

THE ROLE OF SIMULATION IN PEDAGOGIES OF HIGHER EDUCATION FOR THE HEALTH PROFESSIONS: THROUGH A PRACTICE-BASED LENS

- Donna Rooney - *Faculty of Arts and Social Science, University of Technology Sydney, Australia*
- Nick Hopwood - *Faculty of Arts and Social Science, University of Technology Sydney, Australia*
- David Boud - *Centre for Research in Assessment and Digital Learning, Deakin University; Faculty of Arts and Social Sciences, University of Technology Sydney; and Institute for Work-Based Learning, Middlesex University.*
- Michelle Kelly - *Faculty of Health, University of Technology Sydney, Australia*

Abstract: The preparation of future professionals for practice is a key focus of higher education institutions. Among a range of approaches is the use of simulation pedagogies. While simulation is often justified as a direct bridge between higher education and professional practice, this paper questions this easy assumption. It develops a conceptually driven argument to cast new light on simulation and its unarticulated potential in professional formation. The argument unfolds in, and is illustrated via, three accounts of a simulation event in an Australian undergraduate nursing program. This begins with a familiar approach, moves to one that problematizes this through a focus on disruption, culminating in a third that draws on socio-material theorisations. Here, simulation is conceived as emergent, challenging stable notions of fidelity, common in simulation literature. New possibilities of simulation in the production of agile practitioners and learners in practice are surfaced. This paper extends and enriches thinking by providing distinctive new ways of understanding simulation and the relationship it affords between education and professional practice, and by illuminating the untapped potential of simulation for producing agile practitioners.

Keywords: Simulation; professional practice; higher education; practice theory, agile practitioners, agile learners

Introduction

Higher education has a key role in the long process of professional formation through preparing beginning practitioners and in contributing to their further development. This often starts with campus-based lectures and tutorials in which students are introduced to the 'expert or knowledge communities' of their professions (Nerland and Jensen 2012), with a focus on codified knowledges that underpin profession practice (Billett 2009; Kemmis et al 2014). In addition, other approaches are deployed to help students make connections between codified knowledge and nascent professional work. These often include placements, sandwich courses, internships, service learning, training wards and simulation (Cooper et al 2010).

However, Gijselaers et al (2014, following Kanes 2010), propose that 'higher education barely questions the assumptions on which preparation for practice is based' (pp.10). It is not a stable and knowable future where graduates will practice – as assumed by much of the curriculum. Rather, graduates should not only be knowledgeable and skilful in relevant domains, but also adaptive and responsive to the changing nature and demands of work (Billett, 2009; Harteis et al 2012). Such sentiment is echoed by others, including Kemmis (2005) who calls for practitioners that 'do not rely on the application of general principles alone' (p. 406). A common theme arising in this literature is the need to generate some flexibility, or what we term *agility*: agile practitioners who can appreciate professional practice and react (in sometimes unanticipated ways) as it unfolds – and, agile learners open to, and able to seek out, opportunities to learn (and relearn) as well as make judgements about their learning.

This paper frames the higher education-professional practice relationship in terms of the production of agile practitioners and thus agile learners. While the argument is couched in a broader context, nursing education is used as the vehicle through which it is conducted, specifically through the use of simulation in a final semester undergraduate course unit. Our argument is illustrated via multiple readings of a particular episode, in the spirit of Lather's (1992) 'multiple tales'. We address the lack of theoretical richness in approaches to understanding simulation pedagogies in university settings, demonstrating how practice-based approaches, emphasising emergence, provide a foundation for alternative readings that both enrich and disrupt conventional framings.

Drivers for the growth of simulation in higher education

While simulation is firmly established in higher education (in some fields more than others), various issues have a particular and current bearing upon its use. Pressures on universities to produce work-ready graduates have fuelled a significant expansion in the use of simulation across many disciplines, including nursing (Kelly et al. 2014). Concerns regarding patient safety have compounded this growth (Dieckman and Krage 2013). The logic is simple yet powerful: students can practice skills while circumventing the possibility of human injury or distress. Mistakes can be made with little or no consequence, or recast as learning opportunities (Kneebone et al 2004).

Challenges faced by universities in securing undergraduate placements for growing student numbers (Arthur, Kable and Levett-Jones 2011) also contribute to simulation's increased use. Relatedly, some regard simulation as offering students guaranteed exposure to important problems, in lieu of the clinical placement. Questions are asked about how much simulation can replace clinical placements (Kardong-Edgren et al 2012). As such, simulation is in some cases being seen as *standing in* for learning that would otherwise occur in 'real' settings.

Features of simulation in higher education

Simulation learning is widely regarded as a learner-centred, experiential approach that integrates multiple facets of learning (such as cognitive, affective and psychomotor), through some kind of (more or less) authentic reproduction of environments and practices (Breckwoldt et al 2014). It may take a range of forms, as reflected in health disciplines, the focus of our empirical work. Some are 'low-tech', as when, for example, students practice suturing on chicken fillets. Others might be 'no-tech', as when students act out interactions between a practitioner and a patient with no special props at all. However, others make use of developing technologies, including digital simulations of anatomy, or 'high-fidelity' manikins with a detectable pulse, blood pressure, voice and so on: the later coming with considerable cost (Isaranuwatchai et al 2014). Curricular integration of simulation is particularly associated with the use of these high-fidelity manikins (Shearer, 2012), although in some cases professional patients make 'real' bodies available (Kneebone et al 2004).

These forms of simulation reflect a range of pedagogic intent. Some focus on developing individual learning and performance of particular procedural skills, such as suturing or giving injections (Hatala et al 2014). Others are oriented towards generic skills such as communication, or aim to provide an immersive and holistic experience encompassing both specific and generic skills (Kelly et al 2014).

The evidence base relating to the effectiveness of simulation is stronger in relation to some aspects than others. There has been a focus on demonstrating simulation impact on safer or better practices in clinical (or other professional) settings. There is a need to step back and question the assumptions upon which the promise of simulation rests, and open up the conceptual basis for understanding what else simulation might offer. We do so by applying a practice-based lens to empirical material, arguing that research on simulation has overlooked its capacity to produce agile practitioners and agile learners. This contrasts with the received notion that we should look to simulation to produce practitioners capable of undertaking pre-specified tasks and roles.

In the paper, we unravel the conceptual bases for research in simulation-based pedagogy, beginning with an account of existing simulation literature, focusing on pre-registration health fields to which our empirical sources are related. After locating our analysis theoretically, we give brief details of our empirical context. Next we offer multiple readings of a simulation, starting with one that connects closely with conventional references to 'fidelity'. We disrupt this with two further readings in order to reveal the valuable, but not adequately articulated or conceptualised, potential of simulation.

Conceiving simulation in higher education: what existing research reveals

There are clear threads and lacunae in the way contemporary simulation pedagogies are conceived. In this section we illustrate (i) the idea of fidelity, (ii) linking simulation to outcomes in practice, and (iii) pedagogic underpinnings. We show that while there is a significant and reasonably mature body of existing work, this builds on a limited theoretical basis.

Fidelity

A clear theme in this literature relates to the importance of fidelity; the concern that simulation is 'realistic'. It is foundational for assumptions that simulation can stand in for, or reproduce, real situations. While some earlier literature indicated higher fidelity was associated with higher reported student satisfaction and better learning outcomes, this view has become more nuanced. In some circumstances lower fidelity simulations are acknowledged as being more effective (Hatala et al 2014).

Nevertheless, fidelity remains a dominant theme. Studies have explored different dimensions of fidelity including; material or technical (how real is the manikin or the equipment used?); environmental

(is the broader setting realistic?); situational (is the scenario plausible?); and, emotional (is the affective experience equivalent?) (see Fritz et al 2008). Fidelity discourses have strongly shaped approaches to understanding and developing simulation pedagogies. While we account for it somewhat differently here, our first reading embraces this notion. However, we also take up Norman's (2014) argument that if simulation education is to 'come of age', fidelity must be abandoned as a key framing concept. While Norman is unclear what this might be replaced with, our second and third readings offer some suggestions.

Outcomes and protocols

While the notion of fidelity focuses on matching simulation with something 'real', other approaches are more concerned with tracing the impact of simulation. These seek to evidence learning outcomes and/or effects on performances (see Arthur, Levett-Jones and Kable 2013) – particularly if simulation realises promises of producing safer practices (Gaba 2007). Here simulation is conceived as a means to produce particular kinds of practitioners, or to secure particular qualities in future practices. These approaches are premised on pre-specified assumptions about what future work requires.

Such research has informed protocol-led curricular design and teaching practice in simulation: Dieckman et al's (2012) description of 'success factors' in simulation-based learning in health professions, and Arthur et al's (2013) 'quality indicators' for design and implementation of simulation. The emergence of widely used routines involving briefing, simulation and debriefing (Dieckman et al 2012), has been shaped by this research agenda. We suggest that the outcomes driving this work can be somewhat narrow, and there remain other pathways that link simulation and future practice that have not been fully elucidated.

Pedagogical concepts

Among the studies that make explicit reference to pedagogic concepts, the most visible ideas include experiential learning, drawing on Kolb and Dewey (see Shinnick, Woo and Mentes 2011); Vygotskian scaffolding (e.g. Kneebone et al 2004); situated cognition, (e,g. Paige and Daley 2009); and, various hybrids of these (eg. Pela and Poikela 2012).

Numerous researchers question the adequacy of the conceptual basis for simulation pedagogy. Berragan (2011) argues for the need to match evaluative and protocol-driven approaches with theoretical

groundwork, a view echoed by Dieckman et al (2012). Schiavenato (2009) laments the lack of a 'theoretical imperative', leading to a lack of direction or empirical expectation, including in relation to the fundamental questions of why we use simulation in healthcare education, and what it would mean for this to be done well. Finally, Poikela and Teräs (2015) point to the complex and multi-layered phenomenon of simulation and call for further conceptual analysis (p.1028). This paper contributes to an emerging body of work that addresses these important gaps.

A different conceptual foundation

Practice theories challenge the assumptions underpinning many features of conventional educational research (Hager et al 2012). In referring to a 'practice-based lens' we are signalling a distinctive theoretical stance, joining a growing body of work that disrupts conventional accounts of practice, learning and education (eg. Gherardi 2009; Green 2009; Hager et al 2012; Kemmis et al 2014). Elsewhere, we have located our position within this now diverse conceptual terrain (Boud and Rooney 2015), arguing that the value of these perspectives is far from being fully realised when it comes to higher education, including in questions concerning links between the university and professional work. Here we outline key features that set practice-based approaches apart from others, and which inform the readings below. Following Kemmis et al (2014) we view practices as comprising *doings* (socially established and recognised actions), *sayings* (utterances within characteristic discourses), and *relatings* (person-person, person-object). Practices are regarded as teleological, shaped by and moving towards particular intentions or projects. These foundational ideas place the unit of analysis on practices, uprooting the individual human subject as the centrepiece of analysis, instead focusing on actions and relationships, not only between people but also between people and the material world. Such an approach enables us to attend concretely to what unfolds in simulation learning, charting links between what happens in the classroom and in 'real' practice in distinctive and helpful ways.

This distinction and value lies in the notion of emergence, a hallmark of many practice theoretical approaches (Hager 2011). Emergence is a conceptual tool that positions practice-based approaches outside of the binary of structure/agency. It embraces the idea that stability and change can co-occur, as practices do not unfold in isolation, but in dynamic webs of practices, in which preservation of particular doings and sayings may, for example, require new forms of relationships (Schatzki 2013). Emergence holds that doings, sayings and relatings are shaped by practice histories, by social norms, and

by the intentions to which they are oriented. However, these never 'sew up' or determine what happens: there is always scope for change, for difference. We will show how this is a useful idea in picking up the pedagogic significance of what unfolds in simulation learning rather than what is planned and delivered. Learning may display complex (non-linear, unpredictable) qualities, with different outcomes emerging from similar starting conditions.

Furthermore emergence helps us to identify previously overlooked ways in which simulation pedagogy can play a crucial role in professional formation. We cannot fully specify in advance the knowledge required to perform (do, say, relate) as a participant in particular practices (Hager 2011). Therefore we need to think differently about what it means to 'prepare' students for future practices, and the forms of expertise that make them 'ready' for the patterned yet unpredictable, routine yet also changing practices of work.

Adopting such a stance has implications for underpinning concepts of knowledge and learning, again linking to the intervention that practice-based approaches are seeking to make in disrupting dualisms such as knowing/doing, and mind/body. Gherardi (2009) stresses the idea of knowing as something that is *done*, socially and materially, rather than residing in the head. Gherardi and Perrota (2014) use the term 'formativeness' to name knowledge generated in and through practice. Kemmis, draws on the Neo-Artistolean idea of *phronesis* to suggest that practitioners 'search for knowledge in and through practice to correct and amend practice in the light of changing circumstances and new perspectives' (2005, p. 421). In a similar vein, Hager (2011) writes about 'practical reasoning', and Harteis et al (2012) of 'intuition', thus joining a body of work that draws attention to the active knowledge work done in the performance of practice itself. These ideas speak to how experienced practitioners 'think on their feet' in the messy unpredictable world of work, as well as to how knowledge is not just 'put to use' but is relearned with each instance of practice.

Practice-based approaches are showing significant promise in their early application to questions of professional learning, practice and education (see Kemmis et al 2014). These shine new light on fundamental questions and assumptions about the relationship between education and training and work practice. Some are using such practice-based lenses to rethink simulation. For instance, Hopwood et al. (2014) show how practice-based approaches can radically change answers to simple questions such as 'what is being simulated?'. Their account sheds new light on simulation through notions of multiple bodies and performances: resisting stable location as either 'learning' or 'practice'. In a similar vein

Nystrom et al (2014) disrupt the conventional focus on the 'action' around the (simulated) patient, mapping different knowledges across different locations of simulation, including students who observe (an overlooked feature of simulation).

Empirical reference, methods and approach

The conceptually driven argument of this paper has developed through engagement with data derived from a research project asking "How can we conceive simulation pedagogy differently through a practice-based lens?", and "What does this mean for our understanding of professional formation and the particular role of simulation in this process?" Here we briefly outline our empirical reference and methods as well as our analysis processes.

We[1] observed ten simulation events as part of an elective, final semester critical care subject within a 3-year Australian Bachelor of Nursing degree. By simulation event, we mean the common sequence of briefing, simulation and debriefing. Each class comprised either two or three simulation events, with different students participating in one of around five 'acting' roles; the remaining students in each class observed their peers via a live video feed and then joined in the general debrief discussion. All the scenarios involved use of a moulaged manikin (as described above) to simulate a deteriorating trauma patient. It was placed on a hospital bed surrounded by monitors and other equipment expected in a critical care setting. Roles for students included a triage nurse, team leader, two registered nurses, patient (performed remotely via microphone), and patient relatives. The tutor generally played a medical doctor.

The stated objectives included learning how to care for a trauma patient; assessing, recognising and responding to the changing patient condition; and using communication strategies. In one of the scenarios the manikin is given the name of Mr Lars, who is admitted to hospital after a motorbike collision. His initial condition is described in the scenario summary as: 'Burn injuries to R side of body, sternal bruising and facial lacerations / injuries to L side of body'.

The simulation lab observed consists of a classroom made up of different spaces. Half the room appears as a 'normal' classroom with a lectern, student desks, chairs, and a screen. A partition creates another space where there is a hospital bed, and an array of hospital equipment (eg. monitors, trolleys etc.). A third space is the control room where a technician remotely controls the manikin as well as the relaying of video of bedside action to the students observing in the non-acting section of the classroom. A

small fourth space is also created by the partition, and it here that acting students 'gown up' and are further briefed before taking part in the simulation.

In each of the observed simulation events 3-4 researchers were positioned in the different spaces of the room. This enabled each to focus their observation on different activities within the class: eg. at bed-side, control room, and observing students' actions. At times, a fourth was positioned in a transitionary space. All researchers observed the debrief segment of simulations. Researchers took un-structured notes as well as made audio recordings of the 'talk' occurring in the space. In addition to observations and audio recordings the simulation classes were filmed. While it is standard in these classes to film bedside action (to be used for a live video fed to non-acting students), the observing students were also filmed.

Ethnographic methods (among others) are deemed well suited to empirical study of practices (Schatzki 2012, p. 25). Overall, our methods accrued in 493 minutes of video, and 598 minutes of audio recordings. After each researcher 'wrote up' their handwritten fieldnotes, 85 pages of text were produced. Finally, approximately 24 pages of drawings and other non-text fieldnotes were produced and digitised.

Analysis begun by each research independently reviewing all data (video, audio, fieldnotes) and identifying moments that were pedagogically interesting and documenting why they judged them to be so. These provided a basis for what Boeje (2002) describes as an axial work, enabling the team to formulate criteria for comparison, sharpening our collective understanding of simulation pedagogy and why particular moments were of interest. The diverse backgrounds of the team (in experiential learning, workplace learning, higher education, professional practice) generated a productive pluralism (Frost et al 2010) in the process, enriching the interrogation of the data. This multiplicity of interest and interpretation was gradually refined into the multiple readings presented below, as varied theoretical tools were applied, and their application sharpened through consensual but not reductive readings. This process followed what Jackson and Mazzei (2013) describe as (i) putting theoretical and philosophical concepts to work; (ii) working to expand what analytical questions are made possible through different concepts being plugged into data; (iii) re-working the same data chunks not only to create new meaning, but to reveal their suppleness. The presentation of multiple readings below, following Lather, is an appropriate reflection of this process.

Lather developed a 'structuring tactic' to explore "student resistance to liberatory curriculum in an introductory women's study class" (Lather, 1992, p. 94). This involved multiple readings of datum in

what she called *realist*, *critical*, *deconstructive*, and *self-reflexive tales* (Lather, 1991). Her point was not find/tell 'the' truth, but to use the data performatively to illustrate contradictory representations that, in turn, question received truths (p.95). Like Lather, we also want to question received truths: but in our case those of simulation presented and understood as a mirroring of the 'real'. While we share Lather's post-positivist stance, our theoretical lenses are informed by socio-material sensibilities, and practice theory. The readings below are performative in that they work together to offer an alternate conceptualization of simulation (and its promise); in doing so begin to address Norman's (2014) and others calls for such.

Three readings of a simulation event

The three readings presented below offer qualitatively different rather than competing views. One does not replace the other, but rather draws out different features. They arrive, in the third, at a view that represents the most significant shift away from accounts found in existing literature. The readings share the same empirical reference point, and a consistent theoretical basis, grounded in practice theory. Thus in each reading we focus on actions and interactions between people and the material world, and highlight emergent features of what was observed. We show how this approach can be used to cast new light on the established notion of fidelity, while also providing a point of departure for distinctive understandings.

Reading 1: Treating Mr Lars

In this reading, we take up the notion of fidelity, exploring how the simulation reproduces realistic features of clinical practice. Informing this is a practice theoretical sensibility, focusing on doings, sayings and their relationship with materiality. While this by no means constitutes a clean break from existing literature (where it is not technology itself, but what is done around it that is discussed), this lays foundations upon which subsequent readings are based. We wish to cue readers to the sense that fidelity is not accomplished in the technology, nor in the pedagogic design, but is an emergent phenomenon that must be constantly worked at, socially and materially, in order to be produced and maintained.

Our intent is to capture multiple dimensions of fidelity: the wider material set-up (hospital bed, monitors, trolleys etc); the realistic features of manikin technology; and, the plausible scenario of a road traffic accident. Students play the roles assigned to them, and the situation unfolds as if Mr Lars' condition really matters …

Mr Peter Lars lays alone and motionless in the hospital bed when a doctor, three nurses, and his wife and daughter appear at his bedside. The doctor introduces herself to Mr Lars and then explains to the family that they will 'just be doing a little assessment'. A nurse escorts the wife and daughter to a nearby waiting area while the remaining nurses and doctor continue assessing. A few minutes later some ectopic (abnormal) heartbeats are noticed. Within minutes the patient's condition worsens considerably. An adverse reaction to antibiotics sets off activity for the attending nurses and doctor – resulting in the stabilization of the patient's condition.

The following day [another simulation event in the same class] another team sees Mr Lars, who is experiencing chest pain. A doctor arrives and after introducing herself to the patient, discusses with a nurse what is known about Mr Lars' allergies. Soon Mr Lars complains to the doctor about chest tightness. The doctor decides to administer morphine, which a nurse then does through intravenous injection. After a few more minutes the monitor indicates that Mr Lars' heart has stopped beating. The doctor calls loudly. *"Mr Lars! Mr Lars! Can someone start chest compressions?"* One nurse who was checking the drip, climbs on to the bed and begins compressions: *"One. Two. Three…"* she 'counts off' as she does so. Another nurse quickly attends to the doctor's request for a defribillator. A third, leaning in to re-arrange Mr Lars' clothing, stands back from the bed just before the doctor calls *'All Clear!'* as the defibrillator is discharged. She then heads to the medication trolley before the doctor calls for adrenaline. After two minutes of chest compressions and one defibrillation, a weak pulse is picked up, preventing a second defibrillator discharge. He is intubated on the doctor's instruction and his airway declared secure. Mr Lars' wife and daughter return to his bedside, a nurse tells the distressed relatives that he has a little bit of a 'turn', but the doctor will come see them once he is stabilized.

This first reading is as yet incomplete. It is not *all* that occurred: in both events a briefing preceded the bedside action, and a debriefing followed it. In addition, both simulation classes had remaining class members in another part of the room watching a screen that relayed the bedside action. In the briefing the tutor points out anatomically correct features of the manikin, and highlights various equipment that 'might' be necessary.

In the debriefing, questions were directed first to 'nurses', then to 'relatives', and then to the observing students. Questions included how the students felt (addressing the emotional and situational dimensions of fidelity):

> Yeah, it's very hard to catch up on the things going on because just yes, I was focusing on giving morphine and then other things, like condition changed very rapidly, so yeah it's just - it's very hard.

Participants also considered how things might have been done differently, maintaining reference to the simulation as if it were real, for example by referring to clinical roles not student names:

> I think I should have consulted my team leader first like, what should I do.
> I was thinking if you're looking after a patient you still have to do A, B, C, D, E [a protocol for clinical assessment of a patient] all the time because it's going to tell you something.

The tutor provided feedback, continuing the talk that produced (now in retrospect) the simulated action as realistic: "Yes, ABCDE is a very good tool". Some comments from observing students reinforced different dimensions of fidelity, as when they noted that they felt the relatives were well cared for, or that at times Mr Lars may have felt ignored.

In this reading, we see the familiar features of simulation (Gaba 2007; Poikela and Poikela 2012) including briefing, scenario and debriefing. It appears that students suspended disbelief with their actions towards each other and the equipment, producing a realistic instance of trauma and a deteriorating patient that in turn required particular responses from them. Various forms of knowledge (ABCDE), clinical skills (chest compressions), and communication skills were evident in the performance, aligning with the stated learning objectives, and mirroring the kinds of applications and performances that are specified as crucial in the provision of safe, high-quality care.

Reading 2: A focus on disruption

We now present a second reading of the same events. However, this time highlighting disruptions to the smooth production and maintenance of the faithful (re)production of clinical practices. The reading above omits actions and their relationships with the materiality of the simulation where they disrupted the production and maintenance of fidelity: the impression of it being real. Our point is not that simulations overall, nor particular moments in them, are either faithful or not. Rather than a binary, this next reading is suggestive of a more fluid, multiple understanding, taking the idea of emergence further.

Here we begin with a student, designated a nursing role, as she approaches the bedside, turns to face the camera that relays a live feed to the observing students, then smiles and waves. This serves as a

first reminder that her performance 'as a nurse' is also a performance 'as a student', in front of her peers. Central to the pedagogy here is the fact that this is, indeed, *not* a real hospital, but a university classroom.

As the scenario unfolded, other disruptions emerged, complicating (rather than destroying) the fidelity of the action. Students, as nurses, touched the manikin in ways that were folded into the performance of therapeutic touch (such as holding a hand, providing reassurance and comforting). However, at other times, their touch appeared more driven by curiosity – squeezing a limb to see how soft or hard it is. Here they are not touching Mr Lars as part of a practice of care, they are touching a machine. This echoes accounts of how actions around a manikin may produce it as a technical, clinical or human body (Hopwood et al. 2014; Nystrom et al 2014).

Mr Lars' arm is moulaged in a manner to suggest severe burns, yet the nurse giving chest compressions knelt on it. Simultaneously we see a nurse performing CPR contributing to the emergence of a high-fidelity scenario, and a student leaning on a piece of plastic that could not feel pain. In a 'real' case, kneeling on a burned arm would be a problem. Here it was not. Indeed, this disruption from realism was part of what helped keep the simulation going (to have drawn attention to it may have broken the flow of actions, and drawn yet more attention to the 'fake' body being treated).

In all the events we observed, we also noticed moments of laughter, often in response to the groans made by students playing the voice of the patient, or in relation to amusing comments pointing to friction between Mr Lars and his wife. Students stepped in and out of the simulated drama frequently, sometimes fleetingly, sometimes less so. In one sense, these can be read as disruptions to a singular and continuous production of a high-fidelity simulation. However from a practice theoretical viewpoint, we understand these as part of how simulation will always unfold. Fidelity is never completely stable, but is constantly worked on and produced through the actions and interactions of multiple bodies and objects. Through the lens of emergence, such disruptions are not breakdowns. Indeed, just as stability and change can co-exist, so can performances that maintain and disrupt the enactment of simulation 'as if real'.

We can take this reading further, reflecting on how 'real' practices emerge. While there may not be cameras and fellow students around, nonetheless in the clinical setting, there are actions and interactions between bodies and objects that produce multiple layers of meaning. Practices of caring for a patient are often peppered with informal talk, forms of humour as a way to cope with emotionally challenging work, moments of respite from intensity, and so on. In this sense it is through attending to disruptions that we can understand fidelity differently. We conceive fidelity as fragile and resilient at the

same time: easily disrupted, yet able to go on nonetheless. We can see how disruption is thus in some ways a dimension of fidelity rather than a threat to it: 'real' practices emerge in complex, multiple and fractured ways, too.

Before turning to the third reading, we wish to draw attention to the students observing the bedside action. During the simulation some observers behaved in ways that suggested their experience was not one of watching the revival of a near-death patient. Their bodies were still, not showing synchrony with the events being relayed, others engaged in different actions (eg. tying hair), suggestive of a detachment from the action *as real*. Despite their (non-) actions it seems these students *were* paying attention. While some bodies were more indicative of observing classroom performance rather than a 'real' clinical one, they participated in, and contributed to, the debrief: some commenting that they felt a sense of urgency when they noticed ectopic beats. Thus further highlighting how the pedagogy of simulation emerges through complex performances of disruptions to fidelity.

Overall, this reading troubles some assumptions implicit in a fidelity-based discourse. Fidelity, however multi-dimensional in its conception, asks questions about the degree to which features of a simulation match features of 'real' practice. By looking at the way disruptions and fidelity emerge together, in fluid ways through multiple interactions, we are reminded of Solomon's (2007) argument that simulation can be usefully understood not as a more or less complete replica or (re)enactment of another reality, but as its own kind of reality: just as 'real' as anything else. Our third reading takes up this idea.

Reading 3: Emergent practices

In this third reading we foreground further insights afforded through a practice theoretical lens. Recalling Norman's (2014) assertion of the need for alternatives to discourses of fidelity, we suggest practice theory provides one such possibility. As we show in the first reading, this need not be in competition with ideas of fidelity, but sheds new light on them. This final reading stands in for our 'discussion', as it is through this that we develop and present the case for the argument that simulation can serve crucial pedagogic functions in developing agile practitioners and agile learners in practice.

Practice theory leads us to ask: what shapes the emergence of particular actions and interactions, as we have seen them above? Schatzki (2013) holds that practices are governed by understandings (of a practical and general nature), rules, and teleoaffective structures (intentions, purposes). Tracing these helps us to see the kind of knowledge work occurring in simulation. Students are enacting practical

understandings of a range of kinds, including bodily repertoires (as in how to perform chest compressions), how to offer therapeutic touch, feel for a pulse, and so on. Codified knowledge is put to work in the performance of assessments that follow the ABCDE protocol, for example. These are enacted together, too, as when students notice features (like ectopic heart beats on the monitor), attribute meaning to them, and take action as a result.

We see explicit rules as when the tutor explains the ethical aspects of observation and debriefing: nothing leaves the room. Rules are also enacted implicitly as when students tolerate each other's momentary role 'lapses', and the silent policing out of direct personal criticism during debrief. Multiple purposes are reflected in the doings and sayings through each event. In the 'faithful' moments in the simulation, actions are structured by imperatives to provide safe, high quality care (save Mr Lars' life, support his relatives). In the debrief, both actors and observers work together through questions and comments to produce a shared purpose around learning that will benefit future practice. These structuring forces are not static givens, but are both carried forward (from outside and the past), and emergent in the here and now.

What we are beginning to see is a co-presence of practices shaped by different forces: some shaped by the clinical world, and others by what it means to be a student in a university classroom. Taking our cue from this, we see how in each event, specific actions 'hang together' in distinctive forms, such as acting in a simulation, observing peers, contributing to a debrief. These forms also 'hang together' over a whole class, indeed a whole semester. Students in these events are thus navigating a complex array of practices, and responding to rapid shifts in expectations of conduct, the forms of knowledge required, and ways of interacting with other people and equipment. This reveals a remarkable agility on the part of participants in simulation that is not easy to trace in existing literature, where the focus has tended to be on specific skilled performance requirements, encountered in linear sequence, and the support or scaffolding students need to accomplish them.

Here we see how simulation offers significant, and potentially unique, features as 'just as real as anything else' (Solomon 2007 p.125), rather than as a replication of one reality in another setting. Situations that require, foster and support this kind of agility present challenges to students, and may help them develop in ways that are highly valuable in professional practice. We speculate that the agile negotiation of multiplicity in simulation may prepare students for similar negotiations in their work.

Central to scenario-based simulations of the kind we observed is the idea that students do not know exactly what will happen (although the broad progression of events is often anticipated). Indeed as we observed the 'same' scenario being played out multiple times (as do many students), we witnessed the different ways in which the action unfolds. This non-linear quality demands further agility on behalf of students, as they learn and are required to *respond,* as well as to apply what they know, and to anticipate.

In addition to producing agile practitioners, simulations such as these may also be valuable in producing agile learners. The agile practitioner is someone who can navigate and 'go on' in multiple, shifting actions and interactions in emergent contexts. The agile learner in practice is able to exploit these emergent, non-linear qualities as resources for their learning. We saw two key ways in which this was being fostered.

First, some students were asked to take on roles in the scenario that went well beyond what they might have performed in prior clinical placements, and beyond what their university education has prepared them for. This is particularly the case for the student 'playing' team leader. Here, the logic of preparation prior to practice is inverted. What is demanded of the student is not a perfect performance in applying previously acquired knowledge and skills. Instead the role demands the student be ready to, and learn how to, step into unfamiliar territory. The discussion in all ten observed debriefs highlighted how the world of practice makes precisely this kind of demand on graduates: performing tasks unsupervised, or taking new care responsibilities.

Simulation makes this kind of acting and learning possible precisely because it is constituted in a complex and emergent hanging together of the worlds of education and practice. By letting go of some fidelity in terms of matching roles with experience, and by inverting the logic of preparation, the simulation can produce something of significant value, helping to develop graduates who can not only perform pre-specified skills and apply codified knowledge, but who can adapt to changing circumstances, and use their agility to learn in the moment. We suggest this agility may be a key form of what others have called *phronesis* (Kemmis 2005), 'practical reasoning' (Hager 2011), and 'formativeness' (Gherardi and Perrota 2014).

The second means through which we suggest students are learning to become agile learners in practice is through observation. We mentioned above how the simulation performance involved students noticing certain things, interpreting, and acting on them. We also mentioned, in the second reading, how some observing students attended to the materiality and embodied actions unfolding in front of them.

While the learning of observing students is documented as important, particularly with regard to their being folded into debrief discussions, there is a general sense that the observational role is somewhat secondary to the action around the bedside. We extend nascent discussion that expands our understanding of such observation, the learning and pedagogies surrounding it (Nystrom et al 2014; Hopwood et al. 2014).

Observing students are in a special position in that they can (potentially) learn to attune and pay attention to practice in ways that are not possible when fully involved in the action. In debrief discussions, some students commented on issues relating to arrangements and movements of bodies, timing, missed steps in clinical assessment, overlooked signs that could have helped anticipate care needs, and so on. The tutor often made explicit the value of learning to notice in this way for when students *were* on clinical placements. We take this further, and suggest that such attunement (noticing and attributing meaning) remains valuable in practice. When students graduate, they will frequently find themselves on the edge of action. An agile learner in practice will be able to harness these moments as sites of pedagogy, rather than being confounded by not knowing what to do, or how to fill time while waiting to act. The cycle of briefing, (observed) simulation and debriefing is a widespread hallmark of scenario-based simulation. The potential to develop agile learners in practices lies securely within this existing set-up, but is not yet fully harnessed.

Conclusion

Our arguments here are not about abandoning existing conceptual framings (eg. around fidelity or outcomes in practice), nor about suggesting need for a major overhaul in pedagogic practices around simulation. On the contrary, they enrich and complement prior work, while providing distinctive new ways of understanding simulation and relationships between higher education and professional practice. They reinforce the value of simulation and the importance of briefing, noticing and debriefing with all participants no matter whether player or observer. They draw attention to recognising what is emergent and utilising what is not preplanned.

In the first reading we took up the familiar motif of fidelity, recasting it through a practice theoretical lens to highlight the multiple actions and interactions involved in accomplishing realism in simulation. Through this lens we find that fidelity is an emergent phenomenon, displaying qualities of fragility and resilience simultaneously. Conceived thus, fidelity is not fixed in technology, nor in

pedagogic design. Indeed not fixed at all—rather it is shaped by materialities and the forces that shape what people say and do in the world of practice, and in the university classroom. Fidelity is a quality achieved in the practice of simulation. This implies that fidelity needs to be judged primarily in relation to the desired learning outcomes of any act of simulation - not with respect to technical feature of the kit used.

In the second reading we focused on ways in which fidelity is disrupted as a simulation unfolds. Here we argued that instances where the 'as if' reality is questioned or challenged do not necessarily compete with the idea of fidelity. Instead we suggested that a previously overlooked notion might be that of 'disruptive fidelity': a feature of simulations in which the multiplicity and fracturing of the 'real' are brought in. Simulation offers a powerful means to do this through constant interplay between education and practice, the university and work. It is through self-consciousness of the real that it can be constructed. This suggests that apparent transgressions of fidelity are not to be ignored or eliminated, but worked through to explore how they can be utilised in the formation of the particular learners involved.

In the third reading we took this point further and argued that navigating this interplay demands an agility of participants that will be crucial after graduation. We suggest that simulation is not only useful in producing graduates who can perform specific tasks and apply codified knowledge appropriately, but it also has potential in developing graduates who can navigate the unexpected, and unknowable features of practice. Coping with breakdowns in authenticity can build the robustness needed to learn from work tasks.

This leads to our final argument, again developed through the third reading. Simulation offers opportunities to help develop graduates who will be agile learners in practice. By this we mean it can help prepare students for a world of work which is not only itself changing, but in which they will be confronted with demands to take on unfamiliar roles and responsibilities. This is preparation for practice, albeit not linear, nor able to be codified in advance. It can only take place readily in an intermediate space such as simulation: the classroom may be too controlled and unrealistic; clinical placements too uncertain and too risky. To do this sophisticated facilitators, as agile and responsive to emergent situations as it is hoped their students will become, need to be developed.

Through these arguments we have charted a number of pathways between the university and professional practice, with a specific focus on scenario-based simulations in representative clinical settings. This is offered in a spirit of expansion and complementarity rather than in competition with or

replacement of existing ideas. While our approach is drawn from a limited sample in a particular area of nursing education, our conclusions offer sets of possibilities for further development. Induction into stable ways of knowing in professions, instruction in performance of particular psychomotor skills, and varied forms of crossover between the classroom and the workplace will remain crucial. We have shown how a practice approach can offer new insights, not only enriching how we understand fidelity in simulation, but also in elucidating features of simulation-based pedagogy that are hard to discern in existing literature, and which may nonetheless be useful in informing development of simulation pedagogy in the future.

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[To be inserted once anonymity no longer needed]

Compliance with ethical standards

Ethical clearance for the project, which enabled data for his paper to be collected, was gained through the university's Human Research Ethics Committee. All participants provided their informed consent. The project was made possible through funding from the Faculty of Arts and Social Sciences' Research Development Grant scheme.

Endnotes

[1] Observations were conducted by three authors Hopwood, Rooney and Boud while a fourth author, Kelly, was the lead tutor for some observed classes, and in a supporting tutor role for others. A fifth team member Collier contributed to the first round of observation and early discussions. The project was made possible through funding from the Faculty of Arts and Social Sciences' Research Development Grant scheme.

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