re marking the outcome*”?

A further threshold concept emerging from our interviewees related to how collaboration is actually valued within the curriculum, embedded within the assessment processes and criteria. This actual assessment of collaborative skill (rather than assessment of just the final product of a group task) appeared to be a threshold concept for some teachers. As one teacher

recalled, *“We tell them that the grade is about what at the end they produce.”* This idea that the assessment of group tasks ultimately required valuing product over process was repeatedly emphasized, with explanations that *“It’s not group work where we expect them to do the work in front of us, we’re not marking that process, we’re marking the outcome.”* The idea that ‘learning to collaborate’ might require an assessment of collaborative dexterity, and not just group productivity, appears to be a threshold concept. For some teachers this was more uncertain, as they reflected, *“I guess I’m still not clear on if we should be grading them on how they work together, or on what they produce by working together, or both.”* Central to these discussions were teachers confusions regarding how the internal domain of ‘the collaborative process’ might actually be assessed.

Dominant approaches to assessing the collaborative process have involved assessing a student’s individual contributions to a group task; an assessment process advanced by digital technologies designed to quantitatively measure student collaborations (Rowe, 2019). This assessment of ‘contribution’ is based “on the supposed relationship between quantity and quality of contributions” (Jerman & Dillenbourg, 2008, p. 283), and aligns with the standard expectations of formal education to assess individual effort (Brookhart 2013). By rewarding students that can best evidence their own contributions to the project however, this assessment process undermines the development of promotive relationships within the collaboration, and pushes students back into a competitive interdependence within group work. While an ability to contribute is important, effective collaboration requires more than simply expressing one’s own ideas. A key conceptual threshold involves recognizing how collaborative endeavours require a diversity of social skills and cognitive skills, which can be both taught and integrated into assessment procedures.

As Hess et al (2015) argue, social skills related to collaboration include *participation*, *perspective taking* and *social regulation*. *Participation* involves a proactive approach to contributing ideas and feedback, focused on the generation, exploration, review and development of collaborative ideas. For the collaboration to function however, participants need to not only contribute, but also view the task from the perspectives of others in the group. Through this *perspective taking*, collaborators can expand their own understanding of the task while allowing managing “to coordinate and resolve potential differences in viewpoints, interests and strategies” (Hesse et al., 2015 p. 42). To effectively gather the contributions from the whole group and share all of the perspectives, all collaborators need to also engage in *social regulation*; monitoring and managing one’s own behaviour and the behaviour of others in the group, to sustain a constructive, egalitarian and pluralistic leadership process.

While these social skills are necessary to facilitate a pluralistic and symmetrical group, collaboration also requires that participants employ cognitive skills, such as *planning*, *executing and monitoring*, *flexibility* and *learning* (Hesse et al., 2015). *Planning* involves the strategic mapping of the whole project, and sub-sections of the project, which may be developed sequentially or in parallel with other parts of the project. When each collaborator effectively engages with this strategizing process, the social enterprise remains collaborative rather than cooperative (in which participants are simply assigned tasks and workplans from a manager). Similarly, the *execution and monitoring* of tasks within the collaborative project needs to be distributed, to stop the project falling back to a hierarchical assembly-line form of cooperation in which some individuals generate ideas, that others then implement, that others then assess. By remaining involved in the execution and monitoring (including tasks that may be executed and monitored by collaborators separately and in parallel with each other),

collaborators can then collectively respond to issues that arise in the development of the task's outputs. This *flexibility* is an important attribute within the iterative nature of a collaborative project, as it allows collaborators to jointly respond to issues that arise and maintain a shared vision for the project and its goals. Finally, a collaborator's ability to *learn* about collaboration through the project is central to their development as a reflective practitioner of collaboration.

By integrating social and cognitive skills associated with collaborative projects into an assessment rubric (e.g. Hesse et al., 2015), teachers can evidence that collaboration is actually valued by the programme of study, and that small-group tasks are not just a token ritual to appease a graduate profile. Through a rigorous assessment of collaborative skills teachers can also transition their assessment away from production-focused rubrics that only value the final product of a team's efforts (e.g. Bryant & Albring, 2006) and towards an assessment of how the students' collaborative dexterity has been extended by the assignment: the reason why the small group-task exists within the curriculum.

Conclusion: collaborative dexterity

An advanced and sophisticated ability to work interdependently is essential within 21st century workplaces. While a tacit understanding of collaboration remains associated with many small-group tasks in higher education, it is becoming increasingly evident that a robust development of collaborative dexterity presents advantages to graduates within an expanding knowledge economy. As tertiary institutions seek to strategically respond to the needs of employment markets, tertiary educators need to develop more deliberate approaches to the teaching of collaborative dexterity.

Our research has sought to understand what inhibits or extends the development of this graduate attribute within a course of study, through an analysis of teachers' conceptualizations of collaboration in coursework. This has led us to identify five key themes that might be considered threshold concepts for teachers of collaboration; ideas that, once understood, can allow teachers to extend their own teaching of collaboration in higher education. The first threshold concept identifies the importance of an explicit metacognition of collaboration, challenging assumptions that collaboration is just something that 'happens' when people are put in groups. This leads to the threshold concept of scaffolding socialization in the class, challenging the assumption that an abrupt switch into socially interdependent learning activity does not require any progressive, unassessed, learning stages. This opens threshold concepts related to how symmetry and pluralism need to be animated amongst the student cohort, so that students can feel intrinsically motivated to work with each other. Finally, the idea that collaboration is rigorously valued within the curriculum (and not just a token task) can present a threshold concept, which once traversed can allow teachers to explore how their own behaviour models collaborative endeavour, and by how their assessment rubrics recognize diverse facets of collaborative effort.

We have explored these threshold concepts with tertiary educators, as they reflect on how small-group tasks might be more constructively aligned with graduate attributes, and used them within the development of the SALAM professional development micro-credential. These ideas are, of course, not an exhaustive or faultless list of teaching concepts relevant to collaboration; we present them here to prompt further discussion and debate into the teaching of collaborative dexterity.

References

- Aggarwal, P. & O'Brien, C. L. (2008). Social loafing on group projects: Structural antecedents and effect on student satisfaction. *Journal of Marketing Education*, 30(3), 255-264.
- Balan, P., Clark, M. & Restall, G. (2015). Preparing students for flipped or team-based learning methods. *Education and Training*, 57(6), 639-657.
- Bennis, W. G., Benne, K. D. & Chin, R. (1961). *The planning of change*. New York: Holt, Rinehart & Winston.
- Biesta, G. (2006). What's the point of lifelong learning if lifelong learning has no point? On the democratic deficit of policies for lifelong learning. *European Educational Research Journal*, 5(3-4), 169-180.
- Biesta, G. (2012). Becoming public: Public pedagogy, citizenship and the public sphere. *Social & Cultural Geography*, 13(7), 683-697.
- Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education*, 32(3), 347-364.
- Brookhart, S. M. (2013). *Grading and group work: How do I assess individual learning when students work together?* ASCD.

Brown, A. L., Bransford, J. D., Ferrara, R. A. & Campione, J. C. (1983). Learning, remembering, and understanding. In P. H. Mussen (Ed.), *Handbook of Child Psychology (4th ed.) Vol. 3*, (pp. 77-166) New York: Wiley.

Bruner, J. (1985). Vygotsky: A historical and conceptual perspective. In J. V. Wertsch (Ed.), *Culture, Communication and Cognition: Vygotskyian Perspectives*. (pp. 21-34). Cambridge: Cambridge University Press.

Bruffee, K. (1995). Sharing our toys: Cooperative learning versus collaborative learning. *Change*, January/February, 12.

Bryant, S. & Albring, S. (2006). Effective team building: Guidance for accounting educators. *Issues in Accounting Education*, 21(3), 241–265.

Burbach, M. E., Matkin, G. S., Gambrell, K. M. & Harding, H. E. (2010). The impact of preparing faculty in the effective use of student teams. *College Student Journal*, 44(3), 752-761.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, 64, 1-35.

Constant, D., Kiesler, S. & Sproull, L. (1994). What's mine is ours, or is it? A study of attitudes about information sharing. *Information Systems Research*, 5(4), 400–421.

Crookall, D., Jacobs, G., Hussein, A. & Ismail, F. M. (2001). An exploratory study of teacher-required out-of-class academic collaboration among students at a polytechnic in Singapore. *Innovations in Education and Teaching International*, 38(3), 279-291.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. New York: Harper Collins.

Dillenbourg, P. (1999). *Collaborative learning: Cognitive and computational approaches*. Amsterdam: Elsevier.

Dillenbourg, P., Baker, M., Blaye, A. & O'Malley, C. (1996). The evolution of research on collaborative learning. In E. Spada & P. Reiman (Eds.), *Learning in humans and machines: Towards an interdisciplinary learning science* (pp. 189–211). Amsterdam: Elsevier.

Dingwall, R. (1997). Accounts, interviews and observations. *Context and method in qualitative research*, 51-65.

Foth, M. (2006). Sociocultural animation. In S. Marshall, W. Taylor & X. Yu (Eds.), *Encyclopaedia of Developing Regional Communities with Information and Communication Technology* (pp. 640- 645). Hershey: Idea Group Reference (IGI Global).

Frith, C. D. (2012). The role of metacognition in human social interactions. *Philosophic Transactions of the Royal Society: Biological Sciences*, 367, 2213–2223.

Goos, M., Galbraith, P. & Renshaw, P. (2002). Socially mediated metacognition: Creating collaborative zones of proximal development in small group problem solving. *Educational Studies in Mathematics*, 49(2), 193-223.

Griffin, P. & Care, E. (2014). *Assessment and teaching of 21st century skills: Methods and approach*. Dordrecht: Springer.

Hesse, F., Care, E., Buder, J., Sassenberg, K. & Griffin, P. (2015). A framework for teachable collaborative problem solving skills. In E. Care, P. Griffin and M. Wilson (Eds.), *Assessment and teaching of 21st century skills: Research and applications* (pp. 37-56). Dordrecht: Springer.

Horder, J. (1995). Inter-professional education for primary health and community care: Present state and future needs. In K. Soothill, L. Mackay, & C. Webb, (Eds.), *Inter-professional Relations in Health Care*. London: Edward Arnold.

Hung, S. Y., Durcikova, A., Lai, H. M. & Lin, W. M. (2011). The influence of intrinsic and extrinsic motivation on individuals' knowledge sharing behavior. *International Journal of Human-Computer Studies*, 69(6), 415-427.

Järvelä, S., Volet, S. & Järvenoja, H. (2010). Research on motivation in collaborative learning: Moving beyond the cognitive–situative divide and combining individual and social processes. *Educational Psychologist*, 45(1), 15-27.

Jermann, P. & Dillenbourg, P. (2008). Group mirrors to support interaction regulation in collaborative problem solving. *Computers and Education* 51, 279–296.

Johnson, D. W. & Johnson, R. T. (2005). New developments in social interdependence theory. *Genetic, social, and General Psychology Monographs*, 131(4), 285-358.

Johnson, D. W. & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365-379.

Johnson, R. B. & Onwuegbuzie, A. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.

Kankanhalli, A., Tan, B. C. Y. & Kwok-Kee, W. (2005). Contributing knowledge to electronic knowledge repositories: an empirical investigation. *MIS Quarterly*, 29(1), 113-143.

Land, R., Meyer, J. & Smith, J. (2008), *Threshold concepts within the disciplines*. Rotterdam, Netherlands: Sense.

Laughlin, P. R. & Ellis, A. L. (1986). Demonstrability and social combination processes on mathematical intellectual tasks. *Journal of Experimental Social Psychology*, 22, 177–189.

Lindkvist, L. (2005). Knowledge communities and knowledge collectivises: A typology of knowledge work in groups. *Journal of Management Studies*, 42(6), 1189-1210.

Mattessich, P. W. & Monsey, B. R. (1992). *Collaboration: What makes it work. A review of research literature on factors influencing successful collaboration*. St. Paul, MN: Amherst.

McCulloch, A. & Loeser, C. (2016). Does research degree supervisor training work? The impact of a professional development induction workshop on supervision practice. *Higher Education Research & Development*, 35(5), 968-982.

Morgeson, F. P., Reider, M. H. & Campion, M. A. (2005). Selecting individuals in team settings: The importance of social skills, personality characteristics, and teamwork knowledge. *Personnel Psychology*, 58(3), 583-611.

Mosston, M. & Ashworth, S. (1994). *Teaching physical education (4th Edition)*. New York, NY: Macmillan.

Nicola-Richmond, K., Pépin, G., Larkin, H. & Taylor, C. (2018). Threshold concepts in higher education: a synthesis of the literature relating to measurement of threshold crossing. *Higher Education Research & Development*, 37(1), 101-114.

Owen, D. (2015). Collaborative decision making. *Decision Analysis*, 12(1), 29-45.

Raelin, J. (2006). Does action learning promote collaborative leadership? *Academy of Management Learning and Education*, 5(2), 152-168.

Robles, M. M. (2012). Executive perceptions of the top 10 soft skills needed in today's workplace. *Business Communication Quarterly*, 75(4), 453- 465.

Rosen, C. (2018). Task versus process: A taxonomy for group projects. In J. Carter, M. O'Grady, and C. Rosen (Eds.), *Higher Education Computer Science* (pp. 187-202). New York: Springer.

Rowe, N. (2019). The great neoliberal hijack of collaboration: A critical history of group-based learning in tertiary education. *Higher Education Research and Development*.

Rowe, N. & Martin, R. (2014). Dancing onto the Page: Traversing Threshold Concepts Between Careers in Performing Arts and Academia. *Waikato Journal of Education*, 19(2), 25-36.

Rowe, N., Martin, R. & Giacaman, N. (in press). Contrasting coding and choreography: Collaborative and counter collaborative pedagogies. *Studies in Higher Education*.

Ryan, R. M. & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54-67.

Perkins, D. (2008). Beyond understanding. In R. Land, J. H. F. Meyer, & J. Smith (Eds.), *Threshold concepts within the disciplines* (pp. 1-19). Rotterdam: Sense.

Schupp, K. (2015). Teaching collaborative skills through dance: Isolating the parts to strengthen the whole. *Journal of Dance Education*, 15(4), 152-158.

Slavin, R. E. (1995). *Cooperative learning: Theory research and practice* (2nd ed.). Boston, MA: Allyn and Bacon.

Stringer, E. T. (2008). *Action research in education*. Upper Saddle River, NJ: Pearson Prentice Hall.

Thapalia, C. F. (1996). Animation and leadership. In J. Servaes, T. L. Jaconson, & S. A. White (Eds.), *Participatory Communication for Social Change* (pp. 150-161). New Delhi: Sage.

Vlaanderen, K., Jansen, S., Brinkkemper, S., & Jaspers, E. (2011). The agile requirements refinery: Applying SCRUM principles to software product management. *Information and software technology*, 53(1), 58-70.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wasko, M., & Faraj, S. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly*, 29(1), 34-56.

Wysocki, R. (2002). *Building effective project teams*. New York, NY: John Wiley & Sons.

