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Success in *information technology* – what do student nurses think it takes? A quantitative study based on Legitimation Code Theory

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The goal for learners to make successful use of information technology (IT) has become a staple of education policy and curriculum. The literature about how this can be achieved offers various conceptions of this goal, namely, skills, competence, literacy, fluency, capabilities, etc. When these concepts are reified as a taxonomy or model, they are presented in abstract forms distinct from the people who are supposed to attain them: in particular their attitudes and aspirations, which can change over time. This study, informed by Legitimation Code Theory's (LCT) 'specialisation' concept (Maton 2014), surveyed student nurses ($n = 310$) in one UK university to find out what approach to learning they thought would lead to success in IT. The survey asked participants to select from four different 'specialisation' codes for four different subjects, and the responses were normalised. Each of the three year groups revealed a 'code shift', from a 'knowledge code' (ER+,SR-) in year 1, to a 'relativist code' (ER-,SR-) in year 2, to a 'knower code' (ER-,SR+) in year 3. The discussion offers some possible causes for these shifts and points to a possible contribution towards the field of digital literacies which has often depicted success in IT as a knowledge code, largely bypassing aspects of personality and intuition seen in the responses from year 3 students. Clearly further research would be needed to affirm and explicate these shifts.

Keywords: survey; Legitimation Code Theory; digital literacy; information technology

Background

Full participation in an 'information society' would seem to require members of that society to be good with information technology (IT) (van Dijk and van Deursen 2014). In 2018, the United Kingdom's Higher Education Subject Benchmark Statements are unchanged from 2001 in requiring nursing students to graduate with the ability to make 'effective and efficient use of information and communication technology' (Quality Assurance Agency 2001).

In 2002, Goodyear *et al.*'s 'Effective Networked Learning in Higher Education: Notes and Guidelines predicted that students' lack of IT skills would soon cease to present a significant barrier to teachers' deployment of networked learning (see Goodyear and Networked Learning in HE Team 2001, footnote 9, p. 105). Optimistic memes and myths around IT skills, such as 'Digital Natives' (Prensky 2001), may yet encourage curriculum planners to assume that students arrive at university equipped with adequate digital skills to cope with higher education; this is

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in spite of research to the contrary (Bennett, Maton, and Kervin 2008; Jones and Czerniewicz 2010; Selwyn 2009). Successive studies have illuminated a more complex picture of the digital skills landscape. For example, Margaryan, Littlejohn, and Vojt (2011) observed a substantial *quantitative* difference in use of IT between students studying more or less 'technical' subjects, but *qualitative* sophistication varied far less. Selwyn (2009) argues that mere use of IT has been uncritically mistaken for empowered use of IT. Bembridge *et al.* (2011) provide examples of such 'empowered use' in clinical settings where a culture of nurturing technology use prevailed: 'Kate' was encouraged to make comprehensive investigations into patients' treatment histories and results for self-directed learning through and with IT (2011, p. 249). Such positive and generative use of IT, aligned with the purpose and context of use, could, however, be easily stymied within placements where a different climate prevailed, putting 'sitting in front of a computer' in opposition to providing patient care and even the very 'art of nursing'. This may seem strange considering that some clinical areas have bristled with technology for years (e.g. critical care); and paperlight, if not paperless, health care administration systems have become embedded in everyday clinical practice. But there are significant differences between these clusters of IT use: on the one hand they entail knowledge work *about or for* patient care, on the other they are *directly linked to* patient care. Where staffing is inadequate and servicing patients' basic needs is threatened, it is easy to understand how knowledge work is given a lower priority. Yet, this knowledge work is held up for its potential for innovation that could lift service delivery effectiveness (NHS Wales 2015). To borrow Shah's upper echelon of sophisticated use of learning technology by teachers (2014, p. 95), realising these more ambitious aims calls for nurses with a vision for IT's 'omni-potential'. Even as far back as Dearing (1997) graduates were supposed to bring this kind of level of digital skills to bear on the world of work. Yet, the desire, insight or means to support that outcome in higher education can be variable if not uncertain (Selwyn 2002, 2003).

Although somewhat outdated, in 2010, Moule, Ward and Lockyer noted persistently low levels of IT confidence and skills amongst student nurses and nurses (2010, p. 2792). This was after the conclusion of a project to accredit all NHS staff with European Computer Driving Licences (ECDL), and after the favourable evaluation of that project had been published heralding efficiency gains and improvements in patient care (Warm *et al*. 2008). In 2002, it made perfect sense to also fund student nurses to undertake ECDL *before* they entered the workforce. Thus, in my own institution, between 2002 and 2012 all nursing students had to pass four modules of ECDL to progress into their second year. The ECDL aims to equip candidates with 'computer skills', offering a flexible path to proficiency. ECDL is ambivalent about *how* candidates gained their skills, which is, to some extent, typical of how IT is commonly learnt. However, after Bernstein (1975), *classification* (how strongly bounded activity is to a given context) and *framing* (the locus of control within a given educational context – weaker framing entails a ceding of control by the pedagogue to students) tightens considerably in the automated exams. This is reflective of a key tension within education, and a key concern for the networked learning tradition (Beaty *et al*. 2002), that is, how the *human* elements of learning and teaching are side-lined to cater for better scalability. To efficiently up-scale education, performance must be measurable by automated assessment. In ECDL, even though assessment is undertaken using a computer and the test interface replicates the normal computer user's interface, the steps required to answer questions are prescribed.

Tests may provide an accurate representation of IT knowledge, but the 'messiness', the heuristic and contextual elements of IT use are suspended.

Nursing's regulatory body, the Nursing and Midwifery Council (NMC), recently issued revised 'Standards of proficiency for registered nurses' and 'digital' proficiencies make four appearances, such as, '5.11 effectively and responsibly use a range of digital technologies to access, input, share and apply information and data within teams and between agencies' (NMC 2018, p. 20). Here, digital 'proficiency' is required of nurses, including newly qualified ones. Although the word 'responsibly' adds an ethical dimension, the meaning of 'digital proficiency' is elaborated with reference to functional performance, of 'access', 'input', etc. This may be necessarily reductive, but it does not account for the nurses' personal attitude (Wishart and Ward 2002), aims (Selwyn 2003), disposition (Gallagher 2018) and context (Gourlay and Oliver 2018). Johnson's (2016) case study deliberately leaves us to ponder why a digitally proficient nurse would still opt for a very much less effective paper-based process.

Many have written about what being 'good at IT' consists of in terms of skills, literacy, fluency, competency, mastery, etc. (Markauskaite 2006; Martin 2002). A more recent trend references 'digital capabilities' (Joint Information Systems Committee 2015, 2017), although without also noticing Eynon and Geniets (2016) use of Sen's (2009) perspective, where capabilities 'encompass the opportunities which individuals experience to realise a set of different functionings that they may have reason to value'. These values led a student in Gourlay and Oliver's study to microwave a book, melting the binding in order to digitally scan its pages more easily (Gourlay and Oliver 2013). It was this kind of 'socio-material achievement' (Gourlay and Oliver 2013, p. 90) that characterised digital proficiency as much as any generic set of skills. Thus, there are various long-standing critiques of reductionist and/or dichotomous approaches towards 'digital skills', which elide a relationship between students' experiences, values and aspirations and how they are expected to function in terms of 'common sense' conceptions of what equates to being 'good at IT', and, as we have noted, these conceptions become enshrined in normative policy expectations of graduating nurses.

This study seeks to explore another line of complexity offered by Legitimation Code Theory (LCT), to gain and present the students' perspective on 'success in IT', and how that may change as students pass through their undergraduate degree programme. Consistent with LCT's objective of building knowledge (Maton 2014, p. 3), this study contributes to 'specialisation code' literature. Specialisation is concerned with identifying the bases for claims to the legitimacy of knowledge practices. These bases, or codes, can be discerned by the way a practice relates to knowledge and/or knowers. LCT is careful to demark its own languages of description, including shorthand notation, although readers may find it esoteric initially. In specialisation, 'knowledge codes' are referred to as epistemic relations (ER) and 'knower codes' are social relations (SR). These are not dichotomous types, but relational, and can change over time and across contexts (thus, the notation is often expressed as ER+/- to denote stronger or weaker relations). LCT has evolved, through empirical work, to distinguish further legitimation codes (see Figure 1).

In SR, the 'knower' code, interactional relations (IR+/-), implies those practices where actors derive legitimacy from an intuitive 'feel' or 'gaze' for the knowledge practice (e.g. as in master/apprentice settings), whereas for subjective relations (SubR+/-) legitimacy is based upon actors possessing inherent characteristics (e.g. standpoint theorists base their legitimacy upon social category, such as gender or race; England's queen must be female and possess 'blue blood').
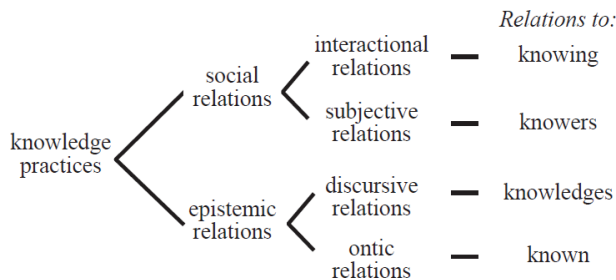
Figure 1.   The 4-K model of knowledge practices and branching legitimation codes (Maton 2014, p. 193).

Within ER, discursive relations (DR+/-) are the extent to which actors learn skills and procedures, and ontic relations (OR+/-) are where actors require a grasp of key concepts and theory. Maton (2014, p. 178) illustrates this within the field of neo-classical economics where the methods and outputs of enquiry were seen to align with mathematical modelling (DR+) for their legitimacy within the field, creating a durable platform for knowledge building, even though the objects of study bore little relation to real-world problems (OR-). These relations to knowledge and knowing have been directly challenged by 'post autistic economics', an ER 'clash'.

Although these specialisation codes have arisen largely through qualitative research, several studies have sought to investigate knowledge practices on a large scale by developing a survey instrument (Howard, Chan, and Caputi 2014; Lamont and Maton 2008, 2010; Maton and Howard 2015).

Method

This study sought to discover nursing students' subject specialisation codes regarding IT as a discrete discipline. Accordingly, Maton and Howard's (2015) version of the survey items required some adaptations. In particular 'content knowledge', originally aimed at an audience of teachers, was redacted to simply 'knowledge' to improve reliability for nursing students Table 1.

Contrary to Oppenheim (2000), the item features a 'forced choice' design, denying respondents the opportunity to express a neutral opinion. However, Oppenheim's main reason for avoiding forced choice is to cater for those who have no experience of the phenomenon or wish to declare genuine neutrality. Firstly, all the participants have had experience of the subjects. Secondly, Brace (2008, p. 72) argues that allowing a neutral response may simply encourage participants to take the 'easy option' without forming and expressing a decided opinion that actually increases validity and reliability.

The subjects in earlier specialisation studies were chosen to represent the different specialisation codes and to create a baseline of data to compare. For this study, four other commonly studied subjects were chosen, as well as IT, analogous with those featured in the previous studies (see Table 2). Taken together, it was assumed they would unequivocally position participants' conceptions of IT within the context of the nursing curriculum and especially knowledge-working practices (i.e. as opposed to, for example, gaining proficiency at computer games or coding computer programs). There are significant differences between the contexts of these subjects in the

Table 1.   An example of the subject specialisation survey item [with specialisation codes].

How important are the following things to do well with information technology?
Options: Not at all, Not very, Important, Very Important
- Having natural talent [SR: Subjective Relations (SubR)]
- Learning about it in terms of knowledge, theory and concepts [ER: Ontic Relations (OR)]
- Learning skills and procedures [ER: Discursive relations (DR)]
- Getting a 'feel' for it [SR: Interactional relations (IR)]

Table 2.   Specialisation subjects chosen in LCT studies.

Lamont and Maton (2008)	Lamont and Maton (2010)	Maton (2008)	This study
Mathematics	Mathematics	Mathematics	Drug calculations
English language	English	English literature	
Science	Science	Natural science	Anatomy & physiology (A&P)
History	History	History	Sociology
Music	Music	Music	Information technology (IT)
	Geography		
	Visual arts		
		Psychology	Clinical skills (Clin skills)

previous studies. Anatomy and Physiology was considered a 'touch-stone' subject, bearing closest resemblance to natural science. Past studies have consistently found science to be a knowledge code, or at least SR- (Maton 2014). This choice became important for validating findings.

As participants knew me, having delivered at least one induction lecture at the start of their programme, there was a threat to reliability in terms of 'socially desirable responding'. Joinson (2005, p. 32) cites two aspects of this: 'impression formation' and 'self-deception', with the latter being almost impossible to account for in surveys. Using the student's first name in the personalised reminder email may have undermined participants' belief that the survey was indeed anonymous: anonymity is a recognised antidote to impression formation. However, the theoretical nature of the survey may have helped to compromise participants' ability to guess how I might want them to respond.

Data and findings

Three hundred and ten responses were received from a target population of 776 undergraduate pre-registration nursing students, a response rate of 40%, possibly aided by the questionnaire's brevity. This is a reasonable response rate for an online survey that was primed by one announcement on the institutional virtual learning environment and two follow-up emails. For IT, the most popular choice from the four question options was 'Learning skills and procedures' (ER+: DR+, see Table 3). Considering the four available options this result has some intuitive appeal, but LCT emphasises a relational analysis.

Table 3.   Means and standard deviations for responses to the IT item displayed by year.

	SR: SubR 'Talent'	ER: OR 'Knowledge'	ER: DR 'Skills'	SR: IR 'Feel'
Year 1 IT mean (SD)	2.46 (0.71)	3.14 (0.76)	3.46 (0.55)	3.13 (0.68)
Year 2 IT mean (SD)	2.40 (0.81)	3.06 (0.73)	3.37 (0.63)	3.12 (0.70)
Year 3 IT mean (SD)	2.59 (0.75)	2.95 (0.79)	3.36 (0.67)	3.30 (0.63)

Following Maton and Howard (2015), the survey data were used to generate plots on a Cartesian plane, revealing the specialisation codes. The data were first exported from the Bristol Online Survey into Microsoft Excel. The forced choice responses were coded with a score from 1 for 'Not at all', to 4 for 'Very important'.

The data were normalised as follows:

1. Baseline means were calculated for SR and ER to provide the x- and y-axis respectively. This was done by averaging scores for the 'talent' and 'feel' responses, then for the 'knowledge' and 'skills' responses.
2. A mean was calculated for each subject.
3. Each baseline mean for the two codes was then subtracted from each corresponding subject mean, deriving two plot references for each subject.

This process renders Table 4 and Figure 2.

Clinical Skills and Drug Calculations appeared as 'élite' codes, meaning that, relative to the others, proficiency in these subjects requires a combination of being the right person and gaining the right knowledge and skills.

IT and Sociology appear in the relativist code quadrant, implying that it is possible to do well in them no matter who you are or how you go about learning them. As expected, the 'touch-stone' subject in this survey, Anatomy and Physiology reported as a 'knowledge code' (ER+/SR-).

Apart from the subject specialisation code questions, the only data collected were year of study. These data were used to sort responses by year, seeking to identify shifts in perception over time on the programme. Response rates were evenly distributed across each of the years facilitating comparison between them. Means were calculated for each year for IT and the overall baseline mean for IT subtracted from them (see Table 5 and Figure 3).

Discussion

This study has sought to explore what student nurses perceive to be important 'to do well with information technology', when set in comparison with other subjects they encounter on their degree programme. LCT's emphasis on illuminating 'relations within knowledge' (Maton 2014, p. 65) highlighted a code shift between year of study, starting in the 'knowledge' code quartile and moving through 'relativist' in year 2, into a 'knower' code in year 3. This result, disaggregating the overall scores for IT reported in Table 3 (see p. 10 above), highlights the complexity that lies beneath such summary data and the danger of drawing firm conclusions from them. Further limitations include the single-cohort, self-reporting nature of the survey. Although the survey was kept as small as possible to retain fidelity with LCT and secure a high

Table 4. Specialisation code coordinates with a summary of LCT specialisation codes.

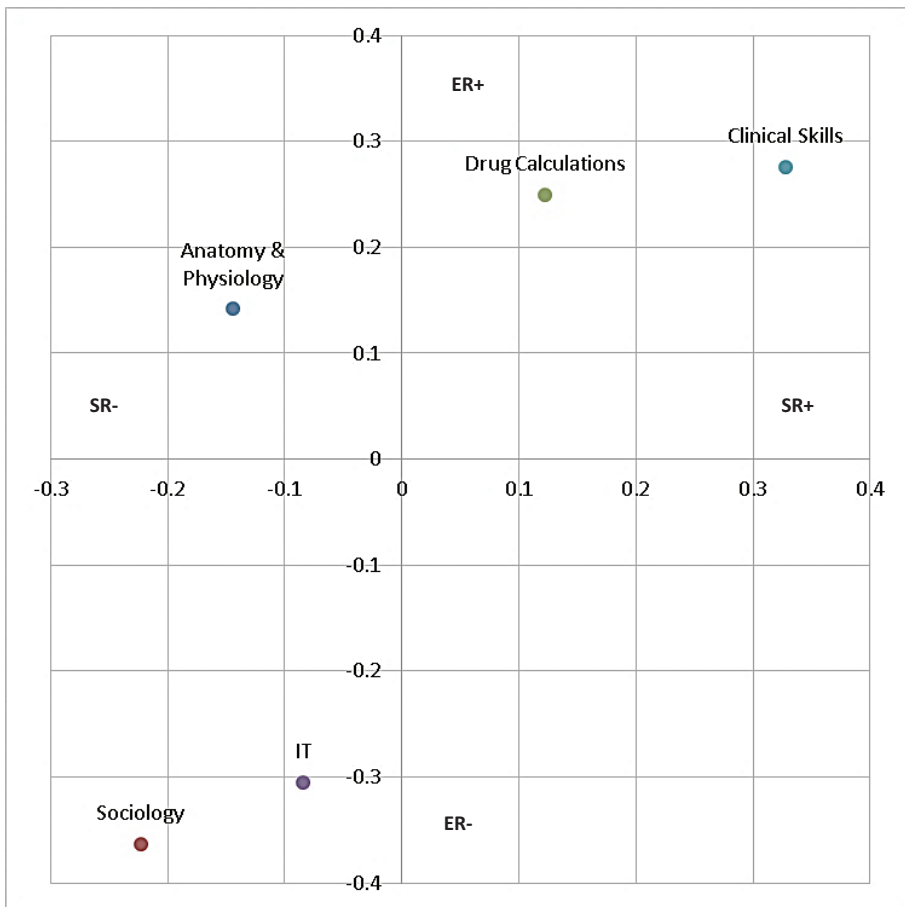|	SR	ER	Summary	Code
Anatomy & physiology	−0.144	0.14	SR-,ER+	Knowledge
Sociology	−0.223	−0.36	SR-,ER-	Relativist
Drug calculations	0.123	0.25	SR+,ER+	Élite
IT	−0.084	–0.305	SR-,ER-	Relativist
Clinical skills	0.326	00.276	SR+,ER+	Élite

Figure 2. Cartesian plane plotting student nurses' perceptions of bases of achievement in five subjects.

participation rate, a more ambitious questionnaire might have elicited useful data to shed further light on the research question. The choice of 'nursing' students was due to convenience of access rather than a strategic decision. Another group of students may produce different results and a longitudinal element, tracking students over a number of years would strengthen the findings.

Table 5. IT subject specialisation scores.

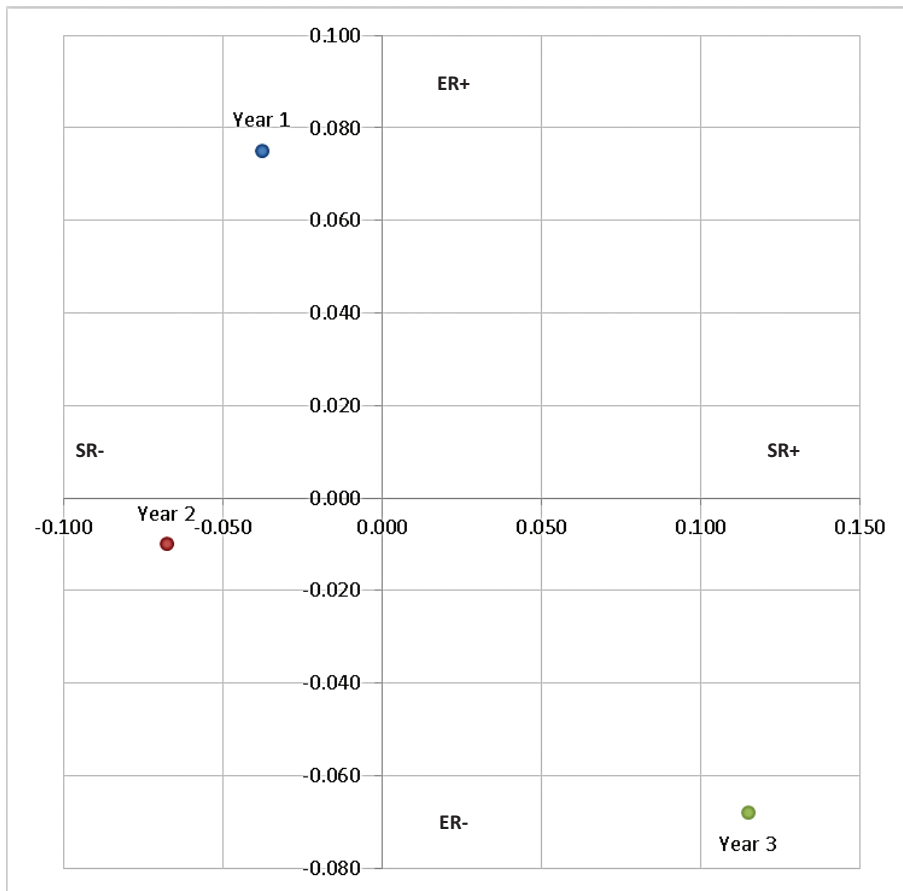|	Year 1 ($n = 103$)	Year 2 ($n = 109$)	Year 3 ($n = 98$)
Social relations	−0.038	−0.068	0.115
Epistemic relations	0.075	−0.010	−0.068
Specialisation code	'knowledge'	'relativist'	'knower'

Figure 3. Cartesian subject specialisation plane for IT at three year points.

With these limitations in view, I offer the following tentative comments:

- In year 1, students are relatively inexperienced in dealing with university and clinical practice IT systems. The amount to be learnt appears steep with many unknowns.
- By year 2, students have achieved much and their confidence and familiarity with IT systems has increased in academic and clinical settings.
- In year 3, students face the hurdle of completing a dissertation and they have a further developed sense of where they stand in relation to IT. They are

approaching the culmination of their degree, aided or not by their IT capabilities. With the benefit of hindsight, they scored 'SRs' more strongly and particularly the IR option, 'getting a feel for it'.

These inferences cannot be verified in this study. For example, motivation is a complex and important factor in learning and it is by no means certain that these students want to attain sophisticated IT capabilities. The year 3 finding could mean that, by that stage, students recognised that their natural talents lay in another direction, that is, nursing, and that cultivating a disposition of sophistication in IT may not be a priority. This would constitute something of a code clash between proponents of digital literacy as essentially a knowledge code (ER+,SR-) and the year 3 students who responded to the survey identifying success with IT as requiring a knower code (ER-,SR+). These are matters for wider reflection on the suitability of teaching IT in a way that focuses only on promoting knowledge code learning: that is, knowledge, theory and concepts (OR+) or 'skills and procedures' (DR+). Conversely, how can IT be 'taught' to those who do not identify themselves as having 'natural talent' (SubR-) and are less than enamoured with the goal of getting a 'feel' (IR-) for IT?

Conclusion

It is said that to participate in an 'information society', students, nurses included, need to graduate with the ability to make 'effective and efficient' use of IT (Quality Assurance Agency 2001, p. 5). Rowlands *et al.* (2008, p. 300) warn that it is not safe to assume that this will happen on its own by trial and error, even though students inhabit a context with substantial expectations and incentives to perform knowledge work that implicates IT (Goodyear 1999; van Dijk and van Deursen 2014, p. 112).

How might 'effective and efficient', even 'good', use of IT be assured? Notwithstanding this study's limitations, first-year nursing students acknowledged that success required learning the 'knowledge, theory and concepts' of IT. For third-year students, responses indicate that they thought there is more to IT than 'learning skills and procedures', although that was also important. Furthermore, the data lend support to the need for educators to nurture 'aptitudes, attitudes and dispositions' (Maton 2014, p. 92), perhaps through course design that embeds discipline-specific use of IT, promoting digital fluency as a side-effect of focusing on epistemic fluency in the design of learning activities (Littlejohn, Beetham, and McGill 2012; Markauskaite and Goodyear 2016).

This study suggests that student nurses' attitudes towards what it takes to succeed in IT evolve over the years of their undergraduate degree programme. Further work to delve deeper into the meaning behind apparent code-shifts may confirm that by the third year, nursing students recognised that success in IT required being a certain type of person. Would they see themselves as such or rather disavow that as a valued trajectory? Such insights may further inform the tentative findings of this study and indicate that generalised models of being 'good at IT', and those who promote them, need to acknowledge student dispositions and opinions about the field when it comes to facilitating the accomplishment of digital literacy, fluency, capability, etc.

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