

# **Stress, a reflective self and an internal locus of control: On the everyday clinical placement experiences of older undergraduate radiographers in the UK**

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## **Abstract**

## **Introduction**

Extant evidence indicates that the stresses experienced by younger undergraduate radiographers and their older counterparts vary considerably. Much of this difference has, however, emerged from analyses of the academic component of a radiography degree whereas little work has focused to date upon the specific business of clinical placement. Given this, the research herein reports findings from a qualitative study of how older undergraduate radiography students in the UK assemble their stress and stressors around clinical placement.

## **Methods**

An Interpretative Phenomenological Analysis was employed. N=6 older undergraduate students undergoing their final year placement were purposively recruited from a variety of

hospitals. With full institutional ethical approval, a semi-structured interview was conducted with each participant.

## **Results**

Four superordinate themes emerged. These were: (1) Self-identity and perceived competence; (2) Understaffing, instability and affect; (3) Episodic experience and feeling 'thrown-in'; (4) Unpreparedness for the challenging patient. Critically, each theme describes an interaction between stressor, experience of stress and self.

## **Conclusion**

While familiar stressors were apparent, the older participating students actively made sense of them *in terms* of their manageability. This provides a strong contrast with existing literature, which tends to imply a more externalised locus of control among (largely younger) students.

## **Implications for practice**

Stress in the NHS is a continuing issue and there is a clear rationale for further investigation to ascertain the level of clinical support available and to determine whether further improvements could assist students on clinical placement. Collaboration between academic institutions and clinical sites would allow open discussion around clinical stress experienced by radiography students, with locus of control a potential point of focus, fostering a proactive partnership approach to stress-management and identification of difficulties before they exacerbate.

## **Keywords**

Stress; Clinical placement; Older radiography students; Interpretative Phenomenological Analysis

# **Stress, a reflective self and an internal locus of control: On the everyday clinical placement experiences of older undergraduate radiographers in the UK**

## **Introduction**

The stress that working towards an undergraduate degree places upon an undergraduate student has for some time been a strong theme in both educational and psychological research.<sup>1-3</sup> In the UK, across the years of fiscal ‘austerity’ (officially 2010-2019), ever-higher numbers of school-leavers attended HE institutions while the graduate job market actively contracted. When unprecedented levels of graduate debt are also taken into account, it can be of little surprise that the contemporary undergraduate student experiences equally unprecedented levels of day-to-day pressure that their forebears did not. This is demonstrably correlated with ever-increasing incidences of mental health problems reported among the UK’s undergraduate students.<sup>1</sup>

With respect to anxiety around an increasingly competitive graduate employment market, undergraduates studying for degrees in allied healthcare professions (henceforth AHPs) are seldom subject to this key concern. In the UK, the likelihood of graduate AHPs moving directly into degree-related work upon graduation remains all but guaranteed, given that the National Health Service (NHS) is typically understaffed in all but a few specialities and/or geographic areas.<sup>4,5</sup> Historically, undergraduate students in AHP domains were also exempt from the UK’s £9000+ per year undergraduate tuition fees. It was not until those beginning a degree in 2017 that full fees became mandatory for AHP study. While smaller annual grants beginning at £5000 per annum were introduced for the 2020 intake, the (re)payment of tuition fees still burdens post-2016 undergraduate AHP students with greater debt than those registered in prior years.

Further to the above, it has been well noted in contemporary literature that experiences of stress among older undergraduate AHP students (i.e. those aged 25 years or more at the point of graduation) can differ substantially from those of the more 'conventional' undergraduate, who typically enters HE at 18 or 19 years of age.<sup>6,7</sup> Research in the medical imaging sphere has specifically emphasised how (re)adaptation to the academic practices endemic to a degree can be a major stressor for an older student.<sup>8</sup> As in the broader AHP corpus, however, experiences of stress during clinical placement have received rather less explicit attention.<sup>7,9</sup>

This paper reports findings from a qualitative study of the clinical placement experiences of older medical imaging students, with a key focus on issues of stress. The participant group involved were interviewed during the final semester of their final year of a diagnostic radiography undergraduate programme, which was itself the final academic year of fee-free AHP study in the UK (i.e. the graduating class of 2019). This, given hindsight, may present the last opportunity for some time to explore a very particular phenomenon. In short, the stress-related accounts provided by participants were, at the time of collection, untainted by the inherently stressful prospect of heavy graduate debt, nor coloured by the spectre of working with COVID-19 and its aftermath.

### ***Stress and medical imaging***

Stress in its everyday form is not inherently pathological but rather a native response to difficult circumstances. It is when stress becomes unrelenting and prolonged that individuals typically become emotionally exhausted, drained of energy and lacking in enthusiasm.<sup>10</sup> This is particularly pertinent within everyday healthcare work which is widely regarded as having high background levels of stress, not least on account of the inherent responsibility for the wellbeing of others, and the potential cost of mistakes.<sup>11</sup> At all levels,

however, stress has a distinctively phenomenological character. To feel stress is to be stressed, and what individuals will interpret as ‘difficult’ circumstances is neither consistent nor inherently predictable.<sup>12</sup>

Stress indicators and responses can be captured in objective/statistical terms, enabling careful delineations of everyday stress from clinical stress and often-associated depression and anxiety disorders.<sup>10</sup> In the medical imaging domain, such concerns have been addressed in a number of instructive occupational studies.<sup>10,13-15</sup> Understanding how individuals working in medical imaging assemble personal and contextual resources in making sense of their own stress, however, remains something more of a work-in-progress. It would be uncontroversial to propose that a great deal of pertinent medical imaging literature, and particularly that addressing student practitioners,<sup>13,16</sup> foregrounds almost exclusively the socio-structural roots of an individual’s stress in the clinical environment; i.e. systems and specific ‘others’. This may be a consequence of an ‘explanatory orthodoxy’ built into research design, whereby structural explanations of individual problems are inherently sought.<sup>17</sup> Alternatively, it might evidence a self-serving bias among participants themselves, whereby attribution for problematic outcomes is natively externalised,<sup>18</sup> although this has not been formally proposed in pertinent literature to date. Whichever the case, it is evident that participants’ own assembly of their stress and stressors has not always been of key concern.

## **Methodology**

Given the matters outlined above, this study proceeds from the largely phenomenological standpoint that participants themselves are in the best position to define and unpack their own relationships with stress and stressful circumstance in the workplace. Thus, whatever is raised by participants in talk about stress during clinical placement is taken to be intrinsically

relevant to the understanding of workplace stress for those participants, without external categorical judgment. In these terms, Interpretative Phenomenological Analysis (henceforth IPA) was taken to provide an optimally participant-centred and non-evaluative qualitative framework for investigation, considering that "...the main currency for an IPA study is the meanings particular experiences, events, states hold for participants."<sup>19</sup> It would be uncontroversial to propose that the bulk of contemporary literature addressing stress among medical imaging students has largely focused on the causes and consequences of said stress. The use of IPA, conversely, encourages systematic emphasis on the essentially primordial matter of what 'stress' itself means to the students experiencing it. This approach (although in some respects cautious) can help to add depth to existing understandings of key phenomena in pertinent contexts, and guide prospective research in directions more sensitive to the diversity of human experiences.<sup>20,21</sup> Although far from a common approach in contemporary medical imaging research, IPA has been finding increasing purchase in recent years with clear, practice-relevant outcomes.<sup>22-27</sup>

### ***Participants***

As is conventional in IPA studies, purposive homogenous sampling was utilised to ensure conversant and maximum levels of topic-relevant experience among participants.<sup>20,21</sup>

Inclusion criteria were set as (a) undergraduate Diagnostic Radiography students, who (b) would be  $\geq 25$  years old at the point of graduation, and (c) would be in the final semester of their degree at the point of participation. With institutional ethical approval, and using the institutional connections of the first author, criterion-aligned students placed (at the time) in a variety of NHS hospitals were invited to participate. Recruitment was closed when six students, placed in six different hospitals, provided full informed consent. This sample size is recommended for IPA studies of this exploratory order, balancing individual voice against topical concern,<sup>20,21</sup> while the exclusivity of placement site ensured that the documented

clinical experiences would not be a consequence of the vagaries of any single workplace therein.<sup>a</sup>

*Table 1: Participant demographics*

| <b>Participant</b> | <b>Gender</b> | <b>Age<br/>(years)</b> |
|--------------------|---------------|------------------------|
| <b>P1</b>          | F             | 25                     |
| <b>P2</b>          | M             | 28                     |
| <b>P3</b>          | F             | 41                     |
| <b>P4</b>          | M             | 26                     |
| <b>P5</b>          | F             | 31                     |
| <b>P6</b>          | M             | 26                     |
|                    | <i>Mean</i>   | 29.50                  |
|                    | <i>SD</i>     | 6.02                   |

### ***Procedure***

Each participant sat for a face-to-face, semi-structured interview conducted by the first author in an environment of their own choosing. Rather than being ‘questioned’ in the conventional sense, participants were encouraged to describe and then reflect upon<sup>23</sup> specific clinical placement experiences across their full course of their degree. All interviews were digitally recorded, with a mean duration of 38 minutes. In line with ethical mandate, sound files were transferred to a secure, two-step authenticated cloud drive at the end of each interview and were subsequently transcribed verbatim. In further line with ethical mandate, all key nominal identifiers relating to persons, places and exact dates were redacted at the point of transcription.

### ***Data analysis***

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<sup>a</sup> It is possible, however, given that participants would be asked to reflect upon all of their undergraduate clinical experiences, that there might (however unlikely) have been some workplace overlap during the full three years.

The characteristic six stage idiographic approach of IPA, shown in Table 2, was utilised in full in the investigation of transcripts.<sup>20</sup>

*Table 2: Analytic stages*

| Stage | Actions   |
|-------|---|
| 1     | Reading and re-reading transcripts / reviewing against recordings |
| 2     | Making provisional notes  |
| 3     | Developing emergent themes  |
| 4     | Searching for connections across emergent themes                  |
| 5     | Moving to the next interview (return to stage 1)                  |
|       | <i>When stages 1-4 are complete for all interviews:</i>           |
| 6     | Searching for patterns and themes across the interviews           |

In IPA studies, acknowledgement of researcher reflexivity is essential,<sup>21</sup> and this analytic process was accomplished coordinatively by three authors with different intellectual and professional positions. The first, an experienced diagnostic radiographer, completed a provisional analysis from stages 1 to 5. This was then reviewed in full by the second, a social psychologist and veteran qualitative health researcher. Both then worked to find consensus on a set of 26 emergent themes, which were then (in stage 6) cross-linked into four superordinate themes. The third author, an experienced radiographer-researcher, then reviewed the correspondence between emergent and superordinate themes. Finally, all three authors worked to establish full analytic fidelity, the outputs of which are demonstrated below.

## **Findings and Discussion**

The four superordinate themes identified by consensus were:

1. Self-identity and perceived competence
2. Understaffing, instability and affect



3. Episodic experience and feeling ‘thrown-in’
4. Unpreparedness for the challenging patient

These are outlined below, with reference to illustrative data and pertinent literature from the medical imaging domain.

### ***Superordinate theme 1: Self-identity and perceived competence***

A highly visible aspect of the data corpus was the way in which all participants provided largely unprompted analyses of their own relationships with stress in general, typically as a precursor to sense-making regarding their clinical working environments.

P1: *“[I am] a very anxious and stressed person I would say. I feel stressed a lot of the time. Well it makes me short-tempered. I’d also say that I am naturally an anxious person and doubt myself so I think that would have been the case no matter what my age.”*

P4: *“I appear as a confident person, but I would describe myself as a worrier. I’m a perfectionist, someone who worries a bit too much.”*

P6: *“[I am] quite a chilled person, optimistic. I always think on the bright side. I do get stressed about things, but maybe not things that normal people get stressed about.”*

Indeed, all participants but P6 pre-announced that they were quite ‘stressed people’.

Furthermore, the participants themselves lined-up issues of self, stressors, stress experience and behaviour in wholly different ways. In the first example above, the relationship between stressed feelings and stressed behaviour was taken to be direct (irrespective of age). In the second, a confident demeanour was no more than a disguise for a stress-prone character. In the third, being a ‘chilled’ person did not preclude the experience of inferably ‘unusual’ stress.

The participants in this study evidently did not view themselves as straightforward ‘victims of circumstance’, but rather emphasised that the stress they experienced at work was always an interaction between self and environment. This understanding was activated in more concrete terms with respect to participants’ inferences about their perceived competence in the workplace and its possible impacts on their future employability.

P2: *“God...what they’re expecting you to do and what they’re expecting you to know, what you’re capable of. I’m very, very worried about not being able to do things that they expect me to do...I lack self-confidence and academically I’m not fantastic, I don’t learn things straight away, it takes time. Then [they’ll] think: ‘Oh who have we employed here?’ What they might think of [me] before they know the real me: ‘Who is this numpty, like?’”*

P3: *“I’m getting close to graduating, am I going to be able to do this? Do I necessarily know, am I going to graduate and I’m not going to be able to do that x-ray? How am I gonna adapt that? How am I actually going to get this x-ray taken?”*

Evidence has indicated that, during the transition between radiography student and professional radiographer, general anxieties regarding ability and competence tend to increase among all students, regardless of age, even though most are well-prepared.<sup>13</sup> This was explicitly true for most of the older students involved in this study, although (as evident above) never attributed exclusively to the circumstances themselves. Moreover, transitional circumstances were not taken to be ‘only’ difficult; the corollary responsibilities were also viewed as an opportunity at times.

P6: *“I think it’s just the fact that it’s all my decision now. Like I can’t just quickly say, ‘is that OK?’, it’s my decision.”*

This, again, flags the essential notion of agency as a key concern for the participants themselves.

## ***Superordinate Theme 2: Understaffing, instability and affect***

A ubiquitous concern for all participants was the practical consequences of understaffing in their placement hospitals. In most cases, this resulted in a sense of feeling ‘rushed’ in daily tasks.

P1: *“At my placement site...they’re so short-staffed that they can’t provide [support] and the staff that are there sometimes aren’t even trained on what they expect you to do, so it’s difficult. It was the busy environment and also feeling a bit under pressure....it meant rushing.”*

This broad experience had been widely noted elsewhere in the medical imaging domain, even among senior staff in ultrasound.<sup>5,28</sup> Among most participants in this study this context was indeed experienced as in-itself stressful, though not for all. P4, for example, derived greater anxiety from the secondary impacts on his work and sense of professional pride.

P4: *“I feel rushed [which] leads me to believe that I have to be very quick with these things and it can lead to me...slipping in my personal standards.”*

P2 noted similar pressure but described the personal impact as tiring rather than stressful, specifically emphasising how his prior life experience had provided a buffer between himself and the fast-moving environment.

P2. *“It’s busy and you’re running about, and people are shouting at you and patients shouting at you, blah-de-blah, I honestly wouldn’t say it makes me feel stressed, I’d say it’s just more like being tired and worn out. [These] demands of placement will have been helped by my life experience that other students may not have.”*

Strongly related to this was the matter of *communicable* stress, in both passive and active forms.<sup>16,28-30</sup> Regarding the former, this entailed an anxiety resultant of simply being around visibly stressed mentors and other qualified colleagues,<sup>30</sup> which was, again, often attributed to understaffing, with destabilising individual and collective effects:

P4: *"[The staff] are very aware of the high workload and if they themselves aren't dealing with it quite well it can lead to me feeling quite flustered as well...a little bit of group hysteria sort of thing...when everyone's stressed, everyone's anxious."*

Moreover, as a corollary, the potential impacts upon patients' wellbeing were cited as a further, compounding stressor:

P6: *"If other people in the room are stressed, the patients aren't getting proper attention. The patient's not getting explained what's going on really. I think if I ever was stressed it would affect my care of the patient cos I'd just be flapping."*

Regarding active communicable stress, meanwhile, all participants noted that, on occasions, staff attitudes towards them had boiled over into the unhelpful, unaccommodating or even dismissive.<sup>16,29,31</sup>

P3: *"Where somebody actually was not willing to help, it's upsetting when somebody treats you like that and kind of left you to it in a difficult situation."*

P5: *"[S]ome of them just completely ignore you, people probably not wanting to get involved with students. I've spent loads of days thinking: God I don't want to step foot in there again, but then, like I say, you just get on with it. I've got to just deal with it...[I]t's feeling like I'm in the way...that's the biggest problem for me. You want to be helpful but then you don't want to get in the way of them doing their job, but that's what's always bothered me is being in the way."*

Again, however, it is evident that similarly articulated circumstances were not reported to have engendered the same stress experience, although a sense of 'not fitting-in' as a result was particularly common.<sup>31</sup>

### ***Superordinate Theme 3: Episodic experience and feeling thrown-in***

Themes 1 and 2 largely address issues that persisted in the participants' day-to day working experience. A further commonly addressed matter related more explicitly to their own

competence in techniques with which they had limited experience, creating a ‘new’ challenge each time.

P6: *“I think you have to [do something] constantly in a row and then you get it, but if you just use it once and then don’t use it for a week, every single time I forget how to use it properly.”*

Techniques and technologies outside of general radiography itself were particularly identified in this respect,<sup>15,29</sup> sometimes exacerbated by a sense of having been ‘thrown-in’ without clear instruction or support:

P1: *“There’s been a few times where I’ve been put in fluoroscopy to help with a PICC line and I’ll get really nervous around the whole sterile environment. Yeah, it just puts me on edge more. I’d rather someone explained...this is what I’d like you to do.”*

P4: *“I felt a little bit of anxiety was when I was asked to control a cath lab table. [It] can cause a lot of anxiety about making mistakes, and that can lead you to not, maybe, do what you should be doing because you’re trying to be too cautious.”*

A ubiquitous concern among participants in this respect regarded working in theatre, a phenomenon previously noted not only among students but also among recently-qualified radiographers.<sup>31,32</sup> Given the infrequent nature of their theatre work, participants routinely reported an anticipation that they would not perform well with the equipment and context *next time*, irrespective of how they might have performed in the past. This also linked to the Theme 1 matter of having to increasingly go-it-alone:

P5: *“I’m probably gonna be nervous about [theatre] when I go back [on placement] ‘cause I haven’t done it for such a long time. I would rather [qualified colleagues] come with me, but then I think: no, I need the practice on my own.”*

Here, as in other examples above, the nominally stressful experience is viewed dually as a personal difficulty and a professional opportunity. As accounts developed, however, a further

layer of trepidation around theatre emerged, connecting the episodic technical aspects of theatre work to the interpersonal dimensions experienced therein:

P1: *"I would say theatre equipment and knowing the positions [are a worry]. I feel like I don't really get to go in there much, or I'm not up there a lot and I'm worried about – I know it shouldn't be this way – but the surgeons are quite, they will shout at you, they make you do something wrong. I don't feel like you're given any chance to even make a slight, well not mistake, but to be any slower than they want you to be."*

Herein, there is a concern that 'rustiness' from sporadic practice might be punished by senior theatre staff. This further diminishes confidence in ability and exacerbates stress, which is an observation conversant with those of Naylor and Foulkes.<sup>31</sup> Even P6, for whom little else had been deemed inherently stressful, indicated that this dynamic was a source of stress, further indexing the issue of actively communicable stress,<sup>30</sup> addressed in Theme 2:

P6: *"I quite like going to theatre, but that can be stressful if there's a stressed surgeon. It can be stressful if it's a big case and they're telling you to do something, and then they tell you off."*

#### ***Superordinate Theme 4: Unpreparedness for the challenging patient***

All participant concerns around workplace stress described above related to self, contexts and colleagues. It was only in one key respect that patients were raised, although it was the most universally cited source of raw stress among participants. This related to handling challenging patients,<sup>29</sup> resultant of both stress communication (see Theme 2) and episodic experience (see Theme 3). The most prominent issues voiced addressed aggressive patients, patients with dementia and, particularly, those patients who presented as both.

It is of note that, while most participants voiced anxiety around the business of handling patients who were simply 'aggressive', there were no experiential examples given. Rather, this anxiety was (where voiced) always voiced hypothetically.

P1: *"[I]f there was a really aggressive patient, it just worries me how I'd deal with [them]."*

More commonly, it was not so much aggression as inebriation that informed their accounts of practical experience in handling otherwise-healthy challenging patients.

P4: *"I'm still not confident with conducting myself or conducting the examination with an inebriated patient."*

It was with respect to patients with dementia, however, that the participants routinely reported their greatest experiential difficulty, a matter that has also been documented to sustain among qualified junior radiographers.<sup>23</sup>

P4: *"[D]ementia patients that are very distressed, that can cause a lot of anxiety...because for them it seems so distressing because they don't know what's going on, and it's me not knowing how to diffuse these situations. There's a certain sort of barrier I think between me being able to effectively help these people and that causes a lot of stress when you have someone who's screaming, and you cannot help them."*

P6: *"I think it's probably more with people with dementia...they're lashing out and things like that, and you really don't know how to deal with it."*

Although all participants had experience of working with challenging patients, and all reported the experiences as inherently stressful, the manner in which they viewed their practice as being affected varied substantially. In the accounts above, this impact was one of profound difficulty. For P5, it was rather more understated, reflecting an observed tendency among radiographers to withdraw into a more depersonalised manner of interaction when handling difficult patients.<sup>33</sup>

P5: *“When I’m stressed [with these] patients, I’m usually a little less responsive to any sort of intimation or subtle cues that they have. It’s possible that I act a bit more forthright. It’s left me feeling that when I’ve finished a certain examination that I didn’t really give that patient my entire self and my entire attention.”*

In another, however, an insistence was made that the stressful nature of the interactions did not affect practice at all.

P2: *“It’s never got to the point where it’s too much and it’s affected how I interact with patients or the level of care that I give patients. I’ve never let it affect the quality of care, but [the stress is] there.”*

## **General Discussion**

One of the clearest elements emergent of the analysis is that the older students’ core sources of stress in the clinical environment do not diverge substantially from those documented in prior studies of medical imaging students (and, indeed, their recently qualified counterparts). Anxieties instigated by short-staffed and rushed workplaces, stressed colleagues, irregular exposure to technologies, working in theatre and challenging patients have all been identified in conversant research.<sup>13,16,23,29,31</sup> This contrasts with studies focused on the academic elements of the student experience in medical imaging (and the wider AHP domain), which have tended to demonstrate differences in stressors between older and younger students, not least (re)acclimatising to working for essays, reports and exams, and balancing academic demands and family life.<sup>7-9</sup>

Within the current study, it appears that greater life experience, or more time spent in the workplace, does not in any way ‘immunise’ an older individual against the particular stressors that are encountered by other medical imaging students during clinical placement. Furthermore, only on occasion did the participants in this study explicitly indicate that their



own prior working lives had prepared them to deal with said stressors more effectively. What did emerge were the more subtle orientations these participants demonstrated towards said stressors. Routinely, stressors and the stress were balanced against reflection on their own relationship with stress at large. Moreover, and perhaps more saliently, little sense emerged of the participants ever viewing themselves as passive ‘victims’ of key stressors. Rather, and outside of the business of handling challenging patients, the stressors were themselves broadly described *in terms* of their manageability. Even a cursory review of the evidence presented above reveals a range of ways in which the participants did, or felt that they could, make workable sense of a nominally stressful clinical situation. Rarely was a stressor-description deployed as insurmountably problematic. To this extent, the only issue of unmitigated stress that emerged from the corpus of data was a sense of participants having not performed their tasks to the best of their ability in the estimation of their peers or, perhaps more so, themselves.

This critically suggests that, at the level of clinical placement at least, there may be a rather different locus of control in play for older and younger students.<sup>34</sup> For the former, in this study at least, there emerged a persistent tacit belief among participants that the stressfulness of most working circumstances was rarely beyond their own management, whether or not those circumstances were themselves controllable; a classically internal locus. This finding has broader prospective implications. AHP research has to date positively correlated internal locus of control with both academic achievement and resilience in the clinical workplace.<sup>35,36</sup> This implies that older radiography students might sustain a distinct advantage in both sectors of their degree programme and, moreover, through detailed investigation of older students’ relationship with locus of control, it may be possible to better understand how ‘internality’ might be more effectively fostered in younger radiography

students. At the very least, any means of potentially boosting resilience in the post-COVID-19 environment should be seriously explored.<sup>37</sup>

Finally, it is important to be mindful that this investigation gave overt voice throughout to participant-derived matters of self, stress and context around clinical placement. This voice might not have been fully afforded in studies addressing younger undergraduate radiographers, which tend to more directly equate structural stressors and individual stress reactions.<sup>16,29</sup> A truly direct comparison is, thus, impractical without similar research into younger students' relationships with stress on clinical placement.

## **Conclusion**

In summary, this paper has ideally clarified some of the subtleties involved in the way that older diagnostic radiography students understand and manage some of the clinical placement stresses that, evidently, impact upon them and their younger peers alike. These participant accounts were, however, provided at a point informed neither by high tuition fees nor the impacts of Covid-19. As such, they might now be viewed as an 'ideal case' from which we might latterly draw context-adjusted inference.

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